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Geological and Geophysical Studies for Multiple Hazards Assessments in an Occupied Residential Area, Puchong, Selangor

TAJUL ANUAR JAMALUDDIN[1], MOHD HARIRI ARIFIN[1], HAMZAH HUSSIN[1,2] & MOHD AMIR ASYRAF SULAIMAN[1]

[1]Department of Environmental Science & Natural Resources, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
[2]Department of Geoscience, Faculty of Earth Science, Universiti Malaysia Kelantan, 17000 Jeli, Kelantan

An occupied residential area in Puchong, Selangor has been badly affected by multiple-geohazards namely sub-surface erosion, ground settlement and slope failures. The multi-geohazard event was first noticed by the residents when the retaining wall and the road above it which bounded the southern-end embankment slope, failed in May 2011. The failed retaining wall and the associated road has been rehabilitated and reinstated in August-September 2011. However, ground movements (vertical and horizontal) still continue to occur. New tension cracks started to appear on the road pavement and development of new and wider dilatational cracks were widespread in the houses and other associated rigid structures (concrete walls, floors, road curbs, road-side drains, concrete walkway). Other sign of distress, such as subsided road surface, tilted lamp posts, leaked fish ponds, propagating cracks in the walls and etc, from time to time. Geological study and geophysical survey were carried out in February 2012 upon request by the residents association, in order to identify the underlying causing factors and to recommend suitable mitigation measures. Surface mapping was carried out by "walk-over" survey and mainly focused on mapping the signs of distress in the ground, such as tension cracks and other dilational cracks in the road and rigid structures, tilted posts and walls, etc. Geology of the area was compiled from the literature and field observation reveals that the fill materials used for the embankment are consisting of chaotic mixture of soils and rock boulders/blocks of variable sizes and shapes. Their lithologic types resemble much of the Kenny Hill's Formation, i.e quartzite, metasandstones, phyllite and metamudstones. Elecrical resistivity survey was also carried out to investigate and characterized the subsurface geologic conditions. A total of 6 survey lines were carried out in the residential area. Interpretation of temporal satellite images of Google Earth, dated 2001, 2004, 2007, 2008 and 2010, was also carried out in order to unravel the geomorphological and topographical changes brought about by earth- and construction-works that have been taken place in the study area. Results of these study surprisingly indicated that the housing area was actually built on a massive and thick embankment which has been placed in a valley and covered-up a stream channel. The existence of the underground stream channel was clearly depicted by the electrical resistivity pseudo section, and on the surface it appears as major springs at the lower section of the embankment slope located downstream. As a conclusion, the underlying factors for the multihazards in this residential area – namely subsurface erosions which subsequently followed by ground settlement and slope failures, are attributed to human error and ignorance. A stable and flat platform for a housing area or any other permanent engineering structures, could not be done by simply dumping rocks and earths to fill up a valley with living stream. The natural stream flow should be properly diverted or provided with sub-surface conduit prior to backfilling of the valley/channel to prevent untoward risks of geohazards. This case study served a very costly lesson that basic geological knowledge is vitally important when come to deal with the water, rocks and earth.

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