International Journal of
Geohazards and Environment
http://ijge.camdemia.ca, ijge@camdemia.ca

IJGE 2016 2(2): 82-89
Available at http://ojs.library.dal.ca/ijge

Technical Notes

Deformation and Strength Characteristics of Simulated Columnar Jointed Rock Mass under Conventional Triaxial Compression Tests

Zhi Song[1,2*], Weimin Xiao[2]
[1]Chengdu Institute of Geology and Mineral Resources, Chengdu, Sichuan, China, 6100811
[2]Southwest Jiaotong University, Chengdu, Sichuan, China 610031

Abstract: The columnar jointed rock mass is a type of extrusive igneous rock. Correctly understanding the deformation and strength characteristics of columnar jointed rock mass under triaxial stress condition is essential for hydropower station and underground cavern excavation. As it is difficult to obtain the mechanical properties of columnar jointed rock mass by field tests, conventional triaxial compression tests were carried out on simulated columnar jointed rock mass specimens with different dip angles between the direction of principal stress and the column prisms. The changes of Young's modulus and peak compressive strength with dip angle β were obtained. The results indicate that the Young's modulus and peak compressive strength increase with confining pressure for the same group of specimens. However, under the same confining pressure, the curves of Young's modulus and peak strength versus dip angle resemble a "decreasing-order shape", that is, the Young's modulus and peak strength decrease with dip angle β from 0° to 45°, reach minimum values at β = 45°, and then remain relatively constant with the increase of dip angle. Furthermore, four typical failure modes of columnar jointed rock mass specimens under triaxial compression condition are summarized based on the test results. Their failure mechanisms are also discussed.

Keywords: rock mechanics, columnar jointed rock mass, deformation and strength, conventional triaxial compression test

1 Introduction

Understanding rock mass deformation and its strength characteristics is critical in rock engineering and design of large underground structures in rock masses. This is one of the most important subjects in rock mechanics and rock engineering. Columnar jointed rock mass, as a special structural rock mass, is characterized by anisotropy, discontinuity and non-homogeneity (Zheng et al 2007). Columnar jointed rock mass dominated by basalt is widely distributed across the southwestern region of China (Zhang et al 1999). With the development of transportation infrastructure and hydropower constructions in this area, more and more extra-large rock mass projects are designed and built based on the consideration of the columnar jointed rock mass. Examples include the Xiluodu Hydropower Station and Baihetan Hydropower Station at the downstream of Jinsha River, Longkaikou Hydropower Station at the middle stream and associated extra-long traffic tunnels. These columnar jointed rock masses are generally in a triaxial stress state. Therefore, research on the deformation and strength characteristics of columnar jointed rock mass in a triaxial stress state is important to understanding failure mode of columnar jointed rock mass as well as to the stability control of the rock masses.

* Corresponding Author: Corresponding author: Song Zhi, songzhi2015@126.com, Tel: +86 139 8076-319
Copyright © Canamaple Academia Services, http://press.camdemia.ca
DOI: 10.15273/ijge.2016.02.009