PERFORMANCE OF BEARING CAPACITY FOR ECO-FRIENDLY RAFT PILE FOUNDATION SYSTEM (ERP SYSTEM) IN SOFT SOIL

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I dedicate this project report to

All my family, the symbol of love and giving,

My friends who encourage and support me,

All the people in my life who touch my heart,

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ABSTRACT

In this study, the total bearing capacity estimation of Eco-Friendly Raft Pile Foundation System (ERP System) that act as a floating raft-pile system subjected to axial loading is presented. The proposed analysis is based on the conventional formulas and the secondary data from the results of foundation prototypes tested on site through Plate Bearing Test. In this study, analytical formulas to estimate the axial pile capacity and the group piles efficiency for piles in clay is reviewed. The calculation using the formulas is compared to the secondary data based on Plate Bearing Test results. Based on the calculation by validating the standard formula, it shows that the allowable bearing capacity is similar with allowable bearing capacity from the secondary data that obtained based on the field test. The axial capacity of the Eco-Friendly Raft Pile Foundation System (ERP System) floating in clays can be concluded higher than the original ground without ERP System. For practical application, the combination formula to estimate the total floating foundation load capacity for ERP System in soft clay is proposed.

ABSTRAK

Kajian ini dilaksanakan adalah untuk menentukan keupayaan galas beban bagi *Eco-Friendly Raft Pile Foundation System (ERP System)* yang bertindak sebagai sistem asas rakit bercerucuk yang menerima beban paksi. Kajian ini menggunakan formula konvensional di mana data-data secondari daripada keputusan ujian model di tapak melalui ujian galas papak digunakan untuk pengiraan. Melalui kajian ini, analisis formula untuk menentukan beban paksi dan efisiensi kumpulan cerucuk bagi cerucuk di kawasan tanah lembut adalah dikaji. Pengiraan menggunakan formula ini kemudiannya dibandingkan dengan data-data secondari ujian galas papak. Berdasarkan pengiraan menggunakan formula conventional, menunjukkan bahawa keupayaan galas beban yang dibenarkan adalah hampir sama dengan keupayaan galas beban yang dibenarkan yang diperolehi daripada ujian galas papak yang dilaksanakan di tapak. Beban paksi yang boleh ditanggung oleh *Eco-Friendly Raft Pile Foundation System (ERP System)* di kawasan tanah lembut adalah lebih tinggi daripada beban paksi yang boleh ditanggung oleh tanah tanpa menggunakan sistem asas rakit bercerucuk *(ERP System)*. Bagi aplikasi sebenar, rumus kombinasi untuk menentukan jumlah kapasiti beban untuk asas rakit cerucuk terapung bagi *(ERP System)* adalah disyorkan.

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CHAPTER 1

INTRODUCTION

1.1 General

Combined raft pile foundation is widely used to increase the bearing capacity of the soil especially in the soft soil that has low bearing capacity and soil strength. Foundation system on soft ground (undrained shar strength Su < 40kPa) have posed various problems such as excessive settlement, negative skin friction on piles and bearing capacity failures (Y.C Tan & C.M.Chow, 2012). Combined raft pile foundation on soft soil is considered an economical foundation system where the bearing capacity of the raft is taken into consideration in supporting the loads and using friction piles as settlement reducer is a technically superior foundation system as the bearing capacities of both the raft and the piles are taken into consideration (Y.C Tan & C.M.Chow, 2012).

1.2 Problem Statement

Soft ground areas commonly subjected to foundation problems. Excessive settlements and bearing capacity problems are commonly occurs in construction in soft ground area (Arman, 2004). Settlement in soft ground areas is uncertain and excessive settlement after construction in soft soil will occurs when bearing capacity of the soil is an adequate. Piling can be considered as a good option to avoid excessive settlement. Several conventional alternatives are available and bakau pile

commonly used for soft soil especially near river and coastal area. However, the usage of bakau pile will lead to indiscriminate felling of mangrove and environmental problem. Therefore, a new method for an innovation for combined raft piles foundation system namely Eco-Friendly Raft Pile System (ERP System) is developed to provide an alternative to bakau pile. ERP System is a mini pilot project that was developed under Department of Irrigation and Drainage (DID). Hence a pilot project, there is no standard formula to determine performance of combined raft pile foundation for ERP System.

Figure 1.1 : Excessive settlement due foundation problem in coastal area

1.3 Objectives Of The Study

The following are the objectives and main aim for this study :

1. To validate standard formula for combine raft and pile foundation for Eco-Friendly Raft Pile System (ERP System)
2. The second objective for this study is to determine the performance of bearing capacity for Eco-Friendly Raft Pile System (ERP System) applied on soft soil condition based on standard equation.

1.4 Scope Of The Study

The area of this study is mainly to focus on the determination of bearing capacity performance for ERP System in soft clay only. The value of maximum axial loading and settlement will first to be predicted by using parameters obtained from Plate Bearing Test results as secondary data. The Plate Bearing Test has been tested for marine clay in soft ground area in Sungai Udang, Klang District of Selangor. Bearing capacity of ERP System will be determined by validate formula and back analyzing the axial loading versus settlements that obtain from secondary data from Plate Bearing Test results. The formula will be used to compare the field work results and expected similar result will be obtained.

1.5 Significant Of This Study

The significant of this study and for economic design purposed, the design should maximize bearing capacity of each pile, raft foundation and include adequate safety against failure for ERP System. Therefore, this study is important to developed standard equation for combined raft pile to determine the maximum bearing capacity for ERP System. The finding of this study is important to provide guideline for designing the ERP system.

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