

**UNIVERSITI TEKNOLOGI MARA**

**REINFORCED GROUT J-HOOK  
HYBRID ANCHOR SOIL NAIL  
SYSTEM FOR SLOPE  
STABILIZATION**

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## ABSTRACT

Malaysian practice on soil nail design is mostly still adopted conventional passive soil nailing system. Unfortunately, there are some limitations of this conventional design concept when many failures reported involved the conventional passive system. Hence, a wider understanding of the soil nailing behaviour is necessary, together with innovation in design. Therefore, this research focused on soil nail pull-out strength based on laboratory scale test, prototype field test and full-scale test on actual project and finite element modelling comparison. The objectives of this study are: (i) to develop new design concept of Reinforced Grout J-Hook Hybrid Anchor (J-Hook) soil nail; (ii) to assess the applicability of the concept by running lab model; (iii) to determine the constructional viability of the system by doing field installation and in-situ pull-out test; (iv) to determine the performance of the J-Hook soil nail in actual slope strengthening project; and (v) to validate soil nail modelling by using Simulation software. The J-Hook was developed at laboratory scale. The tensile load (100 and 200 kN) can be mobilised and maintained under the effective stresses (100 and 200 kPa) for 85 minutes resulting in narrow displacement (0.8 and 1.0 mm). As comparison, conventional system applies 4 and 7 kN tensile load that can be mobilised and maintained under similar effective stresses (100 and 200 kPa) for 85 min resulting in higher displacement equivalent to 9 and 5 mm respectively. Soil nails (length: 1, 2 and 3 m) were installed in the field experiment. The pull-out forces of conventional soil nail (6, 30, and 46 kN) and J-Hook (without bulging end) (24, 46, and 52 kN) were compared. The J-Hook soil nail was able to sustain pull-out force from 50, 82, and 90 kN accordingly. The J-hook soil nail were installed in Shah Alam and Kuantan. The soil nail performance was assessed. The results were satisfactory and have fulfilled the acceptance criteria. The pull-out strength of soil nail was validated using Excel Spreadsheet and Slope W Software. Slope stability of J-Hook was analysed using Slope W software with overall slope stability proven. Hence, this research integrates a wider understanding on the soil nailing behaviour and innovative design for geotechnical engineering solution.

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