The Influence of Stress Level on the Shear Strength of Rockfill Materials

Mozhgan Asadzadeh[1], Abbas Soroush[2], Ata Aghaei Araei[3]
1- MSc student of Geotechnical Engineering
2- Associate Professor
1, 2-Dept. of Civil and Environmental Engineering, Amirkabir University of Technology, Tehran, Iran
3- Senior Geotechnical Engineer, Building and Housing Research Centre (BHRC), Tehran, Iran
m.asadzadeh@aut.ac.ir, soroush@aut.ac.ir, aghaeiaraei@bhrc.ac.ir

Abstract

Shear strength of rockfill materials depends on stress level and wetting. The scope of this paper is to investigate the effect of these factors on the behavior of rockfill materials. For this purpose, a series of medium-scale direct shear tests (30x30x15 cm) are conducted on dry and saturated specimens of a rockfill material, in five normal stress levels. The test results show non-linear shear strength envelope. Therefore, Mohr-Coulomb linear criterion is inappropriate for predicting the behavior of such materials. Also, gradation of the materials before and after test illustrates the effect of stress level and saturation on the amount of particle breakage.

Keywords: Direct Shear Test, Rockfill, Shear Strength, Stress Level, Saturation.

1. INTRODUCTION

Vast application of rockfill materials in geotechnical engineering makes the precise knowledge of the behavior of these materials necessary. Large-scale testing helps the determination of design parameters of these materials. Regarding the simplicity of the direct shear test, this apparatus is used in this research. Two sizes of direct shear box are usually used for rockfill materials (30x30 cm and 50x50 cm). Comparison of the results of tests conducted on rockfill materials in these two sizes showed that the mechanical behavior of the material is relatively similar and the differences are negligible [1].

The scope of this paper is to explore the effect of stress level on the behavior of rockfill materials. For this purpose, taking into consideration the effect of wetting as well, a series of medium-scale direct shear tests (30x30x15 cm) are conducted on dry and saturated specimens of a rockfill material, in five different normal stress levels. The results of the tests are compared and presented in this paper.

2. ROCKFILL MATERIALS

For the present research, the rockfill materials were obtained from a rockfill dam. Table 1 shows the rockfill material characteristics. In addition, point load tests (ASTM D5731-95) were conducted in 8 dry and 6 saturated specimens. According to the results, saturation does not influence the particles' strength. The average point load index is measured about 4 in both dry and saturated conditions and average uniaxial compression strength of the material is estimated about 84 MPa from correlations with the results of the point load testing. The geomechanical classification of rockfill materials by point load testing results [2] shows that this material is classified as pretty hard.

Table 1- Rockfill material characteristics

Mineralogy	Shape	Water Content	Water Absorption	Gs	Point Load Index	Los Angeles Abrasion
Limestone	Angular	0.1% ASTM (D2216-92)	3% ASTM (C127-128)	2.75 ASTM (C127-128)	4 ASTM (D5731-95)	40% ASTM (C535-96)