

COMPRESSIBILITY AND YOUNG'S MODULUS OF FILLED JOINT

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DEDICATION

*To my beloved mum,
Puan Hajah Salmah binti Sardan
And
All my Family.....*

*Especially for,
Mohd Khaire bin Hj Mohd Nor*

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ABSTRACT

A number of the engineering structures such as tunnels, powerhouse cavern and mining shaft are constructed in the rock mass. The stability of these structures are greatly influenced by the engineering behaviour of the rock mass. For intact rock, its low deformability behaviour indicates that it is a stronger material. However, the condition changes with the presences of joint as discontinuity features in the rocks. The presence of this joint influence the strength and deformability of rock to a great extend. The situations become worst when intensive weathering of jointed rock mass under tropical climate leads the formation of the filled joint. Being the weakest component of a filled joint, filling materials contributes significantly to joint deformability and thus reducing joint strength and stiffness. In construction work that involving excavation in rock masses, filled joint poses a number of design and constructional problem that may influence the stability and factor of safety to the structure. Due to the above problems, a series of laboratory testing of physical models, which comprised of filled and unfilled joint, was carried-out. Comparing the stress-strain curves and Young's Modulus value has done analyses of the experimental result. The result suggested that the filled joint exhibits high deformation behaviour due to a lowest value of Young's Modulus. This behaviour contributed by the deformation and compressibility of the infilling material and as well as the deformation of joint blocks.

ABSTRAK

Terdapat beberapa pembinaan struktur seperti terowong, penjanakuasa gegua dan perlombongan dibina di atas atau di dalam massa batuan. Kestabilan struktur-struktur ini banyak dipengaruhi dengan sifat-sifat kejuruteraan massa batuan. Di dalam batuan yang utuh, mempunyai kekuatan yang lebih tinggi seperti yang digambarkan oleh sifat kebolehcanggannya yang kecil. Walaubagaimanapun, keadaan berubah dengan kehadiran kekar sebagai ketakselarasan dalam batuan. Kehadiran kekar ini memberi kesan yang besar terhadap kekuatan dan kebolehcanggannya batuan tersebut. Keadaan bertambah buruk apabila berlaku perluluhawaan secara intensif terhadap kekar dalam massa batuan di bawah iklim tropika yang menjurus kepada pembentukan kekar berinti. Sebagai komponen yang paling lemah, bahan-bahan inti memberi kesan kepada kekar dan kebolehcanggannya, dengan yang demikian mengurangkan kekuatan dan kekerasan kekar. Dalam kerja pembinaan yang melibatkan pengorekan pada massa batuan, kekar berinti menyebabkan beberapa masalah kepada rekabentuk dan pembinaan, dimana ia mempengaruhi kestabilan dan factor keselamatan kepada struktur-struktur tersebut. Berdasarkan masalah di atas satu siri ujikaji makmal telah dijalankan terhadap model fizikal yang terdiri daripada kekar dan kekar berinti. Analisis dari keputusan ujikaji telah dibuat dengan membandingkan lengkung-lengkung tegasan-terikan dan nilai-nilai Young's Modulus yang didapati. Keputusan yang diperolehi mencadangkan bahawa kekar berinti mempamerkan kebolehcanggannya yang tinggi berdasarkan modulus yang terendah. Sifat ini dihasilkan dari canggaaan bahan-bahan inti dan canggaaan blok-blok kekar.

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CHAPTER I

INTRODUCTION

1.1 Introduction

Rock is an excellent material upon which to bear a building foundation. A number of engineering structures such as tunnels, powerhouse cavern and mining are also constructed in rock mass. It is because rock is a very stable material exhibits practically no compression under load. The stability of these structures are greatly influenced by the engineering behaviour of the rock mass. The behaviour of the rock mass is controlled by many factors, such as, joint spacing, joint behaviour, joint orientation and the condition of the joint. The latter include joint roughness, joint wall weathering and infilling material. Therefore, understanding of the mechanical properties of jointed rock mass is important for analyzing, designing and stability performance of structure built in or on rock mass.

Normally, intact rock displays a higher strength is becoming. However, the condition may change by the existence of joints in rocks. It comes worst when joints are filled with infilling materials. The tropical climate facilitates an intensive in-situ weathering of the rock joint, which contribute to the formation of the infilling in the joint aperture. Infilling material normally comprises highly weathered material; therefore, it exhibits compressible and crushable characteristics that lead to high deformation behaviour. The high deformation of the filled joint caused problems to

the structures built in or on the rock mass. These problems are normally associated with block displacement and settlement. Due to a higher degree deformability of filled joint, a study has been carried out to verify the effect of infilling on the behaviour of joint.

1.2 Project Background

The presence of joint in the rock mass will increase its deformability. However, the deformability of the rock mass may increase further when the aperture of the prevailing joints is filled with weak infillings. These types of joints are termed as filled joints and commonly found in tropical countries where intensive and continuous weathering of rock mass is inevitable. The main effect of filled joint is that they weaken the rock mass in terms deformability under both normal and shear loading. Consequently, this critical discontinuity may impose a detrimental effect on the stability of a structure associated with excavation in rock mass.

1.3 Significance of the Study

Filled joint may be subjected to both normal and shear loading due to stress redistribution following any excavation in a rock mass. Study on the deformation behaviour of filled joint under normal loading is therefore form an essential part in understanding this critical geological discontinuity. This knowledge is important in designing a structure, such as slopes and openings, in rock mass that contain filled joints.

1.4 Objective

The main objectives of this study consists of the following:

- a) To review the effect of infilling material on joint deformability
- b) To study the behaviour of filled joint by under normal loading through series of laboratory tests on model filled joint
- c) To verify the effect of infilling on compressibility and elastic modulus.

1.5 Methodology

Methodologies been used to achieve our objectives of study are:

- a) Literature review
- b) The laboratory testing

1.6 Scope of the Study

The study will focus on the following:

- a) A physical model representing a filled joint forms by in-situ deposition of weathered materials in joint aperture.
- b) Infill material that consists of granular, granite residual soils.
- c) Deformation of filled joint due to uniaxial loading only.
- d) Behaviour of filled joint in terms of compressibility and modulus of elasticity.

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