pier of nearly 190 cu. ft. volume had a strength per square inch of cross sectional area proportional to one of 8 cu. ft. volume. The pier actually displayed an ultimate strength of 2,917 lbs. per square inch, indicating substantially the same strength in each size. Similarly the pier which was laid in lime mortar was expected to have an ultimate strength somewhat less than 900 lbs. per square inch. It failed at 757 lbs. per square inch.

Owing to their great size the piers were built in the testing machine, where they seasoned until the time of testing. The test of the cement mortar pier was completed when four weeks and three days old. Ten gauged lengths in all of 20 ins. length each were established on the four sides, the extremities of which were defined by small metal plugs cemented in the bricks. As loads were applied and advanced the compression of the pier was measured on these 20-in. lengths by means of a strain gauge, in practically the same manner as thermal effects on cement filled brick pavements are being observed by means of that instrument. The compression of the lime mortar pier was measured when it was 25 days old.

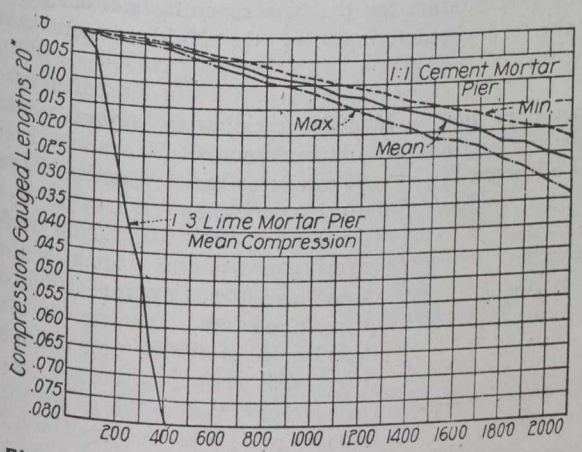

Fig. 1.—Curves Showing Relative Compressibility of Brick Laid in Cement and Brick.

The results of the tests were as shown by Table I.

In failing, along the middle of their heights, the sides opened laterally. Frictional resistance at the ends, between the brickwork and the platforms of the testing machine, strengthened the piers against lateral deformation and probably influenced the pyramidal shapes assumed after rupture. The manner of failure of these large piers was the same as that witnessed in piers of smaller dimensions.

Diagrams are presented to illustrate the behavior of these piers during test and at their ultimate strength. Figure 1 shows the compression curves of the two piers as loads were successively applied. The pronounced difference is in their rate of compressibility is well indicated. This difference is, of course, due to the difference in the mortars used. These curves represent the total compression of the brickwork, which in the case of the lime mortar pier was chiefly permanent set. But that of the cement mortar pier at 1,000 lbs. load was about one-third permanent set and two-thirds elastic compression, or, stated differently, the cement mortar pier would recover about two-thirds of the observed compression upon release of load.

Three curves are given for the cement mortar pier, one representing the mean compression, one representing the minimum compression of the several gauged lengths and one gauged length which displayed the maximum compression. Since the ends of the pier were in contact with and were moved by the rigid platforms of the testing machine this difference in the amount of compression on the several gauged lengths, which were established along the middle of the height of the pier, represents unequal compression locally, and would occasion bending stresses in the bricks and lead to the formation of transverse fractures.

HYDRO-ELECTRIC POSSIBILITIES OF THE MAITLAND RIVER, ONTARIO.

In June of 1912, a report on the power possibilities of the Maitland River was made to the Hydro-Electric Commission of Ontario by Mr. H. G. Acres, hydraulic engineer to the commission. This report, which is incorporated in the last annual report of the commission, just published, gives a considerable amount of data regarding the hydrology of the stream, together with an analysis of the possibilities of commercial development. The report is given herewith in full:

The natural source of power for the county of Huron is the Maitland River, which rises on the height of land between Lake Erie and Georgian Bay, and flows into Lake Huron through the town of Goderich. The watershed of this river is about 950 square miles in extent, and is largely drained and deforested. As a result, the natural flow characteristics have been destroyed, and the watershed of the Maitland River, in common with the watersheds of other rivers in the southwestern peninsula, has an uncontrolled run-off which produces heavy spring freshets, and a consequent low discharge during the late summer and early autumn periods.

The abnormal flow characteristics of the Maitland River to a large extent discount its value as a source of power, the more so by reason of the fact that its watershed is almost entirely lacking in natural storage basins. The country throughout the whole area is cleared and for the most part cultivated, so that the land damages and construction costs in connection with the establishment of remedial works of sufficient magnitude to adequately offset the effects of drainage, cultivation and deforestration would be prohibitive. In view of this fact, the power possibilities of the Maitland River, considered as an independent source of continuous power, can only be discussed on the basis of minimum flow, in conjunction with such advantages as can be derived from local pondage.

The total drop of the Maitland River from headwaters to mouth is approximately 900 feet, but the topography of the watershed is such that no natural heads of any consequence exist, the gradient of the river-bed being fairly uniform and the average velocity high. As a result, power can only be developed by diversion or by the creation of an artificial head, or by a combination of both methods. This condition, in conjunction with the poor run-off regulation, will tend to make power development expensive, and to increase the annual cost of power.

The above general facts and the general conclusions deduced therefrom, comprised practically the sum total of all hydraulic data in connection with the Maitland River which could be safely used when the Huron County scheme first became a definite issue. The proper consideration of the scheme, therefore, necessitated at the outset a systematic investigation of the flow characteristics of the Maitland River. Owing to the desire of the county authorities to have a report at the earliest possible date, it was decided to carry on the hydraulic investigations for one year only, the understanding being that any conclusions arrived at by the end of that period should not be considered as final, but merely as indicating reasonable possibilities. The extent to which this end was attained will now be considered.