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Sand Column Stabilized by Silica Fume Embedded in Soft Soil

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ABSTRACT

This research aims to study the behavior of the sand columns stabilized with silica fume (as an additive with different percentages) and driven in soft soil bed with un drained shear strength (c_u) between 16 – 21 kPa. Holesin the shape of columns with diameter 50 mm and length 300 mm have been drilled in a soil bed and backfilled with sand mixed with several proportions of silica fume with 7-days curing. A rigid circular footing with diameter 64.6 mm was located on each column and loaded axially till failure. The results analysis of the model tests indicated an encouraging improvement in load carrying capacity of the columns and considerable reduction in the settlement compared to the conventional stone columns. The bearing improvement ratio and settlement reduction ratio exhibited by the sand columns are 1.18 and 0.71, respectively. The best possible addition of silica fume content in sand–silica fume columns is 7% giving bearing improvement ratio and settlement reduction ratio of 1.56 and 0.5 respectively.

Keywords: Sand Columns; Silica Fume; Improvement; Soft Soil

INTRODUCTION

Sand and stone column, known as column-type techniques, are the most widely adopted approaches for improving soft and compressible soils due to their high compressive strength and stiffness compared to the soft soil. Depending on the type of installation, the soil surrounding column is compacted due to displacement so it will improve soil stiffness. Sand and stone column are used to reinforce weak soil, reduce the settlement and improve the ability of foundation, accelerate the consolidation rate, improve the soil carrying capacity, and as drainage for excess water pressure dissipation in subsoil under loading [١- 4]. It is common to use crushed stones or gravels as backfill materials for improvement of foundation in many countries around the world but at present time, clean well graded sands are used as alternative backfill materials. The sand columns and sand compaction piles based on similar concept to stone columns except that sand columns are compacted in the field by using vibrating a closed end pipe to the required depth [5]. As the pipe is subsequently extracted from the ground, the hole is filled with sand. In Japan, they have been utilized broadly for the support of fills, embankments, tanks, and other different structures [1]. They are implemented by driving a steel casing down to the desired elevation using a heavy, vertical vibratory hammer located at the top of the pile. As the pile is being driven, the casing is filled with sand. The casing is then repeatedly extracted and partially retrieves using the vibratory hammer. By