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

Cornell University School of Civil Engineering

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

April, 1943

## I. SCOPE OF THIS REPORT

(1) Ten tests were conducted on the following beams (a) 13 - 1/2 - 1, 2, and 3; and 16 - 1/2 - 2. These are the last tests of the original series of beams. Specimens 16 - 1/2 - 1 and 3 after welding showed bad distortions in shape and for this reason could not be used. (b) In order to supplement the tests, six more beams with unstiffened flanges were tested. For three of these beams left over studs of the old stud tests were used. These beams are 4 in. deep and are designated as 16 - 1 - 1, 2, 3, (4"). Three more beams were spot welded in our shop from left over plate elements of the stud investigation and are designated as 16 - 1 1/2 - 1, 2, 3, (4"). It was considered desirable to make these additional tests for the following two reasons: (a) The dimensions of these beams are of the kind most likely to be used in practice, whereas many of the other beams proved too wide for practical application; (b) all other beams were 8 in. deep and therefore it seemed desirable to include beams of a different depth. These tests conclude the series with unstiffened flanges.

(2) Parallel with the tests further work was done on the final evaluation of the entire series. This work is now completed and recommendations for design specifications are being worked out. The results of this evaluation and the corresponding recommendations will be communicated shortly.

# II. GRAPHICAL REPRESENTATION OF RESULTS

Drawings 281 to 290 give the load deflection curves and the load strain curves for the beams listed above.

## III. AETHOD OF TESTING

The method of testing was the same as described in the 28th Report. The span of beams 16 - 1 - 1, 2, 3, (4") and 16 - 1 1/2 - 1, 2, 3, (4") was 66 in. Two equal loads were applied on beams 16 - 1 at a distance of 24 in. from the supports and on beams 16 - 1 1/2 at 21 in. from the supports. The spans and load positions of the rest of the beams are as originally stipulated.

#### IV. RESULTS

The ultimate load of each beam is given on the corresponding load deflection curve. It is seen that, for identical beams, these loads show little variation.

Of all the beams tested only beams 16 - 1 1/2 - 1, 2, 3, (4") kinked before failing. The kinking loads for these three beams are respectively 2000 1b., 1800 1b., and 1900 1b. Beams 16 -1 - 1, 2, 3, (4") did not snow any distortion at all, that is, they failed in pure yielding. Beams 18 - 1/2 - 1, 2, 3, and 16 - 1/2 - 2 all failed laterally without kinking. Pending the detailed evaluation it appears that this lateral failure was precipitated by yielding of the top flange.

#### V. DISCUSSION

The half-width thickness ratios of the present beams cover about the same The general behavior of these beams range as those of the thirtieth report. was exactly the same as that discussed in the 30th report, that is, only becas with comparatively large w/t ratios developed kinks before failing. Reviewing و العدية بالمنظ من يم يم الله الله و الراد بالان في هي 1 4 M 1 1 1 1 1 and a service of the the entire series of tests it becomes clear that this matter of flange distor-- ----tion and kinking below failure is evidently one of the most decisive features on which a design procedure for beams with unstiffened flanges must be based. The evidence, in this respect, obtained from the entire series appears to be sufficient for developing design procedures.

It is worth noting that of all beams tested in this series the two sets of 4 in. deep beams were the most perfect as to regularity of shape and lack of distortion.

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