UNIVERSITI TEKNOLOGI MARA

SLOPE SAFETY FACTOR MAPPING USING DRONE BASED MULTISPECTRAL SENSOR

MOHAMMAD HUSNI BIN SULAIMAN

Thesis submitted in fulfilment of
requirements for the degree of
Bachelor of Surveying Science and Geomatics (Hons)

Faculty of Architecture, Planning and Surveying

January 2020

ABSTRACT

Slope stability analysis is performed to reduce the chances to become slope failure or landslide. Thus, slope stability analysis can be interpreted in context of safety factor where the degree of slope failure risk can be determined. The aim of this project is to calculate safety factor of slope. There are two objectives of this research which are; the first one is to compute factor of safety using selected spectral band from drone image and the second one is to produce safety of factor map. There are three datasets has been used in this project which is RGB, NIR and Thermal image. The image was given from Dr. Wahid bin Rasib in format of single picture. Then the data was processed in Agisoft software to produce orthophoto image. Because of no coordinate for NIR and RGB dataset, georeferencing in GIS software was used to set up the projection for the images. Combination of RGB and NIR image by using raster calculator tools in ArcGis was done in to produce NDVI and SAVI. Moreover, thermal image was used to derive several parameters by using algorithm from Omar, (2010) and Rahardjo et al. (1995) The parameter are soil moisture, soil mechanics properties and gravimetric water content. All those parameters will be calculated using infinite slope stability model to produce slope factor of safety map. As result, the value of factor safety in the study area is between -1.73 to 1.27 with mean of 0.82 respectively. The indicator for factor of safety is if the value <1 the slope is stable, 1, slope is between stable and unstable and 1> slope is unstable. The map factor of safety shows that 95 percent area is stable 4 percent merely stable and 1 percent is unstable. Nevertheless, comparison between NDVI and SAVI parameter with factor of safety show that those two parameters also affect slope stability.

ACKNOWLEDGMENT

Alhamdulillah , thanks to Allah S.W.T for allowing me to finished the thesis of final year project successfully through thick and thin of learning process. Without His bless I know I will be lost and cannot be able to finish this project within the time given

From the first place, my gratitude and thanks go to my supervisor Mr. Sr. Mohd. Khairy bin Kamarudin who had fully supervised me in this thesis project. He is so caring and supportive as he had encouraged me in this thesis project. Second place go to my co-supervisor Mr, Sr. Dr. Wahid bin Rasib from Universiti Teknologi Mara (UTM) the person who give this project and data to be done for my final year project. With his guidance, I can solve problem that occur during this project smoothly without any major problem. With his experience in remote sensing field, he also teaches me a new knowledge about other field that also related to Geomatics. Not to forget my gratitude to the coordinator of Dissertation, Mrs Sr. Dr. Ernieza Suhana binti Mokhtar for her guided in the thesis development by sharing her experience and knowledge in research.

Not to be forgotten, the biggest appreciation to my parent, Mr. Sulaiman bin Yusoh and Mrs.Noraini binti Othman who had given a lot of love, support and motivation to finished up my final year project. Without them, I got not enough spirit and courage to finish my degree level. Thanks also to other family member that teach and give some advice during my degreeon time.

Last but not lease my gratitude goes to my housemate, batchmates and classmates, RAP2208A and RAP2208B for willingness to share idea and thought that contribute to my final year project. Their supported had encouraged me to complete this thesis project.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 Background Study

Slope stability analysis is important because it can affect many huge projects like highway, building and excavation of pit. Our knowledge of the conduct of slope stability has considerably enhanced over the past decade with latest innovations in information acquisition methods, slope tracking and numerical simulation. According to Omar, (2010), slope stability analysis was done to decrease the probability of slope failure or landslide. This because potential slope to become slope failure need to be analyses for the first part. Many countries applied slope stability analysis to determine any instable slope activities that can occur in their region.

Slope stability analysis will be analyzed, and the output is depending on its factor of safety. According to (Zhu & Zhang, (2017) the factor of safety for slope stability relates to the ratio of soil shear strength to the shear stress in the slope of a potential sliding. The force-related to factor of safety (F_s) may be expressed as follows defects in the rock slope still pose major financial, social and environmental threats to society. (Havaej, 2015). Therefore, the factor of safety = 1.0 showing a slope between stable and unstable, factor safety < 1.0 indicates unstable slope and factor safety > 1.0 indicates stable slope. If the slope was too steep, it will readily weaken if the slope is too lean, increasing the quantity of earthwork required (Zhu et al. 2017).

In this research, to get the value of safety factor, the method of limit equilibrium using the infinite slope stability model is used to assess the stability of slopes along the Senai-Desaru Highway. This work tries to derive many parameters that influence the slope's stability. The parameters are soil moisture, soil mechanic properties like soil cohesion, internal angle of friction, dry unit soil weight and gravimetric water content. NDVI and SAVI also were derived to verify the slope area. Via empirical equations, these parameters were derived from photogrammetry image with combination of its