CERAMAH TEKNIK TECHNICAL TALK

Why failures occur at soil cuts and natural ground slopes in the granitic bedrock areas of Malaysia

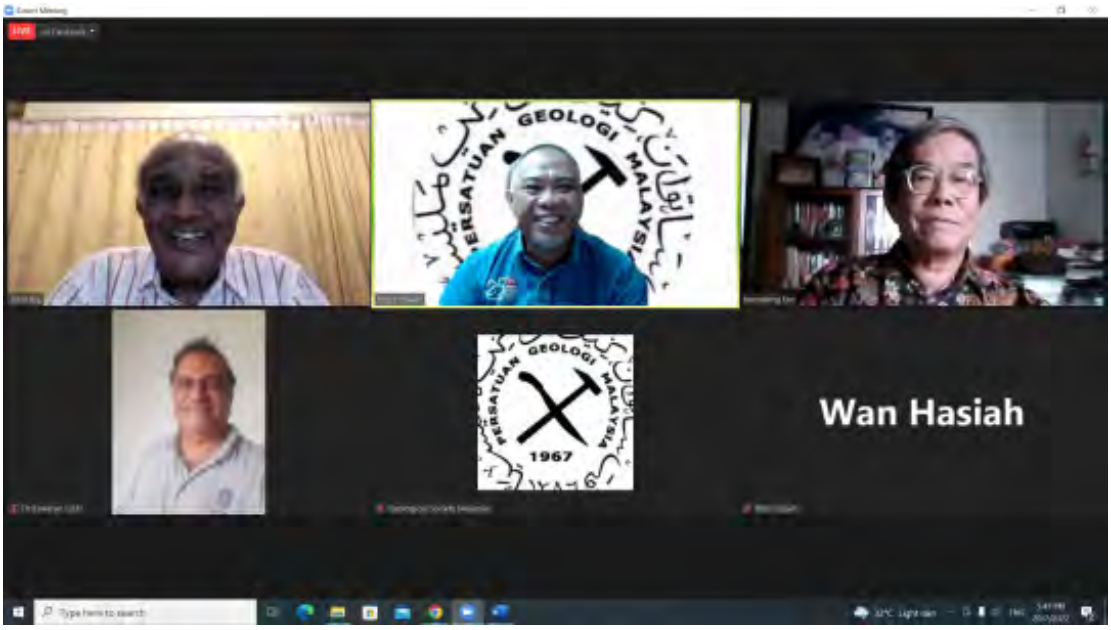
John Kuna Raj
Date: 20 July 2022
Platform: Zoom / Facebook

The above talk was delivered by P.Geol. Dr John Kuna Raj (Consultant) on 20th July, 2022, via Zoom/Facebook Live. Some 40 members participated. An abstract of the talk is given below:

Abstract: Deep weathering profiles are found in granitic bedrock areas in Peninsular Malaysia, though shallower profiles and outcrops are seen in Sabah and Sarawak. The weathering profiles are characterized by three broad zones, i.e. the upper pedological soil, the intermediate saprock, and the underlying bedrock. Several sub-zones can also be differentiated and assigned Rock Mass Weathering Grades. Pedological soil represents completely weathered granite and mainly comprises sandy clays, whilst saprock represents moderately to highly weathered granite and consists of sandy silts and silty sands with distinct relict granite textures and structures and contains core boulders. In geotechnical literature, the term residual soil is used to describe the pedological soil and saprock.

Earth materials at slope cuts are dependent upon their heights; low cuts (<10 m high) exposing pedological soil, whilst high cuts (>10 m high) expose both saprock and pedological soil. Groundwater tables are close to the ground surface in low-lying terrain where failures can occur under undrained conditions. In hilly to mountainous terrain, groundwater tables are located at depth; the overlying residual soils classified as unsaturated soils and failures occurring under drained conditions.

Stability analyses are important in the design of slope cuts, though there is limited published data on the shear strength parameters of residual soils. Published data mainly involves remoulded samples which do not take into consideration inherent relict granitic textures. Back stability analyses of slope failures allow for determination of



average strength parameters as well as recognition of the triggering factors. Back analyses of some soil cut failures are presented to illustrate the usefulness of back stability analyses.

Relatively small failures (<100 m^3 volume) have occurred at steep (>60°) benches and include soil (or earth) falls in pedological soil, and shallow slips in saprock; the failures preceded by development of tension and desiccation cracks. Wedge failures, block and slab slides of small volumes have also occurred at steep (>60°) benches in saprock where there were present steeply dipping and day-lighting, relict discontinuity planes.

Large failures (>1,000 m^3 volume) have also occurred and involve earth materials from pedological soil and saprock. Slumps occurred at cuts where the groundwater table is located close to the ground surface, whilst slump flows involving saturated slope materials moved downslope (in part) along the saprock/bedrock boundary. Debris slides are similar to slump flows but contain a large number of core boulders. Large block slides have also sometimes occurred; the sliding plane being a distinct, day-lighting, relict fault plane.

Failures have also occurred at natural ground slopes in granitic bedrock areas; the most prominent event involving rock falls, slumps and debris slides during the 6.0 Mw earthquake on 5 June 2015 at Mount Kinabalu (Tongkul, 2020). Landslide debris created several temporary dams whose breaching gave rise to devastating debris flows.

We thank Sdr Dr. JK Raj for his support and contribution to the Society's activities.

Tan Boon Kong
Chairman, Working Group on Engineering Geology
21st July, 2022