

INFLUENCE OF BIO LOADING AND THE
SOIL TYPE IN SLOPE STABILITY ANALYSIS
USING 2D PLAXIS

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Ketidakstabilan cerun telah dan merupakan masalah berterusan di seluruh dunia. Ia mungkin disebabkan oleh sifat alam semula jadi atau disebabkan oleh aktiviti manusia. Memandangkan masalah diselesaikan tetapi mengikut masa berlainan jenis atau jenis masalah yang membawa kepada penstabilan cerun timbul. Kajian ini bertujuan untuk mengkaji penyebab ketidakstabilan cerun dengan kesan pelbagai jenis bio-beban yang bertindak di atasnya dan juga jenis tanah. Dalam kajian ini, dengan mengumpulkan data yang relevan dari penyiasatan tanah faktor keselamatan (FOS) dan parameter penting lain boleh dihasilkan menggunakan perisian Plaxis 2D. Ciri-ciri dan sifat-sifat tanah akan direkodkan secara terperinci. Tambahan pula, jenis hakisan tanah dan juga faktor-faktor yang menyumbang kepada kejadian sedemikian digambarkan untuk memberikan gambaran yang lebih baik mengenai keadaan tersebut. Selain itu, pelbagai jenis model tanah juga dikaji dan dibandingkan dengan perisian Plaxis 2D. Dalam bahagian metodologi, selok-belok perisian dijelaskan. Prosedur atau langkah menggunakan perisian Plaxis 2D juga diterangkan secara terperinci. Hasil yang diharapkan untuk penyelidikan ini akan digunakan sebagai panduan dalam menyelesaikan masalah penstabil cerun dengan kaedah tiang hidup yang benar, pengiraan pemuatan dan juga jenis tanah yang digunakan.

ABSTRACT

Slope instability has been and is an ongoing problem around the world. It maybe caused by mother nature or due to human activities. As the problems are being solved but as time goes on different types or kind of problems which led to slope stabilization comes up. This research aims to study the cause of slope instabilization with the effects of different types of bio-loadings acting on it and also the type of soil . In this research, by collecting relevant data from the soil investigation the factor of safety (FOS) and other important parameters can be generated using the Plaxis 2D software. The characteristics and the properties of the soil will be noted in detail. Furthermore, the types of soil erosion and also the factors that contribute to such occurrence are described to provide a better image on the situation. Besides that, different kind of soil models are also studied and compared with the Plaxis 2D software. In the methodology part, the ins and outs of the software was explained. The procedures or steps of using the Plaxis 2D software was also explained in detail. The expected result for this research will be used as a guide in solving the issues of slope stabilization with the correct live pole method, loading calculations and also the type of soils being used.

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LIST OF SYMBOLS

FOS	Factor of Safety
MsF	Median safety Factor

LIST OF ABBREVIATIONS

c'	Soil Cohesion (kPa)
Δs	root cohesion (kPa)
z	vertical depth of the failure plane (m)
β	slope angle (o)
ϕ'	soil friction angle (o)

CHAPTER 1

INTRODUCTION

1.1 Introduction

Malaysia's infrastructure development has been relatively robust for the past decade relating to the population growth. The population growth in Malaysia is increasing year by year. Lately, as a result of rapid economic development, physical systems are disturbed and changed. For example, the modification of the hydrological cycle due to deforestation, urbanisation, development of hill slopes and other human land use have given rise to increased risks of landslides. In that case, slope stability is one of the biggest issue in construction developments based on Malaysia's nature topography.

According to (BADD, 2017) lately, we Malaysians were shocked with a horrific disaster about the collapsing of Highland Towers in December 1993. One of the three towers collapsed due to a landslide which resulted in a total of 48 people being perished under mud and rubble. Besides that, the landslide incident in Keningau, Sabah which recorded the highest number of deaths with a record of 302 deaths according to Jabatan Kerja Raya (JKR). These issues had prompted our government and public to look into deeper and be more aware on the stabilization of slope before more consequences occurs.

As stated by Dr. Haliza Abdul Rahman (2017), landslides is known as the movement of a mass of rock, debris or earth down the slope under impact of gravity. In this case, when the shear stress of the soil overwhelms the shear strength of the soil it loses its strength and cohesion resulting in a landslide. Hence, adequate investigations are needed to overcome this problem from occurring.

One of the famous method that is being used nationwide is the vegetation method. It is surely knew that vegetation impacts slope stability in two different ways through hydrological impacts and mechanical impacts (Buß, J et al., 1999). The use of live pole gives a great impact for slope stabilization especially for shallow slope as it increases the soil suction and decreases soil moisture (Wu et al., 2014).Vegetation planted to provide reinforcement through the plant root framework, but also by a decrease in water content and pore water pressure. Hence the weight acting on the soil is reduced. Live cuttings and stems are purposely embedded and arranged in the ground where they serve as soil reinforcement, horizontal drains and barriers to earth movement, and hydraulic pumps or wicks. (Prasad et al., 2012).

There are few factors which leads to slope failure. One of the main factor is the climate changes. For an instance, rainfall has become the highest contributor to landslides occurrence in Malaysia. The existence of excess water through rainfall penetrates into the ground and makes the slope to become active. It increases the weight of ground mass and decreases the shear strength which in result will automatically decrease the factor of safety of slope (FOS) and subsequently triggers landslide. The type of soils also contributes to soil erosion. The erodibility of the soil is influenced by its texture, structure, and organic matter, nature of day and the amount and kind of salts present. Soil detachability increases as the size of the particle increases but soil transportability increases with the decrease in particle size. Hence to overcome further problems due to slope stabilization from occurring suitable remedial measures could be done by using the software Plaxis.

1.2 Problem Statement

Slope stabilization is tough challenge for a civil engineer. Without proper analysis of slope stabilization it could lead to many fatal disasters. Hence, analysis of soil stability has to made as a priority before any developments were to be conducted using proper methods and software such as the plaxis software.

In University Malaysia Pahang, there are some slopes facing shallow soil erosion even though the slopes are well maintained by using vegetation method. For an instance, the slope located beside the Canselori of University Malaysia Pahang. This study is conducted to understand whether the type of soil of the slope has an adverse effect on the

slope stabilization in contrast with the function of live pole method being used and also the loading of the live pole method acting on the slopes could be the reasons behind the slope failures. The type of soil found beside the Canselori building of University Malaysia Pahang is silty sand clay. Even though the slope is well maintained with using the vegetation method but there are still some serious soil erosions that had occurred. In fact there are many advantages of using this method such as it is environmental friendly and also does not require too much cost. The main disadvantage is that when it is not done the correct way the interaction between the soil and the vegetation will not be there. It is important to account for the influence of each parameters with other influencing factors to obtain the interaction. Hence, proper analysis is important with the help of Plaxis 2D software to evaluate the outcome from my study.



Figure 1.1: Shows that the soil is badly eroded



Figure 1.2: Shows the roots of the vegetation exposed

1.3 Research Question / Hypothesis

To achieve its research objectives, the proposed study aims to address the following research questions:

- a) What is the effect of slope stability when different loadings of the live pole method are applied acting on the soil itself?
- b) Does the soil has a adverse effect on the slope stabilization in contrast with the vegetation being used ?

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