Bulking Effect of Moisture in Sands

Varying Percentages of Moisture in Sand Aggregate an Important Factor in Concrete Making—Wet Sands Weigh Less than Dry— Suggested Methods of Overcoming Irregularities due to Moisture.

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A DEFINITE knowledge of all the conditions which tend to produce widely varying results affecting the strength and durability of concrete, is necessary to a thorough understanding of the full range of its usefulness. "The methods and operations used in the making of concrete are vital factors in the production of conditions affecting the density, strength and permanance of the concrete mass. The materials are too frequently a means to an end without consideration of the end itself."

Before making a laboratory investigation of the mortar or the concrete making qualities of a given sand, the sand particles are very commonly surface dried and the test batch, whether proportioned by the Heath-Edwards "surface area" method, by the Abrams "fineness modulus" method, or by the time-honored but nevertheless irrational and unscientific "arbitrary volume" method, is based upon the use of a weighed quantity of the dry sand. The stone aggregate for a concrete mix is also very commonly dried before being used. The results of the investigation are, therefore, to be interpreted only on the basis of using dry aggregate. It is well nigh axiomatic that if results consistent with those secured from laboratory tests are to be obtained upon the construction work, the conditions under which the sand con-

old practice is, to say the least, haphazard, and when applied to the measuring of the sand aggregate is productive of widely varying results.

Upon the average construction, job so called "barrow measurement" of the sand is the rule; measurement by "struck" box, or better still, by weight, are the exception.
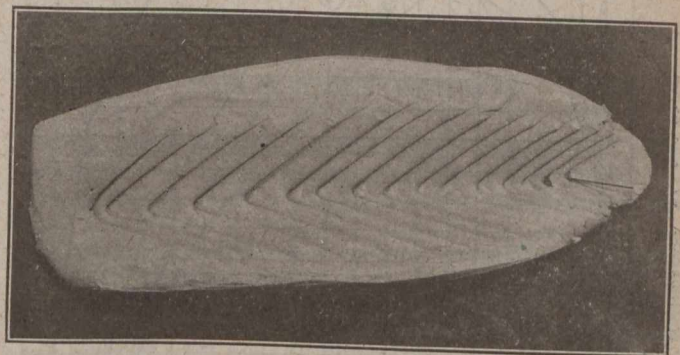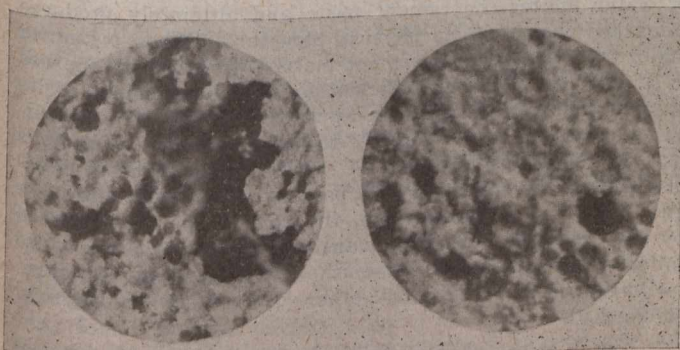

FIG. 2—CONSISTENCY TEST FOR NEAT CEMENT

Assuming that the engineer, or his inspector, has gauged the barrows and has indicated by plainly visible marks the height to which each barrow is to be filled, the careful filling of the barrows will then depend mainly upon the personal equation of the laborers, the personality and vigor of the inspector and the co-operation of the foreman. The volume of sand placed in each barrow will rarely be less than that indicated by the gauge mark. Very commonly, the laborer shows his goodwill toward his employer by the addition of one or more shovelfuls for luck and good measure. The shape of the barrows commonly used tends to minimize rather than exaggerate the appearance of the variations in "barrow-measured" quantities, and, in consequence, these variations are frequently greater than is commonly supposed. Obviously, the strength of the mortar, or of the concrete produced by the use of a given sand, will vary with the irregularities in the measured volume of the sand content of the individual batches.

"NORMAL" CONSISTENCY "WET" CONSISTENCY

FIG. 1—TEXTURE OF CEMENT MATRIX IN CONCRETE OF DIFFERENT CONSISTENCY (x 60)

tent of the mix is measured, must be such as to assure a reasonable uniformity in the net volume of sand entering into each batch.

Notwithstanding the important improvements made in recent years in the manufacture of Portland cement and in the power driven machinery and other accessions used in the field, the method commonly used for measuring the ingredient materials of the mix is by loose volume. This century

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The paucity of published data relating to the effect of varying percentages of water contained in sand aggregate used in mortars and concretes is evidence that this feature has not been given sufficient attention by engineers, architects and construction men. It is not the intention to indulge in a lengthy discussion of all the principles involved, but rather to point out the fallacy of the commonly used method of mortar and concrete making in so far as resulting