in Table V. The economy of the surface-area method of proportioning is here apparent.

Concrete Strength Tests

Fig. 11 shows the average strengths obtained from the tests of concretes and from the tests of mortars secured from the mortar portions of these concretes. For purposes of direct comparison, the average of strengths obtained from normal consistency mortars, sands O and Q, are also shown. In this connection a comparison with Fig. 13 is of interest.

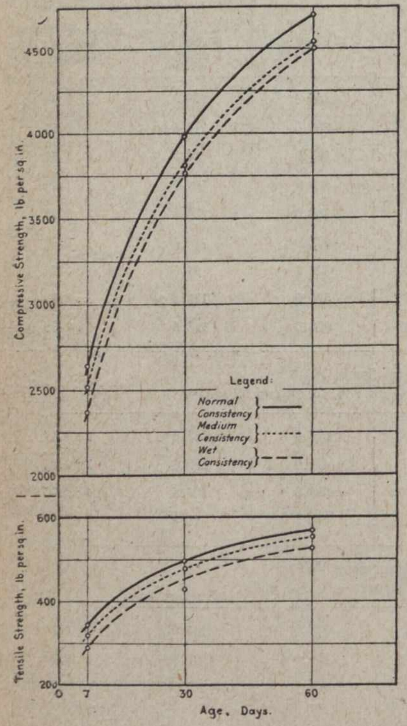

Fig. 12—Strength of Mortars of Different Consistencies and Ages; Sand Q; 1 g. Cement: 15 sq. in. Sand Area

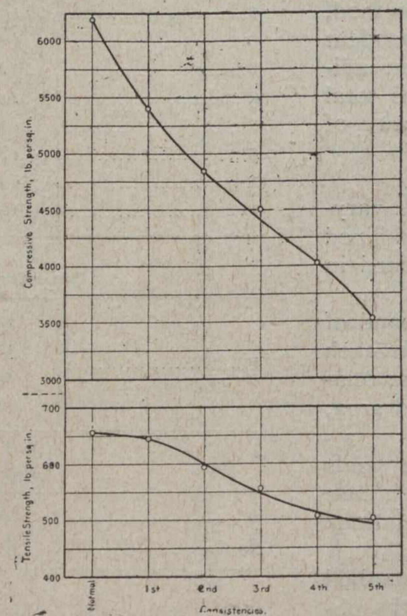

Fig. 13—Strengths of Mortars of Different Consistencies, Age 60 Days; Sand F; 1 g. Cement: 10 sq. in. Sand Area

The weaker strength of the concretes as compared with the mortars is doubtless due in part to the weakening effect of cleavage planes produced by the stone aggregate. A comparison of the strengths shown in Fig. 11 indicates a probability that by this method of proportioning, the relative values of sands for use in concretes can be determined from a comparison of mortars, the cement content of which bears a common ratio to the areas of the sands compared and the water content of which is the same as that to be used in the proposed concrete. The low strength of sand O mortar at an age of 30 days is probably due to the weakening effect of stone particles over ¼ in. in size contained in the mortar as a result of screening through a ⅜-in. screen.

Miscellaneous Tests

In connection with the foregoing tests three miscellaneous tests were made having an indirect relation to the results obtained therein. A description of these tests, together with the results obtained, follows.

Effect of Consistency of Mix upon the Strength of Mortars.—This test was undertaken with the object of securing information indicating the change of strength resulting from (1) the mixing, either by intent or by accident, of test mortars of too wet consistency, and (2) a variation of the water content of the mix from that required to produce a "normal" consistency mortar to that producing a "sloppy" mix, such as is frequently found in concretes of too wet consistency.

In each of these tests the relation of the cement content of the mix to the surface area of the sand aggregate was constant for each series; that is, for the first series a proportion 1 g. cement to 15 sq. in. sand area, and for the second series a proportion 1 g. cement to 10 sq. in. sand area. Sand Q was used in the first series and sand F in the second series.

Table VIII. shows the compositions of the mortars and Figs. 12 and 13 show the average strengths obtained from test specimens for each series of tests.

Weight-Volume, Cement Paste Test.—This test was made as a check upon the common assumption that 110 lbs. of dry cement produces 1 cu. ft. of cement paste. It was found that 2,000 g. of cement when thoroughly mixed with 445 cc. of water (normal consistency) produces 1,140 cc. of paste, corresponding to 109.52 lbs. of dry cement to produce 1 cu. ft. of paste.

An increase of 35 cc. in the volume of water used produced an increase of 20 cc. in the volume of paste, which corresponds to a decrease of 2.11 lbs. in the weight of dry cement required.

Bulking Effect of Cement Content of Mortars.—The bulking effect of the cement was especially noticeable in test mortars in which the granulometric composition or grading of the sands was such as to give comparatively large computed surface areas. Its variation with the proportion of cement used in relation to the surface area was also noted. Both conditions are in full accord with the primary principle of this method of proportioning.

Fig. 14 shows a series of mortar cylinders in each of which 1,200 g. of sand F were used and the cement content was successively decreased in the proportions: 1 g. cement to (a) 5, (b) 10, (c) 15, (d) 20, (e) 25, (f) 30, (g) 35 and (h) 40 sq. in. sand area. The cylinder (i) at the extreme right-hand end of the series contains only a sufficient quantity of cement (15 g.) to retain the 1,200 g. of sand in a cylindrical form, thus permitting a close comparison with the compacted bulk of the sand alone. Fig. 15 shows the relative percentages of volume in relation to the volume of the "sand" cylinder above described.

Table VIII.—Consistency Tests: Composition of Mortars

Test Series No. 1c.
Cement Content—1 g.: 15 sq. in.—Sand Q.

Consistency.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Percentage of Water to Cement and Sand.
Normal	6391	426	124	8.69
Medium	6391	426	136	9.54
Wet	6391	426	147	10.31

Test Series No. 2c.
Cement Content—1 g.: 10 sq. in.—Sand F.

Consistency.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Percentage of Water to Cement and Sand.
Normal	6769	677	183	10.91
First	6769	677	217	12.94
Second	6769	677	251	14.97
Third	6769	677	285	16.99
Fourth	6769	677	319	19.02
Fifth	6769	677	353	21.05