

bread, the standardization of containers for foodstuffs, weights and measures education in the schools, and machine measurements for dry-goods; and the resolutions adopted by the Conference. The report of the committee on specifications and tolerances which was devoted to the subject of liquid-measuring devices is given, as well as the discussion concerning the various provisions. The appendix consists of the complete specifications and tolerances adopted for this class of apparatus.

**EFFECT OF REPEATED REVERSALS OF STRESSES ON
DOUBLE REINFORCED CONCRETE BEAMS.⁸**

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[ABSTRACT.]

THE tests reported in this paper were made as a part of the investigations carried out in the concrete-ship program of the Emergency Fleet Corporation. The purpose was to stimulate to some extent the effect produced upon a ship by the action of the waves which causes an alternate upward and downward deflection of the ship. This is the action known in ship-building terms as "hogging" and "sagging."

The specimens used for the test were concrete beams which had reinforcement both in the top and in the bottom. The beams were 4 by 6 inches in cross section over all and were tested with a span of 8 feet. The load was applied at points 12 inches apart, each point being 6 inches from the centre of the span. It was applied at the rate of about seventeen cycles per minute (one cycle includes one application of load upward and one application of load downward). The load was applied as dead weight by means of levers so designed that ten times as much load came upon the beam as was applied to the lever. The levers were operated by means of an electric motor acting through a walking beam.

Four beams were tested to failure and a fifth was loaded alternately through two million cycles when the test was discontinued. At the time of discontinuation of the test the beam did not appear to be approaching failure.

For all of the beams tested to failure, failure was by tension in the steel. Generally the beams in which the highest stresses were developed in the test withstood a smaller number of repetitions of load than those in which the measured stresses were

⁸ Technologic Paper No. 182.

smaller. However, even the largest number of repetitions was so small that failure in the steel would not have been expected at the time at which it did occur considering that the observed stresses were very low. Other factors than the intensity of the tensile and compressive stresses seem to have had a part in bringing about the early tension failure.

All of the tension failures in the reinforcing bars occurred at sections where large cracks extended entirely across the section of the beam. It is possible that in some cases the bending at these cracks was sufficient to make the bending of the bar an important factor in causing failure. The slipping of bars at the ends, such as happened in one of the beams, would permit the opening of wide cracks and accentuate this tendency.

The presence of the gage holes in the bars seems to have had some influence in hastening tension failure, but this influence was not very distinct.

The quality of steel used for most of the reinforcement was poor and this would contribute to bringing about early failure. However, this alone would not account for the small number of repetitions of stress generally required in these tests to produce failure.

After 7000 cycles of load the slip at the end of the bar in one of the beams was less than 0.001 in.; that is to say, less than the amount which has been taken as the criterion of safe conditions based on tests of the bond resistance between concrete and steel. Yet, after 400,000 cycles of load, the amount of slip had increased so much that failure by slipping of the bars seemed imminent. It seems that the intervention of tension failure at an unexpectedly small number of repetitions of load prevented the bond failure of this specimen.

**PHYSICAL PROPERTIES OF MATERIALS: COMPILED TABLES.
I. STRENGTHS AND RELATED PROPERTIES OF
METALS AND CERTAIN OTHER ENGI-
NEERING MATERIALS.⁹**

[ABSTRACT.]

THIS circular aims to present, in readily accessible form, the best available data on the strengths and related properties of metals, alloys, and certain non-ferrous metals. Among the mate-

⁹ Circular No. 101.