

지구통계학과 콘관입시험기를 이용한 과압밀의 비배수전단강도의 분석

ANAYSIS OF UNDRAINED SHEAR STRENGTH OF OVERCONSOLIDATED CLAY USING GEOSTATISTICS AND CONE PENETRATION TEST

윤길림, GIL-LIM YOON

미국 휴스턴대학 토목환경공학과 박사과정, Doctoral Candidate, Department of Civil and Environmental Engineering, University of Houston, Houston, Texas 77204-4791, USA.

개요(SYNOPSIS) : 지반공학 및 지반환경분야에서 문제의 관건은 표층과 흙의 성질에 대한 정보를 정확히 파악하는 것이다. 표층의 상황은 어느 현상이나 공간적으로 그 성질을 달리하므로 기술자의 경험이나 지구통계학을 이용하여 적절한 현장의 상태를 분석하게 된다. 휴스턴대학에 위치한 미국국립시험현장에서 수행한 28개의 콘관입시험을 통해 얻은 자료를 가지고 지구통계학적분석을 하여 비배수 전단강도의 3차원적 형태를 파악하였다. 본연구를 통하여 지구통계학의 유용함과 현장의 변화가 상당함을 쉽게 이해하게 된다.

INTRODUCTION

In situ measurements of vertical and horizontal variations of undrained shear strength (s_u) using the cone penetration test (CPT) can provide useful information for stratigraphic interpretation on a site. In analysis of CPT data, classical statistical methods such as regression or correlation analysis are occasionally used. However, these methods do not consider soil properties spatially, which may exhibit considerable variation naturally from one location to another (Lumb, 1966, 1974). Properly accounting for spatial variability when predicting geotechnical performance may reduce significantly the uncertainties associated with a particular design if variability characteristics of local soil conditions can be understood.

With the advent and wide application of geostatistics in the fields of geology, mining, and hydrogeology, geotechnical engineers have begun in recent years to appreciate its practical advantages (Soulie, 1983; Baecher, 1983; Christakos, 1985). Most geostatistical development so far has come from mining applications in which lack of sufficient three-dimensional data is rarely a problem. In a recent study, Jaksá et al. (1993) modeled CPT data by geostatistics theory in order to estimate spatial correlation in the vertical direction and horizontal direction in a stiff, overconsolidated clay, similar to the Beaumont formation considered here. Tang (1979) evaluated horizontal correlation distance of CPT data using the autocorrelation function, and Campanella and Wickremesinghe (1989) described the application of CPT data to site characterization using Vanmarke's variance function. These theories give an indication of the degree of variability of a profile and indicate the distance of perfect correlation from point to point (Vanmarke, 1977). Variance functions are related to variograms, which describe spatial autocorrelation between measurements at given locations (Ledvina, 1991).

This paper applies briefly techniques of geostatistics to CPT data (q_c) for estimating spatial variability of s_u at the NGES-UH.

DESCRIPTION OF TEST SITE

The study site shown in Fig. 1 is the National Geotechnical experimentation Site located on the University of Houston Central Campus in Houston, Texas (NGES-UH). It is situated on a series of unconformable Pleistocene-aged transported terrace deposits. Details of geological and engineering site descriptions are given by O'Neill and Yoon (1995), and Yoon and O'Neill (1996). The locations of the CPT soundings in Location