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THE LOOSEST STATE OF SILTY SOILS - NORMALIZATION

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INTRODUCTION

It is well known that with an increase in void ratio, strength of a soil decreases. This is true for both peak and residual strength which are parameters to be used in stability analysis. To obtain a decrease in void ratio in a clayey material, for any confining pressure, it is necessary to load soil element to a higher initial confining pressure and to unload it. In sandy soils, however, it is possible to start from different initial void ratios and to follow different compression paths until the same confining pressure. Moreover, it is possible to prepare a laboratory specimen using different depositional modes. Here data are presented for one sandy silt prepared in three different ways, namely with moist placement, dry deposition and water sedimentation, then saturated, consolidated and monotonically sheared in undrained conditions in triaxial apparatus. Dozen non-plastic materials with silt content varying from *0* to *100%* were tested under similar conditions and with same results (Reference 1).

MATERIAL AND METHODS OF SPECIMEN PREPARATION

Lagunillas is a non-plastic sandy silt from dikes close to the Lake Maracaibo in Venezuela. (74% of particles smaller than 0.074mm, D_{50}=0.05mm, ρ_s=2.69g/cm^3, e_{min}=0.766, e_{max}=1.389.)
In moist placement, **MP**, moist soil (water content 5%) was placed carefully into a loose state and tamped slightly to produce homogeneous structure dense enough to be tested. Air pluviation is an often used method where dry soil is pluviated from a controlled height to obtain a wished void ratio. Produced structure is similar to wind deposited one. It is homogeneous and isotropic. With a decrease in height, void ratio increases and strength decreases. The loosest and weakest structure is produced with dry deposition, **DD**, with falling height equal to zero. In water sedimentation, **WS**, dry soil was pluviated into water, in four layers, producing structure similar to naturally water deposited one, layered and anisotropic.

EXPERIMENTAL RESULTS

Three sets of experiments are shown with their stress paths and stress~strain curves. In p',e diagram, data are shown with squares for MP, circles for DD, and triangles for WS. Initial state, after consolidation, is shown with empty, quasi-steady state with large, and steady state with black marks.

DISCUSSION

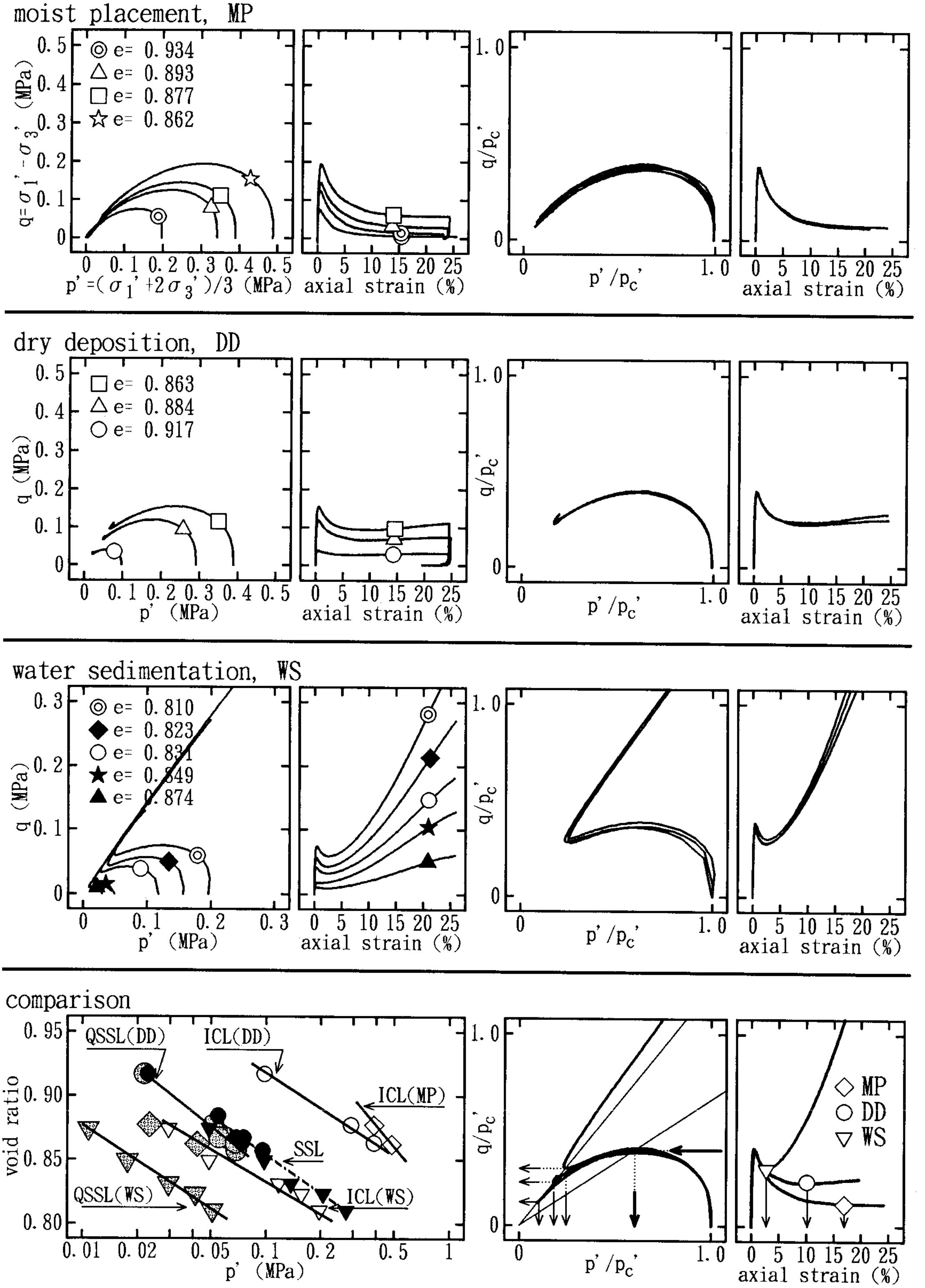
For the DD specimens, which were all prepared into the same loosest state, similarly to normal compression line of clays, initial p',e points lie on a line, initial compression line, **ICL**, which is straight in semilogaritmic scale. Quasi-steady state in DD specimens develops on a line in p',e space, quasi-steady state line, **QSSL**. MP and WS specimens have different ICL and QSSL. However, steady state for differently prepared specimens develops on unique critical or steady state line, **SSL**. To compare the behaviour with the behaviour of clays, stress paths and stress~strain curves are normalized with the initial confining pressure, p_c'. First this is done for each set of data, separately, and than the three sets are compared.

CONCLUSIONS

Non-plastic soils can be deposited into the loosest state in more than one different ways. Both the ICL and QSSL are strongly dependent on depositional mode.
When sheared from such a loosest state, behaviour can be normalized with the initial confining pressure, until the residual strength.
The first part of the stress paths and stress~strain relationship – until the peak strength – is not significantly influenced by the depositional mode if the fabric is the loosest possible in the corresponding mode. However, residual strength is very sensitive to the fabric or the depositional mode. Only *M*, ratio q/p' at the quasi-steady state, is independent of the fabric.
The final strength at very large strains, steady state strength, is a function of void ratio alone. Depositional mode influences the steady state strength through its effects on void ratio.

REFERENCES

(1) ZLATOVIĆ, S. (1994) *Residual strength of silty soils*. D.Eng. Thesis, University of Tokyo


moist placement, MP
e= 0.934
e= 0.893
e= 0.877
e= 0.862
q=σ1'-σ3' (MPa)
p'=(σ1'+2σ3')/3 (MPa)
axial strain (%)
q/pc'
p'/pc'
dry deposition, DD
e= 0.863
e= 0.884
e= 0.917
q (MPa)
p' (MPa)
water sedimentation, WS
e= 0.810
e= 0.823
e= 0.831
e= 0.849
e= 0.874
comparison
void ratio
QSSL(DD)
ICL(DD)
ICL(MP)
SSL
ICL(WS)
QSSL(WS)
MP
DD
WS