Two Case Studies on Soil Nailed Slope Failures

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**Overview**

The case studies in this presentation contain soil failures involving soil nailed slopes in Malaysia. This construction method has been used since the 1980s to reinforce steel cut slopes. During the investigation, additional subsurface tests were performed to confirm previous subsoil profiles and shear strength parameters.

The first failure site consisted of upper cut slope and lower nailed slope which were constructed for the formation of a new road. The site is underlain by completely weathered Shale Facies. The failure consisted of seven upper berms and five lower berms. During the investigation following the failure, joint sets were observed which are thought to have contributed to the slope failure. Several different laboratory tests were conducted from several areas of the failure. With this data, a model of the site was constructed and an analysis using the Limit Equilibrium Method and Finite Element Method was conducted. With the results from these two methods, the first failure was due to an inadequate Factor of Safety for global stability and the mechanism of progressive failure. The Factor of Safety against global and local stability were found to be just marginally higher than 1.0. The finite element analysis shows that the shear failure surface gradually developed as the excavation progresses to the lower berms of the slope, indicating progressive failure.

The site of the second failure, according to geologic mapping, consists of metamorphic and granite rock types. The samples taken from the site showed high composition of coarse materials. Due to this coarse material, the Hoek-Brown method was utilized to generate strength parameters. This site failure had a steep soil nailed slope, which was supported by soil nails of varying length. Assessment was carried out on the facing of the soil nailed slope, and it was found that the reinforcement was insufficient for flexural strength and punching shear strength. Slope stability analysis using limit equilibrium method was also carried out. It was assessed that the Factor of Safety of the soil nailed slope was only 1.12, which is not adequate for long-term stability. The dominant cause for failure in this case is attributed to facing failure at the soil nail head.

These two case studies show what cautions need to be taken when dealing soil nailed slopes. The case study reinforces the need to ensure use thorough analysis of a sloped surface.

**References**

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