A METHOD OF MAKING WEAR TESTS OF CONCRETE.*

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Summary.—The extensive use of concrete in the wearing surface of roads and pavements gives interest to wear tests of concrete.

A brief review is given of tests which have been used for determining the wearing resistance of concrete aggregates and concrete.

A method is described for conducting wear tests on concrete blocks 8 ins. square and 5 ins. thick by means of the Talbot-Jones rattler.

This method is believed to offer the following advantages:—

1. The concrete is subjected to a treatment which approximates that of service.
2. The test piece is of usual form and of sufficient size that representative concrete can be obtained.
3. The test pieces are convenient to make, store and handle, and require a relatively small amount of concrete.
4. The cost of tests is not excessive.
5. The machine used is found in numerous testing laboratories.
6. The wearing action takes place on the top or finished surface of the concrete. This makes it possible to study the effect of various surface treatments or finishes.
7. Several tests may be made at the same time, thus enabling more representative results to be obtained.
8. Tests may be made on sections of concrete cut from roads which have been in service.
9. Other paving materials, such as brick, granite blocks, etc., may be tested in the same way as the concrete.

THE extensive use of concrete as the wearing surface of roads and pavements has given renewed interest to experimental studies of the wearing resistance of concrete.

If weather resistance and structural stresses are properly provided for, the life of a road will depend on the wearing resistance of the material of which it is built. Satisfactory wearing resistance is one of the most important considerations of any materials to be used in road surfaces.

Wear, in the sense in which the term is here used, results from combinations of stresses such as abrasion, impact, bearing and crushing. Wearing resistance is a function of the hardness, toughness, brittleness, etc., of a material. In the case of homogeneous materials, such as natural rocks, it may be satisfactory to study the individual properties mentioned above; however, with a material of the nature of concrete, it is preferable to study the wearing resistance directly, without reference to the value of the more elemental properties.

Numerous testing machines have been designed for use in determining the abrasive resistance of natural rocks, cement mortars and brick. The following are typical of the methods which have been used:

Dorry Hardness Testing Machine.—The Dorry hardness testing machine has been used for natural rocks. The test pieces consist of 1-in. cylinders cut out by means of a core drill. The cylinders are tested in pairs by being held in a vertical position with a constant pressure against a revolving metal disk. The abrasive agents are crushed quartz and water. The hardness of the material under test is measured by the depth of wear. This test was devised by the French School of Bridges and Roads, and used by United States Office of Public Roads and Rural Engineering for tests of rocks for macadam road construction. This test is carried out with considerable difficulty and is of doubtful value as an indication of the useful properties of a rock; it is not adapted to testing concrete aggregates in the form in which such materials are delivered for use, the specimen being too small for use in mortar and concrete tests.

Machines with a cylindrical drum against which the test piece is held have been used in carrying out tests of the same nature as those made in the Dorry machine.

Sand Blast.—The sand blast has been used for testing the wearing qualities of natural rocks, bricks, etc.

On account of the absence of the element of impact, the above-mentioned methods are not satisfactory for tests of concrete.

Deval Abrasion Testing Machine.—The Deval abrasion testing machine for crushed rocks consists of a closed metal cylinder mounted in an inclined position on a horizontal axis which is caused to revolve at a fixed rate. The test sample consists of about 50 pieces of crushed rock weighing 5,000 g. The abrasive action is derived from the falling and rubbing of the particles on each other and on the walls of the cylinder, 10,000 revolutions at about

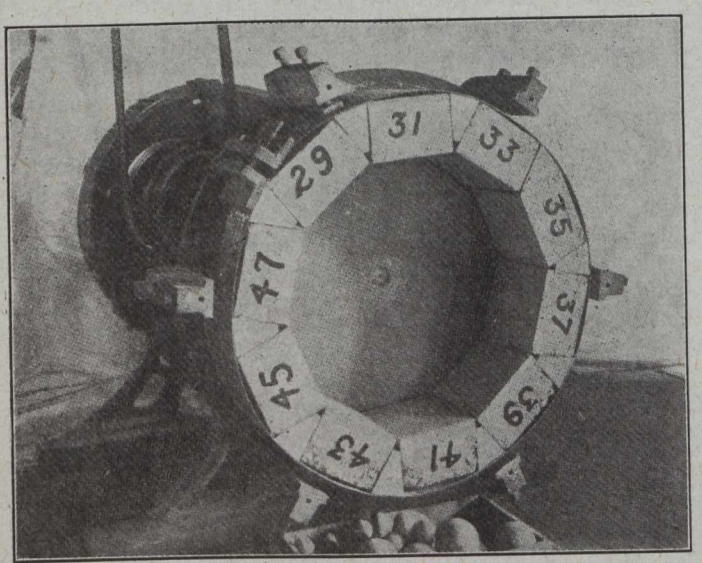

Fig. 1.—View of Blocks Before Test.

30 r.p.m. constituting a test. The percentage of wear is computed from the weight of material which is reduced to a size smaller than a 1/16-in. sieve. This test was devised by the French School of Public Bridges and Roads, and has been adopted by the American Society for Testing Materials as a standard test for abrasion of road materials. The indications of this test have been widely used as a criterion of the value of rocks for macadam road building. The test is of doubtful value in indicating the suitability of an aggregate for concrete road construction. The size of pieces required by the present standard test is not readily obtainable from the aggregates commonly used in concrete road construction. It is not applicable to tests of gravel.

A modified form of the standard Deval test has been used for testing gravel by the Ohio State Highway Department. In this test 2,500 g. of gravel between the ½ and 1-in. screens, and a similar weight of material between the 1 and 2-in. screens, are used with an abrasive charge which consists of six cast-iron spheres 1⅞ ins. in diameter. Otherwise the test is conducted in the same way as the standard test.

Several attempts have been made to use the Deval machine for studying the wearing resistance of mortars

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