Estimating Potential Underground Cavities Volumes - A Case Study in Ipoh, Malaysia

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Abstract

Karst voids are commonly a major engineering risk associated with construction in areas underlain by carbonate rocks. Several problems related to the subsurface karstic voids are road and highway subsidence, building foundation collapse and dam leakage. Due to karst's unique characteristics to exhibit sudden changes in subsurface conditions, extensive geotechnical exploration is needed to achieve the best results. A site investigation that can provide clearer picture of the overall underground conditions should be carried out in order to overcome the problems related to karst voids, such as cavity profiling. The adaption of geophysical methods for engineering purposes represents an important contribution to the improvement of site investigation methodology. The combination of *in situ* geotechnical testing and continuously measured geophysical data can achieve a more reliable subsurface profiling. The cavities study in karst formation provides clear 2D image of underground profiles. However, in recent developments the 2D resistivity images can be extended to 3D images using certain software that can calculate the subsurface volume. Thus, this helps to provide a clearer picture of the overall underground conditions.

A study was carried out due to the occurrence of sinkholes at a parking area during extension works of the area. In order to obtain the subsurface images, initial geophysical surveys using the electrical resistivity imaging method was carried out at the site in Ipoh, Perak of Malaysia. Thirteen (13) parallel lines were laid longitudinally to an area of 600 m length and 60 m width. The subsurface profiles of the study area were successfully analyzed and determined from 2D resistivity images of sectional profiles, for potential cavities and voids identification and volume estimation. Using the simulation of computer software, the volume of the cavities formed in the limestone rock below the surface was estimated. Thus, the findings of this study could help in quantifying the amount of fill material needed for the ground improvement, especially for grouting purposes. The outcome of the study revealed that shallow depths of underground cavities are able to be quantified.