Investigation of the Optimal Resolution for Landslide Monitoring Using Terrestrial Laser Scanner

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SUMMARY

Landslide is one of the crucial natural disasters for countries throughout the world which leads to life threatening, properties and infrastructure damages. Hence, an effective technique is needed to reduce the impact caused by this type of disaster. There are two approaches available for landslide deformation monitoring and they are point-based technique and area-based technique. Nowadays, TLS technology is gaining popular in monitoring and predicting the movement of the landslide body due to the capability of high speed data capturing without needing direct contact with the monitored surface. Therefore, it is a suitable option for monitoring unstable land slopes. It is undeniable that, proper project planning is needed before carrying out any data collection for landslide monitoring. One of the aspects that need to be studied is the optimum resolution of survey. This scan resolution mainly depends on the distance between the scanner and slope surface: cm to mm resolution. Besides that, the type of resolution also depends on the minimum feature size that needs to be collected. Most of the researchers are using high resolution in this kind of application. The resolution of the digital terrain model (DTM) that can be generated for deformation analysis and easiness for data handling are directly influenced by the point cloud density set. Therefore, the objective of this study is to determine optimal level of resolution for landslide deformation monitoring purpose. In this research, the data acquisition was conducted at a cutting slope in Universiti Teknologi Malaysia (UTM), Skudai by using Leica ScanStation C10. Five control points were well distributed and established around the interest area for point clouds registration purpose. Two scan stations were used to cover the entire land slope surface. Three types of resolution were utilized at each scan station and they are low, medium, and high. The difference between generated DTMs for each resolution was compared with one another through model deviation analyse. At the same time, some artificial targets were placed on the land slope surface in order to evaluate the displacement measured from TLS with the value obtained from reflectorless total station. This study shows that the scanning resolution affects the generated DTM especially the low resolution sample. Hence, it can be concluded that the scanning resolution must be set carefully according to the accuracy required. In conclusion, this study demonstrates that TLS can be used to analyze the condition of the entire slope surface.