

IDENTIFICATION OF SUBSURFACE CAVITIES IN MARBLE – A CASE STUDY FROM VIJAYA SRI GAMA AREA, DIGANA, KANDY

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Subsurface cavities in calcareous rocks cause serious restrictions in urban development and trigger significant geotechnical and geo-environmental hazards, due to development of unusual cracks on the buildings and subsidences in Sri Lanka, especially as recorded in Matale. Such kind of problems have also been reported in Digana, Kandy town and Gampola due to subsurface cavities. For this study, problematic area of Wijaya Sri Gama, Digana in Kandy district was selected. Four causative factors such as subsurface erosion, landslide toe bulging effect, presence of expansive soils and collapses of cavities were suspected on the development of cracks in the houses of the affected area. Geological and geomorphological studies, crack monitoring with rainfall, testing of expansive nature of underlying soils and geophysical investigation (2D ERT) were carried out to identify the influence of the above-mentioned factors.

Study area is situated at the toe of a NE dipping slope and almost all area is flat except western part, which has 25°-30° inclinations. According to geological studies, the area is underlain by fresh to moderately weathered dolomitic marble with accessory minerals of diopside, apatite and graphite. The observed soil type is residual, reddish brown in color, gravely sand with minor occurrences of silt and clay and the overburden thickness is 0.5-1.0 m. Results obtained from crack monitoring have clearly shown that 0.38 mm widening rate of cracks during three months period. Rainfall was not significantly fluctuated during this period, hence it can be inferred that the effect of rainfall on widening the cracks is insignificant. Based on geological, geomorphological, hydrological features and crack orientations on the houses, it is clear that the subsurface erosion and landslide toe bulging are not the typical causes of the problem. Also swelling index of all soil samples are very low (<50%) to low (50%-100%). Hence an underlying shrinkable clay formation also could not be the problem. Results of 2D ERT clearly indicated the presence of large cavities and caverns underneath the surface of the study area. Therefore, cracks on building in this area is possibly an initial indication of ground subsidence due to cavity and cavern formation as a result of chemical weathering and dissolution of subsurface marble rock. As future studies, borehole drilling and 3D ERT are to be carried out to confirm the cause and assess the hazardous level of the issue. The findings will be used to propose mitigatory measures and address the same issue in other areas of the country.

Keywords: Cracks on buildings, ERT, Subsurface cavities, Swelling index, Dissolution
