Consolidation Characteristics of Stabilized Clayey Soils

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ABRIDGMENT

•THREE typical clayey soils were stabilized with portland cement, lime, and sodium hydroxide, and their consolidation characteristics were compared with those of the natural soils.

The soils, whose clay content varied, contained kaolinite, illite, or montmorillonite as the clay mineral. They were compacted to standard proctor density at optimum moisture content, then cured for 28 days in near 100 percent relative humidity at room temperature and subsequently tested in a double drainage fixed type consolidometer up to 8 kg/cm^2 loads. Two sets of tests were run: the saturated and the unsaturated.

In all cases, the beneficial effect of stabilization was observed by the flattening of the e-log p curves. However, it was difficult to distinguish between the relative effects of stabilizing agents as the e-log p curves tended to fall within a narrow band whereas the 28-day unconfined compressive strengths indicated the differences very conclusively. This is explained by the fact that the unconfined compressive strength is a measure of a property well within the plastic range of the soil, but the consolidation test covered only a small part of this range. The rebound curves attest to this. Also, the rebound curve data obtained after the application of the 8 kg/cm^2 load indicated that the difference between the natural soils and the stabilized soils was minimized. Thus, consolidation seemed to have a stabilizing character, whose influence approached that of the stabilizing agents at high compressive loads only.

The application of the consolidation load caused a rearrangement of the particles and the geometry of the soil structure apparently changed. The change was large for the natural soil and small for its stabilized counterpart. The major contribution of stabilizing agents was to bring about an initial bonding which prevented the detrimental effect of thickness change in the soil-pavement components.

Consolidation, being a time-dependent phenomenon, presents a problem which is analyzed in terms of the coefficient of consolidation, C_v. The effects of stabilization were apparent when comparing C_v values of natural and stabilized soil mixes. Increases from about 40 to 400 percent were observed, with the kaolinitic clayey soil located in the lower range, the montmorillonitic in the upper range, and the illitic in between. However, the increase in the coefficients of consolidation appeared functionally related not to a specific property but rather to a composite parameter of the clayey soils. In the saturated consolidation tests, the C_v values remained constant for the incremental load system used but in the unsaturated consolidation tests they tended to decrease slightly with an increase in compression loads.

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