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Investigation on Collapse Potential of Loess Soil

Dolrerdee Hormdee
Department of Civil Engineering, Khon Kaen University
Khon Kaen, THAILAND

ABSTRACT

A collapsible soil has relatively high strength in dry condition but gaining large settlements when soaking without any increasing in normal stress on itself so easy occurrence of differential settlement. Thus to determine and to predict the collapse potential is our objective. The specimens are reconstituted condition by controlled the initial dry density and water content. The results from laboratory test and model give the same prediction the collapse potential that decreases when initial dry density increase and the location of maximum value is around normal stress at soaking between maximum past pressure in dry and saturated condition.

KEY WORDS: Collapsible soil, collapse potential and double consolidation test.

INTRODUCTION

One of the most problematic unsaturated soils is the collapsible soil, which is a common geotechnical concern in arid regions. Although these relatively high void-ratio soils exhibit a significant strength and low compressibility at their natural, in-situ water content, they collapse significantly upon wetting under load. The decrease in soil suction and weakening of bonds associated with accidental or intentional wetting triggers the collapse. Most often, the damage to constructions results from differential deformations, which had not been anticipated at the design and construction stages. Therefore, the estimation of the collapse settlements which linked with the collapse potential and shear strength become major components in the moisture-sensitive soil sites. A laboratory or field test is commonly used for structuring the model to estimate the collapsible potential settlements of soils under a certain rainfall condition. Many researchers have already carried out the studies on the collapsible behaviors of unsaturated soils from theoretical and practical points of view (e.g. Chen et.al., 1999, El-Ehwany & Houston, 1990, Fredlund & Rahardjo, 1993, Habibagahi& Mokhberi, 1998, Nishimura et.al., 1998, Tadepalli & Fredlund, 1991 and Sharma & Singhal, 2006).

The objective of the study presented here is first investigating the deformation characteristics and collapse potential of the compacted soil during infiltration, with reference to the effects of loading history and normal stress level for soaking in consolidation test. In addition, an experimental based model, which can simply estimate the collapsible strains and/or settlements of the compacted soil during infiltration, is presented. The empirical relationship is mainly considered to reflect the characteristics of collapse settlement during soaking under one-dimensional compression conditions. Secondly, to investigate the shear characteristics, direct shear tests are performed to measure and compare the shear parameters when shearing at dry condition and saturated condition of soil specimen.

SOIL DESCRIPTION

The soil sample was collected at a depth of 1.0 – 2.0 m from Khon Kaen University, Thailand and is locally referred to as red loess soil. The natural soil was collected as undisturbed sample for direct shear testing and as disturbed sample for determining its index properties, compaction characteristics (Table 1) and collapse potential in consolidometer test.

Table 1 Index properties of loess soil.

Property	Khon Kaen Loess
Specific gravity	2.63
Liquid limit	16.2%
Plastic limit	13.1%
USCS	SM
Natural water content	9.0-10.3 %
$\gamma_{d,field}$	1.55 g/cm^3
e_{max}	0.98
e_{min}	0.62
Air dried water content	0.6-1.2 %
OMC	8.6 %
γ_{dmax}	2.07 g/cm^3

DEFORMATION CHARACTERISTICS

Sample Preparation

The experimental program was a parametrical study aimed at studying the effect of important reconstituted conditions of soil such as initial water content, initial dry density and soaking stress (namely, normal stress at which soil inundated with water) on collapse potential.

As using disturbed samples, they were prepared in 'identical' fashion by controlling initial water content (Air-dry water content) and initial dry density of 20%, 65% and 80% of relative density (D_r) by slowly pressing to 60 mm in diameter and 20 mm in height of oedometer ring.