

IPL Project, IPL-155 Annual Report 2018

1 January 2018 to 31 December 2018

1. Project Title:

Determination of Soil Parameters of Subsurface to be Used in Slope Stability Analysis in two Different Precipitation Zones of Sri Lanka.

2. Main Project Fields - Technology Development

Category B. Hazard Mapping, Vulnerability and Risk Assessment

3. Name of Project Leader :

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Core members of the Project

Eng.(Ms) S. S. I. Kodagoda [BSc(Hons)Eng,MEng(Geotech)],,CEng,; Deputy General Manager

Eng.(Ms) M A S N Mallawarachchi (BSc Eng(Hons)-Civil Engineer

Ms H.M.J.M.K. Herath(BSc(Geology Special).- Engineering Geologist

Eng.(Ms) L K N S Kulathilake (BScEng(Hons)- Earth Resources Engineer)

4. Objectives:

Determination of critical and other important insitu soil parameters for various soil types that are present in two different precipitation zones in Sri Lanka and comparison of the same. The selected two precipitation regions are based with:

- (a) Heavily precipitated zone in wet zone with annual average rainfall above 4000mm
- (b) Wet zone with annual average rainfall between 2500-3000 mm

5. Study Area:

- a. Heavily precipitated zone in wet zone with annual average rainfall above 4000mm-Watawala, Nawalapitiya
- b. Wet zone with annual average rainfall between 2500-3000 mm Haldummulla, Haputale, Ratnapura, Kalawana

6. Project Duration:

Originally proposed project duration is January 2010 to end December 2011. However, due to the requirement of further study project period extended until June, 2019)

7. Report

7.1 Progress in the project: -

The comparison of soil module E50 of residual soil slope failures in two different rainfall precipitation zones is an experimental study to formulate a relationship between the potential slope failures quantify shear strength characteristics of soils which could be easily discussed on scenarios of the first time occurrence failures and repetitive failures in residual soil formation. However, number of failures were recorded in rock or interface of rock-soil conditions. According to the present progress of the testing programme there were thirty five(35) samples were selected for the determination of initial moisture content, initial void ration, dry density, shear strength parameters and secant modulus of E50. Sample diameters for triaxial samples are 50mm to 70mm diameter and tested under isotropic consolidated undrained (CIU) triaxial compression state with pore water pressure measurements for the determination of stress strain parameters of soil. In addition another set of samples were tested under undrained condition to determined the elastic properties. All testing were conducted at the Advanced Soil Testing Laboratory at the CECB Laboratory Services, Central Engineering Consultancy Bureau, in Colombo.

The proposed project is expected to extent until 2021 due to extended activities as proposed in the 7.2 below.

7.2 Planned Future Activities or Statement of Completion of the Project

7.2.1 January 2019 to December, 2019

- a. Determination of possible values for parameters mainly for the critical of them such as cohesion and friction parameters for each soil type in both regions
- b. Collection of new samples from the high precipitation zones , Ragala, Watawala, Nuwara Eliya Haputale, Balangoda, Kandy, Nawalapitiya etc.
- c. Collection of different soil types to determine the variability of shear strength properties

7.2.2 January 2020 to December, 2020

- a. Selection of case study samples
- b. Comparison of values obtained in above and study the variation
 - a. Numerical interpretation of properties and validity of laboratory strength properties
 - b. Interpretation of invers analysis and comparison of laboratory parameters
- c. Conducting one day seminar on design parameters for slope stabilization in the hill country of Sri Lanka

7.3 Beneficiaries of Project for Science, Education and/or Society

Project proponents of development projects and residents in landslide prone areas, professionals, academics, design groups, planners

7.4 Results (resent Outputs):

The study on evaluation of E50 (secant modulus) is an experiment setup to understand the behaviour of interface of rock under changing stress conditions at site due to various reasons such as prolong period of rainfall precipitations, movement of soils, unloading effects and re-loading effect caused by deposition. Therefore, it is advised to explore more sample representation in a detail study before the comparison or evaluation of the interdependence of soil coefficients of soils. Therefore, further tests are recommended with more representations of soil samples and also widening the range of test parameters to verify the interdependence capacity of soil parameters and to make it applicable over a wide range of actual failures of residual soils under prolong period of saturation. From the results presented, it can be observed that each void ratio function can only be applied for a certain type of residual soil (minimum to be satisfied with soil structure, moisture content, dry density gradation and LL, and PI). The results do not conclude a strong interdependence of e_0 and E50 with the shear strength characteristics due to the small sample size represented in this study. It seems that no universal void ratio function, which can be applied for all soils with their wide range of void ratios, exists.

8. Publications (Journal Papers and conference Papers)

1. "Soil Moduli E50 of Residual Soil Slopes, Sri Lanka"; AA Virajh Dias, L K N S Kulathilaka, W M J K Wendakoon & E M T M Ekanayake; Proceeding of the UNESCO – IPL Symposium, November, France, 2017.
2. "Comparison of soil modulus E50 of residual soil slope failures in two different rainfall zones"; Proceeding of the World Landslide Forum3 (WLF3), Beijing, China, 2-6 June 2014; Volume 1, Landslide Science for a Safer Geoenvironment, PP 135- 141.; Authors were M A S N Mallawarachchi, E M T M Ekanayake, S S I Kodagoda and A AVirajh Dias; ISBN 978-3-319-04998-4; Springer.

References

1. Briaud, J.L., 2001; Introduction to Soil Moduli, Geotechnical News, June 2001, BiTech Publishers Ltd, Richmond, B.C. Canada, (geotwchnicalnews@bitech.ca).
2. Ekanayake, E M T M , Herath, H M J M K & Dias, A A Virajh (2015), Empirical Relationships of Elastic Modules and Uniaxial Strength of Intact Metamorphic Rocks of Sri Lanka; International Conference of Geotechnical Engineering(ICGE); PP 515 -518;
3. Fahey, M. (1999). Determining the parameters of a non-linear elastic model for prediction of ground deformation. Australian Geomechanics, Vol.34, No. 1, March, 39-59
4. Mallawarachchi, M A S N, Ekanayake, E M T M, Kodagoda, S S I and Dias, A A Virajh (2014), Comparison of soil modulus E50 of residual soil slope failures in two different rainfall zones; World Landslide Forum3 (WLF3), Volume 1, PP 135- 141..