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!

HP Shapes

What does a steel shape that is called HP 10×57 look like? We have never run across this before nor has our steel supplier.

Question sent to AISC's Steel Solutions Center

HP Shapes look like W-Shapes with a very wide flange in the form of an H. These are commonly used for and referred to as *bearing piles*. Another characteristic of HP Shapes is that the web and flanges have the same thickness. The HP 10×57 of your reference has a nominal depth of 10" and a nominal flange width of 10¼".

Kurt Gustafson, S.E., P.E.
American Institute of Steel Construction

One-Third Stress Increase

This regards designing for block shear per page 4-8 of the 9th edition *ASD Manual*. Is it permissible to increase allowable loads resulting from these calculations by ⅓ for seismic loads per UBC 1612.3.2? Can these results be increased by 1.7 per UBC section 1633.2.6 for collector elements?

Question sent to AISC's Steel Solutions Center

The AISC *ASD Specification* no longer allows for the strength-side ⅓ stress increase, which was eliminated in AISC *ASD Supplement No. 1*. However, your model building code may allow "some" increase on the load side of the equation. There is a good article on this that covers all of the model building codes (and ASCE 7) and how they each treat the increase. The article is entitled "The ⅓ Stress Increase: Where is it now?" A copy of this article is available at: www.aisc.org/stressincrease.

Be sure to look at the section of the article that addresses UBC 97 Sections 1612.3.1 and 1612.3.2.

Sergio Zoruba, Ph.D.
American Institute of Steel Construction

Stud Weld Substitution for Deck Weld

Does a welded stud take the place of a puddle weld on decking installation?

Question sent to AISC's Steel Solutions Center

The answer to this question can be found in the SDI Specifications and Commentary, Section 4, Installation Commentary: "...If studs are being applied through the deck on the structural steel the stud welds can be used to replace the puddle welds."

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Moment Connections to HSS Columns

We have designed a moment-resisting frame consisting of wide flange beams and HSS columns. The applicable building code is IBC 2003. We have used an ordinary steel moment frame (OMF) with R = 3.5. We have detailed the connection to consist of column through-plates (horizontal) at the beam flange elevations, and complete penetration groove welds of the beam flanges to these thru-plates. The welds specified conform to AISC's *Seismic Provisions* for FR moment connections (including backing bar detailing, removal, and reinforcing welds). We received a phone call from a fabricator who told us he thought AISC does not permit using an R factor greater than 3 for moment frames with HSS columns. Is this true?

Question sent to AISC's Steel Solutions Center

The requirements for OMF in the 2002 *Seismic Provisions* (adopted by IBC 2003) does not include a mandate for the use of prequalified connections, nor does one need to qualify (test) the moment connection. Thus, HSS can be used in OMF.

Typically it would be economical to use R = 3 (if the structure is in SDC C or less) and avoid using the *Seismic Provisions*. In this case the connections can be designed using the HSS *Connections Manual*. Using R = 3, the base shear force will increase, however the design will avoid the special seismic detailing requirements of the *Seismic Provisions*. You should see a cost savings by choosing R = 3 rather than R = 3.5.

If the structure is in SDC D or higher, IBC 2003 mandates that a framing system from the *Seismic Provisions* be used. You can choose OMF, but your columns will need to be stronger than the beam for multi-story frames to avoid plastic hinging of the column.

Sergio Zoruba, Ph.D.
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Architecturally Exposed Structural Steel

I am working on a project where the architect wants to specify Architecturally Exposed Structural Steel (AESS) for the braced frame. I am hoping there are some standardized requirements so that the architect, engineer, fabricator, and erector are on the same page. Does AISC have a specification for AESS? The best information that I have located (so far) is the May 2003 supplement to *Modern Steel Construction*.

Question sent to AISC's Steel Solutions Center

Section 10 of the AISC *Code of Standard Practice for Steel Buildings and Bridges* (COSP), March 7, 2000 covers AESS. The COSP is available as a free download from the AISC web site at www.aisc.org/code.

There are two things that you will want to keep in mind:

1. You have to designate the steel as AESS on the design drawings.
2. The steel is to be inspected (visual acceptance criteria) from a distance that is appropriate to where the steel is located in

the structure. For example, you may want to consider an agreement that finishes, welds, bolts, etc. 30 ft or more in the air are not subject to aesthetic approval. This should help to minimize costs.

Bill Liddy
American Institute of Steel Construction

Balanced Welds

I seem to remember when an angle is welded to a gusset plate that the weld should be "balanced" about the angle's neutral axis. Can you direct me to a code reference or design guide that confirms my recollection?

Question sent to AISC's Steel Solutions Center

Your recollection is correct for cyclically loaded applications. However, exceptions are made for end connections of statically loaded single angle, double angle, and similar members or if provision is made for the eccentricity. Reference to this subject can be found in Section J1.8 of the 1999 AISC *LRFD Specification* and in AWS D1.1-2004, Section 2.5.2. If you do not have a copy of the AISC *Specification*, it is available as a free download from the AISC web site at **www.aisc.org/lrfd-spec**. This information is also covered in Section J1.9 of the 1989 AISC *ASD Specification*.

Kurt Gustafson, S.E., P.E.
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Shop Inspection

Do all components require inspection prior to leaving the fabricator for erection, even if it has been verified that the fabricator meets all the requirements for certification?

Question sent to AISC's Steel Solutions Center

There is no direct answer to this question as it is very project related. The answer depends largely on the applicable building code for the project as well as any supplementary requirements specified by the design professional. For example, if the project is governed by the IBC model building code and the fabricator is certified by an approved agency as stipulated therein, it is not specifically required by the building code that the shop fabricated components be inspected. However, the building code stipulates minimum requirements, which may be superseded by the project requirements or by the building official.

If the fabricator has not been certified by an approved agency, then the special inspector is required to perform that certification of the fabrication and implementation procedures as described in Section 1704.2.1 of 2003 IBC, in addition to inspecting the product produced for the project.

Section 1704.2 of the 2003 IBC covers inspection of fabricators.

Kurt Gustafson, S.E., P.E.
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Welding ASTM A992 Steel

ASTM A992 is noted in the AISC *LRFD Manual* as the preferred structural steel for W-shapes. Does A992 have the same welding properties as the old A36?

Question sent to AISC's Steel Solutions Center

Weldability is a consideration of the AWS Structural Welding Code – Steel AWS D1.1. Therein you will find weld processes, procedures, and requirements for welding ASTM A992 steel. ASTM A992 was added to AWS D1.1-2000 in Table 3.1.

ASTM A992 also has a carbon equivalent (CE) limit of 0.45 for most shapes (0.47 for heavy shapes—those with flange thicknesses greater than 2 in.) and places a maximum yield-to-tensile ratio of 0.85 on the material to assure a minimum level of ductility.

For seismic design, the AISC 2002 *Seismic Provisions* stipulate a design requirement in the form of an R_y Factor to assure this level of ductility. ASTM A36 steel can be used, but the associated R_y Factor is greater than that for ASTM A992 material. The 2002 AISC *Seismic Provisions for Structural Steel Buildings* are available for a free download from the AISC web site, **www.aisc.org/seismic**.

Among other requirements of the *Seismic Provisions*, toughness characteristics of the weld filler metal are also specified as 20 ft-lbf at -20 °F. There are additional filler metal toughness requirements for SMF and IMF systems as well.

Kurt Gustafson, S.E., P.E
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Steel Interchange is a 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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