

and concretes. The test pieces used were small cubes or spheres of mortar or concrete, which were placed in the test chamber in sets of three or four, with or without a charge of metal shot. On account of the small test pieces which must be used, these tests have not proved entirely satisfactory.

Development of Rattler Test.—The development of the rattler test for paving brick is of interest in this connection. The present standard rattler is an adaptation of the ordinary foundry rattler. The Talbot-Jones rattler was designed for testing paving brick, but was not officially adopted as a standard method.

A "pavement determinator" was on exhibition in Detroit and at the Cement Show in Chicago in 1913, for use in testing sections of finished pavements. This was a motor-driven mechanism which subjected the pavement to impact stresses closely approximating the action of horses' hoofs. The cost of this method would make it prohibitive for either research or routine testing.

As early as 1913 Professor Charles F. Shoop, of the University of Minnesota, made use of the Talbot-Jones rattler for studying the wearing resistance of concrete.

In the tests carried out by Professor Shoop, the test piece was a ring 28 ins. inside diameter, 4 ins. thick and $8\frac{1}{2}$ ins. wide. These rings were cast in a horizontal position with the axis vertical, and were reinforced with two circular steel bars.

Method of Testing.—The writer is now making studies of the wearing resistance of concrete at the Structural Materials Research Laboratory, Lewis Institute, Chicago, in which the Talbot-Jones rattler is being used. The machine is shown in Figs. 1 and 2. The test pieces consist of blocks 8 ins. square and 5 ins. in thickness. The blocks are arranged around the perimeter of the drum of the rattler, as shown in the accompanying illustrations. Ten blocks constitute a test set. The concrete test pieces are separated by wedge-shaped wood blocks. The ten-sided polygon formed by the test blocks presents a nearly continuous inner surface, as shown in Fig. 2. The out-

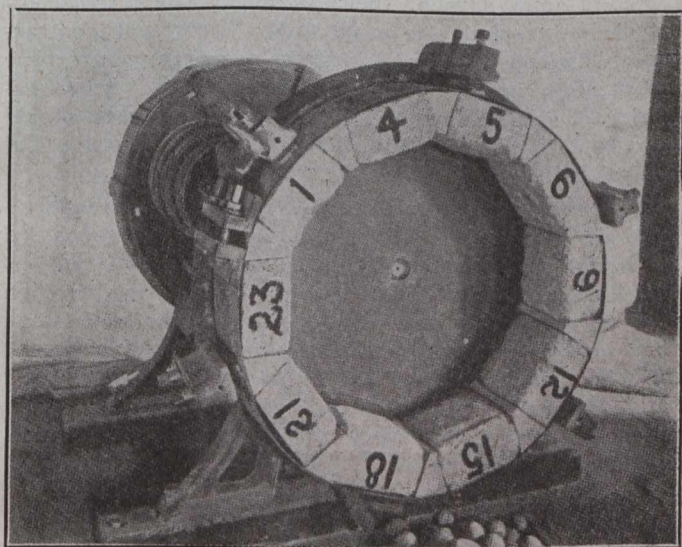


Fig. 2.—View of Blocks After Completion of Test.

side diameter of the polygon thus formed is 36 ins., and the inside diameter 26 ins. During the test, the front of the chamber is closed by means of a heavy wire screen.

The abrasive charge consists of 200 lbs. of cast-iron spheres—about 133 spheres $1\frac{1}{8}$ ins. and 10 spheres $3\frac{3}{4}$ ins. in diameter. These spheres conform to the specifica-

tions for spheres for use in the standard rattler test of paving brick. The test consists of exposing the inner faces of the concrete blocks to the wearing action of the charge of cast-iron spheres for 3,600 revolutions, at the rate of about 30 r.p.m. Best results have been obtained by reversing the direction of the machine two or three

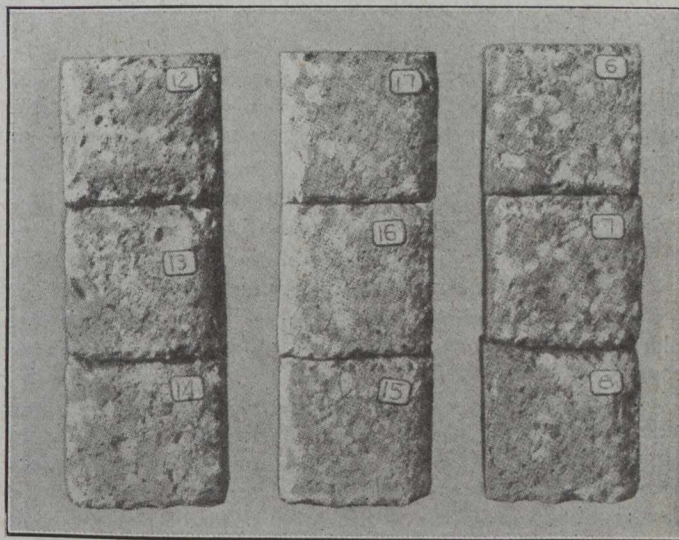


Fig. 3.—Concrete Blocks After Test. Blocks 8 ins. Square, 5 ins. Thick, Age About 5 Months.

Nos. 6, 7, 8 1: $1\frac{1}{2}$: $2\frac{1}{2}$ gravel concrete.
Nos. 12, 13, 14 1: 2: 3 gravel concrete.
Nos. 15, 16, 17 1: 2: 3 limestone concrete.

tions during the test. Each block is weighed immediately before and immediately after the test. The loss in weight is considered to be the wear. This loss may be reduced to a percentage of the original weight, or it may be expressed as depth of wear in inches. In comparing concretes of widely different characteristics, or in comparing concrete with other materials, the latter method is preferable.

Results of Tests.—About 200 concrete blocks have been tested in this way. The tests thus far made have been carried out primarily for the purpose of studying the action of the machine. The weight of shot to be used, the proportion of small and large spheres, the rate and number of revolutions, the effect of the position of the block in the ring with reference to other blocks of the same or widely different properties, have been studied. A few variations in the mix, aggregates, condition of storage of the concrete, etc., have been made, but the tests are not considered to be of sufficient scope to justify presenting the results at this time. The loss in weight due to the test has varied from 8 to 25 per cent. Figs. 2 and 3 show the appearance of representative blocks after the test. A few paving brick have been tested in the same ring as the concrete blocks, with satisfactory results.

In making the concrete test blocks, it is our custom to proportion and mix each block separately. Only in this way can consistent results be secured. Metal forms made from 5-in. steel channels are used. These forms make it possible to mold the blocks of uniform size and true to shape. Blocks which have been stored in water or in damp sand are allowed to dry out a few hours prior to test, in order that the weights may not be appreciably affected by evaporation during the test.

Advantages of Rattler Test.—This method of making wear tests of concrete is believed to have the following advantages:—