

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 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
1 East Wacker Dr.
Suite 3100
Chicago, IL 60601

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).

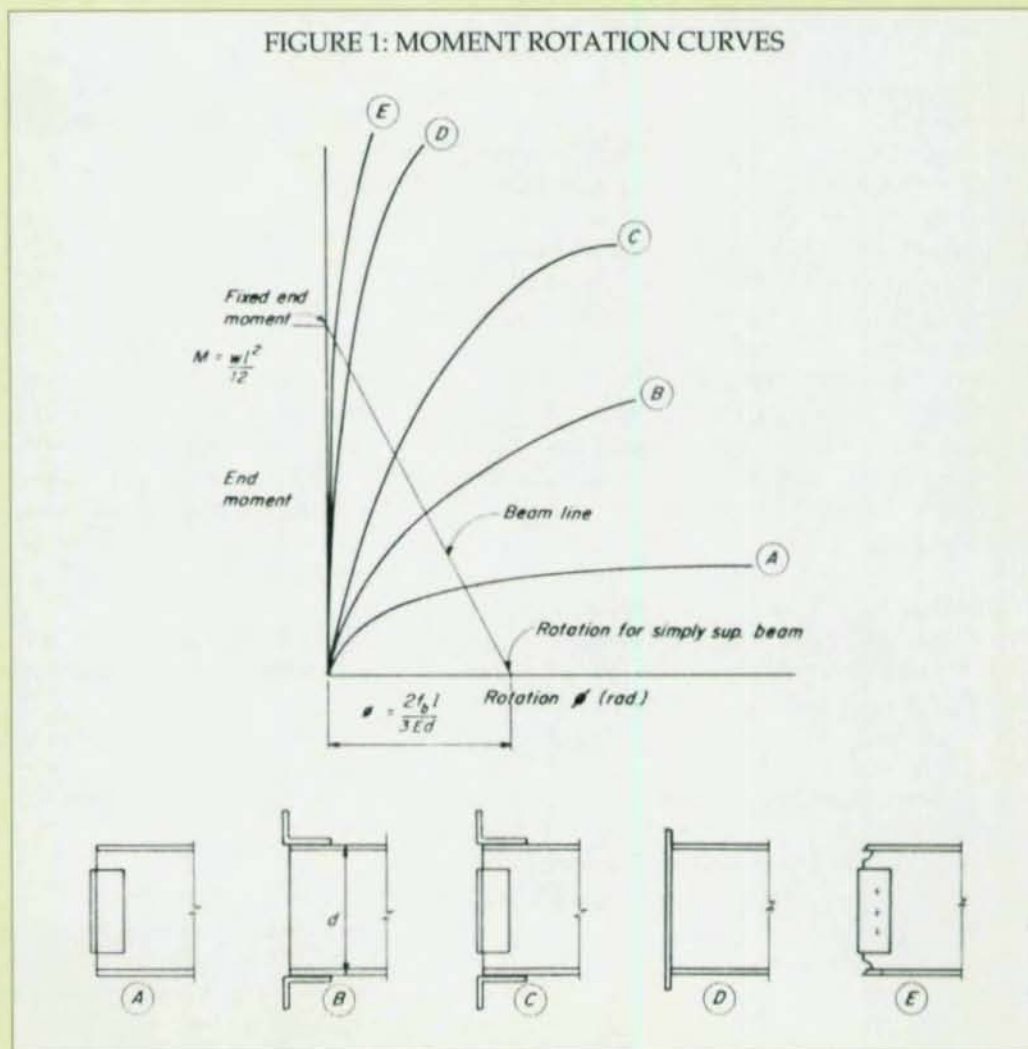
The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principles to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 312/670-2400 ext. 433.

In the AISC Manual, section 4, there is some information on moment connections. Several different types are shown. One opinion interprets them as "Fully Rigid" connections, able to make a rigid bent or frame. The opinion of the other side holds that they are intended to be "Semi-Rigid" connections intended for wind applications, etc., only. The first group cites the bolted end plate connection in the manual as being fully rigid. The other connections are welded and therefore must be rigid also. What is the intent of the moment connections in the AISC Manual?

(Answer appears on following page.)

FIGURE 1: MOMENT ROTATION CURVES



Steel Interchange

The AISC publication *Manual of Steel Construction: Volume II - Connections* is a very helpful source in explaining the connection design terminology used by AISC. This publication will be available from AISC in the fall of 1992.

Simple shear connections are used when the frame is designed assuming that the members are unrestrained or free ended, that the ends of the beams are connected for shear only, and that the ends are free to rotate under gravity loading. Rigid frame, moment frame or continuous construction, identified as Type 1 in ASD and fully restrained in LRFD, assumes that the beam-column members are connected with sufficient rigidity to transfer the design moments with little or no rotation of the members relative to each other. The AISC Specification also allows semi-rigid framing, this type of construction assumes that the connections of beam-to-column members have a "dependable and known moment capacity intermediate in degree between rigid and simple construction".

In the real world that we all live in there probably is not a fully rigid connection nor is there a fully flexible connection. Figure 1 (previous page; this chart is reprinted from the AISC Manual) shows moment rotation curves for different types of connections. Type A is considered "simple" with little fixity; Types B and C are considered "semi-rigid"; and Types D and E, "rigid", are close to complete fixity.

The simple connections are connected for shear only, while the rigid connections normally would be developed for the indicated axial force in the flange areas on the basis of 100 percent fixity and would have a web or seat connection to develop the shear force.

The AISC Manual section on connection includes both simple shear connections and moment connections. It is the intent of the manual that the connections that are listed as simple be designed for shear; these are considered to be flexible connections. These connections would fall into Type A in Fig. 1. The connection section also labels some connections as moment connections. These connections are considered to be fully rigid and the design of them should be accordingly. These moment connections fall into Types D and E in Fig. 1.

As mentioned in the initial question, there also are "wind" connections. These connections are not fully rigid nor are they completely flexible. These connections are a simple, reliable and economical method of

design. This type of connection is designed as if it were a simple shear connection in that the beam-to-column connection is assumed to be pinned and the members are sized for gravity loads. An independent lateral load analysis is next made, with certain connections assumed to be rigid. The selected connections are then designed for the calculated moment capacities.

The advantages of this design are: (1) simplified calculations and analysis; (2) beams and girders are designed on the basis of simple shear construction for gravity loads; and (3) the columns are designed as axially loaded members with applied wind moments.

The AISC *Engineering Journal* has published several articles on this type of connection including: "Wind Connections with Simple Framing" by Robert O. Disque in July of 1964 and "Simplified Frame Design of Type PR Construction" by Michael Ackroyd in the 4th quarter of 1987. The *Manual of Steel Construction: Volume II - Connections* will also include discussion and design examples of this type of connection.

New Questions

Listed below are some 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. 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.

1. What procedures should be followed when assessing steel that has been exposed to a fire?
2. How has the recent specification change allowing snug-tight high-strength bolting for certain types of shear/bearing connections affected your projects?
3. How do you decide when to use doubler plates and when to increase the size of the column?
4. What is a good "wind" connection for the top of a column?