SIZE AND STRESS GRADIENT EFFECTS ON THE MODIFIED POINT LOAD STRENGTHS OF SARABURI MARBLE

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Abstract

A modified point load (MPL) testing technique is proposed to correlate the results with the uniaxial compressive strength and tensile strength of intact rock. The test apparatus is similar to that of the conventional point load (CPL), except that the loading points are cut flat to have a circular cross-sectional area instead of using a half-spherical shape. Diameters of the loading point vary from 5, 10, 15, 20, 25, to 30 mm. This results in a new loading and boundary conditions on the rock specimens that mathematically allow correlating its results with those of the standard testing. To derive a new solution, finite element analyses and laboratory experiments have been caried out. For this early stage of development, the MPL specimens and models are taken as a circular disk. The simulation results suggest that the applied stress required to fail the MPL specimen increases logarithmically as the specimen thickness or diameter increases. The minimum tensile stress occurs directly below the loading area with a distance approximately equal to the loading diameter. The MPL tests, CPL tests, uniaxial compressive strength tests and Brazilian tensile strength tests have been performed. Over 400 specimens of Saraburi marble have been prepared and tested under a variety of diameter and thickness (or length). The uniaxial test results indicate that the strengths decrease with increasing length-to-diameter ratio. The Brazilian tensile strengths also decrease as the specimen diameters increase. Post-faulure observations on the specimens also suggest that shear failure is predominant when the specimens thickness is less than twice the loading diameter while extension failure is predominant when the specimens are thicker than three times the loading diameter. This can be postulated that the MPL strength can be correlated with the compressive strength when the MPL specimens are relatively thin, and should be an indicator of the tensile strength when the specimens are significantly larger than the diameter of the loading points. Even though both MPL and CPL tests overestimate the uniaxial compressive strength of the rock, the MPL results yield a better correlation than does the CPL strength index. The rock tensile strength predicted by the MPL testing is about twice the Brazilian tengile strength.

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