

EFFECT OF APPLIED LOAD ON THE STABILITY OF UNREINFORCED AND REINFORCED SLOPES

LOKE KOK FOONG

A project report submitted in partial fulfillment of the
requirement for the award of the degree of
Master of Engineering (Civil – Geotechnics)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

JANUARY 2012

I dedicated this study to my beloved parent, Loke Yoke Hung and Yeoh Kim Lin for their everlasting love, care and support, which keep my spirit burning in achieving my goals.

ACKNOWLEDGEMENT

With a fully sincere and faithful heart, I would like to express my deepest gratefulness to the Almighty God for giving me the strength throughout this period in completing my project. Even though this project was hard but I gain a lot of knowledge and also experience went doing this research.

First of all, my heartiest gratitude goes to my supervisor, Associate Professor Dr. Nurly Gofar for continuous guidance and support as well as patient in advices, instructions, constant motivation and invaluable knowledge given to me along the process to complete the project. Without her continuous support and interest, this project report would have not been the same as presented here.

I would also like to express my sincere gratitude to my beloved family for their continuous faith and support to me. I would also like to thank all the UTM lecturers have contributed whether directly or indirectly to this project.

Appreciation also expressed to geotechnic lab technicians, they have been giving me a helping hand during my project. Lastly once again, all the kindness, patience, contribution, support and everything, I will not forget in my life.

ABSTRACT

Recent development in hilly area has highlighted issues related to instability in engineered as well as natural slopes, hence; it is a challenge to both professionals and researches in Malaysia to address the problem related to landslides and slope failures. Several occurrences during the past few years include Highland Tower collapse in December 1993, Bungalow collapse at Taman Hillview in November 2002, the massive landslide occurred at Bukit Antarabangsa in December 2008, and the recent landslide at Hulu Langat in May 2011. Therefore, uncontrolled development which place structural foundation too near to the slope crest on hilly area may lead to slope failure. Thus, it is essential to consider the safe distance between the foundation and the slope crest. The aim of this study is to determine the safe distance of foundation on slope crest using a commercial software Slope/W (Geostudio, 2007). Morgenstern-Price and bishop method are selected for slope stability analysis due to the flexibility in selecting the critical slip surface. A case study at PT 4697, Seksyen7, Shah Alam, Selangor was selected for the analysis. Applied loading of 10kPa, 15kPa, 20kPa, 30kPa and 50kPa will be placed at various distances from the crest of the slope. The result from the slope stability analysis had indicated that the construction of reinforced earth wall improved the stability of slope but the loading on slope crest decreases the factor of safety of both unreinforced slope and reinforced slope. Therefore the load within unstable area will results in the depressions at the point of applied load, however once the load is moved beyond the unstable area, its effect become significantly minimized and the pattern of safety factor is constant start from a stable distance where the increasing of loading will remain constant for the factor of safety.

ABSTRAK

Pembangunan semasa di kawasan berbukit telah menekankan isu-isu yang berkaitan dengan ketidakstabilan dalam kejuruteraan seperti cerun semula jadi, justeru itu, ia adalah satu cabaran kepada kedua-dua profesional and penyelidikan di Malaysia untuk menangani masalah yang berkaitan dengan tanah runtuh dan kegagalan cerun. Beberapa kejadian dalam tempoh tahun yang lepas termasuk Highland Tower runtuh pada Disember 1993, Bangalow runtuh di Taman Hillview pada November 2002, kejadian tanah runtuh besar-besaran berlaku di Bukit Antarabangsa pada Disember 2008, dan tanah runtuh di Hulu Langat baru-baru ini pada Mei 2011. Oleh itu, pembangunan yang tidak terkawal yang menempatkan asas struktur yang terlalu dekat dengan puncak cerun di kawasan berbukit boleh membawa kepada kegagalan cerun. Sehubungan dengan itu, ia adalah penting untuk mempertimbangkan jarak yang selamat di antara asas bangunan dan puncak cerun. Kajian ini bertujuan untuk menentukan jarak yang selamat di puncak cerun dengan menggunakan perisian komersial Slope/W (Geostudio 2007). Kaedah “Morgenstern-Price” dan “Bishop” dipilih untuk analisis kestabilan cerun disebabkan oleh fleksibiliti dalam memilih permukaan slip kritikal. Satu kajian kes di PT 4697, Seksyen 7, Shah Alam, Selangor telah dipilih untuk analisis. Beban kenaan 10kPa, 15kPa, 20kPa, 30kPa dan 50kPa akan diletakkan pada jarak yang pelbagai dari puncak cerun. Hasil dari analisis kestabilan cerun telah menunjukkan bahawa pembinaan “Reinforced Earth Wall” meningkatkan kestabilan cerun tetapi pembebanan pada puncak cerun mengurangkan faktor keselamatan cerun pada kedua-dua cerun tanpa bertetulang dan cerun bertetulang. Oleh itu, beban di dalam kawasan yang tidak stabil akan membawa kepada keputusan dalam lekukan pada titik beban kenaan, apabila beban dipindahkan ke luar kawasan yang tidak stabil, kesannya adalah ketara dikurangkan dan corak faktor keselamatan adalah malar bermula dari jarak yang stabil di mana peningkatan pembebanan akan kekal malar untuk faktor keselamatan.