



Estimating Internal Friction Angle of Soil Using Standard Penetration Test Data (A Case Study in Babolsar)

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Abstract

One of the important parameters considered as a typical characteristic for reconnaissance of granular soils is the internal friction angle. Nowadays, the advances and developments taken place in the equipments of in-situ tests such as those of the standard penetration test (SPT) have facilitated the determination of strength parameters at the site. On the other hand, the existing empirical correlations based on logical argumentations which are provided for estimation of internal friction angle of soils and the standard penetration test, have resolved the problems of experts within the field of construction. Therefore, in this research it is tried to provide a proper correlation between internal friction angle and the corrected SPT blow count for sandy soils of Babolsar based on the results of nearly 46 standard penetration tests and the direct shear tests at the corresponding depths.

Keywords: Internal friction angle, Standard penetration test (SPT), Empirical correlations

1. INTRODUCTION

The standard penetration test, developed around 1927, is currently the most popular and economical means to obtain subsurface information (both on land and offshore). It is estimated that 85 to 90 percent of conventional foundation design in North and South America is made using the SPT. This test is also widely used in other geographic regions. The method has been standardized as ASTM D 1586 since 1958 with periodic revisions to date [1].

Currently, there are several correlations and empirical relations available with regards to the SPT results and the internal friction angle of soils that are being used by the experts. But, then this question is raised that whether it is possible to consider these correlations as inclusive and comprehensive for a particular project. Also, this fact should not be refuted that the practical relationships and correlations provided in this area have been introduced based on limited data bases and/or provided for different local situations. Therefore, it is not necessary to use those relations for specific regions. However, it seems logical to use the correlations that are proportional to the same situations and conditions as those of a region with various geotechnical characteristics. On the other hand, it should be taken into account that this correlation relationship be based on solid and logical argumentations.

2. GENERIC REVISION ON STANDARD PENETRATION TEST

Standard penetration test is often carried out during boring. But, it should be noted that the results of standard penetration test (SPT) in coarse granular soils have limited application. The large particles of cobblestone and gravel are not easily driven into the SPT sampler and the blows are mainly obtained to the level of refusal limit. Another limitation of this test is that it does not yield an indicator for the cohesion resulting from cementation of granular soils [2]. This test method provides the desirable samples for both reconnaissance of soil and conducting of appropriate laboratory tests related to soil and yields adequate samples from a soil which would incur disturbance if sampled through high shear strain. This test method is widely used in geotechnical investigations projects. Local correlations and vast practical relations that affiliate the SPT blow count or N-value to the engineering behavior of earthworks and foundations are available [3].

Considering the followings is of high importance in terms of standard penetration test [4]:

1- Numerous correlation relations have been developed for the results of this test and strength parameters of soil. Of course, this test was primarily suggested for determination of relative density of sands, but its results are conservatively used for estimation of strength properties of other soils such as silts and clays.