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Insights into durability assessment for compacted soils treated with paper sludge ash-based stabilizers

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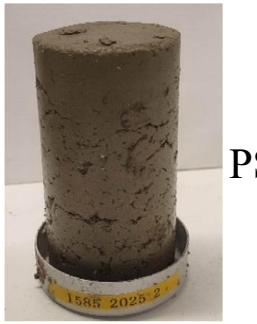
[Background]
Fine particle and high-water content soils from excavation → Difficulties encountered in compacting them.
Therefore, treating construction-generated soils by incorporating stabilizing chemicals is occasionally required to enhance the soil features, although doing so can have negative financial and environmental effects.
Studies on the use of sustainable materials, have been conducted to address these issues.

[Outline]
Soil stabilization using paper sludge ash-based stabilizers (PSASs) developed.
PSASs can be manufactured by insolubilizing the heavy metals in original paper sludge (PS).

[Objective]
Assessing the durability of clays treated with PSASs in wet-dry or dry-wet environments.

[Method]
1. Particle size distributions in the clays that had undergone various pretreatments were assessed.
2. Unconfined compression tests on PSAS that had wet-dry cycles using demolded specimens.
3. Cone index tests on the treated clays in molds that had undergone dry and wet curing cycles.
4. compare the results with PSAS clay and cement treated clay

[Results]
Contain more fines as more washing the samples prior to sieving was increased.
PSAS-treated clays will eventually become muddy.
After several dry-wet cycles, PSAS strength had decreased.
PSASs is less resistant to dry-wet curing cycles than cement treatment.


PSAS-N after 5 cycles


PSAS-R after 2 cycles


PFCB after 5 cycles

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Primary and secondary consolidation characteristics of a high plasticity overconsolidated clay in compression and swelling

Emil Mejlhede Kinslev, Ole Hededal, Irene Rocchi, Varvara Zania

[Background]

Soil deformations prediction requires 1st and 2nd deformations according to the time, especially for high plasticity overconsolidated clays.

Those are based on the constant c_v and creep index ($C_{\alpha e}$).

Those have complex stiffness and k relationships.

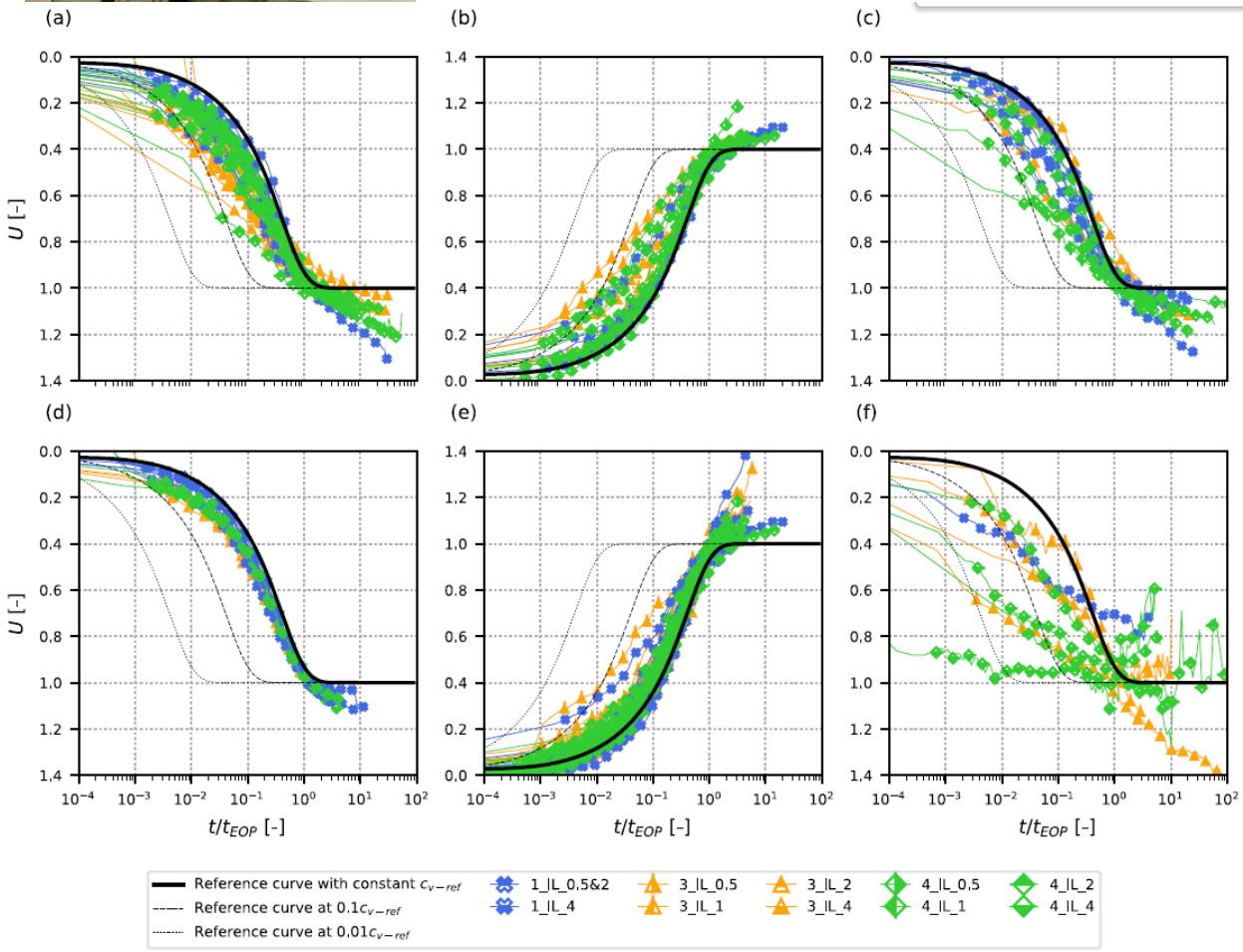
[Method]

1D oedometer and constant rate of strain test.

[Results]

- c_v increases during consolidation significantly.
- This variation has been attributed to a transient effect of k.
- Linear relationship between 1st and 2nd deformation indices was confirmed as an upper bound.
- 1st time deformation index, was defined as the slope at the inflection point of the time-curves.
- This parameter was linearly related to the creep index.

1D oedometer



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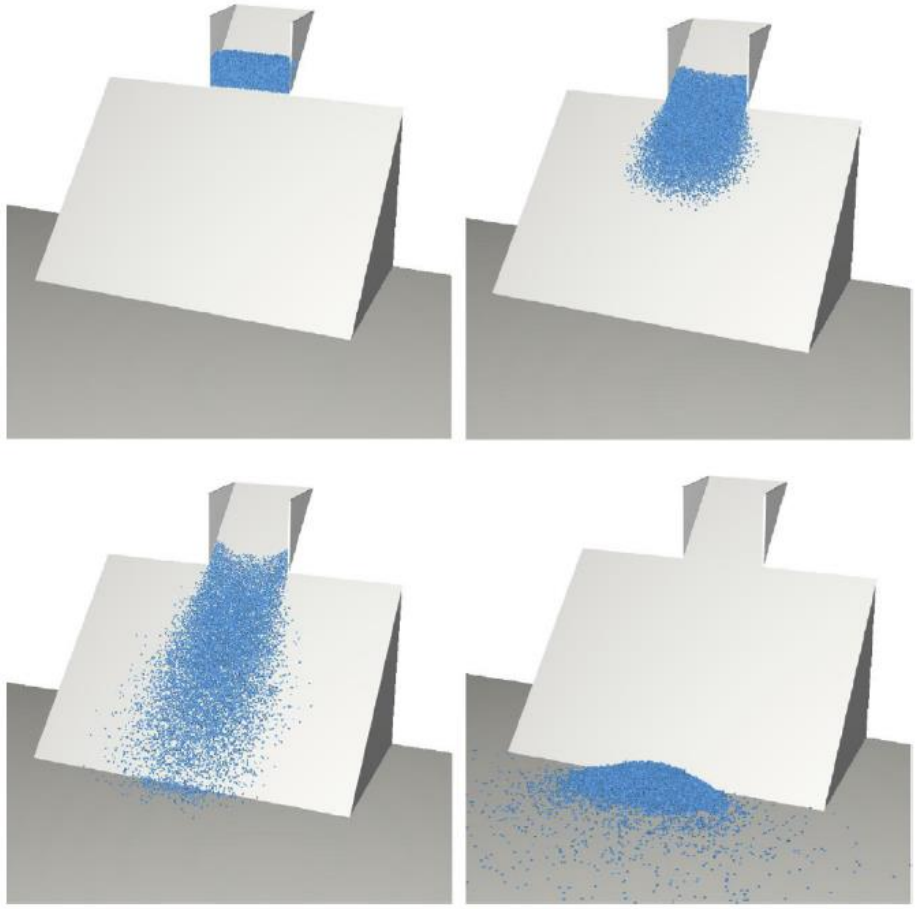
Quantification of the contribution ratio of relevant input parameters on DEM-based granular flow simulations

Junsen Xiao, Kenta Tozato, Shuji Moriguchi, Yu Otake, Kenjiro Terada

[Outline] To quantify contribution ratio of relevant input parameters in DEM.
[Method]
- Input Parameters:
*Spring coefficient *friction angle *coefficient of restitution *bottom friction.
- Sampling Method: Latin Hypercube Sampling was used to generate various combinations of input parameters.
- Simulations: Conducted with different particle shapes (clump, polygon) & contact models (linear hysteretic model, Voigt model).
- Response Surface Construction: Radial Basis Function (RBF) to construct the response surface from simulation results.
- Contribution Ratio Calculation: Monte Carlo simulations to calculate the contribution ratio of each input parameter.
[Results]
- Bottom Friction: Found to have a significant influence on the run-out distance.
- Friction Angle and Spring Coefficient: Showed relatively low contribution.
- Coefficient of Restitution: Had a considerable contribution ratio, especially in the front part of the particles.
- Particle Shape and Contact Model: Their influence on the contribution ratio was found to be minimal.
- Further validation under various parameters are needed to enhance.



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Resistance responses and design recommendations for driven piles in coarse-grained soil-based intermediate geomaterials

Nafis Bin Masud, Kam W. Ng, Shaun S. Wulff

[Background] IGM: Intermediate GeoMaterials
transitional materials that are harder than soil but softer than rock.
Challenges in pile design and construction.
Lack of understanding of how piles respond when driven into IGMs, making pile design challenging.
Absence of well-defined classification criteria and static analysis (SA) methods.
Piles driven into IGMs exhibit setup and relaxation responses over time, which can significantly affect pile resistance.
[Method]
Test pile data from establish classification criteria (U.S) for coarse-grained soil-based CG-IGM.
Develops new SA methods for predicting unit shaft resistance (qs) and unit end bearing (qb) in CG-IGM.
Time-dependent responses of piles driven into these materials and provides design recommendations based on the findings.
[Result]
- The unit shaft resistance in CG-IGM increases with the ratio of effective vertical stress (r0v) to the corrected N.
- The unit end bearing increases with the ratio of corrected N to r0v.
- Pile setup was observed in the qs of piles driven into CG-IGM, while pile relaxation was mostly observed in the qb.
- The proposed SA methods is more accurate for qs and qb compared to the existing b-method.

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Response of soil–water characteristics to pore structure of granite residual soils

Qixin Liu, Liansheng Tang, Yang Chen

[Background]

Granite residual soil:

[special mineral composition and pore structure characteristic]

→ easy to induce serious geological problems.

↔ effect of γ_d, initial w, SWCC are unclear

[Method]

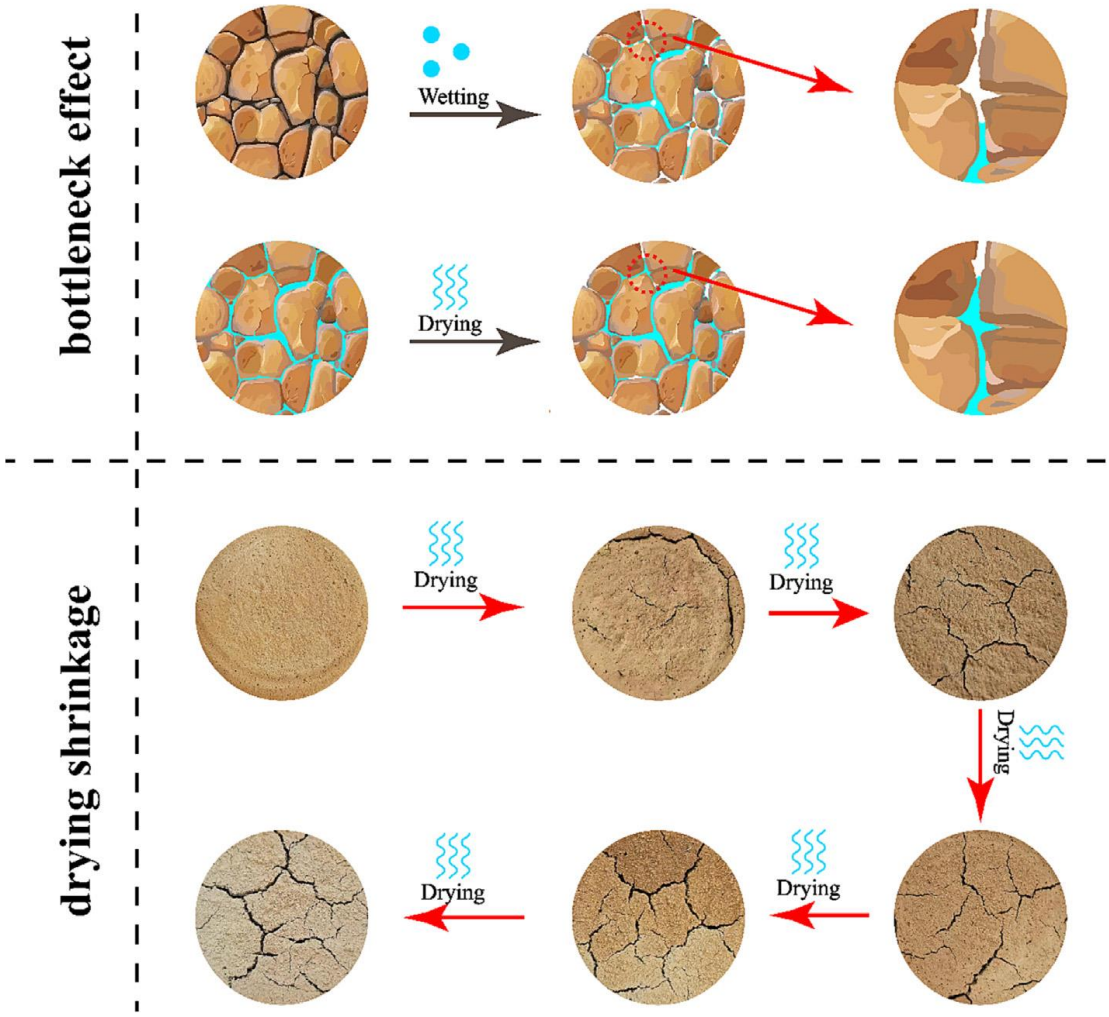
γ_d, initial w, SWCC test

Scanning electron microscopy (SEM) test

Pore-size distribution (PSD) test

[Results]

- γ_d affects low suction segment of SWCC, not the high suction segment.
- Initial w changes SWCC from unimodal to bimodal, influencing high suction segment.
- Initial w causes significant hysteresis in the high suction segment.
- Initial w shifts pore structure from trimodal to bimodal.
- Hysteresis in SWCC is due to pore water migration bottlenecks (low suction) and clay mineral behavior (high suction).



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Stability of tunnel face in unsaturated sand possessing apparent cohesion: A micro-macro analytical approach

Junzuo He, Shaoming Liao, Mengbo Liu, Iwanami Motoi, Junhua Xiao

[Background]
Stability of tunnel faces in USG.
[Method]
- Interparticle Capillary Water Force (ICWF)
- Self-Stabilized Arch (SSA)
- Limit Support Pressure (LSP)
- Direct Shear Test
- 1-g Model Test
[Results]
- LSP is negatively correlated with apparent cohesion.
- Improved compactness, internal friction angle, and contact angle enhance tunnel face stability.
- LSP decreases then increases with saturation degree, reaching a minimum value at a specific saturation range.
- LSP has parabolic distribution along the depth, peaking between 0.3D and 0.45D.

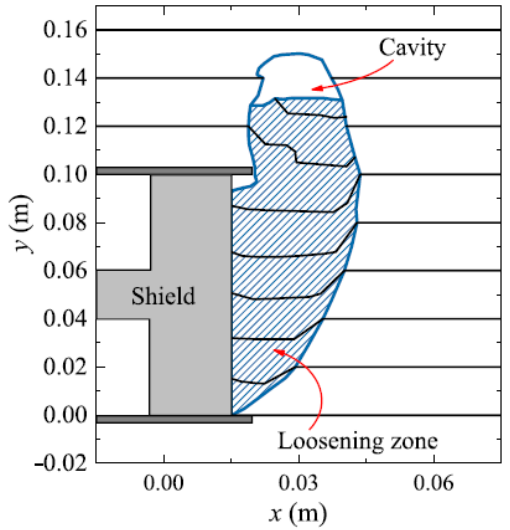

Fig. 1. Local failure induced by tunnel face unloading in unsaturated sand (Dziuban et al., 2018).

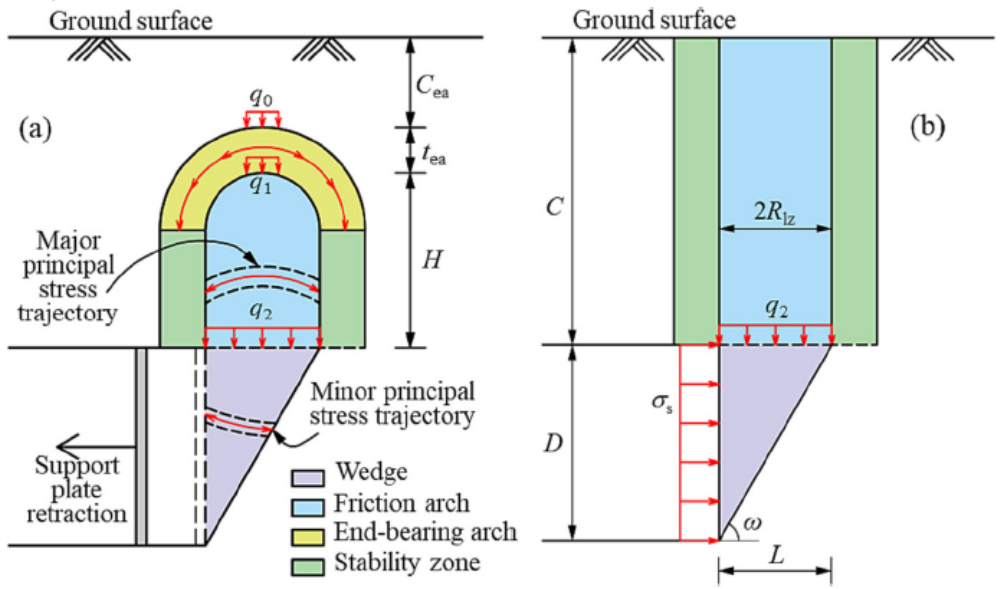

Fig. 5. Schematic diagram of the multi-arches model when: (a) end-bearing arch self-stabilizes; (b) end-bearing arch destructs.

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Suffusion in densely compacted Satozuka pumice sand and its impact on static loading undrained shear strength and dilation behavior

Rupali Sarmah, Yoichi Watabe

[Background]

Pumice sand of volcanic origin contains a high fraction of non-plastic fines.

May alter the soil microstructure by wash away of fines.

w and *C* affect the suffusion characteristics.

Their effect has not yet been evaluated.

Sapporo, consisting of pumice sand, will require a high *C*.

This study: assess the impact of suffusion on compacted pumice sand about shear strength and dilatancy.

[Method]

1. Suffusion characteristics of Satozuka pumice sand were evaluated.
2. CU tests under monotonic loading for with suffusion & without suffusion.

[Results]

k, *S*, stress paths, dilatancy: noticeably affected by suffusion.

Suffused specimens with exhibit an increase in residual *S* and σ_{dmax} under shearing and earlier phase transformation.

Therefore, suffusion has no significant negative impact on the deterioration of earth fill made from pumice sand and non-plastic fines, and that it persists at degrees of compaction between 80 % and 100 %.

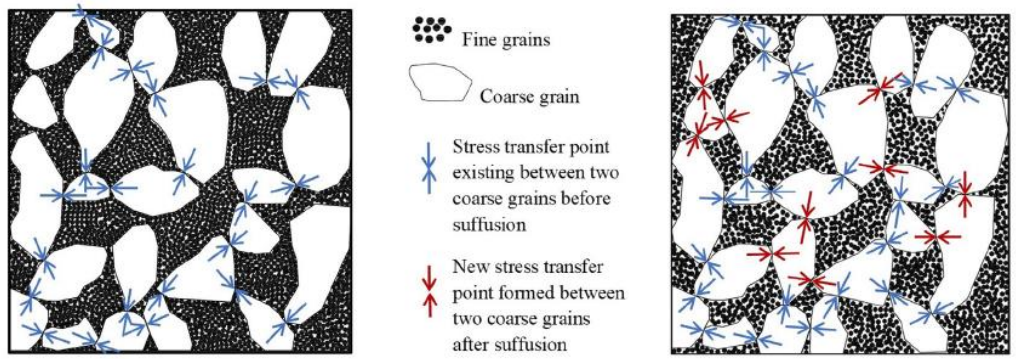

Fig. 26. Changes in soil microstructure and stress transfer mechanism (a) before suffusion, and (b) after suffusion.