

**BACK ANALYSIS OF SLOPE FAILURE AT  
WALIPANNA, SOUTHERN EXPRESS WAY**

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Degree of Master of Science in Foundation Engineering and Earth  
Retaining Systems

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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Engineering in Foundation Engineering and Earth Retaining Systems

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## **DECLARATION OF THE CANDIDATES AND SUPERVISORS**

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## ABSTRACT

Slope failures due to excessive rainfall are a common geotechnical hazard in tropical countries where residual soils are abundant. These soils possess significant matric suctions in dry seasons and are in a stable state. Heavy infiltration of rainwater causes destruction of matric suctions, development of perched water table conditions and rise of ground water table. Thus shear strength is reduced causing slopes to fail. In order to understand the mechanism of rainfall induced slope stability it is necessary to model this process with a reasonable accuracy.

Sri Lankan residual soil formations are formed by weathering of the metamorphic parent rock and have inherited significant abrupt variations in engineering characteristics as; soil water characteristic curves (SWCCs), variation of permeability with water content and unsaturated shear strength parameters.

Cut slope at chainage of 42+340 to 42+400 in Walipanna at southern expressway failed after few days of rain. The back analysis of failure indicated that the safety margin is less than unity when saturated shear strength parameters of soil were used in the analysis. Infiltration of the rainfall that was recorded in nearby rain gauges was modeled using the SWCC and permeability function derived from the tests conducted on undisturbed samples recovered from the site.

The presence of relict joints was confirmed during the rectification work and the combination of the relict joints and failed surface drainage system would have contributed to the failure. The results of the analysis also revealed that if the drainage measures are in position in perfect working order this failure would not have occurred. Those measures were found to be capable of tolerating even a rainfall of much higher intensity than that actually occurred.

The modeling of infiltration revealed that the rise of ground water table is quite significant at the toe of the wall. Therefore when natural slopes are excavated into steeper profiles it is recommended to have a series of sub horizontal drains at the toe level even if the ground water table is found to be lower than the toe level. Also, the importance of routine maintenance of the drainage systems of all slopes is highlighted very strongly.

**Key Words** :Slope stability; Matric Suction; Unsaturated soil; Infiltration.

## **DEDICATION**

This thesis is dedicated to my loving parents Mr H.B Idirimanna and  
Mrs.F.R.Wickramasinghe.

For their endless love, support and encouragement

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## **LIST OF ABBREVIATIONS**

<b>Abbreviation</b>	<b>Description</b>
CH	Chainage
KU	Kasetsart University
NBRO	National Building Research Organization
SM	SILTY SAND
SWCC	Soil Water Characteristic Curve
STDP	Southern Transport Development Project

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