

NORMAL BUILDING SAND.

An important feature in connection with the use of mortars and cements in masonry structures is the nature of the sand used in the mixture; yet in nearly all tests the cement is the main object under consideration, the sand being often rather neglected. It is this fact which gives especial interest and value to the tests, of so-called normal sands selected from various countries, recently conducted by Herr M. Gary at the Berlin Testing Laboratory. From the Mitt. aus den Kgl. Technischen Versuchsanstalten, in which the full report appeared, the following abstract of the work is given. It is well that attention has been directed to so fundamental an element in building construction.

Ten different varieties of sand were tested, and in order that there might be no doubt as to the high quality and character of the samples, care was taken to have them selected by experts of acknowledged reputation in the various countries from which they were obtained.

Two varieties from Germany were treated, one being a crushed quartz from Freienwalde in Prussia, and the other the sand obtained from the Rhine by dredging. Single samples of standard sand were obtained from Austria, Switzerland, Russia, Norway, England, and the United States, and two samples from France, one of these being from Leucate, a natural sand brought down by the mountain streams of the Pyrenees, and the other a crushed quartz from Cherbourg.

The tests of the ten varieties of sand consisted in a chemical analysis, and a measurement of the loss of weight at red heat, as well as a determination of specific gravity, and size of grains, after which briquettes were made with Portland cement and subjected to tension tests after seven, twenty-eight, and ninety days hardening under water. Two sets of briquettes were made with each kind of sand, one set containing one part by weight of cement to three of sand, and the other one part of cement to five of sand. The former proportion represents the usual practise in nearly all countries; the latter was used to the extent to which the addition

of a greater proportion of sand affects the strength. Very interesting microphotographs were made of the samples of sand, and the difference in the character of the grains were in some cases very marked.

It is impossible to go into the details of these interesting tests which are fully tabulated and illustrated with diagrams in the original report, but some of the conclusions are here given.

Among other points it was found that the very sharp crushed quartz sand, which under the microscope showed an angular structure, gave a high tension test and a low compression test, while the natural sand, with rather rounded grains gave proportionately better results in compression. Thus for the American sand, a crushed quartz from Massachusetts, the ratio between the tension and compression tests was 1:2.7, while for the English sand, which, under the microscope showed round smooth grains, the ratio was 1:10.

The resistance to tension for the mixture of three of sand to one of cement was, for the English and American sands, respectively 424 pounds and 451 pounds per square inch, while for compression the figures were 4,300 pounds and 2,660 pounds. The American sand stood among the highest in the tension tests, being equalled only by that from Switzerland, but in the compression tests it was much lower than any other, the next higher being 3,500 pounds per square inch. On the other hand the only sand which equalled the English sample in compression was that dredged from the Rhine, which also showed a similar rounded constitution. This feature is one which is worthy of further investigation, as, if it is possible to obtain high tension tests for a cement by the use of a sharp sand, while at the same time its resistance, while applied in practice with similar sand under compression, is diminished, these facts should be taken into consideration, or else, more properly, both tension and compression tests should be required.

Tests made with mixtures of sands of coarse and fine grains showed inferior results to those obtained with sands uniform in size of grain.

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