Engineering Geological Assessment (EGA) on Slopes Along The Penampang to Tambunan Road, Sabah, Malaysia.

ABSTRACT

This study focused on the engineering geological investigation of slope failures along Penampang to Tambunan road, approximately 12th km to 101th km from Kota Kinabalu city, Sabah, Malaysia. The area is underlain by the Crocker Formation (Late Eocene to Early Miocene age) and the Quaternary Deposits (Recent age). These rock units show numerous lineaments with complex structural styles developed during several regional Tertiary tectonic activities. The tectonic complexities influenced the physical and mechanical properties of the rocks, resulting in a high degree of weathering and instability. The weathered materials are unstable and may experience sliding due to by high pore pressure and intensively geomorphological processes. In this study, a total of 31 selected critical slope failures were studied and classified into two main groups: rock slope and soil slope. Failures in soil slopes (including embankments) are 21 (67 %) whereas 10 of all failures (33 %) of rock slope. Soil slope failures normally involved large volumes of failed material as compared much rock slopes, where the failures are mostly small. Of the 21 failures in soil slopes, 15 (71 %) are embankment failures making them 48 % of all types of failures. Physical and mechanical properties of 84 soil samples indicated that the failure materials mainly consist of poorly graded to well graded materials of clayey loamy soils, which characterized by low to intermediate plasticity content (9 % to 28 %), containing of inactive to normal clay (0.34 to 1.45), very high to medium degree of swelling (5.63 to 13.85), variable low to high water content (4 % to 22 %), specific gravity ranges from 2.57 to 2.80, low permeability (9.66 X 10-3 to 4.33 X 10-3 cm/s), friction angle (ϕ) ranges from 7.70˚ to 29.20˚ and cohesion (C) ranges from 3.20 KPa to 17.27 KPa. The rock properties of 10 rock samples indicated that the point load strength index and the uniaxial compressive strength range classified as moderately week. Kinematics slope analyses indicates that the variable potential of circular, planar, wedges and toppling failures modes as well as the combination of more than one mode of aforementioned failure. Rock and soil slopes stability analysis indicates that the factor

of safety value as unsafe (0.52 to 0.98). Engineering geologic evaluation of the study area indicates that the slope failures took place when rock and soil materials were no longer able to resist the attraction of gravity due to a decrease in shear strength and increase in the shear stresses due to internal and external factors. Internal factors involve some factors change in either physical or chemical properties of the rock or soil such as topographic setting, climate, geologic setting and processes, groundwater condition and engineering characteristics. External factors involve increase of shear stress on slope, which usually involves a form of disturbance that is induced by man includes removal of vegetation cover, induced by vehicles loading and artificial changes or natural phenomenon such as tremors. Development planning has to consider the hazard and environmental management program. This engineering geological study may play a vital role in slope stability assessment to ensure the public safety.