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ANISOTROPY OF MECHANICAL PROPERTIES OF TUFF AT YUCCA MOUNTAIN

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ABSTRACT

This study investigates anisotropy of mechanical properties, namely, compressive strength and modulus, for Tiva Canyon welded tuff from the starter tunnel at Yucca Mountain. Triaxial compression test results show that there is no strength anisotropy present between cores taken in a horizontal and vertical direction however, there is a modulus anisotropy present at low confining pressures.

I. INTRODUCTION

The purpose of this study is to investigate anisotropy of mechanical properties, namely, compressive strength and modulus, for Tiva Canyon welded tuff from the starter tunnel at Yucca Mountain. Mechanical properties of Tiva Canyon Tuff are needed for the design of the ramps and drifts within the Tiva Canyon horizon. Approximately one cubic foot block samples, all of which were from the thermo - mechanical unit TCw [1], were obtained from a muck pile containing excavated rock from the starter tunnel. Specimens were cored from the block samples in two distinct orientations: parallel and perpendicular to the lithophysal cavity orientation. Since lithophysal cavity orientation is predominantly horizontal in the field, parallel specimens can be considered horizontal and perpendicular specimens vertical with respect to the rock mass. The specimens were NX sized (5.4 cm diameter) and had a length - to - diameter ratio of 2:1. The air dried specimens were tested at room temperature in a triaxial chamber at confining pressures of 0.1, 5, and 10 MPa, and at a compressive axial strain rate of 10^{-5} s^{-1}. The Young's Modulus values were calculated by a least squares fit of stress - strain data between 10 and 50% of the ultimate strength.

II. RESULTS

Table 1 presents the average of three to five tests for compressive strength and Young's Moduli at each of three confining pressures and two specimen orientations. The average compressive strength for both the horizontal and vertical specimens increases with increasing confining pressure. There does not seem to be any difference between the average compressive strength of the horizontal and vertical specimens. Accordingly there is no strength anisotropy within the confining pressure range tested. Confining pressure does not show any effect on the modulus values of the vertical specimens. However, the average modulus values of the horizontal specimens increases with confining pressure. There is a marked difference in the average modulus values between vertical and horizontal specimens at low confining pressures. This difference seems to diminish at high confining pressures (10 MPa). Accordingly, stiffness anisotropy, especially at lower confining pressures, cannot be ignored. These observations regarding stiffness anisotropy of Tiva Canyon Tuff agree with those published for volcanic tuffs from the Nevada Test Site [2].

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Table 1. Average Compressive Strength and Young's Modulus Values With One Standard Deviation.

Confining Pressure (MPa)	Number of Specimens Tested		Compressive Strength ± One Standard Deviation (MPa)		Young's Modulus ± One Standard Deviation (GPa)	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
0.1	5	5	82 ± 26	83 ± 13	20 ± 4	27 ± 3
5	4	4	118 ± 33	126 ± 19	21 ± 2	24 ± 3
10	3	5	153 ± 43	156 ± 37	25 ± 3	26 ± 2

III. CONCLUSIONS

The Tiva Canyon welded tuff specimens tested in this study show that there is no strength anisotropy between the vertical and horizontal directions. However, the tests show that there is an appreciable stiffness anisotropy at low confining pressures: the vertical stiffness being larger than the horizontal.

REFERENCES

1. Ortiz, T.S., R.L. Williams, F.B. Nimick, B.C. Whittet and C.W. South, "A Three - Dimensional Model of Reference Thermal/Mechanical and Hydrological Stratigraphy at Yucca Mountain, Southern Nevada", *Sandia Report SAND84-1076*, Sandia National Laboratories, Albuquerque, NM (1985).

2. Olsson, W.A. and A.K. Jones, "Rock Mechanics Properties of Volcanic Tuffs from the Nevada Test Site", *Sandia Report SAND80-1453*, Sandia National Laboratories, Albuquerque, NM (1980).

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