cretes, made up to have the same mobility, are also dependent upon the surface area. Concretes having the same water-cement ratio give nearly the same strength through a part of the range of water-cement ratio values, but for each maximum size of particle, the results diverge from the main curve,—this occurring at places along the curve which vary with the maximum size of particle and which are quite far apart."

The Hydro-Electric Power Commission of Ontario has been conducting investigations along similar lines. Some of the conclusions so far reached are:—

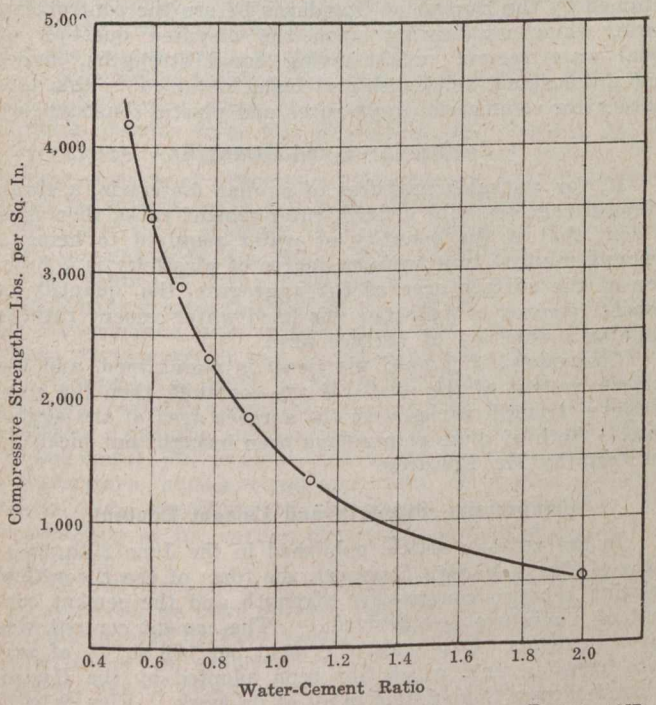

FIG. 8—RELATION BETWEEN WATER-CEMENT RATIO AND STRENGTH OF CONCRETE (H. E. P. C. TESTS)

1. That the fineness modulus is but another and somewhat approximate method of defining the surface area.

2. That within the range of workable mixtures, both the "strength" and "water required to bring a mixture to a uniform degree of plasticity" vary with the surface area, the relation being actually that described by Messrs. Talbot and Edwards.

3. That there is a fixed relation between water-cement ratio and strength for mixtures of the same cement, same aggregate and same age.

Fineness Modulus and Surface Area

Fig. 1 shows the relation found when the fineness moduli of mixed aggregates are platted against their surface areas as determined by the Edwards method.

This figure is similar to one given by the writer in *The Canadian Engineer*, June 26th, 1919, issue, except that it covers materials from dust to 1½ ins., while the former included only sands graded from dust to ¼ in. In the article just referred to, algebraical expressions for both the fineness modulus and surface area were derived, and it was shown that no mathematical relation exists between them. While an infinite number of values of fineness modulus may be found for any one value of surface area, and vice versa, yet it is a remarkable fact that for the materials ordinarily encountered, fineness modulus varies approximately with the surface area.

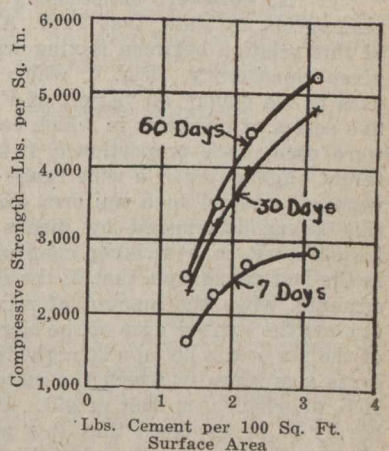

FIG. 12—RELATION BETWEEN CEMENT CONTENT AND COMPRESSIVE STRENGTH (PLATTED FROM MR. EDWARDS' TESTS)

Figs. 2 and 3 show similar curves obtained from the data of Mr. Edwards and Prof. Abrams, respectively.

Fig. 2 was reported by Mr. Edwards in *The Canadian Engineer* for October 9th, 1919, while Fig. 3 was worked up from Prof. Abrams' published results, and includes materials graded from 0-No. 28 sieve to 0-1½-in. sieve, a wider range than is included in either Figs. 1 or 2.

The relationship is probably the explanation of the reason that Prof. Abrams has found fineness modulus to be a measure of the effective size and grading of the aggregate.

Consistency and Surface Area

Prof. Talbot's conclusion that the water in concretes of equal cement content, necessary to produce a concrete of a given consistency, is equal to a constant plus a term which

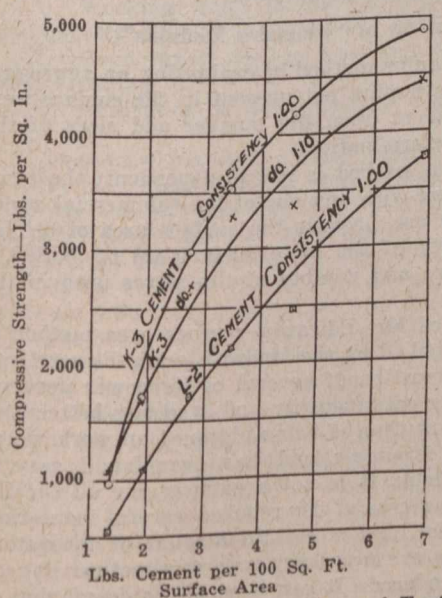

FIG. 9—*Derived from Prof. Abrams' Tests*

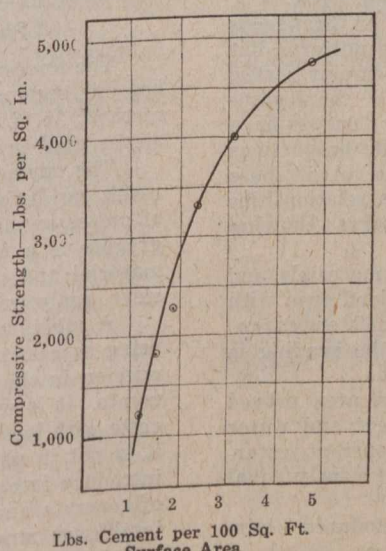

FIG. 10—*Derived from Bureau of Standards' Tests*

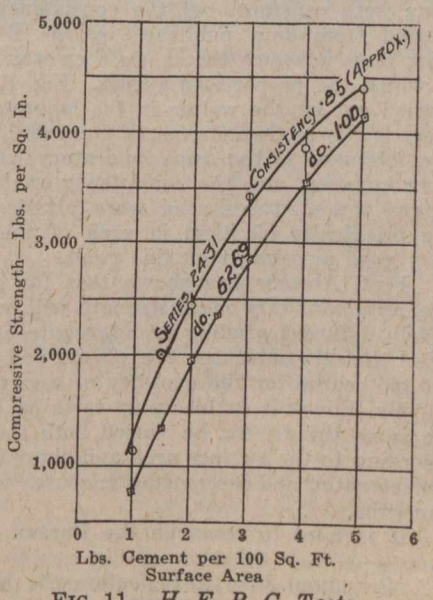

FIG. 11.—*H. E. P. C. Tests*

RELATION BETWEEN CEMENT CONTENT AND COMPRESSIVE STRENGTH OF CONCRETE