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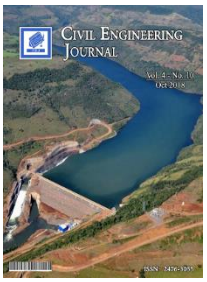

Forensic Evaluation of Compacted Soils using RAMCODES

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Abstract

Unexpected failure of compacted soils was explained using design curves of the Rational Methodology for Compacted Geomaterial's Density and Strength Analysis (RAMCODES). Forensic geotechnical evaluation, applied to a compacted soil used at a construction site, demonstrated that the bearing capacity of the soil was influenced by the water content and the dry unit weight. At the construction site, the only criterion used for quality control of the compacted soil was the minimum compaction percentage; the maximum dry unit weight (achieved using the standard Proctor test) was used when the soil was compacted with light equipment, and the maximum dry unit weight (achieved using the modified Proctor test) was used when it was compacted with heavy equipment. After changing water content conditions, the soil compacted with heavy equipment and the soil compacted with light equipment exhibited changes in bearing capacity; the soil compacted with light equipment showed a failure, whereas the soil compacted with heavy equipment did not. The causes of failure were evaluated from samples of soil analyzed in the laboratory; analysis was performed using design curves obtained through a factorial experimental design. Our analysis revealed that the criterion of minimum compaction percentage was not adequate to determine the actual mechanical performance of the soil. We sought to determine why the soil compacted with light equipment did not satisfy the bearing capacity expected after compaction, and what other actions should performed at a construction site to avoid failure of soils compacted with light equipment.

Keywords: Soil Failure; Base Course; RAMCODES; Design Curves; Compacted Soils; Quality Control.

1. Introduction

Specifications for quality control of compacted soils are frequently based on a minimum compaction percentage [1, 2]. The compaction percentage is defined as the ratio between the dry unit weight measured at the construction site and the maximum dry unit weight measured in the laboratory. The maximum dry unit weight used as a reference for the compaction percentage can be obtained in the laboratory using a pre-defined compactive effort (i.e. standard Proctor or modified Proctor tests). Although the minimum compaction percentage does not measure a mechanical property [3], it is strongly ingrained in the verification process of quality control of compacted soils [2, 4]. For instance, Hilf [5] states that the use of "the simpler density and moisture measurements has been generally accepted for field control".

In 1987 Hermann and Elsbury [6] suggested that, for compacted soils destined to resist load, the minimum compaction percentage should be at least 95% of the maximum dry unit weight obtained by the standard Proctor test, or 90% of the dry unit weight obtained by the modified Proctor test. However, this suggestion has been considered as an unbreakable rule by many Latin American designers and constructors [7]; once a minimum compaction percentage is achieved, it is assumed that the mechanical performance of the compacted soil will be optimum [2, 8].

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