

MODIFICATION OF SLOPE MAINTENANCE PROGRAM ALONG FT59,  
JALAN TAPAH-CAMERON HIGHLAND, PERAK

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*“Praise to Allah S.W.T, lots of love to my wife and son; Dalila and Iffat,  
special thought for both of my parents, big huge to all my siblings include my  
late sister, all the lecturers and my best friend, Mior Saifulnizam, thank you  
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## ABSTRACT

Generally slope failure is a stochastic event. Slope failure occurs without warning. Thus it is quite difficult to determine where and when failures will occur. This critical situation becomes worse due to the unpredictable climate, poor maintenance, lack of education on slope failure and pre-assessment of slope was not conducted as scheduled. Regular maintenance is essential for all man-made slopes and retaining structures, disturbed terrain features and natural terrain hazard mitigation measures to avoid deterioration or to upkeep their functions. The purpose of this study is to recommend a standard of good practice for the maintenance of man-made slopes and retaining structures, disturbed terrain features and hazard mitigation measures provided to natural terrain (e.g. boulder fences and check dams). The thesis is aimed at professional geotechnical/civil engineers, although it will also be useful to the general public, many of whom carry responsibility for slope maintenance as owners of property. Jabatan Kerja Raya has already employed Slope Risk Management System in monitoring the slope performance. However, a flaw in the system is inevitable. The purpose of this work is to look in depth and propose for a betterment of the system. This thesis outlines the objective of the study, including the way the study will be conducted and the expected hypotheses that can be concluded from the study. Although the study done is quite superficial in terms of slope monitoring, however it was thought to be invaluable in alerting responsible personnel to acquire systematic knowledge in slope maintenance program.

## ABSTRAK

Secara umumnya, kegagalan cerun berlaku secara 'stochastic'. Kegagalan cerun berlaku tanpa sebarang amaran. Oleh itu, agak sukar untuk menentukan di mana dan bila kegagalan akan berlaku. Keadaan kritikal ini menjadi menjadi lebih teruk kerana iklim yang tidak menentu, kekurangan penyelenggaraan, kekurangan pendidikan mengenai kegagalan cerun dan pra-penilaian cerun yang tidak dijalankan mengikut jadual. Penyelenggaraan berkala amat diperlukan untuk semua cerun buatan manusia dan struktur penahan, bentuk muka bumi yang terganggu dan muka bumi semula jadi bagi mengelakkan kemerosotan atau menambah kebolehtahanannya. Tujuan kajian ini adalah untuk mengesyorkan piawaian amalan yang baik bagi penyelenggaraan cerun buatan manusia dan struktur penahan, bentuk muka bumi yang terganggu dan muka bumi semula jadi (contohnya pagar batu dan memeriksa empangan). Tesis ini adalah disasarkan kepada jurutera geoteknik / awam, walaupun ia juga akan berguna kepada orang awam, yang kebanyakannya menjalankan tanggungjawab penyelenggaraan cerun sebagai pemiliknya. Jabatan Kerja Raya telah menggunakan kaedah Slope Risk Management System dalam memantau prestasi cerun. Walaubagaimanapun, kelemahan dalam sistem yang tidak dapat dielakkan. Tujuan kerja ini adalah untuk melihat serta mencadangkan penambahbaikan system ini. Tesis ini menggariskan objektif kajian, termasuk cara kajian itu akan dijalankan dan hipotesis yang dijangka yang boleh disimpulkan daripada kajian. Walaupun kajian yang dilakukan ini adalah memaparkan asas di dalam pemantauan cerun, ia adalah bernilai untuk menyedarkan mereka yang bertanggungjawab untuk mempunyai pengetahuan yang sistematik di dalam program penyelenggaraan cerun

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

Slope areas are extremely sensitive to disturbances of any sort with respect to numerous landside occurrences in Malaysia recently. Landslide at Genting Highlands slip road in 1996, landslide at Gua Tempurung in 1996 and collapse of Highland Tower in 1993 are among the events that indicated what could happen when things go wrong. These events over the pass years have captured the attention of the government and social especially to geotechnical engineers to carry out investigation or research to prevent and to maintain existing slopes from these indicates.

Landslide and other slope failures are the natural results of decomposition of geologic material, steepening of slopes by erosion and alteration of inclination by tectonic movements such as rainfall. The incident of occurrence is related primarily to topography, geology and climate. Certain geologic conditions have a probability of susceptibility to land sliding, but natural failure depends for the most part on ground saturation and rainfall intensity. Therefore actual prediction of failure can be uncertain, even when small movement already occurring.

In natural slopes almost all failures occur during or immediately after periods of heavy rain or during wet seasons, indicating that pore-water and seepage pressures are the most important aspect of stability analysis. These pressures result in generally from rising water-table levels. In constructed embankments, failures during or after construction are usually the result of high pore pressures induced by embankment loads or rising water levels (Hunt, 1986).

Many hill slopes areas in Malaysia are particularly vulnerable to soil erosion due to their steep slopes and an approximately 3000 mm heavy rainfall per year (Abidin and Arbai, 1998). Slope instability and erosion of the soil by water and wind are major environment hazards. Soil on slope and elevated areas has natural tendency to slide under the influence of gravitational, which is resisted by the shearing resistance of the material. Instability of slopes occurs when the shearing resistance is not enough to counterbalance the forces tending to cause movement along any surface within a slope.

In the stability analysis of slopes, many design factors cannot be determined with certainty. Therefore, a degree of risk should be assessed in an adopted design. The factor of safety fulfills this requirement. The factor should take into account not only the uncertainties in design parameter but also the consequences of failure are slight, a greater risk of failure or a lower factor of safety may be acceptable.

However, when a slide takes place, it necessary to determine the causes of the slide, so that proper remedial measures can be taken to correct it. The processes involved in slide comprise a continuous series of events from cause to effect. Seldom, it ever, can a slide be attributed to a single definite cause. The detection of the causes may require continuous observations, and a final decision cannot be made in a short time (Young, 1972). In other words, slope stability is one of the most prominent problem encounters in geotechnical engineering.

## 1.2 Background

FT 59, known as Jalan Tapah – Cameron Highland is the main road for traffic users from south bound heading to Cameron Highland. Jabatan Kerja Raya had started the construction of the road in the past 30 years to facilitate all users. Almost all the road alignment are surround by cut and embankment slopes. The road held by two authorities; JKR Perak and JKR Pahang.

Many stretches of the road would need to cut through hilly and rugged terrain and deep valleys due to stringent geometrical requirements for a comfortable driving and economical issue. As a result, more than 100 cut slopes and fill embankments along FT 59 was formed. Although very stringent maintenance and inspection strategies have been implemented, some slope failures are inevitable due to design optimization and many factors that could not be foreseen during the design and construction stage. It is very important that these cut slopes and fill embankment are maintained because significant investment is constructing them and the risk to road users and disruption to operation should major failure occurred. In many instances, slope failures, as well as erosion and flooding, are neither preventable nor controllable, even with the expenditure of very large sums of money.

This study is essentially to assess the slope maintenance programmers that has been carry out by JKR Perak in order to maintain the cut slopes and fill embankment along the FT 59, Jalan Tapah – Cameron Highland focusing only in the JKR Perak jurisdiction that is section 0.00 until section 46.00.

### **1.3 Problem Statement**

In an earth or rock fill the important signs of impending slope instability are increasing rate of lateral movement at the toe of the slope and formation of cracks at the crest. Initially the cracks will merely open in width, but when the failure has progressed there will be a vertical separation. Ordinarily, the lateral movements and any toe heaves will be imperceptible, at first, and can only be picked up by appropriate subsurface instrumentation and surface surveying. These are therefore an essential and integral part of any slope control programme.

The purpose of slope treatment can be placed in either preventive for potentially unstable cut slope and fills, or remedial for existing unstable or moving slope or slope totally failed. Slope failure potential usually can be established with some certainty by an experienced practitioner, although in many cases the actual occurrences of a failure is not predictable because of many natural transient factors such as weather conditions. In addition, there are many forms of slope failure that cannot be prevented. However, prevention to any slope failure incident could be done through slope maintenance programme, which will allow close monitoring and inspection of the slope condition. Preventive measure can be done if the inspection if the inspection and monitoring result shows that the slope conditions need to be maintained. Therefore, the slope maintenance programme cover in this study is hope to provide appropriate or sufficient knowledge on how slope maintenance programme and work was done along the North South Road. Assessment of this programme is made to fulfill the aim and objectives of this project.

## **1.4 Aim and Objectives**

The aim of this study is to assess the overall maintenance programme carry out along the FT 59 Jalan Tapah – Cameron Highland and also to determine the slope failure risk involved.

The objectives of this study are outlined as follows :

- (i) To determine the various types and programme of maintenance works related to slope along the road.
- (ii) To determine the condition and criteria of slope along the road.
- (iii) To determine the effectiveness of slope maintenance programme carry out along the road.

## **1.5 Project Scope**

FT 59, Jalan Tapah – Cameron Highland is divided into five section as illustrated in figure 1.1, Therefore, it is important to identify the scope of the projects.

The scopes of this project are as follows :

- (i) Identification of slope failure types and programme of maintenance works carry out along the road in southern region (Seremban to Johor Bahru stretch).
- (ii) Identification of slope failure features, with respect to slope condition and criteria along the road in southern region.

## **1.6 Importance of the Study**

The assessment on the slope maintenance programme is important because of the following factors :

- (i) This study is essentially to find out the effectiveness of slope maintenance programme with the cost involved in order to maintain the slope along the road
- (ii) This study is hoped to provide and contribute to research work on slope carry out by student, researcher as well as practitioner.
- (iii) If the slope maintenance programme carry out is a well-established programme, it will certainly be a helping toll understanding the features and frequency of occurrence of slope failures along the FT 59, Jalan Tapah – Cameron Highland especially in JKR Perak authorities. Apart from that, the economic evaluation on whether the programme under considerations is worth investment at all.

## **1.7 Brief Project Methodology**

The methodology of this study is to used and analyze the existing slopes condition along the road acquired from the slopes inspection form and physical reconnaissance as well as visual observations based on the aerial photo assessment. All the information and data acquired will be used to identify the overall slopes conditions along the road. Using this information, the slopes are ranked accordingly. The maintenance programme carry out along the road will be identified to gives the information on maintenance frequency, goals and strategy. The programme will then be assessed whether the programme is in line with the overall slopes condition along the road.

## **1.8 Sequence of Project Writing**

This project is basically divide into 6 parts with the sequence of writing are as follows :

- (i) First part (Chapter I), will consists of introduction, background of the study, problem statement, aims and objectives of the study, the importance of the study, and also the sequence of project writing.
- (ii) Second part (Chapter II), is a review of literature on type and characteristic of slope, explanation of the factors that affect the slope stability, classification of slope failure, and also slope stabilization and remedial works.
- (iii) Third part (Chapter III), consists of explanation on project methodology which involved interviews with parties that involved in slope maintenance programme, data collections procedure and data analysis.
- (iv) Fourth part (Chapter IV), contains the results obtained from the analysis. Result were divided into three parts namely the maintenance systems, criteria and conditions of the cut slopes and embankment.
- (v) Fifth part (Chapter ) will explain on the results, discussions on the high-risk area, factors will contribute to slope stability, frequency of maintenance work and type of maintenance work
- (vi) Sixth part (Chapter VI) is the last part of the project where conclusions for the project and suggestions to extend the study in the slope maintenance programme.



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