

THE EFFECT OF ROCK JOINT SYSTEMS IN RAIN INDUCED SLOPE FAILURES

J. P. D. C. M. Karunaratne

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Degree of Master of Science in Geotechnical Engineering

Department of Civil Engineering
Faculty of Engineering

University of Moratuwa
Sri Lanka

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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Name of the candidate: J.P.D.C.M. Karunarathne

Signature of the candidate:

Date: 08.05.2024

The above candidate has carried out research for the Master's thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Signature of the supervisor:

Date: 08.05.2024

Professor S.A.S Kulathilaka,
BSc. Eng. Hons (Moratuwa), PhD (Monash), CEng, MIE (SL)
Senior Professor,
Department of Civil Engineering,
University of Moratuwa,
Sri Lanka

DEDICATION

This thesis is dedicated to my family members with heartfelt gratitude. Thank you for always being there for me with love and support. Your belief in me has fuelled my journey.

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ABSTRACT

In tropical countries like Sri Lanka, slope failures due to excessive rainfall are a common geotechnical hazard. These soils are typically stable during dry seasons due to the presence of matric suctions in the soil. However, with the infiltration of rainfall, matric suctions would diminish, perched water table conditions may develop and there could be a rise in the groundwater table. This series of events would eventually lead to a failure.

The extensive weathering of Metamorphic parent rock across Sri Lanka has given rise to residual soils that now cover much of the island's terrain. Sloping grounds in Sri Lanka exhibit significant heterogeneity owing to the inherited variable nature of the metamorphic rock, diverse levels of weathering, joint patterns of variable nature in the bedrock, the presence of relict joints in the residual soils, and the presence of colluvial deposits.

As a result, conventional techniques of slope stability assessment may yield misleading results. Therefore, a comprehensive understanding of the prevailing geological condition will be essential in doing a realistic study. In addition to the direct infiltration, the water flow that comes through a jointed rock mass at an upper elevation of a slope (exfiltration) can have further destructive effects on the stability of the sloping grounds at a lower elevation. Recent landslides at Malapattawa, Ihalakotte railway station, and Kadugannawa are typical examples.

In this study, the effects of exfiltration through the jointed rock on the stability of the sloping grounds at the lower levels of the slopes were studied through parametric studies conducted on two sites. The orientation of joints and the characteristics of joint infills were varied to study the response of the slope to critical rainfall that the site is likely to experience. The results of the study identified the critical orientations of the joints and the infill characteristics that would make a slope more vulnerable.

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