Soils and Foundations 64 (2024) 101403 https://doi.org/10.1016/j.sandf.2023.101403

Mixture design for eco-friendly hybrid clay treated with two stabilizers based on water absorption and retention of stabilizers

Shafique Raihan Shovon, Alula Kassa, Ryo Sekine, Kimitoshi Hayano, Yoshitoshi Mochizuki

[Outline]
High-water-content clay material
Clay reinforcement: previous method is time consuming (Sun drying), pollution (chemical agents)
Eco-friendly method is required. → Through wasted material compound [bamboo chips & fly ash]
Bamboo → to absorb/retain the surplus water / Fly ash → replacement of cement

[Method]
Water absorption/retention capacities measure (filtration under vacuum suction).
Cone Index tests
According to the mixture material ratios
pH and theoretical CO2 fixation capacities of the hybrid-treated clays were assessed.

(a) Bamboo chips

(b) Fly ash

[Results]
Design & Reinforcement: Accurately predict the specific Cone Index value & improve the structural strength and sustainability of the clay.
Environmental properties: pH measurements and evaluation of CO2 fixation capacity observed to be eco-friendly material.

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Critical application zone of the jet grouting piles in the vicinity of existing high-speed railway bridge in deep soft soils with medium sensibility Yao Shan, Jun Luo, Binglong Wang, Shunhua Zhou, Bo Zhang

(Outline)

Jet grouting treatment: a grouting slurry is pumped through a nozzle near the end of a rotating drilling rod into the soil with high pressure and high velocity to break up the soil skeleton and produce a soil–cement structure.

Risk: in soft clayey ground, deformation such as lateral displacement of the existing railway.

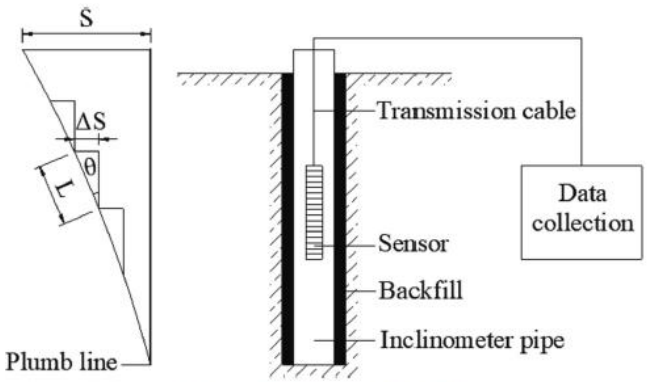

Fig. 18. Measuring principle of the inclinometer.

Objective)

Discover…

Critical distance between the jet grouting piles and the existing high-speed railway infrastructure

Normalized protection zone of the high-speed railway available for the jet grouting piling

Through…

Inclinometer/Earth pressure measure/SPT

Fig. 19. Installation procedure of the inclinometers.

Jet grouting pile should locate at least pile length × 2 away from railway.

Soft soil's compressibility is susceptible to installing jet grouting pile.

[**In situ tests** and laboratory test]

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Evaluation of the effect of constant and non-constant Poisson's ratio on reinforcement load of reinforced soil walls

Mauricio Ehrlich, Seyed Hamed Mirmoradi, Gustavo Fonseca Silva, Gabriel Nascimento

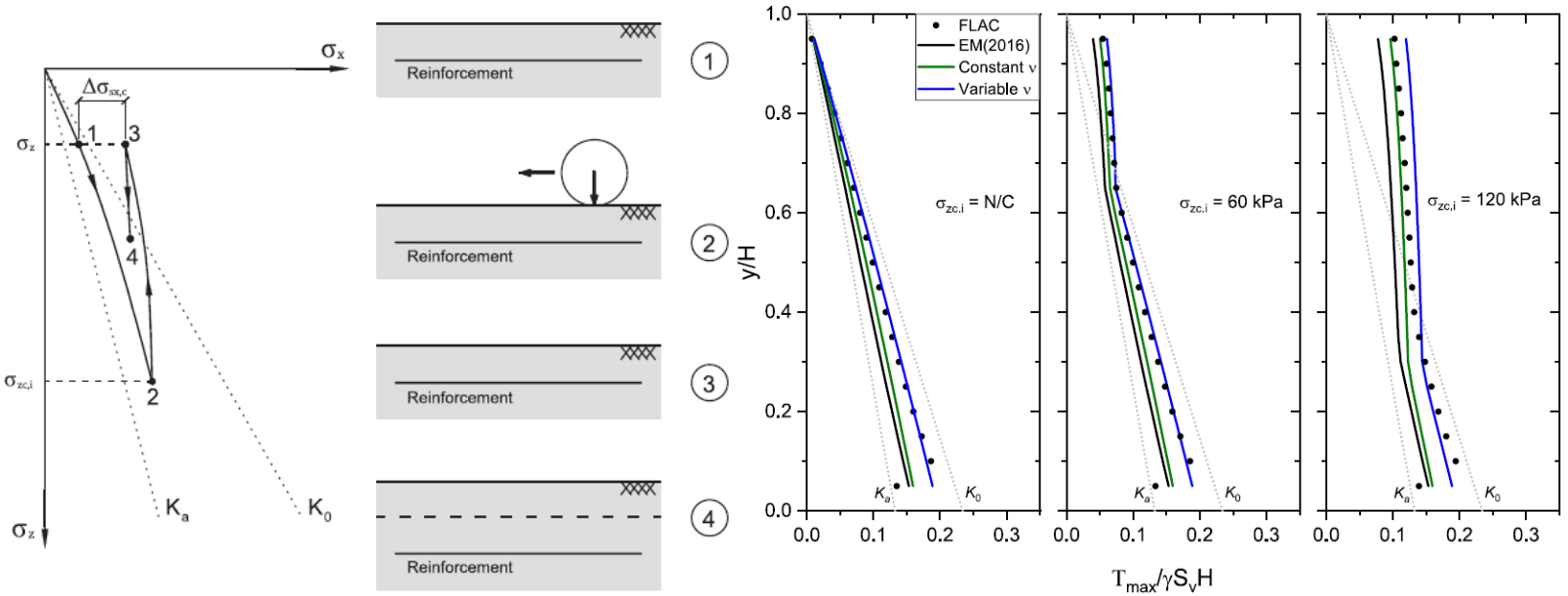
The performance of reinforced soil structures as a composite material depends on the soil-reinforcement interaction, which determine the value of loads mobilized along the reinforcements.
Existing previous method have flaws such as ignoring the effects of reinforcement and soil deform-abilities, compaction, and cohesion.
→ working stress design methods through considering influence of constant and non-constant values of ν used in calculating the maximum load on reinforced soil walls, T_{max}.

Constant

$$\nu_t = 0.5 - \frac{E_t}{6B}$$

Non-constant

$$\nu_t = 0.5 - \left(\frac{\sin\phi'}{2(1-0.5R_f)^2(2-\sin\phi')}\right)\left[1 - R_f\frac{(\sigma'_{zi}-\sigma'_{xi})(1-\sin\phi')}{2c'\cos\phi'+2\sigma'_{xi}\sin\phi'}\right]$$



Analysis and numerical modeling showed a max difference of about 20% between the T_{max} values calculated using constant and variable ν, highlighting that reinforcement **stiffness** has a greater impact.

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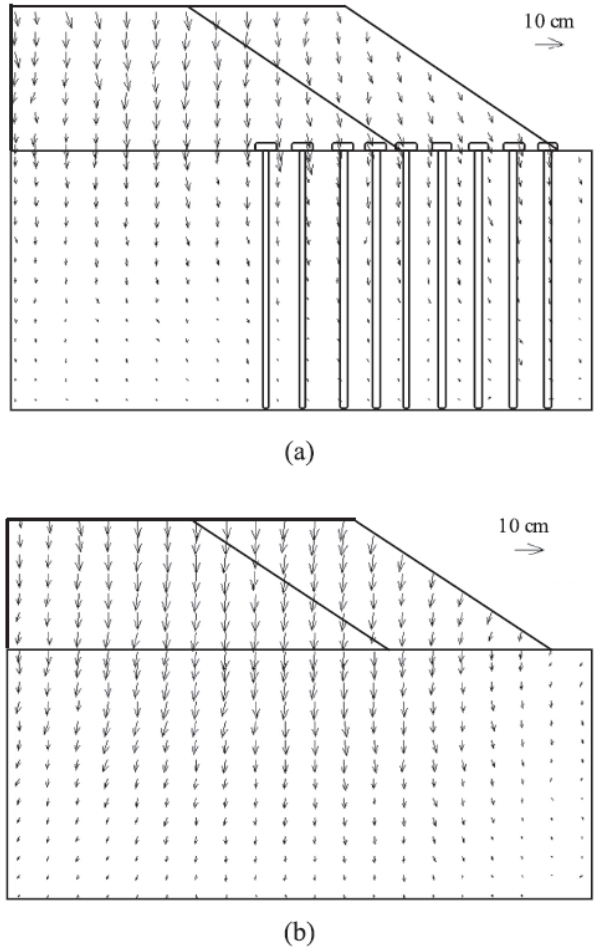
Centrifuge modeling of pile-supported embankment on soft soil base for highway widening

Tianyi Chen, Ga Zhang

For widening highway…
Widening embankment leads to settlement + differential settlement.
Considering [Existing & New] → piles are arranged only under new one. [differential settlement ↑]

Objective
(1) Observe the response and deformation distribution of the subgrades subject to new embankment
(2) Analyze the effect of old embankment on deformation due to the new embankment
(3) Illustrate the effect of piles on the subgrade deformation due to the new embankment
(4) Clarify the influential rule of pile layouts on the deformation characteristics of the soft soil base.



Displacement vector of the subgrade.

Different settlement and the effects from old and new is required to considered.
Also, effect of the more piles is significant.

+ + + + +
Through the centrifuge experiment, discovering the range of the pile's effect according to the number of the pipes is remarkable.

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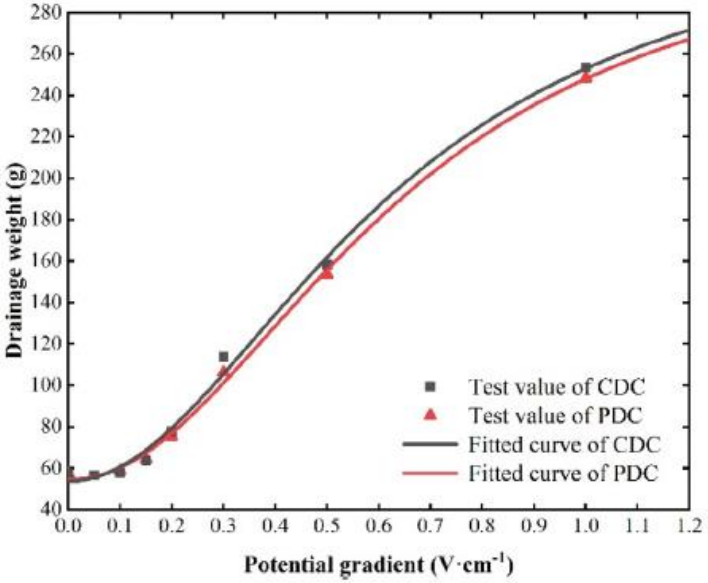
Electroosmotic reinforcement mechanism and laboratory tests of pulsating direct current with a high energy efficiency ratio

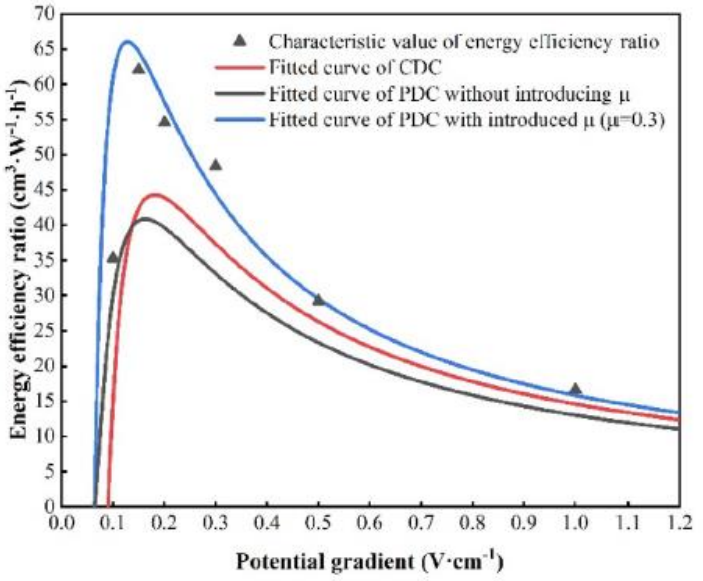
Xunli Zhang, Lingwei Zheng, Shangqi Ge, Xudong Zheng, Xinyu Xie

[Background]
Electroosmosis: method for treating soft ground, involves the application of an electric field by inserting electrodes. → Accelerates drainage and consolidation.
In coastal regions, offshore wind and tidal energy are extensively harnessed.
The production of high-power output in power supplies remains a challenge when addressing extensive areas.
[Objective]
Exploring the applicability of high energy efficiency ratio (EER) operating mechanisms through experiments using indoor experimental voltages.
Basically, the above method is a well-used method, but this study is being conducted because not much research on the mechanism has been conducted yet.

[Results]
Contact resistance exponentially decreases with the increase in electric current.
→ Contact resistance of PDC fluctuates with changes in the current intensity within the electroosmotic system.
It was possible to derive the efficiency ratio by controlling the voltage variable.



Variation curves of drainage weight with potential gradient.



Relationship between the electroosmotic EER and potential gradient.

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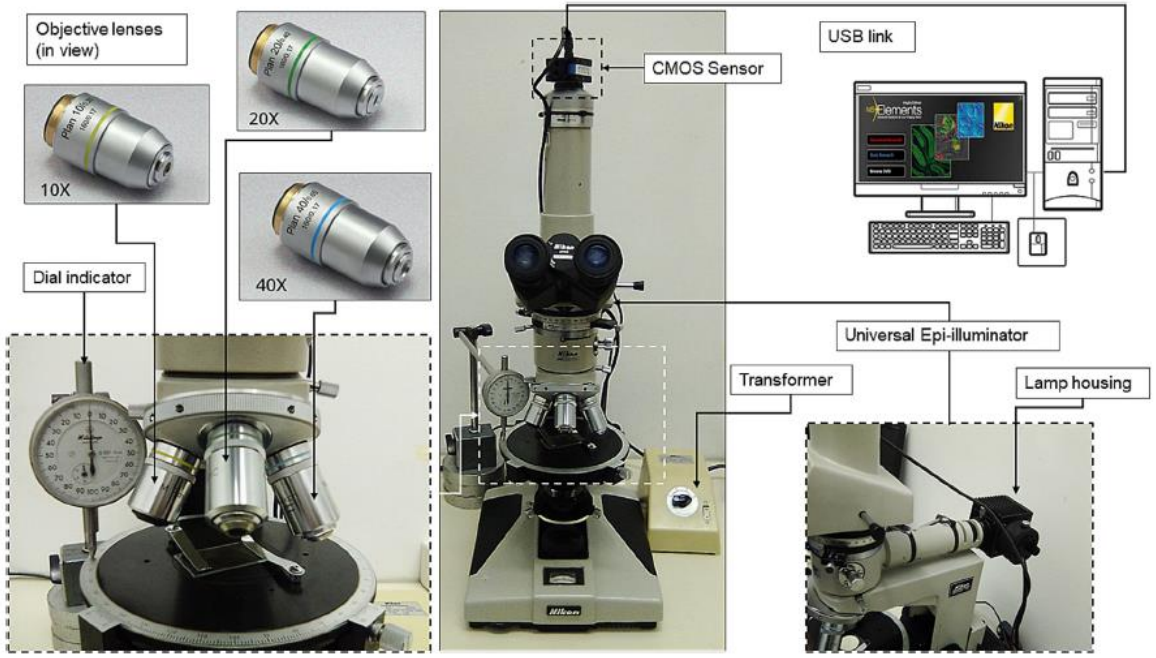
The shape of sand particles: Assessments of three-dimensional form and angularity

A.W. Bezuidenhout, M. Bodhania, L. Tiroyabone, C. Eddey, L.A. Torres-Cruz

[Outline]
Particle shape description: form, angularity, and roughness.
Particle characteristic: ellipseness -> angularity
3D particle description through 3D measurement is impossible -> 2D [With depth of field (DoF) ~ 2D + height by focus variation]
[Objective]
Applicability of DoF for particle size of 520 μm



[Results]
Form Measurement:
Focus variation technique enabled measurement of small particle.
Particle form varies within a given soil type and even within a narrow particle size range.

Angularity Assessment: There is a systematic correlation between particle form and the ellipseness metric.

Both form and angularity are crucial for understanding and predicting the behavior of granular materials.

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Elastic wave velocities during triaxial shearing influenced by particle morphology

Yang Li, Masahide Otsubo, Reiko Kuwano

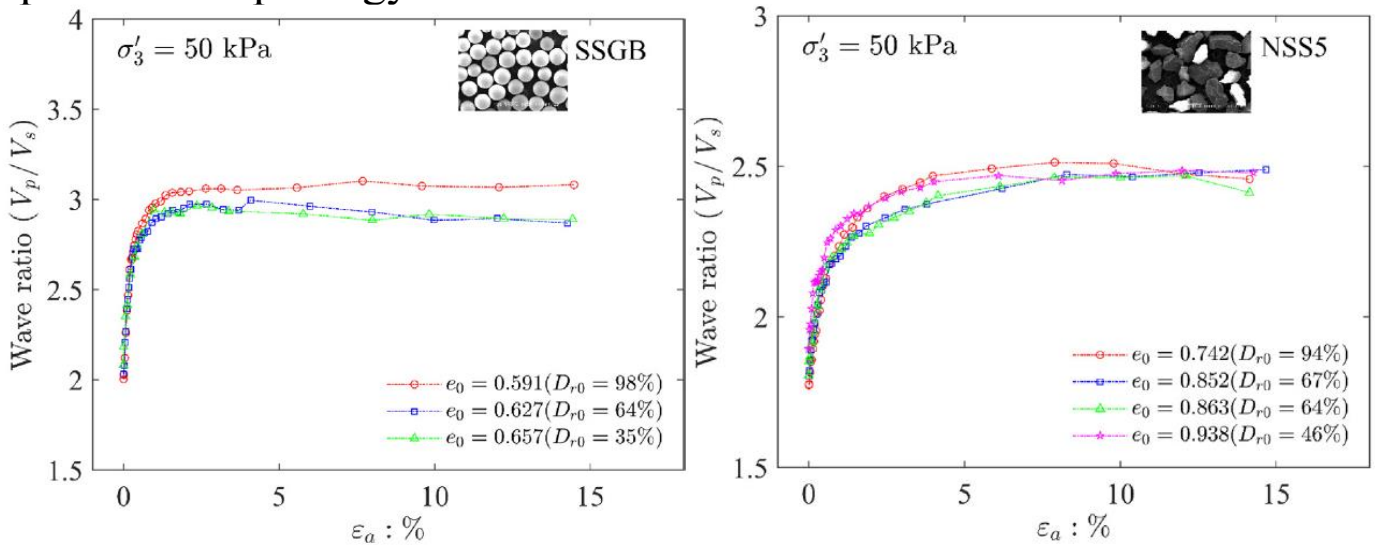
[Objective]

To investigate how different particle morphologies affect elastic wave velocities in soil during triaxial shearing tests.

[Methodology]

Tests using samples with varied particle morphologies, maintaining e_0, D_r, N_t.

V_p, V_s were measured under different conditions to study their relationship with particle morphology, stress, density.



[Results]

V_p, V_s → Linear relationship with e_0

Exponential relationship with the σ'.

$$V = af(e_0)\left(\frac{\sigma'}{1\text{kPa}}\right)^b$$

a ↓, while b and B are ↑ for more angular materials.

a ↓, while b and B ↑ with an increase in surface roughness

V_p ↑ with ε_a and ↓ gently with further shearing.

Converging trend observed in the $V_s - (\sigma_1' - \sigma_3')^{0.5}$ plane.

V_p/V_s increases significantly with ε_a and tends to be stable against ε_a

V_p/V_s ↑ with the ↑ in surface roughness consistently observed with the same e_0, D_{r0} or N_t.