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Undrained shear strength of soft clay reinforced with encapsulated stone dust columns

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Abstract

Purpose – The stone dust column was used to strengthen the sample and had a significant effect on improving the shear strength of the kaolin clay. The application of stone columns, which can improve the overall carrying capacity of soft clay as well as lessen the settlement of buildings built on it, is among the most widespread ground improvement techniques throughout the globe. The performance of foundation beds is enhanced by their stiffness values and higher strength, which could withstand more of the load applied. Stone dust is a wonderful source containing micronutrients for soil, particularly those derived from basalt, volcanic rock, granite and other related rocks. The aim of this paper is to evaluate the properties of soft clay reinforced with encapsulated stone dust columns to remediate problematic soil and obtain a more affordable and environmentally friendly way than using other materials.

Design/methodology/approach – In this study, the treated kaolin sample's shear strength was measured using the unconfined compression test (UCT). 28 batches of soil samples total, 12 batches of single stone dust columns measuring 10 mm in diameter and 12 batches of single stone dust columns measuring 16 mm in diameter. Four batches of control samples are also included. At heights of 60 mm, 80 mm and 100 mm, respectively, various stone dust column diameters were assessed. The real soil sample has a diameter of 50 mm and a height of 100 mm.

Findings – Test results show when kaolin is implanted with a single encased stone dust column that has an area replacement ratio of 10.24% and penetration ratios of 0.6, 0.8 and 1.0, the shear strength increase is 51.75%, 74.5% and 49.20%. The equivalent shear strength increases are 48.50%, 68.50% and 43.50% for soft soil treated with a 12.00% area replacement ratio and 0.6, 0.8 and 1.0 penetration ratios.

Originality/value – This study shows a comparison of how sample types affect shear strength. Also, this article provides argumentation behind the variation of soil strength obtained from different test types and gives recommendations for appropriate test methods for soft soil.

Keywords Soft soil, Stone dust column, Shear strength, Encapsulated, UCS, Geotechnical engineering
Paper type Research paper

1. Introduction

Soil constitutes the fundamental medium of support for all engineering structures (Amadi, 2023). The stability and settlement of the structure may be affected when building over

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