The effect of moisture content on the shearing strength of loess

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The main chapters

1. Introduction
2. Testing program
3. Test results
4. Result interpretation
5. Conclusions

1. Introduction

Significance of this research

- Ø Loess in nature mostly exists in unsaturated state
- Ø Slope instability is mainly caused by the increase of moisture content
- Ø The effect of moisture content on the shear strength of loess is of great significance

Introduction

Background (Summary of previous results)

- Research object: saturated sand or saturated clay; Remolded sample
- Shear parameters: Total stress
- Study areas : of different sedimentary environment
- The test results : having no accordant conclusion

There are disputes about the effect of water content on the shearing strength

Introduction

So ...

It is quite necessary to conduct further studies of the effect of moisture content on the shearing strength.

2. Testing program

- Preparation before laboratory experiments
- Conventional test

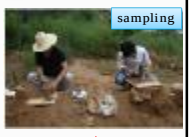
Physical parameters of this stratum

- Sample preparation and testing procedure

Ø *Experimental equipment*
Ø *Experimental method*
Ø *Setting of confining stress and water content*

Preparation before laboratory experiments

Samples taken from Loess 5, Q_2 ,
located in Huangling county, Shaanxi province



Conventional test

Physical parameters of the specimens

clay content (%)	27.4
Specific gravity	2.71
Unit weight ($g.cm^{-3}$)	1.53
Water content (%)	13.9
Plastic limit (%)	22.8
Liquid limit (%)	37.0
plasticity index (%)	14.2
liquidity index	- 0.63
Dry density ($g.cm^{-3}$)	1.37
Void ratio	0.972

Sample preparation and testing procedure

– CU triaxial test

The saturated moisture content of the specimen was calculated to be 32%

Water content

Dripping method

– The specimens were divided into 7groups with the expected moisture content of 3%, 11%, 16%, 21%, 26%, 30%, 32% respectively.

confining stress

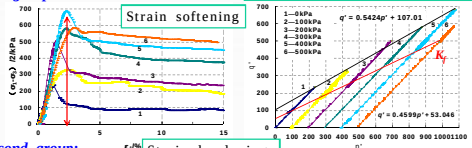
– The 6 specimens of each group were consolidated under a given confining stress (s_3) of 0, 100, 200,300,400 and 500 kPa

3.Test results

The pore water pressure u is equal to zero, so the total stress path is equal to the effective stress path. That is to say there is only K_f curve.

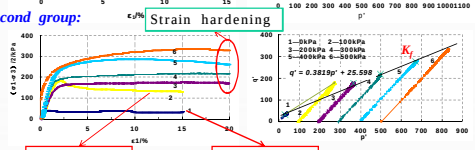
The first group :

3%



The second group:

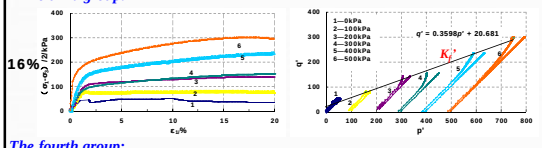
11%



Test result

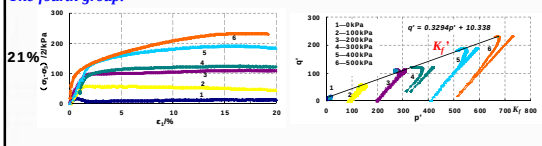
The third group:

16%



The fourth group:

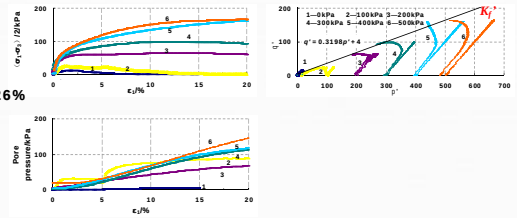
21%



Test result

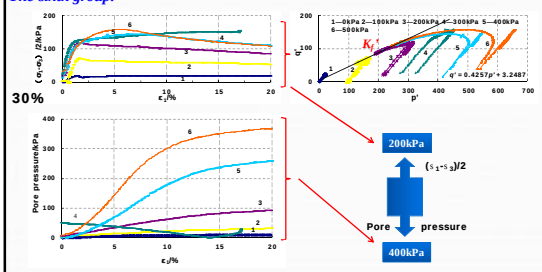
The fifth group:

26%

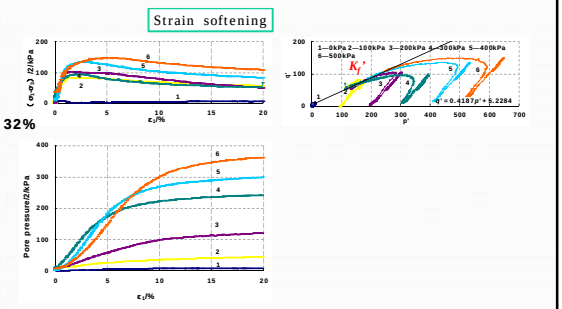


Test result

The sixth group:



Test result



Test result

Strain-softening

Pore pressure

Strain-hardening

Confining pressure Moisture content

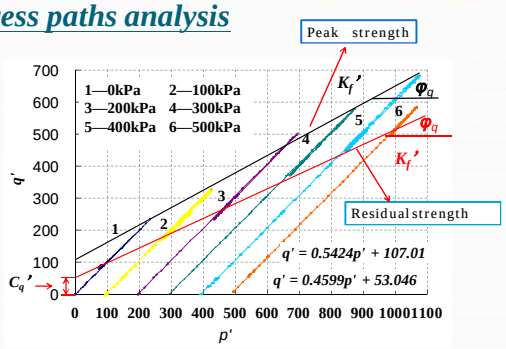
Perfect plastic

Confining pressure Moisture content

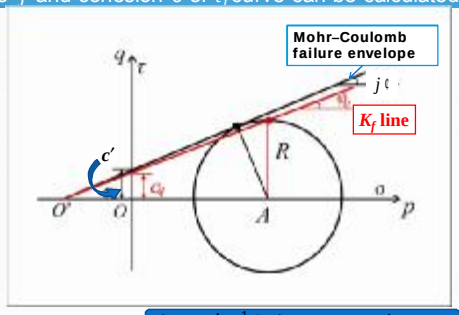
Strain-softening

Test result

Stress paths analysis



Based on the dip j_q and intercept c_q of K_f curve, friction angle j and cohesion c of t_f curve can be calculated as:

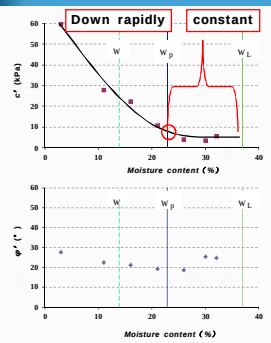


$j = \sin^{-1} tgj_q \quad c = c_q / \cos j$

The effective cohesion c' and friction angle j' measured at different moisture content

Group NO.	moisture content (%)	c_q (kPa)	φ_q (°)	c' (kPa)	φ' (°)
1	3	53.05	0.46	59.74	27.38
2	11	25.60	0.38	27.70	22.45
3	16	20.68	0.36	22.17	21.09
4	21	10.34	0.33	10.95	19.23
5	26	4.00	0.32	4.22	18.65
6	30	3.25	0.43	3.59	25.19
7	32	5.23	0.42	5.76	24.75

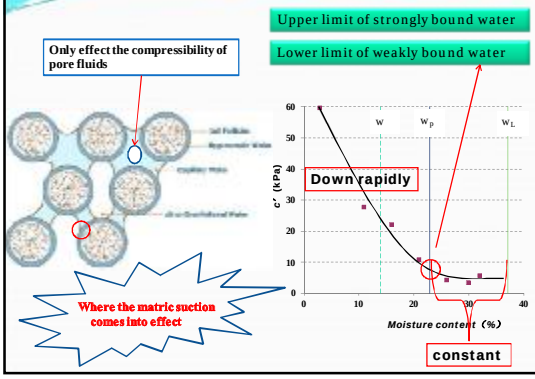
The effective cohesion c' and friction angle j' measured at different moisture content



Ø The effective cohesion c' has a reverse correlation with the moisture content

Ø The effective friction angle j' is independent of moisture content

4.Result interpretation



Conclusions

The research conclusions are all shown as follows:

Ø *The test research show that the water content almost has no effect on the effective steady-state friction angle, but its impact significantly on the effective cohesion.*

Ø *The test found that even in the case of sample saturated, the effective cohesive force measured is not zero, so the loess has its unique property the inherent cohesion.*

Ø *The effect of moisture content on the cohesion is essentially the effect of water content on the matric suction.*

Thank you

for your attention!