

# The Regular Research of Stress Level for Vertical Displacement of Loess

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**Key words:** Vertical displacement; Stress level; loess; Water content; pressure

**Abstract.** At present, the research is not enough for the vertical displacement and stress level in domestic. The paper aims how the law between the vertical displacement and stress level by shear test for loess. The results showed that: under the high shear stress level, the effect of soaking sample of vertical deformation is large. When the water is fully infiltrated, the primary structure of the loess is destroyed and the vertical displacement increases rapidly. In the process of wet shear test, the vertical displacement is mainly caused by the deformation of the collapse.

## Introduction

Loess special sensitivity to water has always been the research center of loess mechanic characteristic. In recent years, there are more and more depth study of loess deformation characteristics. And has obtained certain achievement. WANG Shuo et al<sup>[1]</sup> propose that the cohesion of unsaturated remolded loess will increase with the increment of dry density due to the influence of reciprocity of particles and tension action of inter-granular water, showing an index change. Internal friction angle of unsaturated remolded loess gets a little increase with the increment of dry density, approximately showing a linear variation. ZHANG Jun ran et al<sup>[2]</sup> think that other conditions are the same, the samples experienced drying-wetting cycle have higher relationship of stress ratio-strain, higher strength, smaller volumetric deformation than the sample not experienced drying-wetting cycle. The samples experienced drying-wetting cycle have low saturation but high relationship of stress ratio-strain and strength. It is because larger suction experienced previously which is equivalent to larger effective pressure experienced, that makes the sample to become over consolidated state. WANG Hui et al<sup>[3]</sup> think that the permeability coefficient of intact loess assumes a decreasing tendency along with penetration time extension. The intact loess microstructure is destroyed after disturbance and remodeling. And dry density changes have a significant impact on penetration coefficient which tends to decrease while the dry density increases. In the previous research, the study of vertical displacement of the loess humidifying shear have less research<sup>[4]-[10]</sup>.

With the help of shear tests to research the characteristics of loess for different stress level and different water content, coming up with some conclusions. The research have certain theoretical significance for the study of loess properties.

### The loess of test

The loess of tests is taken from certain foundation at the Jinnan district, in a depth of 6m below the surface, which is silty clay, with a small amount of worm holes. The soil samples have been whittled to length 35cm~45cm cube in the field. The natural moisture content of soil samples was 9.5%, through the burette method to configure the required moisture content for the sample.

### Test Instruments and Test Method

#### Test Instruments

The test instrument is the conventional direct shear apparatus. Through the improvement of instrument application, make the strain type apparatus into stress type, which can realize some stress conditions of humidifying direct shear test.

#### Test Method

Prepare eight original state compression sample (diameter 6.03cm, height 2cm). The vertical pressure of test is 200 kpa and 400 kpa, with the humidifying direct shear test to measure the law of vertical displacement and moisture content. Installed the vertical load, until the need of the vertical pressure, compression after stability, start the motor, began to shear and shear stress at a certain stress of 0.3, 0.4, 0.5, 0.6 times of the stress level. In the process of shearing by water flooding until sample shear failure or shear stability. The stability criteria for displacement increment is less 0.01mm for ten minutes.

#### Test Results and Analysis

In the condition of the vertical pressure 50 kpa, the affect law of different stress level for vertical displacement is indicated in figures 1 to 4:

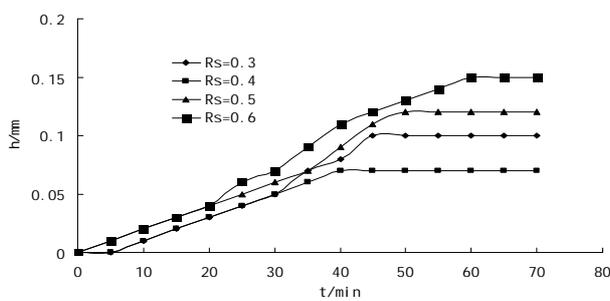


Figure 1. The shear curve for w=8% to w=10%

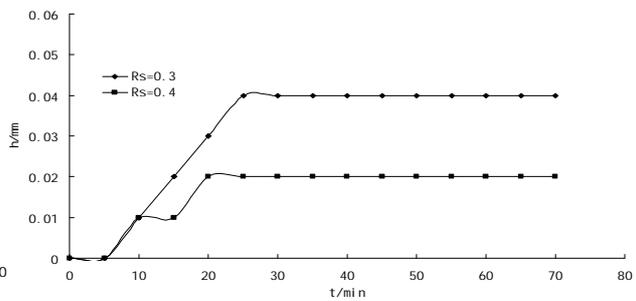


Figure 2. The shear curve for w=10% to w=12%

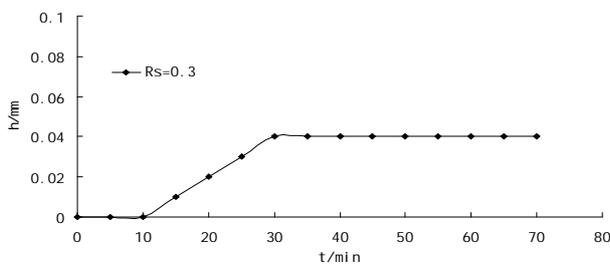


Figure 3. The shear curve for w=12% to w=14%

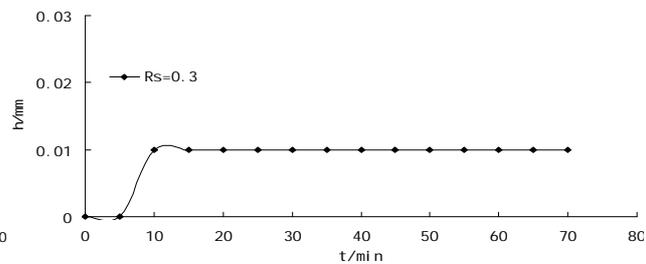


Figure 4. The shear curve for w=14% to w=16%

Figure 1-4 shows that under the high shear stress level, the effect of soaking sample of vertical deformation is large. This is due to the high shear stress more damaged on the loess structural. And the

weakening of the structure will produce large vertical deformation.

In the condition of the vertical pressure 100 kpa, the affect law of different water content for vertical displacement is indicated in figures 5 to 8:

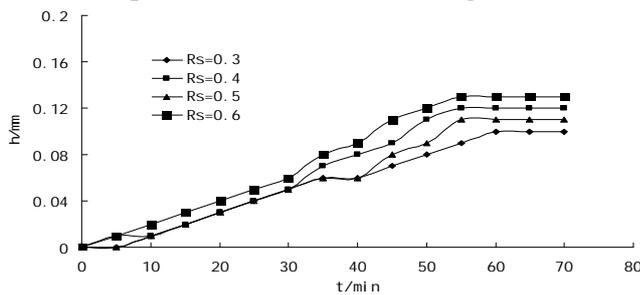


Figure 5. The shear curve for  $w=8\%$  to  $w=10\%$

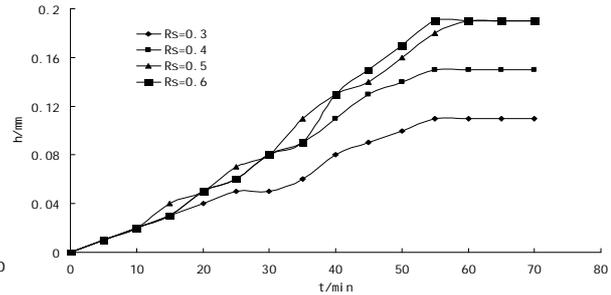


Figure 6. The shear curve for  $w=10\%$  to  $w=12\%$

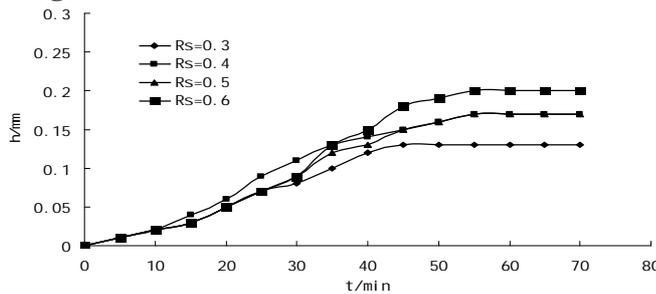


Figure 7. The shear curve for  $w=12\%$  to  $w=14\%$

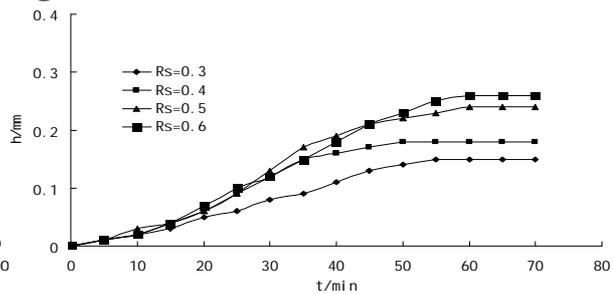


Figure 8. The shear curve for  $w=14\%$  to  $w=16\%$

Figure 5-8 shows that when the water is fully infiltrated, the primary structure of the loess is destroyed and the vertical displacement increases rapidly. In the process of wet shear test, the vertical displacement is mainly caused by the deformation of the collapse.

## Conclusions

In this paper, direct shear apparatus is applied to study properties of loess. The main conclusions are as follows:

- (1) Under the high shear stress level, the effect of soaking sample of vertical deformation is large. This is due to the high shear stress more damaged on the loess structural. And the weakening of the structure will produce large vertical deformation.
- (2) When the water is fully infiltrated, the primary structure of the loess is destroyed and the vertical displacement increases rapidly. In the process of wet shear test, the vertical displacement is mainly caused by the deformation of the collapse.

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