Journal of New Approaches in Civil Engineering
(ISSN PRINT: 2588-6886) -(ISSN ONLINE: 2588-7122)-Vol.2, No.2, Pages: 27-38.

Determination of the Internal Friction Angle of Gravel based on the p-q Graph for Direct Shear Tests

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ABSTRACT

Since its simplicity and availability, direct shear test is a current one. This test, compared to the triaxial test, provides different values for the parameters of the gravel due to the specific shape of the test device and the test approach. Triaxial testing, due to the feasibility of providing conditions similar to the natural behavior of gravel in a natural state, can provide more realistic values of material strength parameters. Due to being time consuming, costliness, problems in performing a triaxial test and the difficulty of sample preparation, direct shear test is still used more than triaxial test. In this paper, by studying the results of direct shear test and triangular experiments on gravel material, the stress paths in p - q space and the internal friction angle of these two tests are compared and the relation between them is obtained. To ensure the obtained results, large-scale triaxial and direct shear tests are used. The values of φ, τ_f and σ_n are calculated in every direct shear test, and using different lateral pressure coefficients (k), the failure points in the space p and q are obtained. Using the points, failure envelope is depicted in these graphs and then, using the relationships, the gradient of the failure envelope is converted to the friction angle of the sample; and, it is compared with the triaxial test results. Subsequently, the stress path is studied via the results, and it is compared with the stress path of the triaxial test. Finally, it can be concluded that, when the internal friction angle of the gravel in direct shear test is analyzed via lateral pressure coefficient (kp), it is approximately the same with the internal friction angle obtained by the triaxial test in p- q space.

Keywords: *Internal friction angle, p-q space, Direct shear test, Triaxial test.*