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This change in the structure of the cement matrix can be readily seen by the aid of a microscope; but, like sunlight, it is far easier seen than described. However, in the microscopic examination of the fractured surface of a "normal" consistency specimen, say, at 50 to 75 diameters magnification, the observer takes special note of three conditions of the matrix, namely :-

I. It is grayish in color.

2. It adheres to the particles of agregate in amorphous pasty-appearing masses.

3. It contains myriads of minute voids, permeating the entire formation.

As compared with the above, the cement matrix of a "wet" consistency mortar specimen presents a radically changed appearance, that is :---

1. Its color is changed from grayish to nearly a milky white

2. It no longer adheres firmly to the surfaces of the aggregate, but instead appears as a comparatively loose, semi-crystallin formation, which, although containing. few, if any, real crystal forms, may be compared to rather loosely massed snow crystals.

3. It contains, when closely examined, comparatively few of the well-defined globular-shaped voids observed in a "normal" specimen.



(b) 15 sq. in.





(c) 25 sq. in.

(d) 35 sq. in.

Fig. 18-Texture of Fractured Surfaces of Mortars Proportioned 1 g. Cement: 5, 15, 25 and 35 sq. in. Sand Area (× 20)

(a) Sand A.

(b) Sand D. Fig. 17-Texture of Fractured Surfaces of Mortars, Proportioned 1 g. Cement: 13 sq. in. Sand Area (× 20)

When examined under a lower magnification, say, 16 to 25 diameters, the matrix of wet-consistency mortar specimens presents a loose "sugary" or granular appearance. Doubtless this change in the physical structure of the matrix from a comparatively dense, compact material to an attenuated, fluffed up, skeleton-like mass, lacking cohesiveness and other attributes of strength, discloses the deep, underlying, but nevertheless primary cause contributing to the low strength, friability, shortness and other undesirable properties found in wet-consistency mortars and concretes.

Fig. 20 shows photomicrographs (\times 75) of "normal" and of "wet" consistency mortar specimens. The latter specimen was produced from the mortar of the former by the addition of sufficient water to render it of a "mushy" rather than of a liquid consistency.

Design vs. Construction

Whether a structure be composed of mortar or of concrete, the ideal of its construction is that it shall fulfil the predetermined requirements of strength, durability, utility, etc., at the lowest cost; that is, other things being equal, economy and efficiency demand the development of the full value of the cement and of the aggregate. A

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(a) $\times 20$. (b) ×75. Fig. 19-Texture of Medina Sandstone



(a) "Normal" Consistency.



Fig. 20-Texture of Cement Matrix in Mortars of Different Consistencies (× 75)