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Proposed program for seat angle research

Norman G. Schreiner

PROPOSED PROGRAM FOR SEAT ANGLE RESEARCH

by Norman G. Schreiner

I. OBJECT - Since the action of seat angles in structural steel construction is a subject of so much uncertainty, this investigation will concern itself with the following aspects of the problem.

1. Stress Distribution in Seat Angles themselves.
2. Stress Distribution in the connection of the Seat Angles to the supporting member.
3. Stress Distribution in the supporting member.
4. Stress Distribution in the supported member.

Both welded and riveted connections will be studied from the standpoint of field conditions, and an attempt made to develop either a rigid or rational theory of design.

II. LITERATURE - A study of the record of past and contemporary theory and tests is assumed of greatest importance.

III. PRELIMINARY PROGRAM - Determination of stress distribution in seat angles themselves under concentrated loading at various points on the outstanding leg, in accordance with Mr. Priest's program, extended to include a few coated wire welds.

This program should be further extended to include the same type of information on similar riveted connections.

IV. PHOTO-ELASTIC STUDIES OF MODELS

V. MAIN PROGRAM, FULL SIZED CONNECTIONS - Research into the problem of seat angles resolves itself into a study of their practical applications and the limits thereof, the examination of the methods of laboratory testing in order to simulate field conditions, and yet develop results suitable for application to a theory of design.

Seat angles are often used in erection for supporting the end of the beam prior to attaching the web angles which carry the end reaction. Used in this way, their strength should be sufficient to insure against construction failure.

Seat angles are more often used to carry the total end reaction of the beam. In such a case the beam must be rigidly held against lateral displacement. This qualification makes it necessary to consider the structure of which the beam is a part. If the beam top flange supports flooring of some kind, it may be considered as being adequately supported laterally. If, on the other hand, the beam is a member of an open framework, it will be necessary to support it laterally either by a top angle or by web angles; in either case the auxiliary angles are not considered as taking any of the vertical load in present design practice.

Beam seats of other types are also used, the split beam type being most common. Split channels are also used for light loads.

Common sizes of seat angles range in thickness 3/8" to 3/4", length of outstanding leg of 3-1/2" to 4", and length of vertical leg from 4" to 8". The limitations may be assumed as follows:

(a) The outstanding leg is limited to a maximum of 4" in order to more definitely place the reaction; this position even then is very indefinite.

(b) The length of the vertical leg is defined by the necessity of sufficient space for welding or rivets to carry the vertical load.

(c) Minimum dimensions of the angles are dependent upon size of rivet used, usually 7/8" diameter, or 3" minimum leg.

(d) Thickness of the angle should be determined by the reaction to be carried.

Beams are usually attached to the seat angles at their flanges by welding, rivets, or bolts.

A test program would contain the following variables.

1. Both welded and riveted connections should preferably be tested.

2. Beam seats as follows:

(a) Seat angle only.

(b) Seat and top angle.

(c) Split beam connection.

(d) Seats with stiffeners.

3. Method of attachment of beam to seat.

   (a) welded

   (b) riveted

   (c) bolted

4. Location of end of beam in relation to heel of angle.

It will be desirable to approximate actual field conditions in the laboratory tests, and it is felt that this can be obtained only in the use of a full sized specimen consisting of two stub columns, the beam connection, and a beam of approximately 10-ft. span.

Other methods of laboratory test are open to the criticism that they do not approximate actual conditions, for example, block loading of the angle as used in III, is objectionable in that the restraining action of the beam flange is not considered. However, it seems desirable to establish some relationship between a concentrated load equal to the actual reaction and the action of the seat angle for simplicity in design.

5. Angles of varying sizes and thickness should be included in order to determine:

   (a) Effect of length of outstanding leg
   (b) Effect of length of vertical leg
   (c) Effect of thickness

on the carrying capacity and stiffness of the connection.

Many other problems will present themselves such as the use of gas and electric welding (plain and coated wires), rivets in tension, combinations of welding and riveting in the same connections, and action of the joint in resisting wind loads in addition to those of testing technique.

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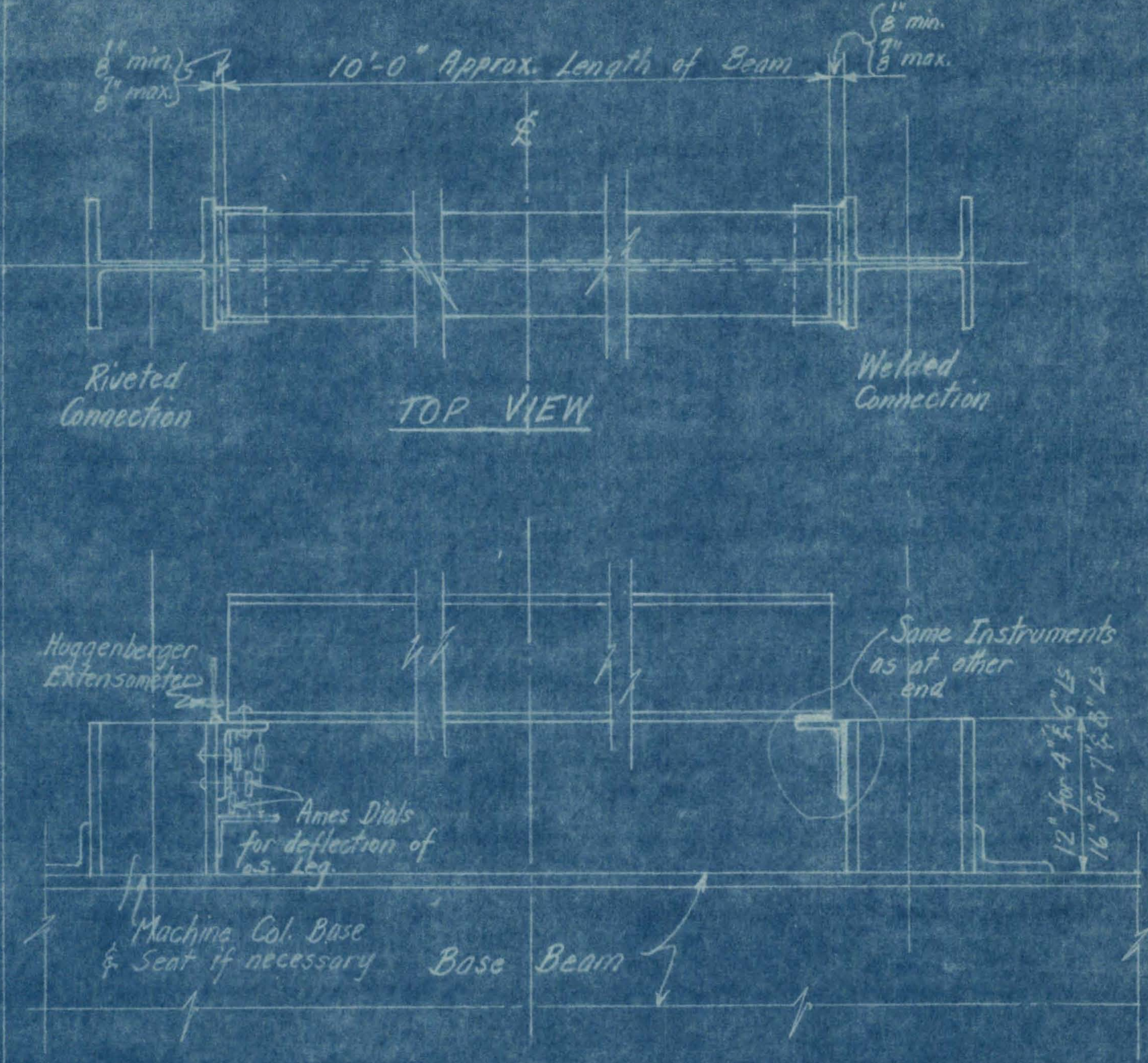

TABLE OF SPECIMENS

Specimen No.	Size of Angles	Welded End: Total Side Welds	Welded End: Size of Fillet	Riveted End: No. of Rivets	Riveted End: Dia. of Rivets	REMARKS
1	4×4×1/2	8"	3/8"	2	7/8"φ	
2	6×4×1/2	12"	3/8"	4	do.	
3	6×4×5/8	12"	1/2"	4	do.	Repeat test with Beam Flange welded, bolted & riveted to seat.
4	6×4×3/4	12"	1/2"	4	do.	
5	7×3½×7/8	14"	5/8"	6	1 φ	
6	8×3½×1	16"	3/4"	8	1"φ	
7						
8						

PROPOSED TEST SPECIMEN
MAIN PROGRAM
SEAT ANGLE RESEARCH
Scale 1" = 1'-0"

by
Norman G. Schreiner
Lehigh University
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Sketch No. 1