

Comparison of Direct and Indirect Tensile Strength of Brittle Materials and Accurate Estimate of Tensile Strength

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Abstract : In many geotechnical designs in rocks and rock masses, tensile strength of rock and rock mass is needed. The difficulties associated with performing a direct uniaxial tensile test on a rock specimen have led to a number of indirect methods for assessing the tensile strength that in the meantime the Brazilian test is more popular. Brazilian test is widely applied in rock engineering because specimens are easy to prepare, the test is easy to conduct and uniaxial compression test machines are quite common. This study compares experimental results of direct and Brazilian tensile tests carried out on two rock types and three concrete types using 39 cylindrical and 28 disc specimens. The tests are performed using Servo-Control device. The relationship between direct and indirect tensile strength of specimens is extracted using linear regression. In the following, tensile strength of direct and indirect test is evaluated using finite element analysis. The results are analyzed and effective factors on results are studied. According to the experimental results Brazilian test is shown higher tensile strength than direct test. Because of decreasing the contact surface of grains and increasing the uniformity in concrete specimens with fine aggregate (largest grain size= 6mm), higher tensile strength in direct test is shown. The experimental and numerical results of tensile strength are compared and empirical relationship which is obtained from experimental tests is validated.

Keywords : tensile strength, brittle materials, direct and indirect tensile test, numerical modeling

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