FRITZ ENGINEERING LABORATORY
LEHIGH UNIVERSITY
BETHLEHEM, PENNSYLVANIA

PRELIMINARY PROGRAM FOR THE TEST OF RIVETED STEEL FRAMES FOR CONTINUITY

by Hechtman 1939

This report presents a preliminary program for the investigation of continuity in riveted steel frames sponsored by the American Institute of Steel Construction. This study is a research project being carried out at the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pennsylvania.

Investigations of continuity in riveted frames have been made by the Steel Structures Research Committee[1], 1929-1934, and by J. Charles Rathbun[2], 1934. The British Committee studied the effects of the variation of type and size of connection for one beam and column size. Professor Rathbun investigated the effects of varying both beam and column size and type of connection. Other tests of riveted joints for continuity have been made, but only the above tests are of use in this problem of partial continuity.

The application of the results of the British investigation to design is limited for these reasons: first, only ten tests fell within the desired rigidity range of 50 to 75 per cent; second, only one size of beam and column was used, a 12-in. I at 30 lb. beam and a 12-in. I at 65 lb. column; and third, only beam connections to column flanges were studied.

Likewise, the results of Professor Rathbun's tests are not sufficiently extensive to be a guide to design for similar reasons: first, only nine tests fell within the desired rigidity range of 50 to 75 per cent; and second, these nine connections were beam to beam, i.e., without a column between beam connections.

Therefore, it is proposed that an investigation of riveted beam-to-column connections of sufficient scope to become a guide to design be made before any tests of riveted steel frames for continuity. In the preparation of this program, the British[1] and the Rathbun[2] tests served as a basis for design of the test specimens and as a guide in setting the limits of investigation. The report of a similar investigation[3] of continuity in welded steel frames, carried out in the Fritz Engineering Laboratory, was also used as a basis for determining the general procedure to be followed.

Further, it is proposed that the following variables be studied for beam-to-column flange connections:

1. Beam depth.
2. Web angle size.
3. Top angle size.
4. Seat angle size.
5. Column flange thickness.
6. Column flange width.
7. Fabricator.

After these studies, a study of beam-to-column web connections would complete a program which would be an adequate guide to development of design methods.

Of the above variables, those having the greatest effect on the rigidity of the joint are the angle size in a web connection and the seat and top angle sizes in a flange connection. For example, an increase in beam depth with no increase in size of top and seat connection angles produces a less rigid joint. Similarly, a decrease in the top angle size gives less rigidity. The British committee found a lesser effect upon rigidity by the change of the seat angle size, and indicate that flexibility of the seat angle may be desirable. The seat angles are designed to carry the simple beam reaction for the given loads. No conclusive study of these factors has been completed.

The column flange thickness and the column flange width have a small effect upon the rigidity of the connection. No study of the effects of local bending and yielding in the column flange has been made.

The variation in rigidity in identical connections fabricated in different shops has not yet been studied.

A study of beam-to-column web connections will provide a comparison with beam-to-column flange connections. Deformation of the column web in the former case may reduce the rigidity of the connection, particularly in the case of outside columns.

The preliminary test program presented herein includes only beam-to-column flange connections. The standard web-angle connection and the seat-angle type of connection are used because these two types produce the desired degree of rigidity. Web-angle connections having less than three horizontal rows of rivets are too flexible[2]. Split-I connections and combinations of web angles with split-I or with seat and top angles are more rigid than is desirable for economy[1,2]. From the standpoint of obtaining the desired degree of rigidity, web-angle connections are better for larger beam depths and seat and top angle connections for smaller depths.

Since all tests are overlapping, the study will be extensive without a large number of specimens. For instance, the same specimen may be used in the study of variation of beam depth and column flange width, or of beam depth and web angle size.

---

1. Steel Structures Research Committee
   SECOND REPORT OF THE STEEL STRUCTURES RESEARCH COMMITTEE
   FINAL REPORT OF THE STEEL STRUCTURES RESEARCH COMMITTEE
   Department of Scientific and Industrial Research

2. J. Charles Rathbun
   ELASTIC PROPERTIES OF RIVETED CONNECTIONS
   American Society of Civil Engineers Transactions
   pp. 524-596, Vol. 101

3. Bruce Johnston and E. H. Mount
   DESIGNING WELDED FRAMES FOR CONTINUITY
   American Welding Society Journal, October 1939