(Copy)



FRITZ ENGINEERING LABORATORY
Department of Civil Engineering
Lehigh University
Bethlehem, Pa.

May 20, 1941

Mr. Brent Wiley, Managing Director
Association of Iron & Steel Engrs.
Empire Building, Pittsburgh, Pa.

Dear Mr. Wiley:

The following is a brief summary of what I gave in my report to the meeting of the Crane Specifications Committee.

First in order to review the objectives of the research, I read the summary of our PROGRESS REPORT OF CRANE GIRDER RESEARCH AT LEHIGH UNIVERSITY dated March 18, 1940.

Secondly, I reread the specific test program as given in the minutes of the meeting of March 19, 1940 and compared each section with the program actually tested. Where the reports have been completed, conclusions based on the results of that phase of the program were given.

1. Full Size Crane Tests.

(a) Lateral load tests have been made on three box girder mill cranes in the fabricating shop.

(1) No. 4683, a 10-ton riveted crane of uniform section and of 88 ft. 4 in. span.

(2) No. 8441, a 30-ton welded crane of uniform section and of 104 ft. span.

(3) No. 5886, a 60-ton riveted fish-belly crane of 120 ft. span.

These tests showed that the whole section of the box acted to resist the lateral load and should be so considered in design.

End fixity which reduced the stresses and deflections appreciably was present, but probably should not be used in design, since the loosening of the end tie in service would reduce the fixity.

A lateral load test was also made on a 175 long-ton trussed I-beam crane of 100 ft. 11 in. span.

It was found that the whole truss resisted the lateral load as a space frame.

(b) Mill Tests. Tests to measure the accelerating, braking, and impact stresses were made on the 10-ton Niles Crane in the laboratory and on three cranes at the Bethlehem Steel Company.

Impact stresses on the laboratory crane were measured by running the crane over wedges under both ends of one girder which allowed the crane to drop 9/16 in. This resulted in an impact of 56 per cent of the live load when the load was hung low and about 100 per cent when the load was hung high.

Jerk impact on this crane varied from 7 to 20 per cent with a maximum of 33 per cent.

The maximum braking force was equal to a lateral load of 12-1/2 per cent.

The tests in the Bethlehem plant were made on a 10-ton mill crane No. 430, on a 5-ton hand-operated crane No. 410, and on a 30-ton Skullcracker.

The maximum lateral force on crane No. 410 was about 6 per cent.

The maximum braking force on crane No. 430 was about 10 per cent.

The measured impact on the skullcracker was 20 per cent as the ball was released. The jerk impact was 12 per cent. The ball did not leave the magnet until about 1.2 seconds after the switch was thrown.

The above mill tests indicate that a lateral force of about 10 percent when half the wheels are braked, should be ample for design. There is not enough data to draw any conclusions on the value of impact. Further tests on this phase should be made.

2. Laboratory Tests.

The first series consisted of bending tests with l/b ratios of 80, 60, 40, 30. This ratio is the l/b ratio between the load points. The total overall ratio was 110, 90, 70, 60. Two riveted girders with l/b ratios between load points of 58.2 and 29.1 and overall ratios of 78.0 and 61.0 were also tested.

These tests showed that within the range tested there is no tendency for the girders to buckle laterally, and therefore there should be no reduction in the allowable compression stress due to this factor.

Retests were made on four of the above girders with a ten per cent lateral load. All girders failed at yield-point stress.

The second series varied the width-thickness ratio of the coverplate. Tests were made on girders with w/t ratios of 32, 48, 64, 80, 96.

Retests were made on the above girders loaded through a beam to simulate a rail.

The third series varied the h/t ratio. Tests were made on girders with h/t ratios of 320, 192, 176, 160, and 144. The girder with the h/t ratio of 320 had a longitudinal stiffener. This stiffner was found very effective in increasing the buckling stress of the girder.

Two girders of hi-tensile steel were also tested. These girders were similar to carbon steel girders in the other series. The use of the hi-tensile steel increased the strength of the girders in proportion to the increase in yield point.

No appreciable stress was found in the diaphragms of the girders in the bending tests.

Torsional tests were made on two riveted I-beams and on two I-beams with intermittent welds. The torsional rigidity of the riveted I-beams was about 1/3 the theoretical, and the welded was more than 2/3 the theoretical.

Three riveted box girders with various diaphragm spacings were also tested. Their torsional rigidity averaged about 1/3 the theoretical.

The above summarizes briefly what we reported at the meeting. If this does not cover all your points, please let me know.

Very truly yours,

(signed)

I. E. Madsen
Asst. Research Engineer

IEM:EY