SCALE AND FABRIC EFFECTS IN OEDOMETER-BASED PREDICTIONS OF FILL SETTLEMENT

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ABSTRACT

The compression behavior of a soil is predicted by testing standard specimens collected from the field, or compacted in the laboratory. However, settlements experienced by the fills may be different from settlement predictions provided by the standard oedometer tests. This can be related to two main reasons: the size and the fabric of the tested specimens. Small specimens (70 mm diameter) are tested and assumed to represent the behavior of an entire embankment. The question arises whether this is a correct assumption knowing the heterogeneity of a compacted fill. Or sometimes small specimens compacted in the laboratory, using soil processed through sieves #4 or #10, are tested to predict the fill compression behavior. This gives rise to a second question as to whether this is a good assumption knowing that differences in the specimen fabric exist between lab specimens and the embankment soil.

This study focuses on the scale and fabric effects for different types of soils, to examine differences between laboratory specimens and fill embankment compression behavior.

Large oedometer specimens (560 mm diameter) were tested and compared to standard specimens (70 mm diameter) to study the device effect. The fabric-induced scale effect is studied by comparing tests on large specimens collected from the field to tests on standard specimens compacted in the laboratory using different methods (ring compaction and proctor compaction). Large specimens were collected from the field by trimming directly into the large oedometer ring. The trimming procedure was successful but very tedious and time consuming, and the water content and dry density were quite different from one specimen to another. To achieve the goals of this study, it was essential to have similar specimens regarding dry density and moisture conditions. To overcome the field sampling problems, a new procedure and apparatus was developed for producing large oedometer samples with simulated field compaction. Soil processed in the field during construction was collected prior to compaction and stored in sealed buckets, so that the soil characteristics (clod sizes, moisture content) were representative of an actual fill layer compacted in the field. An apparatus was designed to compact the collected soil directly in the large ring oedometer; this closely reproduces field compaction conditions.