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).

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

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

OSHA safety requirements state that tie off points for fall protection be designed and evaluated for a 5000 lb. load. What is the correct load combination and associated steel member stress condition for acceptance for this required load?

The question refers to the "prescriptive" "(conservative) requirement in OSHA CFR 1926.502 (d) (15), which states "anchorage used for the attachment of fall arrest equipment shall be....capable of supporting at least 5,000 lbs. per employee attached." This provision does not specify whether the prescribed load represents a working load or strength condition. What is the intent of the phrase "capable of supporting at least 5,000 lbs"? The Federal Register (vol. 59, No. 152, pg. 40707 dated August 9, 1994) provides some commentary regarding the evolution of this requirement. The value of 5,000 lbs. was chosen to align with strength requirements elsewhere in this section (e.g. minimum breaking strength of lanyards and lifelines). Clearly, the prescribed load is a strength (or factored load) condition and includes the weight of the worker, equipment and impact allowance.

For anchorage design, the most straightforward approach is to use the Load and Resistance Factor Design Specification with a "required strength" of 5,000 lbs. Which load combination applies is applies is a moot point, since the required strength is given (rather than calculated using a factored load combination). Anchorage "design strength" must be greater than or equal to the "required strength". An allowable stress approach will also work as long as the minimum strength requirement is met.

Alan Carr, P.E.
Issaquah, WA

The structural steel design manuals establish a minimum length of thread on structural bolts, referencing ANSI B18.2.1. They also give a formula of 2D+¼" for bolts less than 6" in length, and 2D+½" for bolts longer than 6" long. What are the consequences if the bolts are fabricated with thread lengths less than this amount, but still capable of making up a proper connection? Is this grounds for rejecting the bolts? Why is this length the same regardless of what type of bolted connection (N, X, SC) is used? It would seem that the thread length values should differ depending on the type. Finally, the Specification for Structural Joints Using ASTM A325 or A490 Bolts states "The length of the bolts shall be such that the ends of the bolt will be flush with or outside the face of the nut when properly installed." With this added criteria, it would seem that the thread lengths could be shorter than those specified in the Table, because a single nut and washer is never greater than 2D in length.

Various devices used by bolt manufacturers for producing threads require a certain length "run-out" so that the threading can be thrown clear without leaving a burr or an abrupt end to the thread root.The threading in the runout area is too shallow to accept a nut. The last thing an iron worker wants to happen is for a nut to "shank-out", that is, run out of thread before the plies are in proper contact and the prescribed torque attained. Providing a little extra thread helps to assure this doesn't happen, regardless of what type of bolted connection (N, X or SC) is used. Threading shorter than called for in ANSI B18.2 should not be cause for rejection if it can be demonstrated that a proper connection has been made.

I have just measured four ¾" diameter HS bolts (by four manufacturers) and the thread length *plus runout* on all four specimens measured 1½". A nut was run on each bolt to the end of the threading and the distance measured from the face of the nut to the bolt end. On two bolts, this distance was 1¼", on the third bolt 1⁵⁄₁₆" and the final bolt 1⅜", illustrating the non-uniformity existing in the threading process. Note also that these values are well below the ANSI recommended thread length, and suggests that the washer required under the nut may serve an additional purpose other than to distribute the load and prevent scouring. The potential problems from futher thread shortening far outweigh any benefits.

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

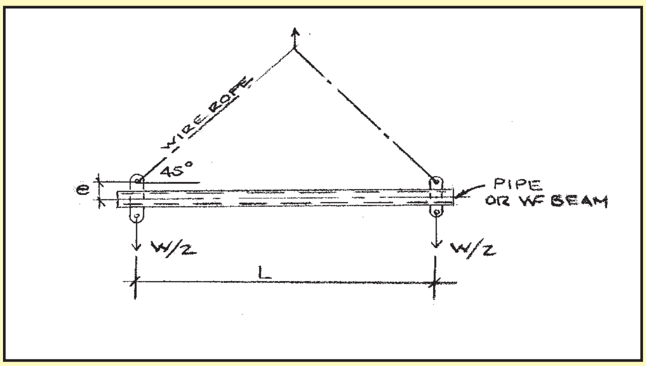
A typical lifting beam or strongback in the materials handling, crane and rigging industry take the form of either a horizontal pipe or wide flange beam, with padeyes top and bottom at both ends. The lifting wire rope bridle with 2 legs at about a 45 degree angel attaches to the top padeyes and the supported 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?

Procedures for both analysis and design of lifting beams are given in an article titled "Design and Construction of Lifting Beams," in the 4th Quarter 1991 issue of *Engineering Journal*. A more efficient section for resisting both bending and compression is generally a hollow structural section (HSS) rather than the pipe or wideflange section shown in the sketch above.

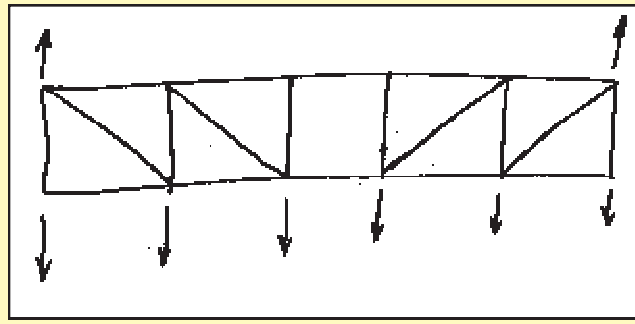
David T. Ricker, P.E.
Payson, AZ



New Questions

Is there any need for a diagonal in the center panel of the sketch below (showing a Pratt truss with an odd number of panels)?

Barry Lawrence
Sapulpa, OK



The following figure shows the connection of a beam and a supporting column with a stiffener that is not full length. The beam is under uniform loading of *w*. There is nothing bracing the column along its length. What is the correct dimension for the unbraced length of the column?

Kunming Gwo, P.E.
HCI Steel Building Systems, Inc.
Arlington, WA