

The Strength of Soft Clay Reinforced with Singular and Group Bottom Ash Columns

Muzamir bin Hasan

*Lecturer, Faculty of Civil Engineering and Earth Resources,
Universiti Malaysia Pahang, Kuantan, Pahang, Malaysia.
e-mail: muzamir@ump.edu.my*

Aminaton binti Marto

*Professor, Faculty of Civil Engineering,
Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
e-mail: aminaton@utm.my*

Masayuki Hyodo

*Professor, Faculty of Engineering,
Yamaguchi University, Ube, Yamaguchi Prefecture, Japan.
e-mail: hyodo@yamaguchi-u.ac.jp*

Ahmad Mahir bin Makhtar

*Associate Professor, Faculty of Civil Engineering,
Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
e-mail: amahir@utm.my*

ABSTRACT

Stone column is a ground improvement technique in which some of the soil is being replaced with granular material such as crushed rocks or sand. Stone columns are usually installed in soft cohesive soil to improve bearing capacity and accelerate the dissipation of pore water pressure when load is imposed to the soil. Since "bottom ash", as the by-product of coal burning, has same properties to granular materials, there is a potential of using bottom ash as stone columns. By introducing bottom ash columns, the cost of project could significantly be reduced and the disposal problem for bottom ash would be solved. Besides that, sustainability in construction can be achieved by the utilization of bottom ash. This paper discusses the results of the improvement in strength of soft clay when inserted with singular and group bottom ash columns. A total of 8 batches of kaolin samples had been tested to determine the shear strength. Each batch consisted of three samples to represent samples without bottom ash column, samples with partially penetrating bottom ash column and samples with fully penetrating for singular and group of bottom ash columns. A total of 24 unconfined compression tests had been conducted on soft kaolin specimens. The specimens used were 50 mm in diameter and 100 mm in height. The diameter of the bottom ash column is 10 mm and the heights of the column are 60 mm and 100 mm. For singular column, the column was installed at the centre of the specimen and for the group columns had been arranged in square pattern. The improvement rate for partially and fully penetrating singular column is between 13 to 26 % and from 2 to 15 % respectively. While for group columns, the improvement rate for partially and fully penetrating column is between 20 to 27 % and from 9 to 66 % respectively. It can be concluded that that the shear strength of soft clay could be improved by the installation of bottom ash columns. However for singular column, the value of shear strength of soft clay inserted with partially penetrating column increased more significant compared to the fully penetrating column.

KEYWORDS: Soil improvement; sustainable construction, bottom ash column.