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Lightweight Expanded Clay Aggregate (LECA) as replacement materials for geotechnical application

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ABSTRACT

Settlement is a common geotechnical problem occurs in soft soils. The replacement method is the easiest way to improve this problematic soil. This technique is carried out by removing the unwanted part of the soil and replacing it with a more suitable material or soil. This study focuses on using Lightweight Expanded Clay Aggregate (LECA) as a construction material to replace normal sand and aggregate in filling work. LECA is one of the best alternatives that can be used to improve soil properties because it is lightweight, strong and environmentally friendly. However, there are no specific guidelines for the LECA replacement in filling work. Therefore, this study was conducted to develop the construction procedures and LECA replacement requirements for geotechnical application in Malaysia. LECA aggregates have been used as a filling material to solve the settlement problem at Masjid At-Taqwa, Teluk Intan, Perak, Malaysia. LECA samples were collected from different location at different compaction levels for inspection of physical properties and quality of compaction examination. The level of compaction effort performed on LECA replacement represents by the number of passes. The relationship in compaction conditions related to LECA replacement is determined by two graphs namely LECA Compaction Effort and Targeted Compaction Level. The compaction quality of LECA aggregate filling work can be checked using Lightweight Deflectometer (LWD). The maximum desired density can be determined in advance. With reference to the LECA Compaction Effort plot established in this study, the number of passes that need to be performed during the placement work can be planned according to the desired compact density. Whereas, the compaction level, R% can be predicted based on the Target Compaction Level plot. An LWD test should then be carried out to ensure that the compacted density reaches the required level.

1. Introduction

When problematic ground conditions are encountered there are a number of alternatives that can be utilized to achieve project objectives such as bypassing the poor ground, remove and replacing unwanted soil with suitable materials and modify the poor soil with chemical additive. A variety of terms are used to describe the poor soil alteration or fixing the ground such as soil improvement, ground improvement, ground treatment, or ground modification. Charles (2002) notes that the process of altering the ground is ground treatment, while the purpose of the process is ground improvement, and the result of the process is ground modification (Schaefer et al., 2017a). The function of ground modification is, to increase shear strength and bearing resistance, increase resistance to liquefaction, improve settlement, to transfer development loads to more competent subsurface layers, decrease imposed load, speed up consolidation process in soft soil, improve the soil properties and many more. The replacement method is the easiest way to improve soft soil weaknesses especially settlement problems. This technique is carried out by removing the problematic part of the soil and replacing it with a more competent material or soil (Han, 2015).

This study focuses on Lightweight Expanded Clay Aggregate (LECA) used as a construction material to replace normal sand and aggregate in filling work. LECA is among the common lightweight materials that have been applied successfully in civil engineering works in Norway, Russia, Germany, Italy, Denmark, Switzerland, Finland, Portugal, U.K, Iran and India. LECA is one of best alternative that can be used to improve soil

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