Geo-disaster Mitigation Engineering

IIS UNIVERSITY OF TOKYO
GDM

Stabilization of Indonesian expansive soil and its small-strain characteristics using rice straw ash

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Expansive soil and binder material

Expansive soil is considered as destructive soil, where it expands its volume rapidly after being submerged in water and shrinks significantly after losing water.
In this research, expansive soil was stabilized with rice straw ash (RSA), which contains high pozzolanic material. The objectives of this study are (1) determining correlation of RSA proportion and curing conditions in terms of unconfined compression strength, q_u and stiffness, E_{50}; (2) obtaining relationship between small-strain characteristics and isotropic stress under unsaturated drained condition.

Fig. 1 Potential damage due to expansive soil

Fig. 2 Rice straw

Effect of RSA and curing conditions on q_u and E_{50}

Sample preparation procedure :

1. Soil mixing RSA4%, RSA6%, and RSA8%
2. Reconstituted sample (d=5cm, h=10cm)
3. Curing time (T= 1, 3, 7, 28 days)
4. Subjecting vertical load of 30 kPa

- Mix design of soil and RSA 6% is the most optimum combination.
- Both q_u and E_{50} increase as curing time longer.
- Confining pressure affects on 5-15% increment of q_u and E_{50}.
- Confining pressure effect decreases as curing time longer.

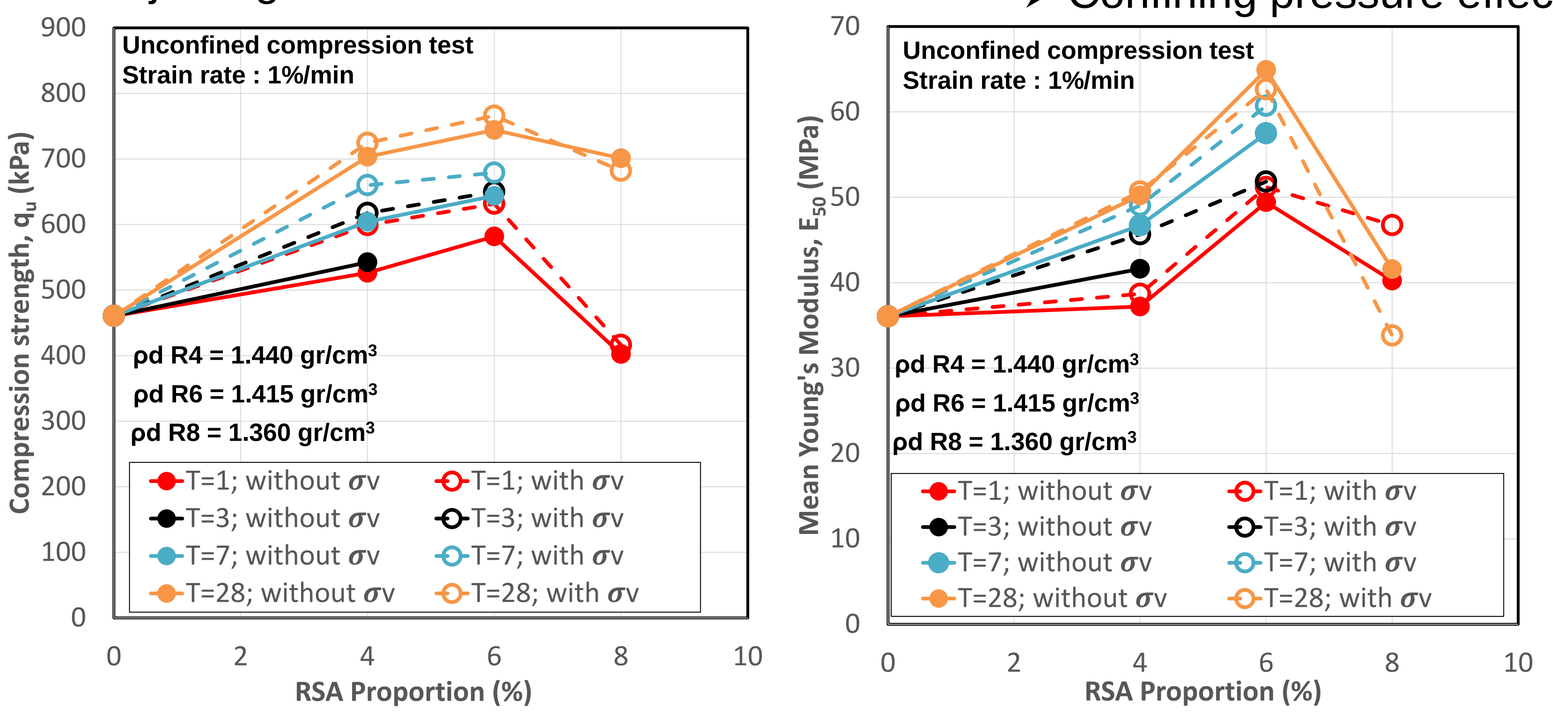


Fig. 3 Comparison of RSA proportion, curing time, and confining pressure effect on (a) unconfined compression strength (b) mean Young's modulus

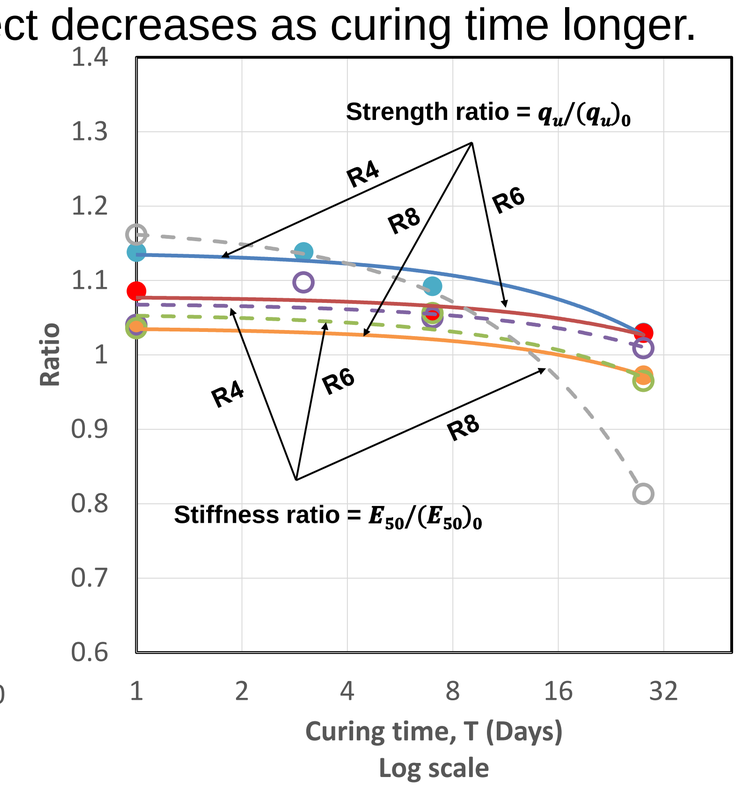
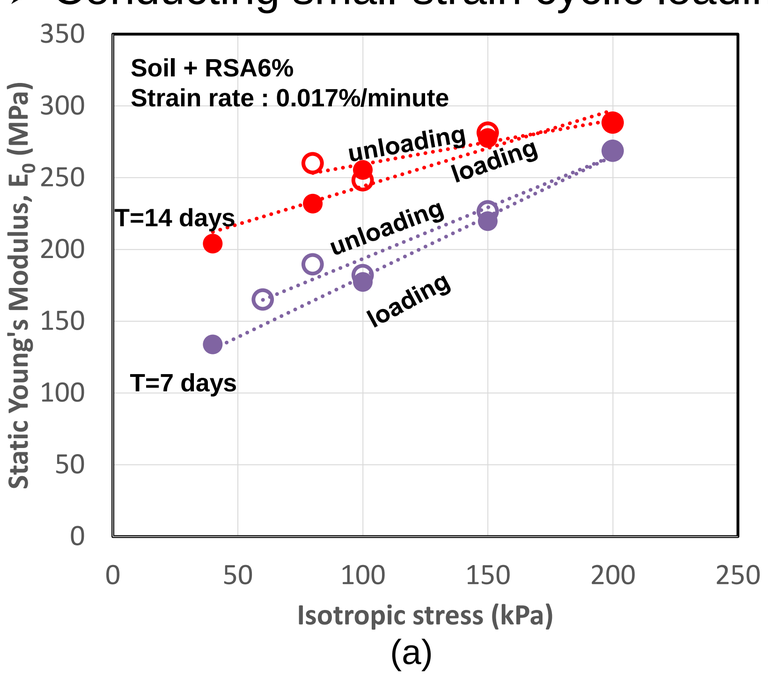


Fig. 4 Curing time effect on strength ratio and stiffness ratio

Small-strain characteristics

- Applying isotropic pressure (30, 40, 60, 80, 100, 150, 200 kPa, and the unloading scheme) on drained condition.
- Conducting small-strain cyclic loading (amplitude 0.001% and 11 cycles) and Vs measurements.



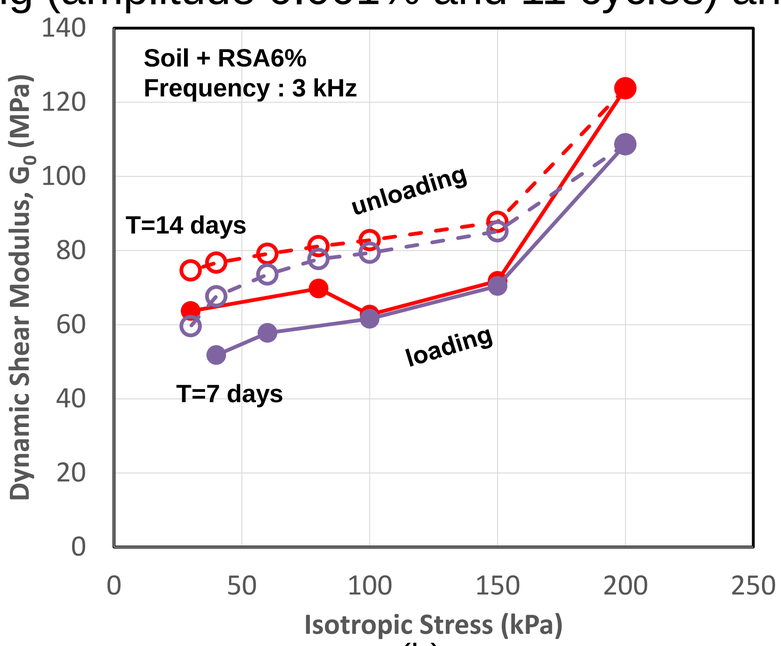


Fig. 5 Isotropic stress relationship on (a) E_0 (b) G_0

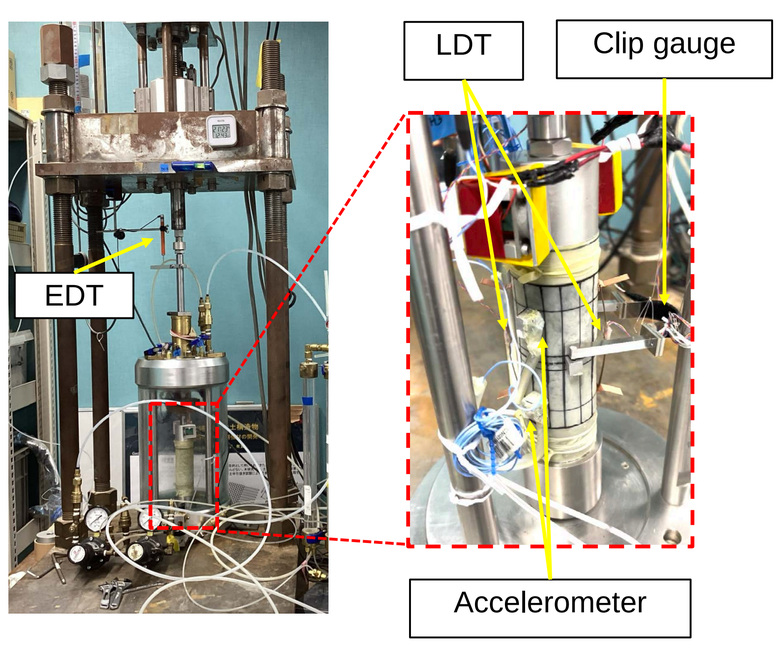


Fig. 6 Instrument installation

- Static E_0 and dynamic G_0 increase as pressure is higher due to densification of specimen
- The model prepared by longer curing time has higher stiffness