Influence of Compaction Energy on Soil Engineering Properties

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ABSTRACT

Strength and deformation parameters of a compacted soil are known to be related to soil type and moisture. However, little attention has been directed towards understanding the influence of compaction energy on soil type and moisture. This paper describes a laboratory study conducted to evaluate the relationship between soil type, soil moisture content, and compaction energy on five cohesive soil types.

Specimens were compacted with impact energy at levels of 355, 592 (standard Proctor), 987, 1643, and 2693 kJ/m^3 (modified Proctor) over a wide range of moisture contents to determine dry unit weight, unconfined compressive strength, and the secant (50% strain) stiffness. In total, 125 Proctor tests and 95 unconfined compression tests were performed. At each energy level, a soil specimen was tested at four to five moisture contents with respect to its standard Proctor moisture range. In addition, 48 consolidated undrained triaxial tests were performed at the five energy levels and four moisture content levels for a silt to evaluate changes in effective stress shear strength parameters.

This paper summarizes the results of statistical analyses performed on all tests conducted. The models that best explain variability in dry unit weight, strength, and stiffness are presented. Models are presented for each individual soil type and for all soils grouped together. Independent variables used in the modeling include compaction energy, moisture content, Atterberg limits, material passing the No. 200 sieve, and clay fraction. Results show that compaction energy is a key factor in determining soil strength and stiffness parameters and should be considered during the planning phase of any earthwork construction operation.

Note: This research was still in progress at the time of publication; contact the lead author above for more information.

Key words: compaction energy—soil moisture content—soil stiffness—soil strength

Proceedings of the 2005 Mid-Continent Transportation Research Symposium, Ames, Iowa, August 2005.