01 Jun 1940

Cornell University School of Civil Engineering Tests on light beams of cold-formed steel

Cornell University School of Civil Engineering

SCHOOL OF CIVIL ENGINEERING, CORNELL UNIVERSITY
TESTS ON LIGHT BEAMS OF COLD FORMED STEEL
FOR THE AMERICAN IRON AND STEEL INSTITUTE

ELEVENTH PROGRESS REPORT, JUNE 27, 1940

I. SCOPE OF THIS REPORT

All tests on the present series of 24 beams (series D and E) have been completed. In particular since the time of the 10th Progress Report the following tests have been carried out:

Failure tests on eleven beams, viz. D-18-18-88a and b; E-18-14-88a and b; E-18-16-88a and b; D-18-14-88a and b; D-18-16-88a and b; E-18-12-816a.

In addition further investigations have been made on the bottom flanges of the beams D-18-16-88a and b and E-18-12-816a.

II. METHODS OF TESTING

The failure tests have been carried out in the same way as described in the 10th Report, section II. Two photos are included in this report, the first of which shows the general set-up of the beams in the testing machine and the second of which gives a close-up view of the mounting of the strain gages and the means of taking deflection measurements. The first photo shows the beam supported by two rockers resting on an I beam extension of the table of the machine. The quarter point load is transmitted to the beam by means of an auxilliary aluminum I section fastened to the head of the machine and loaded through a roller. From this aluminum beam the load is transmitted further by the aid of two short I sections placed at the quarter points of the specimen. Between one of the I sections and the aluminum beam a roller is inserted, whereas the load is transmitted to the other I section through a half round. In order to take deflection readings, a wire is fastened to the supports of the specimen by means of C clamps. Tension in the wire is maintained by means of a rubber band. The second photo shows the mounting of eight strain gages on the top flange, six of which can be seen on the picture. The gages on the left side are mounted longitudinally, those on the right side transversely. A doorbell buzzer is attached to each gage to eliminate frictional lag. At the bottom of the picture the transformer unit used to control the intensity of vibration is shown. A 1/100 in. steel scale is seen fastened

to the center stiffener of the beam with the deflection wire in front of the scale. Deflection readings are takenon this "wire scale" set-up by means of a telescope, (not shown in the picture).

The tests on the bottom flanges mentioned in section I have been carried out in exactly the same way as heretofore.

III. TESTS ON BOTTOM FLANGES

Bottom flange tests were previously carried out on D-18-16-88a with the bottom flange as received. As pointed out in previous reports, higher location of the spot welds in the web tends to produce lateral movement of the two halves of the flange, thus increasing the stress concentration at the web. In order to further investigate this fact, tag welds were placed at 3 in. c.c. along the joint between the halves of the bottom flanges of beams D-18-16-88a and b, thus preventing motion laterally. Then the strain readings were carried out on those beams as usuab.

Several times previously it had been observed that beams failed because of spot welds failing in the vicinity of the supports. This results from the tendency of both halves of the flanges to spread apart near the supports. In order to arrive at an estimate of the force to be carried by the spot welds in order to prevent this spreading, it seemed advisable to attempt a determination of the transverse tension stresses acting in the flanges near the supports. Such an attempt was made on beam E-18-12-816a. Strain gages were mounted 3 in. from the support and 0.8 in. from the web, and strains were measured. Although the strains observed clearly indicated the presence of such tension stresses, their magnitude is too small to allow exact determination. It can only be said that at a total load of 6000 lbs. the order of magnitude of these stresses in this particular beam seems to be about 1000 to 1500 psi. With spot welds located 2 in. c.c. this would result in a tension force per weld of the order of magnitude of 100 to 200 lb. If a closer investigation of this behavior is of interest, it might be attempted analytically on the basis of Dr. Winter's thesis. Considerable numerical work would be involved in such an investigation.

IV. RESULTS

The evaluation of the data from the tests described

above was started a week ago. Since very extensive computations will be required in order to evaluate all the tests mentioned in this and the 10th Progress Reports no data resulting from the later tests are given in the present report. It is expected that all data concerning the whole work on beam testing will be worked out by the end of this summer.