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. If you have a question or problem that your fellow readers might help you to solve, please forward it to *Modern Steel Construction*. At the same time, feel free to respond to any of the questions that you have read here. Please send them to:

Steel Interchange
Modern Steel Construction
One East Wacker Dr., Suite 3100
Chicago, IL 60601-2001

Answers and/or questions should be typewritten and double-spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a Word file or in ASCII format).

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 principals to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 800/644-2400.

*** * * * Questions and answers can now be e-mailed to: newman@aiscmail.com * * * ***

The following responses from previous Steel Interchange columns have been received:

Should connections involving bolts and welds used in combination be welded first or bolted first?

The sharing of load between bolts (both A307 and high-strength bolts) and welds in bearing type connection is not recommended. However, high-strength bolts in slip-critical connections can be used in combination with welds. In this case bolts should be fully tensioned before the weld is made. Additional ½ to ¼ turn of a nut is recommended to apply after the welding is done.

The combination of bolts and welds is discussed in *LRFD Manual 2nd Edition* Vol. I Chapter J1.9. and Vol. II p.8-211 and in similar chapters in ASD *9th Edition Manual*.

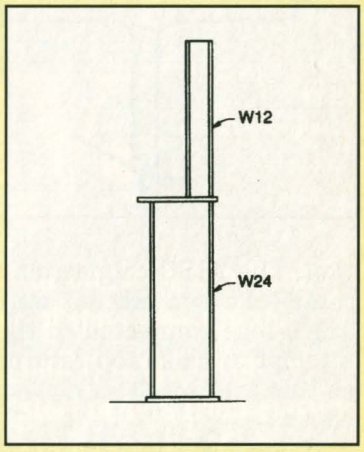
Boris S. Fayman, P.E.
Engineered Endeavors, Inc.
Mentor, OH

Another response:

A designer must consider ease of construction as well as structural integrity when using welded and bolted connections together. For example, when I worked as a steel fabricator a typical connection for splicing beams (say at a zero moment point as in cantilever construction) involved welding and punching holes in the splice plates. These plates were welded to opposite sides of each beam flange. In the field, the holes were aligned, bolted, then the remainder of the plates welded. Overstressing of the bolts in this situation is not a problem because the strength of the connection comes from the welds and not the bolts.

Ray Schork P.E.
Bayer Becker Engineers
Fairfield, Ohio
via email

How does one design a stepped column?



In designing a stepped column the first task would be to determine the slenderness "K" value for the upper and lower shafts. AISC in Steel Design Guide Series number 7, *Industrial Buildings*, publishes an excellent article in appendix B. This article by Krishna Agrawal and Andrew Stafiej presents tables in which the engineer may determine the following characteristics of the upper and lower shafts of stepped columns.

1) Ratio of inertia of upper shaft to lower shaft.
2) Ratio of lower shaft length to total length.
3) Ratio of "P" load at column step to total column axial load.

From these ratio the article provides tables for selection of the "K" values for the upper and lower shafts. The article provides several conditions in the stepped column tables ranging from a pinned - pinned condition to a fixed -fixed condition. Once the slenderness ratios are known, the allowable axial stress may be determined. Step columns are generally provided for installation of a crane girder at the step. This will result in a bending moment which will produce a moment acting on the upper and lower shafts. The bending moment from the upper and lower shafts may then be determined by simple statics. After the bending stress is determined, one could the apply AISC interaction equations for selecting the column size.

Michael A. Morgan, P.E.
BE&K Engineering, Inc.
Birmingham, Alabama
via email

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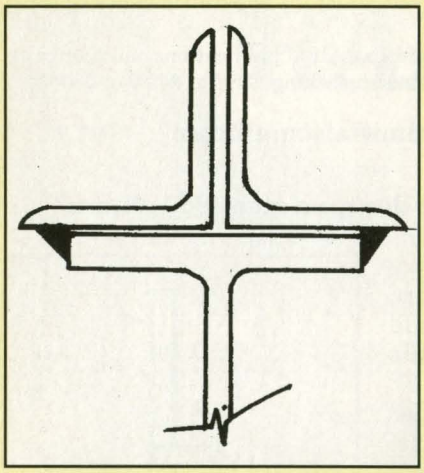
How is a welded double angle connection designed when the double angles are connected to the flange of the column and welded on the back side of the double angles? See figure. This may be necessary when the column flange is short.



The design of double-angle connections using "back-side" welds is no different than when using conventionally placed welds. In fact, "back-side" flare bevel welds are quite common in HSS (hollow structural section) construction. The AISC connection tables can be used as these take into account weld eccentricities on the angle legs connected to the column. But, do not attempt to make top returns on the vertical welds as this may result in notches in the column flange edges.

If one needs to avoid a "back-side" weld, one can use angles with shorter legs such as a 3-1/2 x 2-1/2 and use the normal weld placement. If this won't work, another connection such as a shear plate could be used.

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

New Questions

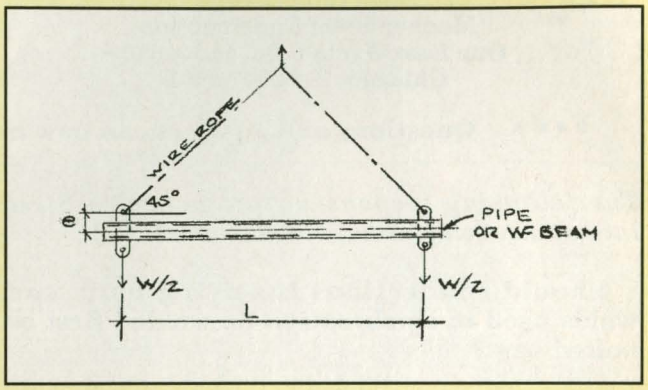
Listed below are questions that we would like the readers to answer or discuss.

If you have an answer or suggestion please send it to the Steel Interchange Editor, Modern Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001. Questions can also be sent via e-mail to newman@aiscmail.com.

Questions and responses will be printed in future editions of Steel Interchange. Also, if you have a question or problem that readers might help solve, send these to the Steel Interchange Editor.

A variation of the lifting beam question.

A typical lifting beam or strongback in the materials handling, crane and rigging industry take the form of either a horizontal pipe or wide flange beam, with padeyes top and bottom at both ends. The lifting wire rope bridle with two legs at about a 45 degree angel attaches to the top padeyes and the supported weight attaches to the bottom padeyes. (see sketch)



The wire rope bridle induces both compression and bending moment in the lifting beam. Again there is no lateral support.

What analysis would be used to solve for the safe lifting capacity of this form of lifting beam?

R. McCardell
Harbor Design Engineers

What is the procedure for designing a hole for piping in a simply supported steel beam? Are there special details?

Charles J. Collins, Jr.
Charles J. Collins, Jr./Architect
Medford, NJ

How does the AISC *Code of Standard Practice* address the possible tolerance for vertical and horizontal alignment of crane rail in a mill type building?

Dan A. Torrence
United Steel Erectors
Houston, TX

What size mig wire is considered structurally acceptable or comparable to an E70XX specification? Is there a solid wire that is acceptable? With what gas? Can the penetration and weld properties be equivalent to arc welding with, say, an E7018 rod?

Tim Quinn
Quinn Steel Services
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via email