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An attempt to predict soil shrinkage without fitting

V. Chertkov
Technion, Haifa, Israel (agvictor@tx.technion.ac.il)

Despite the availability of research results on soil shrinkage curve, further clarification is especially needed in regard to structural shrinkage. Except for that, the existing fitting models do not explain how the interaction between a clay shrinkage curve, silt-sand admixture, and aggregate structure leads to the observed shrinkage curve of an aggregated soil. The current study examines aggregated soils with clay content exceeding 40%. The soils have the unit slope of the shrinkage curve in the normal shrinkage area with sufficiently slow drying and sufficiently small samples, but with many aggregates. The major objective of this work is to account for the above three-factor interaction and to suggest an approach for the non-fitted prediction of the reference shrinkage curve of an aggregated soil. Accordingly, all shrinkage curves possible for the soil, as the result of different crack-volume development (at different drying conditions), may be compared to the above reference curve. Towards this end, two consecutive generalizations of a clay shrinkage curve model are formulated. The gist of the first generalization is the introduction of the water content of the maximum aggregate swelling, based on the clay microstructure. The gist of the second generalization is the introduction of a violated superficial layer of aggregates (interface layer) as a water source whose pores are emptied simultaneously with intra-aggregate (matric) pores. In particular, the model explains, the shrinkage curve shapes in the structural shrinkage area. The reference curve is predicted by eight physical (immediately measured) parameters of (i) intra-aggregate matrix; (ii) soil clay content; (iii) aggregate structure; and (iv) a mean silt-sand grain size. The results are in agreement with data on the shrinkage curves and other properties of eight American, British, and African soils.