PROPORTIONING THE MATERIALS OF MORTARS AND CONCRETES BY SURFACE AREAS OF AGGREGATES

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(Continued from last week's issue.)

HAVING determined the means of securing a "normal," uniform mix, little difficulty was encountered in the preparation of test mortars intended to establish the efficiency of the primary theory of this method, namely: "The strength of mortar is primarily dependent upon the character of the bond existng between the individual particles of the sand aggregate. Upon the total surface area of these particles depends the quantity of cementing material."

Test mortars were prepared as follows:—

1. A series of nine mortars, composed of sands varying widely in their granulometric composition, combined in each case with a quantity of cement proportioned in the relation: 1 g. cement to 13 sq. in. sand area.

2. A series of four mortars, composed of a sand of uniform granulometric composition, combined in each case with quantities of cement proportioned in the relation: 1 g. cement to 10, 15, 20 and 25 sq. in. sand area, respectively.

3. A series of two mortars, composed of the sands used in two of the concrete tests, combined in each case with a quantity of cement proportioned in the relation: 1 g. cement to 15 sq. in. sand area.

It is evident that, if the primary theory of this method of proportioning is correct, the ultimate strengths obtained from the first series of tests will be uniform and equal. It is equally evident that the relation of the ultimate strength to the cement content of the mortar is securable from the results of the second series. However, it must be borne in mind that the strengths obtained in each series are not necessarily the same as those which might be obtained from the use of a sand having its origin in a different rock material. The third series of tests provides a means of comparing the ultimate strengths obtained from mortars of normal consistency with those obtained from the mortar content of concretes forming a part of the general tests herein described.

Table VII.—Strength Tests: Composition of Mortars

Sand Letter.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Ratio of Cement to Aggregate by Weight.
Test Series No. 1 — Cement Content—1 g. : 13 sq. in.				
A	5 856.6	450.5	128.0	1 : 2.22
B	5 106.1	392.0	111.5	1 : 2.55
C	7 683.7	591.0	134.5	1 : 1.69
D	6 758.4	520.0	148.0	1 : 1.92
E	12 816.4	986.0	280.5	1 : 1.12
F	6 769.1	521.0	148.0	1 : 1.92
G	4 182.0	321.5	91.5	1 : 3.11
H	6 564.6	505.0	143.5	1 : 1.98
I	6 564.6	505.0	143.5	1 : 1.98
Test Series No. 2 — Cement Content—1 g. : 10, 15, 20 and 25 sq. in.				
F	6769	677.0	183.0	1 : 1.47
	6769	451.0	132.5	1 : 2.21
	6769	338.5	105.5	1 : 2.95
	6769	270.5	92.5	1 : 3.61
Test Series No. 3 — Cement Content—1 g. : 15 sq. in.				
O	7353.4	490.0	144.0	1 : 2.41
Q	6391.0	426.0	126.0	1 : 2.35

Table VII. shows the composition of the test mortars of the three series described above. It also shows for each mortar the ratio existing between the cement content and the sand aggregate, by weight.

Fig. 8 shows the average ultimate compressive and tensile strengths obtained from test specimens of the first and third series while Fig. 9 shows the results obtained from the specimens of the second series.

Fig. 10 was deduced from the information contained in Tables VI. and VII. It shows by percentages the relation between the surface area of sand E and that of each of the other sands described

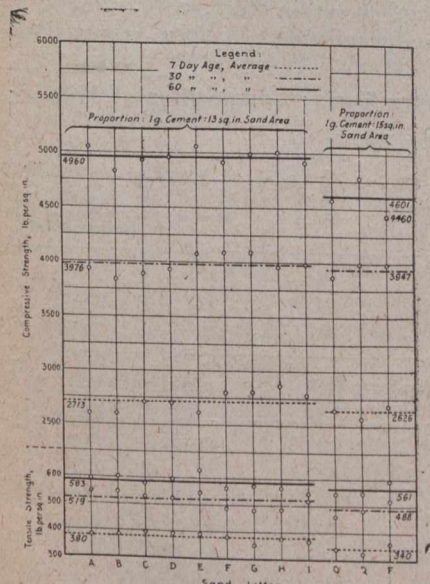

Fig. 8—Strength Tests—Compressive Strengths of 2-in. Mortar Cylinders and Tensile Strengths of Mortar Briquettes

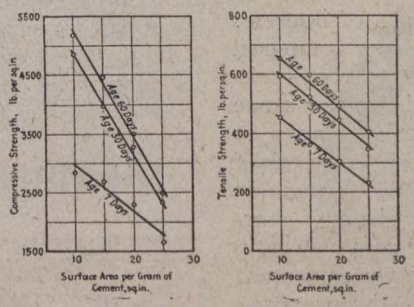

Fig. 9—Strength Test—Compressive Strengths of 2-in. Mortar Cylinders and Tensile Strengths of Mortar Briquettes; 1 g. Cement: 10, 15, 20 and 25 sq. in. Sand Area

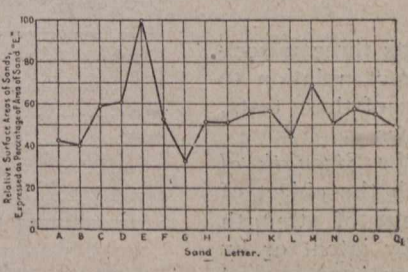

Fig. 10—Relative Surface Areas of Sands (Deduced from Tables VI. and VII.)

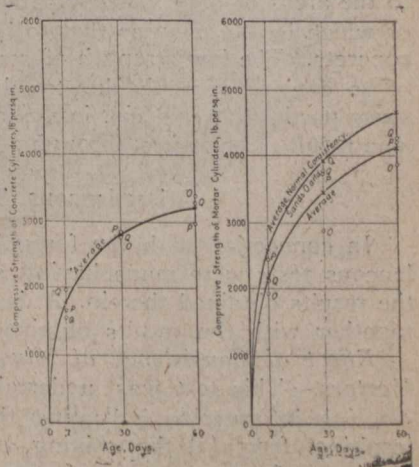

Fig. 11—Compressive Strengths of Mortar and of Concrete Test Cylinders