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 at:

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WELDING ON LOADED STRUCTURE

from 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 (for example, if the member is being reinforced) and that the weld must 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.

Here are two references for your information:

1. "Reinforcing Roof Truss Frames Under Load," by Timothy E. Donovan, Vytautas Izbickas, and Nicholas Mariani, *Civil Engineering*, April 1984.

2.. "Modification of Roof Trusses and Columns to Support Air Pollution Control Equipment" by Timothy E. Donovan and Vytautas Izbickas, James F. Lincoln Arc Welding Foundation, 1982 Award Program.

The strengthening concept was based on keeping the existing structure intact without plant shutdown. Truss members were strengthened while in stressed condition with the building under load. The modified cross sections of the structural members with the additional material because of increased loading were designed on the assumption that no initial stress existed in the material of the parent member.

Timoth E. Donovan, P.E.
Stowe Power
Norwell, MA

It is not a given that members must be unloaded prior to being welded or reinforced. Two good papers that address the issues are:

1. Ricker, David T. "Field Welding to Existing Structures." *Engineering Journal*, 1st Quarter 1988.

2. Tide, R.H.R. "Reinforcing Steel Members and the Effects of Welding." *Engineering Journal*, 4th Quarter 1990.

Charles Carter, P.E., S.E.
American Institute of Steel Construction
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SLIP-CRITICAL CONNECTIONS

from December 2001 Steel Interchange

Is there any situation where the design of a slip critical bolted connection would not be required to address bearing requirements? How about a connection using slotted holes?

Question sent to AISC's Steel Solutions Center

No. Bearing connection limit states must always be checked in slip-critical connections. See the latest (2000) RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, Sections 4.3 and 5. Making a connection slip-critical does not guarantee it will never slip, just that the joint will not slip until the load exceeds the service-load level calculated as the slip resistance.

In addition, the Commentary in Section 5.4 of the RCSC Specification states, "Although the design philosophy for slip-critical joints presumes that they do not slip into bearing when subject to loads in the service range, it is mandatory that slip-critical joints also meet the requirements of Sections 5.1, 5.2 and 5.3. Thus, they must meet the strength requirements to resist the factored loads as shear/bearing joints."

Sergio Zoruba, Ph.D.
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LATERAL DRIFTS

from October 2001 Steel Interchange

There are numerous sources that provide recommendations and opinions regarding a permissible lateral drift of steel buildings that are supporting

exterior walls comprised of brick veneer or concrete masonry unit (CMU) block. These include AISC *Design Guide No. 3 Serviceability Design Considerations for Low-Rise Buildings* by J. M. Fisher and M. A. West. Does any other established entity comparable to AISC provide explicit specifications for this situation?

Kevin B. Westervelt, S.E., P.E.
Mallia Engineering
Knoxville, TN

It depends on what lateral drift you are talking about. If it is the lateral drift of the structure as a whole, you have cited the only publication of which I am aware.

If you are concerned about out of plane lateral drift of the panel, I would direct you to a study by Clemson University. The Metal Lath/Steel Framing Association. (ML/SFA) and the Brick Institute of America (BIA) sponsored the Clemson study and came away with somewhat different conclusions. The ML/SFA recommends limiting the lateral drift to l/360 for the 50-year wind. The BIA recommends l/600. There are some that recommend l/2000. The Canada Mortgage and Housing Corp. recommends l/720.

It is a serviceability issue (cracks, leaks, and future corrosion) not an immediate safety issue therefore it is up to the EOR and the architect. Often times serviceability issues use a 10 year wind as opposed to a 50 year wind.

If it is a multi-story building that could develop expensive repair costs and falling hazards, I would be tempted to use the l/600 for a 50-year wind if I had a wind tunnel study. I would also consider a test panel, G-90 galvanized studs, and using a good N mortar that has good crack healing properties. If I don't have the luxury of a wind tunnel study, test panels, and good material quality control, I would opt for the l/720 with a 50-year wind for almost any multi-story building. You can probably afford to take a bit more of a risk with a single story building, but that is the EOR's call.

Harold Sprague
Black & Veatch

CURVED MEMBERS

What are some good references for designing curved structural members?

Question sent to AISC's Steel Solutions Center

AISC's *Design Guide No. 9, Torsional Analysis of Structural Steel Members*, would be a good reference, as well as its companion software WinTORQ. More information can be found on this design guide and software in the bookstore at www.aisc.org/bookstore.html.

Depending on the specific application, the following articles from *Engineering Journal* may also be useful:

"Straight Element Grid Analysis of Horizontally Curved Beam Systems." Herbert A Weissman, April 1970.

"Analysis of Curved Girder Bridges." Charles Culver et al, January 1970.

"Approx. Torsional Analysis of Curved Box Girders by the M/R-Method." David H.H. Tung, July 1970.

"Box Girder Bridge Design - State of the Art." C.P. Heins, 4th Quarter, 1978.

"The Application of Flexural Methods to Torsional Analysis of Thin-Walled Open Sections." Thomas E. Boothby, 4th Quarter, 1984.

Reprints of any of the above papers can be obtained from www.aisc.org/ejreprints.html for a nominal charge.

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UNANSWERED QUESTIONS

DRAFTING GUIDELINES

Are there any standards or guidelines for design drawings, particularly for the presentation and content? I am interested in finding "rules" about showing the weights of beams on plans and column weights on elevations, etc. Each company seems to have developed its own convention, but I would like to know if there are industry-wide standards.

Brian W. Bersch, P.E.
September 2000