



Development of Correction Factor of qc-CPT for A Thin Soft Clay Layer between Dense Sand Layers: Laboratory Works and Numerical Analysis

Endra Susila¹ and Hermansyah²

ABSTRACT

The Cone Penetration Test (CPT) has currently become one of most commonly used for soil investigation in Indonesia. It has advantages: results are relatively operator independent, user-friendly, cost effective and quick. However, previous studies have shown than the CPT could not accurately interpret thin layers and predict their shear strengths. Unfortunately, uniform soil is rarely found. This paper presents a proposed correction method of qc for thin soft clays interbedding a dense sand layer. Analyses for developing the correction factor utilize the finite element method using a professional software called Plaxis. For verification, laboratory tests by calibration chamber were also performed. The proposed correction factor of cone resistance (qc) could be used to obtain the more accurate predicted shear strength of clays.

Key words: *Cone Penetration Test (CPT), correction of cone resistance (qc), finite element, calibration chamber test*

I. INTRODUCTION

In the planning and design of civil engineering constructions that are rested on soil, supporting parameters are required in analyzing foundation which has the function as a media agent for the transfer of load from the upper structure to the supporting soil. The investigation of soil parameter is one of important preliminary works prior to the building of the structural constructions such as building, road, bridge, seaport, airport, etc.

One of the methods in soil investigation is Cone Penetration Test (CPT) or widely known as *sondir*. CPT has advantages over other investigative tools, such as: results are relatively operator independent, user-friendly, cost effective and quick. The method is currently becomes very popular for geotechnical exploration.

Initially, CPT was used to predicting directly soil bearing capacity by measuring the tip resistance (qc) and side friction resistance (fs). In its development, CPT can be used to figure out the condition of soil layer. By arranging the position of CPT point, we can figure out roughly the cross section of soil layer profile in that location. In addition to qc and fs, CPT can also be used to predicting type of soil, soil shear

strength, soil relative density, consistency, internal friction angle, and Young Modulus based on methods that have been widely accepted.

Uniform soil layer is rarely found in the field. In layered-soil, interpretation of CPT has become complex because qc and fs are not entirely reflecting soil property at that depth. For soft clay layer with $\leq 2-3$ cone diameter (Schmertmann, 1978; Treadwell, 1976), CPT will be difficult to recognize it. Cone has started reading changes in the stress before reaching the intended layer. Furthermore, the cone is also still affected by the previous layer although it has penetrated the new layer. This will result in an error in interpreting stress at that particular soil layer.

This paper presents the method of qc correction of thin soil layer. Correction factor is arranged based on numerical study using finite element method which is verified with laboratory test. Analysis is conducted on thin soft clay layer in solid sand layer. The analysis is conducted with finite element method using Plaxis program and with laboratory test using calibration chamber. The product of this analysis is a correction factor of cone resistance (qc) vis-a-vis the thickness of the studied clay layer. The product of this correction factor can be used to obtain an accurate cone resistance (qc).

¹ *Assistant Professor and Head of Soil Mechanics Laboratory, Research Division of Geotechnics, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia, e-mail: endrasusila@si.itb.ac.id; endrasusila@gmail.com*

² *Graduate Study Program of Civil Engineering, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia, e-mail:*