Study of Volta River aggregate samples

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TECHNICAL NOTE

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PREPARED FOR Sir William Halcrow and Partners. DATE May 1957

SUBJECT Study of Volta River Aggregate Samples

Four samples of stone and sand were submitted to the Division of Building Research for determination of alkali reactivity. These are designated in the accompanying table as A, B, C and D.

Two tests were carried out as described below but it has not yet been possible to obtain a detailed petrographic evaluation as to the presence or absence of constituents known to be deleteriously reactive with high alkali cements.

The chemical test, ASTM Designation C289-54T, is "a method for determining the potential reactivity of aggregates and their potentiality for producing abnormal expansion in concrete when used with high alkali cement". The results of this test for the four samples submitted are shown in the accompanying table, which also shows comparison data for a highly alkali-reactive material and a non-reactive material, both used as control samples. These data should be interpreted on the basis of the generally accepted criterion.*

The data, thus evaluated, indicate that the two arkose quartzite rock materials (C and D in the table) are both potentially capable of producing abnormal expansion in concrete when used with high alkali cements. This test is not considered conclusive by itself, however, and the results obtained should be compared with those from physical and petrographic tests. The two sands may be considered, on the basis of this test, to be not deleteriously reactive when used with high alkali cements.

The standard mortar bar test, ASTM Designation C227-52T "is intended to determine the potential expansive alkali reactivity of cement aggregate combinations". The four aggregates submitted produced negative results in this test. The mortar bar test is generally considered to provide more reliable information than the chemical test as to the probability of alkali-aggregate reaction in the field.

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* See R.C. Mielenz, K.T. Greene, and E.J. Benton; "Chemical Test for Reactivity of Aggregates with Cement Alkalis; Chemical Processes in Cement-Aggregate Reaction", Proc. Am. Conc. Inst., p. 213, Vol. 44, 1948.

It is expected that a detailed petrographic evaluation will be carried out shortly to supplement the results of the above tests.

On the basis of these two tests, and without benefit of petrographic evaluation, it can be tentatively concluded that the two sands are not deleteriously reactive to high alkali cements, and that the two stone materials are not entirely free from suspicion.

TABLE SHOWING SILICA RELEASE (Sc) AND REDUCTION IN ALKALINITY (Rc) IN MILLIMOLES PER LITRE

	Aggregate Sample	Sc mM/l	Rc mM/l
A	Sand, from east channel near line 99	32.8	47.8
B	Sand, from west channel near line 99. Deficient in coarse fractions.	29.3	49.3
C	Sandstone, (Arkose Quartzite) from Quarry No. 3, taken from rockpile after blasting. From power house site.	42.8	33.5
D	Quartzite from Power house site, Quarry No. 1. Taken from rock pile after blasting.	62.0	25.9
	Reference Materials		
E	Sand-gravel sample known to be very reactive to high alkali cements.	98.3	63.1
F	Sand sample known to be innocuous.	9.7	70.3

As a rough guide to those who want a general idea as to the interpretation of data in the quick chemical test, if the Rc value exceeds the Sc value, and the latter is not unduly high (as for aggregates A and B in the above table), the material being tested is probably innocuous. If, however, the Rc value is lower than the Sc value, and the latter is sufficiently large (as for aggregates C and D in the table) the material may be suspect.