

NUMERICAL SIMULATION IN FOUNDATION DUE TO SETTLEMENT
PROBLEM

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Specially dedicated to my

Dearest Husband, Norasman Bin Kadir and my father and mother, Tuan Haji Jeman Bin Harris and Puan Hajjah Salmah Binti Sait , my brothers and sister, all my family members, and friends who helped me accomplish this research. Thank you for all your valuable contributions, patience and love. You are my inspiration.

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ABSTRAK

Kajian ini dijalankan bertujuan untuk mengkaji sifat-sifat tanah terhadap dua jenis cerucuk dengan menggunakan perisian PLAXIS 2D. Ia bagi menentukan asas mana yang sesuai digunakan dimana kriteria beban bangunan ,fungsi rekabentuk berdasarkan kepada jenis tanah dan jenis struktur yang akan dibina. Beban bangunan yang besar akan memerlukan saiz asas yang besar juga. Bagaimanapun, ianya tidak ekonomikal dari segi bahan binaan yang banyak akan diperlukan. Jenis asas yang berlainan akan memberi kesan serta impak yang berlainan juga kepada sifat tanah. Ini amat penting di dalam analisis rekabentuk dimana berdasarkan kepada analisis PLAXIS 2D dapat memberi manfaat dari segi gambaran keadaan sebenar tanah dan jangkaan hasil kajian. PLAXIS 2D berpotensi dan telah berjaya memberi jangkaan penurunan aras tanah berdasarkan jenis cerucuk yang digunakan pada tanah lembut.

ABSTRACT

This study describes a study on the geotechnical behavior of two different type of footing using finite element code, PLAXIS 2D. In determining the suitable of footing to loadings, design criteria should function according to the soil and types of structures erected on it. Higher loading will require bigger footing as this will give better support. However, this is not economical as more materials will be needed for the construction of the footing. Different type of footing might affect the performance of geotechnical behavior. It is essential since such design analysis, which based on numerical analysis, could have advantages in providing preliminary expected outcomes for the modeling purposes. In conjunction to this matter, the potential of PLAXIS 2D finite element to predict the settlement of soft soil base on different type of footing are performed successfully.

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LIST OF SYMBOLS

c	-	Cohesion
C_c	-	Compression Index
C_r	-	Recompression Index
e_o	-	Initial Void Ratio
H_o	-	Thickness of Soils to Secondary Consolidation
K	-	Coefficient of Lateral Earth Pressure
P_c	-	Preconsolidation Pressure
P_o	-	Initial Effective Vertical Stress
Q_b	-	End Bearing Resistance
Q_s	-	Shaft Resistance
Q_{ult}	-	Ultimate Capacity
S	-	Shear Strength
u	-	Pore Pressure
σ	-	Total Normal Stress
σ'	-	Effective Stress
\emptyset	-	Angle of Internal Friction of Soil
Ψ	-	Angular Distortion

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CHAPTER 1

INTRODUCTION

1.1 Background of the Problem

Soft soil deposits are generally widespread in the coastal area. The soil possesses low shear strength and high compressibility and thus having low bearing capacity. Due to high compressibility and low shear strength, it may result with high settlement and deformation to the structure, if constructed on soft clay. Stability, deformations and time required for consolidation are the major concerns in the design and construction of building over soft foundations. Therefore it may need improvement to avoid excessive settlement and prevent stability failure.

The problem such as high compressibility and low shear strength usually occur and it is common in the construction at soft soil area. The stress is always acting in the direction of vertical and horizontal, and effective stress is dependent on stability condition during and after construction. Common behavior of foundation soil is like settlement, lateral movement, pore water pressure and total stress. All of these behaviors are related to each other.

Pile foundation is one of the most popular forms of deep foundations. Piles are generally adopted for structures in weak soils, characterized by low shear

strength and high compressibility, as well as in good soils, in cases where structures are subjected to heavy loads and moments. The maximum settlement of the pile and its ultimate load bearing capacity are the governing criterion in the design of vertically loaded piles. These are evaluated by carrying out a number of theoretical and numerical approaches. However, the evaluation of the magnitude of soil movement and settlement, with reasonable confidence and accuracy, is difficult.

Particularly, it is challenging to decide the termination depth. Methods to evaluate the skin resistance for friction piles and socket length for end bearing piles are not well understood. Finite element software, like PLAXIS 2D, are usually used to perform the analysis of piles under different types of loading. Finite element analysis offers an excellent opportunity to study pile-soil interaction, pile response and soil movement under vertical loading in difficult geoenvironments.

1.2 Statement of the Problem

Foundation and footings are crucial to success of a building. At present, there are many different methods of calculation and design available for analyzing soil structures. Because all of these methods are based on simplified analysis, it could not provide the engineer with all desired design information and only provide very limited indications of soil. Therefore, many researchers are motivated to find alternative materials and technique that not contributing too much cost. Simulation or finite element method has proved to be the most of the cheaper, faster and realistic tool of the construction process than performing the multiply test of the design each time. The numerical software is sophisticated, computer hardware and software has resulted in considerable advances in the analysis and design of geotechnical structures and building structures. Therefore, it is of great encouragement to study and understand the use of software in solving practical problem.

1.3 Objectives of the Study

The aim of this study is to identify the most suitable footing for soft soil at Rumah Mesra Rakyat (RMR) Muara Tebas. In order to achieve that, four objectives have to be fulfilled in this study: -

- (1) To simulate soil condition at site
- (2) To proposed and model different type of footing using Plaxis 2D
- (3) To monitor the settlement with different type of foundation
- (4) To determine the foundation to be used in the soft soil.

1.4 Scope of the Study

The study will concern on simulation analysis of soil in two different type of footing on the given condition of soft soil using PLAXIS 2D software. In this regards, PLAXIS 2D will be used to perform two dimensional analysis of soil. It will concentrate on the earthworks at Proposed Housing Rumah Mesra Rakyat (RMR), Stage 1, Muara Tebas, Kuching, Sarawak. It is only covers about 23.92 acres of land size. The load will be based on actual drawing of detached building calculated using ESTEEM software and manual calculation. Only the heaviest loading footing point will analyze in this study. The parameter of the soil on this study is based on the Soil Investigation Works Report by Geological and Geotechnical Specialists consultant, M/s Geospec Sdn Bhd.

1.5 Significance of the Study

The evaluation is made by a comparison of soil displacements using software PLAXIS 2D analysis between different types of loading footing on the given condition of soft soil. Therefore, the settlement of different foundation to be used in soft soil can be satisfy and useful for foundation design. Thus, the comparison of cost effective will be compared to achieve economical development.

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