SILICA PORTLAND CEMENT.

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or particle of silica is enveloped, wrapped up, in a layer of flour-like cement, and offers a clean sharp surface for the cement to adhere to. All very finely ground cements show strong adhesive properties, hence we see the useful function the silica performs. It takes the place of, primarily, the unground clinker, and secondarily, is an excellent filling material, wholly inert under the usual conditions to which cement mortar is exposed, and in itself is stronger than the unground particle of clinker it has displaced. Owing to the exceedingly fine conditions of the material, when tested neat it does not give as high a tensile strength as the more coarsely ground Portland cement, yet when made up into mortar with three parts of sand it actually equals in strength a like proportioned mixture of the Portland.

It is a peculiar fact that mortars made from very finely ground cement do not show quite as strong a resistance to abrasion, although they excel in adhesive properties. Hence the concrete for pavements and such like work preferably should be made of silica Portland and the top wearing surface of the coarser Portland cement.

There are certain uses which silica cements are peculiarly well adapted to. Speaking generally, all cases where the low percentage of lime is an important factor. In lining digesters for the manufacture of sulphite wood pulp, it has been found of the very highest value, also in sewers where free ammonia or acids are likely to attack the mortar, and in all such cases.

In pointing fine stone work, the color and permanent properties are peculiarly valuable.

Silica Portland cement has already largely entered the market and proven itself a valuable cement. The following partial list will show to what extent and the nature of the work where it has stood the test of experience: The Laurentide Pulp Co., Grand Mere, Que., 21,000 barrels in concrete masonry, floors, brickwork, etc.; Montreal Street Railway Company, in concrete and floors, etc., 2,500 barrels; Canada Paper Company, Windsor Mills, 1,000 barrels; W. W. Ogilvie, Montreal, 1,000 barrels; Holland-Emery Lumber Company, Byng Inlet, for gang saw foundations, 750 barrels; Riordan Paper Mills, 1,000 barrels; Dalhousie street station, C.P.R., Montreal, masonry, floors, etc., 2,200 barrels, Longue Point Asylum, Montreal, 880 barrels; Ottawa pavements, 3,500 barrels; Cornwall pavements, 600 barrels; Waterloo pavements, 900 barrels.

It has also been used in sidewalks and pavements in Ontario towns to the extent of some 10,000 barrels. Among other users are the Grand Trunk and Canadian Pacific, Central Ontario and Bay of Quinte railways, and the Public Works Department, Ottawa. In all over 75,000 barrels of Silica Portland cement have been used in Canada, although the manufacture was not undertaken until the season of 1897. Arrangements are being made to double the output for the ensuing season.

It has been said by rivals that this cement gives facilities for adulteration not equalled by other cements, and objections have been made by some that they had plenty of sand without buying it in the form of cement. Of course, all such objections are met at the outset with every new material. When Portland cement was first produced, it had to undergo an equally hostile criticism, and this naturally brings us to consider the testing of cement, a subject on which there has been a great deal written.

The following scheme conforms to the best thought and experience in the engineering world:

TESTING: HOT BATH TEST.—Fajas apparatus is so simple and so well known that it is unnecessary to describe it, but let me draw attention to a point sometimes overlooked. The sample when trowelled on the glass should be well worked up, the air and excess of moisture worked out, and the sample be covered with a wet cloth, otherwise drying cracks may show up across the thickest part of the slab. This drying crack is sometimes mistaken for an expansion crack and the cement condemned. Too much importance is sometimes attached to the fact that the sample cleaves the glass. If, as is usual, smooth glass is used, the slightest jar will loosen the slab. If it preserves its shape and does not curl up, or show fine hair cracks at the edges, there is no danger to be apprehended from free lime; in fact, from the low percentage of lime present a blowey Silica Portland cement is almost an impossibility.

SPECIFIC GRAVITY, WEIGHT PER BUSHEL, OR OTHER DENSITY TEST.—Silica Portland cement weighs a little less than Portland cement. It is so very finely ground that for equal measures, owing to greater bulkiness, it must weigh less. In any case, the old test of weight per bushel should be abandoned as being unscientific and misleading, offering, as it does, a premium on coarse grinding.

SPECIFIC GRAVITY.—The specific gravity test is a delicate laboratory test, and is one requiring a high degree of care and skill; as usually constructed by volumetric displacement, confined air, a minute error in reading, a slight change in the temperature of the liquid used, or irregularity in measuring apparatus or weighing, may give widely varying results. The object of the test is to determine the density of the cement, i.e., the sufficiency of the burning, in other words the soundness, hence the hot bath test practically suffices, and is much more easily made.

TENSILE STRENGTH.—Neat tests, as usually made, show Silica Portland to be slightly weaker than Portland cement. This is probably due to the fine grinding. Mortar tests, however, are the best of all and show the real working qualities of any cement; and it is as a mortar maker that silica Portland proves its good qualities.

Having satisfactorily determined the safe qualities of the cement, having shown it to be sound and strong, both in neat and mortar tests, all of which should be a condition precedent to beginning the work, it sometimes happens that still the concrete or masonry shows poor work. Well, what are we to do then? Condemn the cement? No, suspect the sand, examine the gravel or broken stone, the water, the temperature of the air, the methods of mixing and measuring the aggregates, depositing in place, ramming, etc. After all, the cement is only one of the factors in the problem; for a complete solution we should investigate the whole of them.

Do not try the experiment of building works out of cheap lean concrete. Consider the relatively small saving a few barrels more or less of cement amounts to in comparison with the value and importance of the work at stake. Your reputation as engineers will depend upon your capacity to do good sound work.

A LARGE COVERED RESERVOIR.

One of the largest covered reservoirs in Southern California, if not on the Pacific coast, is that which was recently completed at Pasadena. It measures 525 feet in length by 350 feet across its widest part, and varies in depth from 17 feet to 19 feet 8 inches. It is said to have a capacity of 21,000,000 gallons. It was originally constructed in 1875, but as in the summer months the warm rays of the sun cause vegetable growth to accumulate in open reservoirs, it was decided to cover the reservoir in order to prevent this. In the present instance the cover is made of inch Oregon pine boards, which rest upon 2 x 8 joist 6 feet apart, these being supported by 4 x 10 girders. The girders in turn are supported by 2-inch iron pipes as posts, and set 18 feet one way by 15 feet 9 inches the other. The cover or roof is raised by about 2 feet above the rim of the reservoir, a wire screen covering the intervening space to afford ventilation.