OHN10103450376
Using the Point Load Test to Determine the Uniaxial Compressive Strength of marble and travertine rocks

Mojtaba Pirpanahi[1], Massoud Palassi[2]

1- MSc Student, Department of Civil Engineering, University of Tehran, Tehran, Iran
2- Assistant Professor, Department of Civil Engineering, University of Tehran, Tehran, Iran

⋮

pirpanahi@ut.ac.ir

Abstract

Point load testing is used to determine rock strength indexes in geotechnical practice. The point load test apparatus and procedure enables economical testing of core or lump rock samples in either a field or laboratory setting. In order to estimate uniaxial compressive strength, index-to-strength conversion factors are used. These factors have been proposed by various researchers and are dependent upon rock type. This study involved the uniaxial compressive testing and point load testing of marble and travertine rocks from ten different rock quarries in Iran. Around 300 individual test results, including 159 uniaxial strength tests and 139 point load tests, were used in this study. Rock lithologies were classified into two general categories and conversion factors were determined for these categories. This allows for intact rock strength data to be made available through point load testing for numerical geotechnical analysis and empirical rock mass classification systems such as the Rock Mass Rating (RMR).

Keywords: point load test, uniaxial strength test, marble and travertine, correlation factor.

1. INTRODUCTION

The point load test has often been reported as an indirect measure of the compressive or tensile strength of rock [1–4]. It has been used widely in practice due to its testing ease, simplicity of specimen preparation, and possible field applications.

Although ISRM [5] suggested that the ratio between uniaxial compressive strength (UCS) and point load strength (I_s) varies between 20 and 25, many researchers have found different ratios. The derived ratios between UCS and I_s by different researchers exhibit a very large range; the ratio for the equations using the zero-intercept varies between 8.6 and 29.

The main objective of this paper is to investigate the relation between UCS and I_s for some rock quarries in Iran. For this purpose, the results of the uniaxial compression test on marble and travertine rocks were correlated with the corresponding results from point load test.

2. PREVIOUS INVESTIGATIONS

D'Andrea et al. [1] performed uniaxial compression test and the point load test. They used a linear regression model to get the correlation between two tests. It should be noted that their point load specimen diameter was
25 mm, and that size adjustments must be made to use their relation. Broch and Franklin [3] stated that the compressive strength is approximately equal to 24 times the point load index (I_s), referred to a standard size of 50 mm. They also developed a size correction chart so that cores of various diameters could be used for strength determination. Bieniawski [4] showed that the compressive strength is nearly 23 times I_s. Pells [6] showed that the index-to-strength conversion factor of 24 can lead to 20% error in the prediction of compressive strength for the rocks like dolerite, norite and pyroxenite. Greminger [7] and Forster [8] also showed that the conversion factor of 24 cannot be adequately applied to anisotropic rocks. Hassani et al. [9] studied the point load test using an expanded database with tests on large specimens and revised the size correlation chart commonly used to reference point load values from cores with differing diameteral sizes to the standard size of 50 mm. With this new correction, they found the ratio of compressive strength to I_{s50} to be approximately 29.