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 Wordperfect 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 expertiseof 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 312/670-2400 ext. 433.

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

How can one take into account blast effects in the design of steel structures?

I read with great interest the response by Richard P. Linck, P.E. in the October 1993 Steel Interchange. It was an excellently written response and it brought to the attention of many of those who have not concerned themselves with this serious problem.

As the article pointed out, there are many many factors and parameters that influence the response of structures to blast loadings. I have over 30 years of experience in the design of structures to resist blast loadings, and I have written the article, Dynamic Structural Analysis with Short Time History, in June 1965, for the Journal of the Structural Division of ASCE. This was one of the main articles that revealed how structures responded to blast loadings.

I would like to point out a few things that Mr. Linck did not go into detail in his response:

1. A structural member does not have to absorb energy in order to resist a blast loading. It may absorb energy if one wishes, which will depend upon the conditions of how one wishes to design the structure. If one wishes the structure to absorb energy, then there must be some kind of failure that occurs, which may also be minor. If one does not wish any failure to occur, then the response of the structure is very similar to the response of a static load. The structure will deflect under loading and then return to its original position after loading. There is no absorption of energy under such conditions.

2. There is a great deal of discussion about the Pressure Wave that strikes a structure as a result of an explosion. There is another wave that is generated by the same explosion at the same time, which is called the Dynamic Wave, and which can be of almost equal significance in the response of structures. These two waves have different time histories and are superimposed on one another when striking the structure. In order to obtain a correct response of the structure, both of these waves should be taken into consideration.

3. The shape of the time- history curves for all explosions is strikingly very similar. About the only differences is in the initial peak overpressure and the duration of time for the blast wave to run its course. This is a very fortunate phenomenon for the understanding of blast waves and for the design of structures to resist such waves.

The design of structures to resist the effects of explosions is a condition that should be seriously considered for many structures. To date, the concept has not had a very high priority. It is also extremely important to obtain help from those who have enough experience in this field, so as to feel confident that when one has designed a structure to resist blast loadings, it will do just that.

George L. Henderson
San Mateo, CA

The letter on blast effects from Richard P. Linck, P.E., in the October 1993 Steel Interchange is well written and provides a tremendous amount of information on the subject. However, I would go one step further and caution structural engineers who are otherwise unfamiliar with blast effects against attempting to evaluate these effects simply by reading literature on the subject.

There are several firms who specialize in characterizing and quantifying the effects of accidental explosions. These firms are typically familiar with the many volumes on the subject and have extensive background in observing actual explosion damage. Our firm has worked with some firms and find that our knowledge of local structural engineering practices and project requirements and their knowledge of "blast engineering" produced very satisfactory results.

James R. Miller
J.R. Miller & Associates, Inc.
Brea, CA

(The next question and answer is in response to the reply by Mr. Khasat that was published in the Steel Interchange column in the October 1993 issue .)

Under what circumstances does the designer have to consider torsion in the design of a beam?

Steel Structures by Salmon and Johnson is a good reference that addresses this subject. They consider the use of the flexural analogy without modifications as presented by Mr. Khasat to be "...a very conservative approach." They follow up with examples on a "modified flexural analogy" that is also very simple to follow and produces solutions that closely approximate differential equation solutions. However, this procedure is applicable to wide flange shapes only.

For crane girders with cap channels, as depicted in Mr. Khasat's example, the AISC Design Guide No. 7, Industrial Buildings, by Fisher and Buettner (AISC publication D801) is an excellent reference.

Gerrett Swearingen
BE & K Engineering
Mobile, AL

When welding to AWS D1.1 requirements what is a "seal" weld and what are the applicable inspection criteria for same?

Seal welds are non- structural welds intended to fill or seal the crevice formed where two surfaces are joined. Structures subjected to heavy corrosion incorporate these welds as a detail when using hot-dipped galvanizing or protective coatings. Without seal welds to bridge the crevice, surface preparation and coating application are difficult.

Crevices which are not sealed adversely affect galvanizing in several ways. Molten zinc will not bond properly to steel when these crevices are contaminated and not cleaned. Even where cleaned, the crevice tends to hold pickling solvents or alkalis from the galvanizing preparation process. A safety problem occurs when the hot zinc contacts with the solvent or other liquid. Lastly, the crevices can trap excessive amounts of zinc raising the material costs for galvanizer and creating a disfigured product.

Similarly, without a seal weld, a crevice can hold contaminates which react with a protective coating or create a stress riser in a protective coating. A crevice can also wick causing an uneven coating application.

The size of this weld is controlled by the welding equipment used and the skill of the welder. Per se, AWS D1.1, the Structural Welding Code, does not apply to non-structural welds. Nevertheless, there are some important things to keep in mind:

Concern—Fatigue critical members. (An otherwise good weld can be fractured by the poor design of a seal weld). Possible Solutions: Consider smaller throat continuous welds in lieu of seal welding between intermittent fillet welds. For protective coating applications, consider caulking instead of seal welds.

Concern—Sloppy workmanship with sharp peaks, slag intrusions, undercutting, etc. Possible Solutions: Repair the welds. For protective coating applications, consider caulking instead of seal welds.

Hugh Lee, P.E., S.E. C.C.S.
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Los Angeles, CA

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 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.

I have been unable to locate the historical origination of the Vierendeel truss. I am curious about who was Vierendeel, when the truss structure was first utilized, why was it names, and for what contributions to structural engineering was he/she recognized.

Rick Love
Garver & Garver
Little Rock, AR

Can an existing steel beam and concrete slab be made to work together in composite action by adding studs to the steel through cored holes? Are there any special considerations?

The AISC Manual includes dimensioning information for countersunk bolts, are there any special design requirements for these bolts?

Are there any good connection details for a truss made up of all WT sections?

Is is possible to use clamps in structural steel connections? Are there any design requirements?