

## Estimation of Physico-Mechanical Properties of Tuffs (Turkey) from Indirect Methods

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**Abstract :** In rock engineering applications, determining uniaxial compressive strength (UCS), Brazilian tensile strength (BTS), and basic index properties such as density, porosity, and water absorption is crucial for the design of both underground and surface structures. However, obtaining reliable samples for direct testing, especially from rocks that weather quickly and have low strength, is often challenging. In such cases, indirect methods provide a practical alternative to estimate the physical and mechanical properties of these rocks. In this study, tuff samples collected from the Cappadocia region (Nevşehir) in Turkey were subjected to indirect testing methods. Over 100 tests were conducted, using needle penetrometer index (NPI), point load strength index (PLI), and disc shear index (BPI) to estimate the uniaxial compressive strength (UCS), Brazilian tensile strength (BTS), density, and water absorption index of the tuffs. The relationships between the results of these indirect tests and the target physical properties were evaluated using simple and multiple regression analyses. The findings of this research reveal strong correlations between the indirect methods and the mechanical properties of the tuffs. Both uniaxial compressive strength and Brazilian tensile strength could be accurately predicted using NPI, PLI, and BPI values. The regression models developed in this study allow for rapid, cost-effective assessments of tuff strength in cases where direct testing is impractical. These results are particularly valuable for geological engineering applications, where time and resource constraints exist. This study highlights the significance of using indirect methods as reliable predictors of the mechanical behavior of weak rocks like tuffs. Further research is recommended to explore the application of these methods to other rock types with similar characteristics. Further research is required to compare the results with those of established direct test methods.

**Keywords :** brazilian tensile strength, disc shear strength, indirect methods, tuffs, uniaxial compressive strength

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