PROGRESS IN SOIL-CEMENT CONSTRUCTION

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SYNOPSIS

In this symposium representatives of six State highway departments presented the most interesting features of the use of soil-cement encountered in their practice.

W. H. Mills, Jr.. presented the general procedure of soil-cement stabilization as practiced in South Carolina. He reported that if suitable sand-clays or top-soils are available within a 6 to 8 mi. haul, stabilization is not economical. Both road-mix and traveling pugmill methods are used, road-mix methods being preferred in heavy clay soils. Compaction is the most important of the operations, and moisture must be carefully controlled.

Described in detail by L. D. Hicks of North Carolina were methods for sampling and determination of cement requirement in relation to soil classification. Key samples of each "horizon" were used to determine cement required and smaller samples taken from the subgrade at 1000 foot intervals used for field control. The clay soils reacted well with portland cement. The thin, coastal plain sandy top soils generally require a high cement content for successful treatment but they can be economically discarded and the "B" or "C" horizon soils used in the usual manner.

F. W. Vaughan of Mississippi described in detail the field tests, and the control of moisture and compaction on a 24 mi. soil-cement project. Also described is a method of determining cement content after processing. The mixture is digested with hydrochloric acid and ammonium hydrate is added which precipitates iron and aluminum as hydroxides. Calcium in the filtrate is precipitated as calcium oxalate and dissolved in dilute sulphuric acid. Oxalic acid thus released is determined by titration with potassium permanganate and the equivalent weight of calcium is computed. The cement percentage is computed from the calcium-cement ratio.

The Ohio experience reported by R. R. Litehiser and H. E. Brooks is notable for the use of a road building machine which cuts, pulverizes, mixes and hydrates the soil and cement in one operation. Satisfactory relation was found between the moisture content of the mix and that of the compacted roadway. If the moisture in the mixture was within 2 points of the optimum the compaction was within the minimum requirement of the specifications.

The hills of Maryland gave an excellent opportunity, as reported by J. E. Wood, for the exercise of ingenuity in combating the tendency of the material to drift downhill and to lack of traction for the mixing equipment. The experience indicates that rather steep grades and sharp curves can be successfully constructed by the mix-in-place methods.

Carl R. Reid of Oklahoma described the construction of a "cement-modified" subgrade for a concrete pavement including the procedures followed in testing and a tabulation of data on the soils encountered. Cement content varied from 0 to 16 per cent, with an average of 6 per cent. Control sections without cement

and with various compaction methods and degrees of moisture control were also constructed. It is believed that some curing protection should be provided.

E. J. Sampson and H. G. Henderson, also of Oklahoma, reported on a laboratory investigation of the effects of various dispersing agents on the mechanical analysis of soil-cement mixtures. Sodium carbonate, sodium oxalate and sodium silicate were found to be effective in this order. The data also yielded interesting information on the effects of curing soil-cement mixes.

Some cost data are given from South Carolina, North Carolina and Ohio.

TOPICAL INDEX

GENERAL PROCEDURE, SOUTH CAROLINA PRACTICE

By W. H. Mills, Jr.

In South Carolina stabilization is not considered if suitable sand-clays or topsoils are available economically. These materials can usually be hauled six to eight miles before their price in place exceeds that of stabilization.

When no suitable soil can be found within economical haul distance, preliminary samples are obtained for determination of the methods of stabilization and a recommendation for quantities on which bids will be received. If time is available, a complete set of laboratory data is obtained on these preliminary samples before any recommendation is made, if not, a recommendation is based on previous experience in soils having similar gradings and other characteristics. The laboratory tests include mechanical analysis, determination of liquid limit, plasticity index and shrinkage limit and determination of optimum moisture content for compaction on a mixture of soil with the quantity of cement which is estimated will be necessary for stabilization. Artificial weathering tests on specimens of soil-cement mixes containing various percentages of cement are always made. The percentages of cement are varied, depending on the type of soil, but usually the tests are made with 5, 7, and 9 per cent by weight. An estimate is made of the quantity of each type of soil to be encountered in the final grade and the quantity of stabilizer is determined for the average of the project with maximum and minimum limits to care for variations in the soil. Data from these tests are also used in setting quantities for construction by matching similar soils.

During grading operations, soils which require excessively high quantities of stabilizer are eliminated, if economically possible, by placing them in the bottoms of fills or wasting. Generally the soils as found within the limits of the cut sections are used throughout the project but in a few instances select materials from borrow pits are stabilized more economically. For instance, one location on a certain project would have required at least 12 per cent cement for stabilization but by using selected material from a