IF YOU'VE EVER ASKED YOURSELF "WHY?" *Modern Steel Construction'*

Plates as Beams

I'm used to the old ASD approach. How do I design a plate in strong-axis bending using the 2005 AISC *Specification*?

A plate designed as a main member in strong-axis bending would be designed according to Section F11 of the 2005 AISC *S*. Typically strong-axis bending will not govern the strength of plates used for connections, except for the extended configuration of the single-plate shear connection. Bending in this case is checked as described on page 10-103 of the 13th Edition AISC *S C M*.

L S. M, P.E.

Weld Metal Choice in Seismic Applications

Are my choices of electrode strength level more limited in high-seismic applications? Specifically, where could I choose to use E60 electrode for welding ASTM A36 material?

For the purposes of this inquiry there are three types of welds in a high-seismic application (when AISC 341 applies): Demand Critical, which is required where AISC 358 says it is required; AWS D1.8 welds in the seismic force resisting system other than those that are Demand Critical; and AWS D1.1 welds for connections that are not in the seismic force resisting system (SFRS).

The welds outside the SFRS meet D1.1 requirements that define E60 as matching weld metal and permit its use in prequalified welding procedure specifications (WPS) where the connected base metal is A36 and less than ¾ in. thick (see AWS D1.1 Table 3.1 Category I). In the SFRS, AWS D1.8 requires the use of E70 or E80. Additionally, the filler metals used in these welds need to be Charpy V-notch (CVN) tested and exhibit 20 ft-lb at 0 °F or better (see AWS D1.8 Section 6.3). Demand Critical welds add a further requirement that the filler metal must be tested to show a level of toughness at a range of heat inputs by passing heat input envelope testing.

J. S

Minimum Percentage for Composite Design

The Commentary to the AISC *Specification* recommends that small levels of partial composite design (low percentages) should not be used. I like that it is left to my engineering judgment, but what guidance can you give me?

AISC has used 25% as a minimum amount of composite action in tables and information in the AISC *M* because low levels of composite action may require significant deformations to achieve the strength. Figure C-I3.5 of the Commentary to the 2005 AISC *S* (which is available as a free download at **www.aisc.org/2005spec**) illustrates this graphically. Moreover some tests have shown that below composite action ratios of 25% some physical separation between the steel and concrete may be exhibited at maximum loading.

A G, P.E.

Fire protection for HSS

Can I fill an HSS or steel pipe with concrete to serve as fire protection?

Yes. Filling with concrete works better if it is reinforced (the rebar maintains the heat sink capability as the concrete inside the section cracks when exposed to heat). A calculation procedure to determine the fire rating is discussed in AISC *S D G 19*, which is available as a free download for AISC members at **www.aisc.org/epubs**.

C J. C, S.E., P.E., P.D.

Sawing Inside Corners

Can I use a band saw to cut an inside corner square or do I have to form a radius at the intersection of the sides of the cut?

It is not acceptable to cut an inside corner square, and I also should point out that an "overcut" at this corner creates an even worse condition. Section M2.2 of the *S* states:

"Reentrant corners, except reentrant corners of and weld access holes, shall meet the requirements of AWS D1.1, Section 5.16. If another specified contour is required it must be shown on the contract documents."

L S. M, P.E.

Tee Stem in Compression Due to Bending

I'm comparing the 2005 AISC *Specification* (Chapter F, Section F9 as well as F6 and F11) and an "ancient" article that was published in the 1965 AISC *Engineering Journal* titled "One Engineer's Opinion," by William A. Milek. There are some differences between these references; does the 2005 information agree with the Milek paper?

The Commentary to Section F9 (see page 277) discusses the derivation of the lateral-torsional buckling equation used in the 2005 AISC *S*. There is a reference in this information to the 5th Edition of the *G S D C M S*, while the Milek paper references the 1st Edition of this same document (note that the 6th Edition is now current, available at **www.stabilitycouncil.org**). Both references recognize that the solution of this limit state is somewhat complex, and each provides a simplified equation for s in bending.

The 2005 AISC *S* benefits from additional, more recent research, which allows a further simplification beyond what the Milek paper recommended. The effect of the stem in compression on the lateral-torsional buckling strength is accounted for with the B factor. It is negative for stems in compression, thus reducing the available flexural strength.

H. M, P.E.

00