TESTS OF CONCRETE SLABS TO DETERMINE THE EFFECT OF REMOVING EXCESS WATER USED IN MIXING.*

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THE importance of proper water content for concrete is generally recognized. The amount of water producing a maximum strength makes such a stiff mixture that it is impracticable in most concrete road work. It is necessary, therefore, to use a certain excess of water above that which will give the greatest strength.

In concrete road work, owing to the method of handling, it is of considerable convenience to use a fairly wet mixture. It has been found, however, that much of the excess water can be removed by proper manipulation of the concrete after it is placed. As a consequence, some methods of finishing concrete roads have been productive of exceptionally good results. A study of the methods employed shows that while they differ as to detail, in each case the concrete surface has been so treated as to remove a considerable amount of the excess water, thereby making the surface more compact and dense.

Of the different methods which have been observed, that devised by Captain Gaillard, city engineer of Macon, Georgia, seems to be the most efficient and least expensive. This method consists in rolling the surface of the concrete with a light roller about 8 ins. in diameter and 5 to 6 ft. in length, attached to the end of a long pole. The roller is made of light sheet metal; the total weight of a 6-ft. roller being in the neighborhood of 70 lbs. The operator stands at one side of the roadway and rolls the newly laid concrete transversely to the direction of the road.

This method was originally developed to remove any unevenness in the surface, but it really accomplishes a very much more important result as it squeezes out of the concrete much of the excess water.

In order to determine the effect on the strength of a concrete produced by the finishing method described above, a number of slabs were made for testing purposes, mixed and molded in much the same manner as in concrete road work, the exact proportions of water and other materials being recorded. The principal variation was in the consistency of the concrete and the method of finishing the surface.

The tests were made in co-operation with Prof. D. A. Abrams, in charge of the Structural Materials Research Laboratory, Lewis Institute. Professor Abrams gave his personal supervision to all of the details of the tests.

Twelve slabs, 2½ ft. wide, 5½ ft. long and 5 ins. in thickness, were made and tested. Pebbles were used as coarse aggregate for six of these and crushed limestone was used for the others.

The concrete was mixed in the proportion of 1 part cement to 4 parts total mixed aggregate by volume—a proportion approximately equivalent to the ordinary 1:2:3 mix. Three sets of slabs, two slabs in each set, were made from both crushed limestone and pebbles as a coarse aggregate.

The following consistencies of concrete were used in the test:—

1. Dry consistency, finished with a wood float in the ordinary way;

2. Wet consistency, finished with a wood float in the ordinary way;

3. Wet consistency, finished by means of a roller, as previously described.

The slabs were made on the concrete floor of the laboratory, the form being placed on a sheet of building paper.

The concrete for the slabs of dry consistency was mixed as stiff as could be easily handled—stiffer than is ordinarily found in concrete road work. The mixtures for the remaining slabs contained a somewhat larger amount of water, making a consistency that would ordinarily be classed as "good" in practical work. (See Table I.)

All slabs of the stiffer consistency, as well as one of the slabs of each other set, were finished by being first struck off with a straight edge and then floated by hand with a wooden float. The remaining slabs of each of the wet consistency sets were finished by the use of a roller. The concrete was left a little more than flush with the sides of the mold, and instead of being struck at once with a straight edge, it was first rolled; the straight edge was then used to strike off what surplus concrete remained. To bring the full weight of the roller—which was just long enough to rest upon the side forms—on the concrete the slab was rolled transversely at intervals of about 15 minutes for 1½ hours, five rollings being made. The roller was moved back and forth over the width of the slab, moving sidewise a few inches with each stroke. As each rolling was made, considerable water was squeezed out of the concrete and forced over the sides of the mold. The rolling continued until the amount of free water became very small. No particular difference in the amount of rolling to effect this was noticeable for the limestone concrete and the gravel concrete. It was noticed, however, that the roller sank into the gravel concrete considerably more than into the rock concrete during the first one or two rollings.

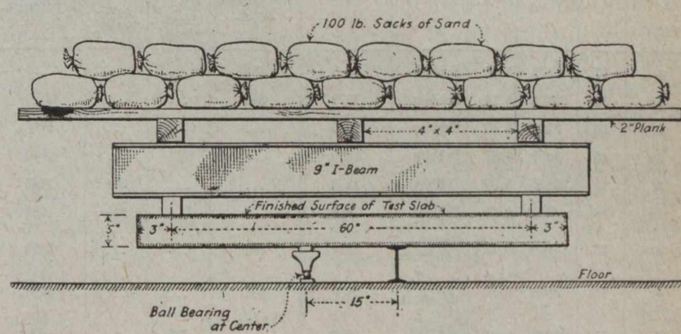

Fig. 1.—Method of Testing Slab.

The roller used was 2½ ft. long, 6 ins. in diameter and weighed about 50 lbs. In practical road work, an 8-in. roller about 6 ft. long, weighing about 70 lbs., is recommended.

The forms were removed the following day, when the slab was covered with a layer of damp sand which was kept moist until the slabs were one week old. The sand was then removed and the slabs lifted from the floor and permitted to dry out during the remaining eight days before the load was applied.

The arrangement for applying the load to the slabs is shown in Fig. 1. The slabs were placed on two supports spaced 15 ins. on centres, resting on the floor. A ball bearing on the lower side of one support compensated for what warp there might be in the lower surface of the slab. The load, which consisted of 100-lb. sacks of sand, was supported by two 9-in. I-beams, and was transmitted to the slab through two bearings spaced 5 ft. apart. The upper surface of the slab was thus put in tension. Each

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