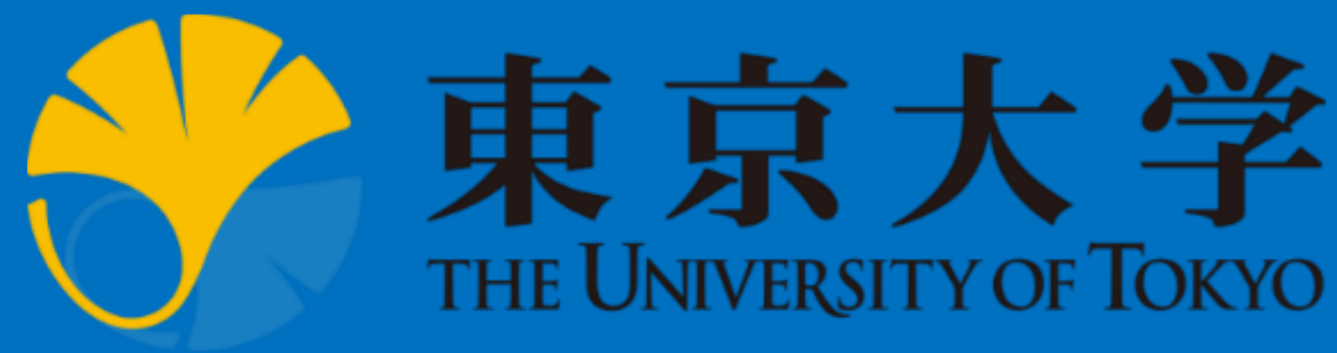


Effective compaction method for utilizing low-grade material with non-plastic fines content for railway embankment

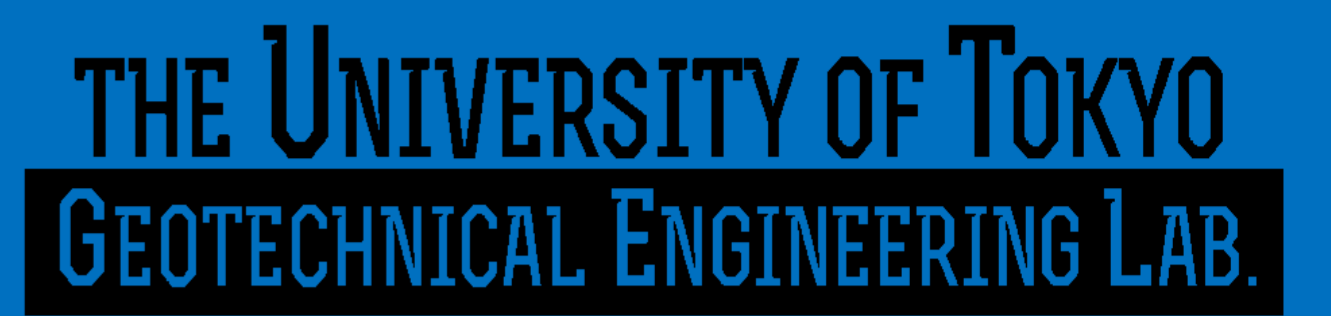
(非塑性細粒分を含む低級盛土材料の鉄道盛土への有効活用のための効果的な締固め管理方法)



BHARGAVI CHOWDEPALLI

(Outline of Doctoral Thesis, March 2023)

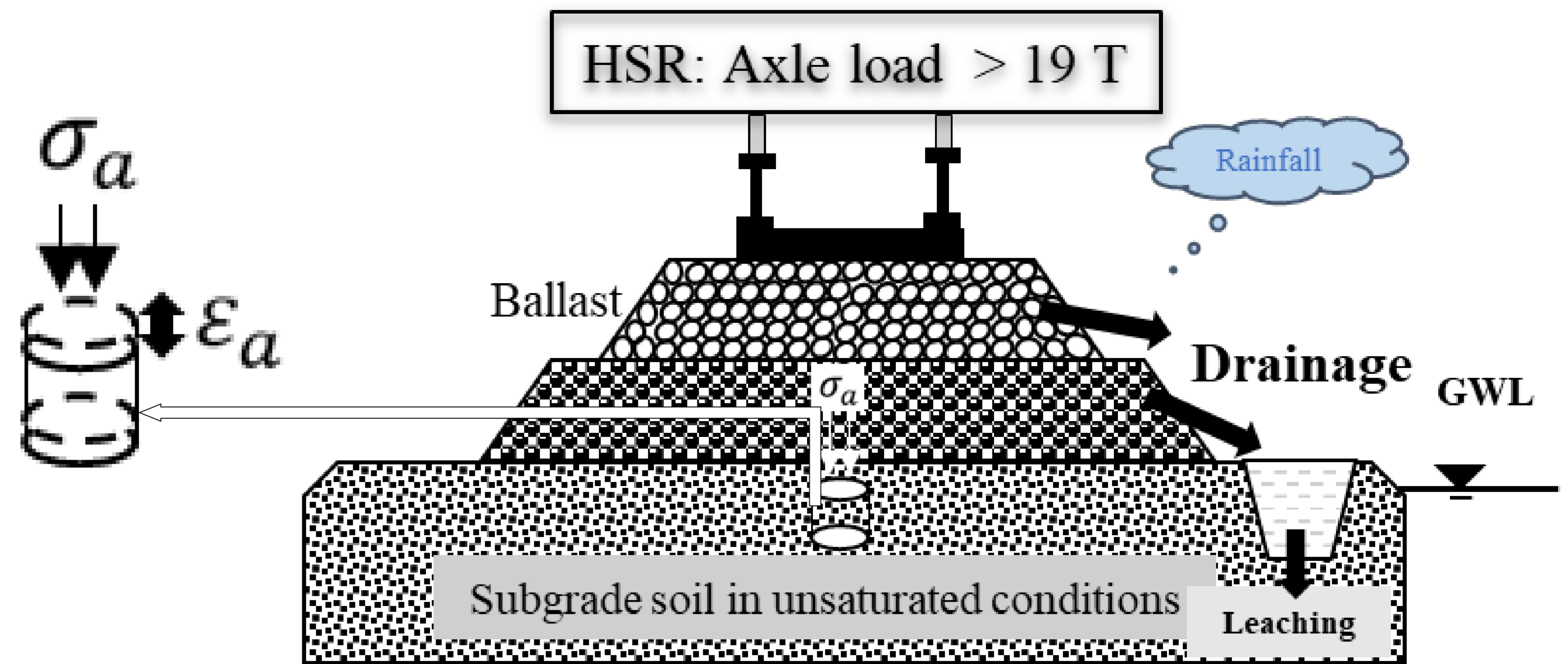
Department of Civil Engineering, The University of Tokyo, Japan



Research Introduction

Engineering problems associated with unsaturated soil conditions on high-speed railway embankment (HSR) –

- ❖ Lack of good quality material
- ❖ No guideline for heavy axle load performance structure which considers both the external loads (**Traffic vehicle loading**) and environmental conditions (**Heavy rainfall**)

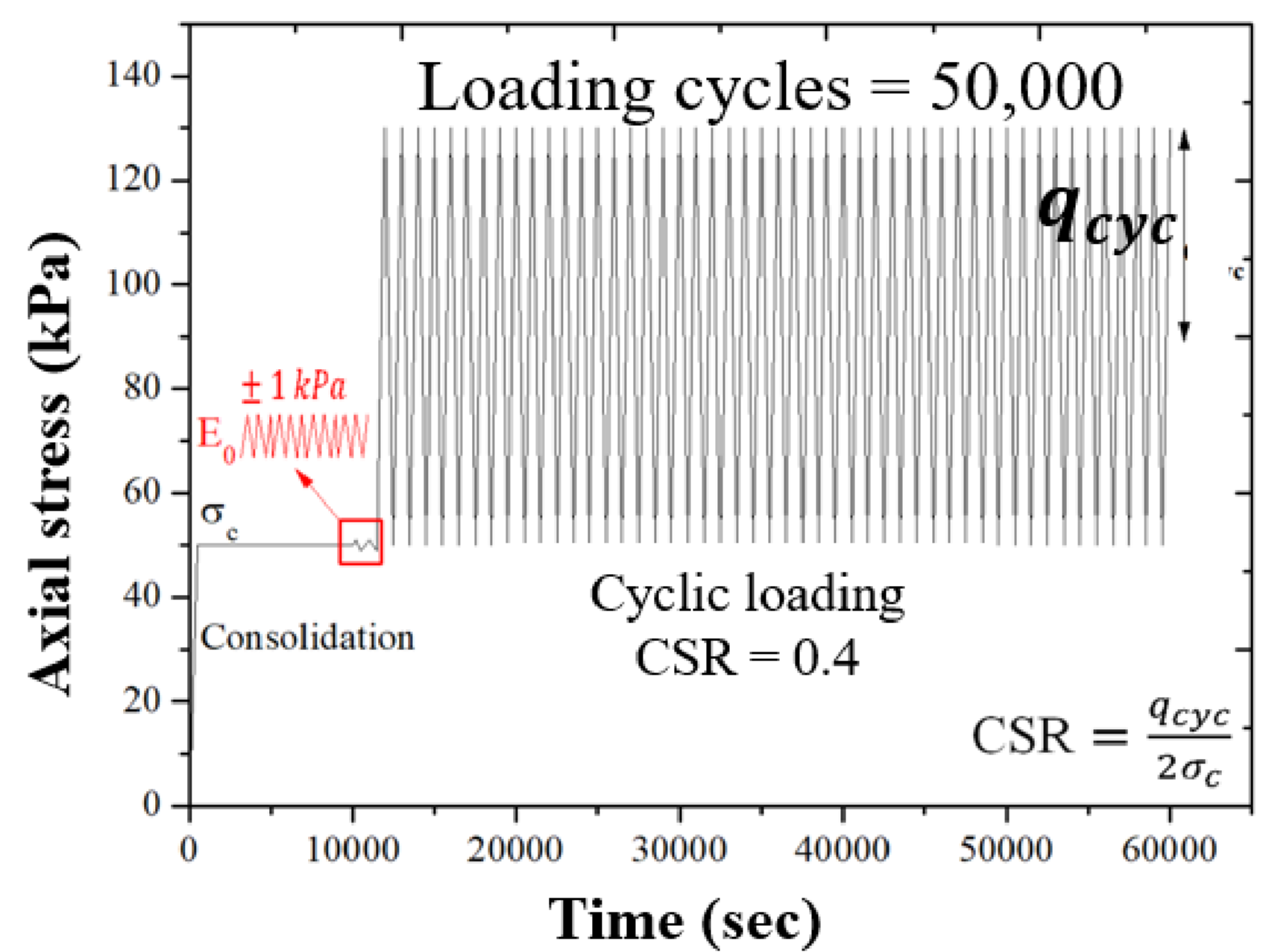


Testing conditions of the soil specimen shown in railway embankment

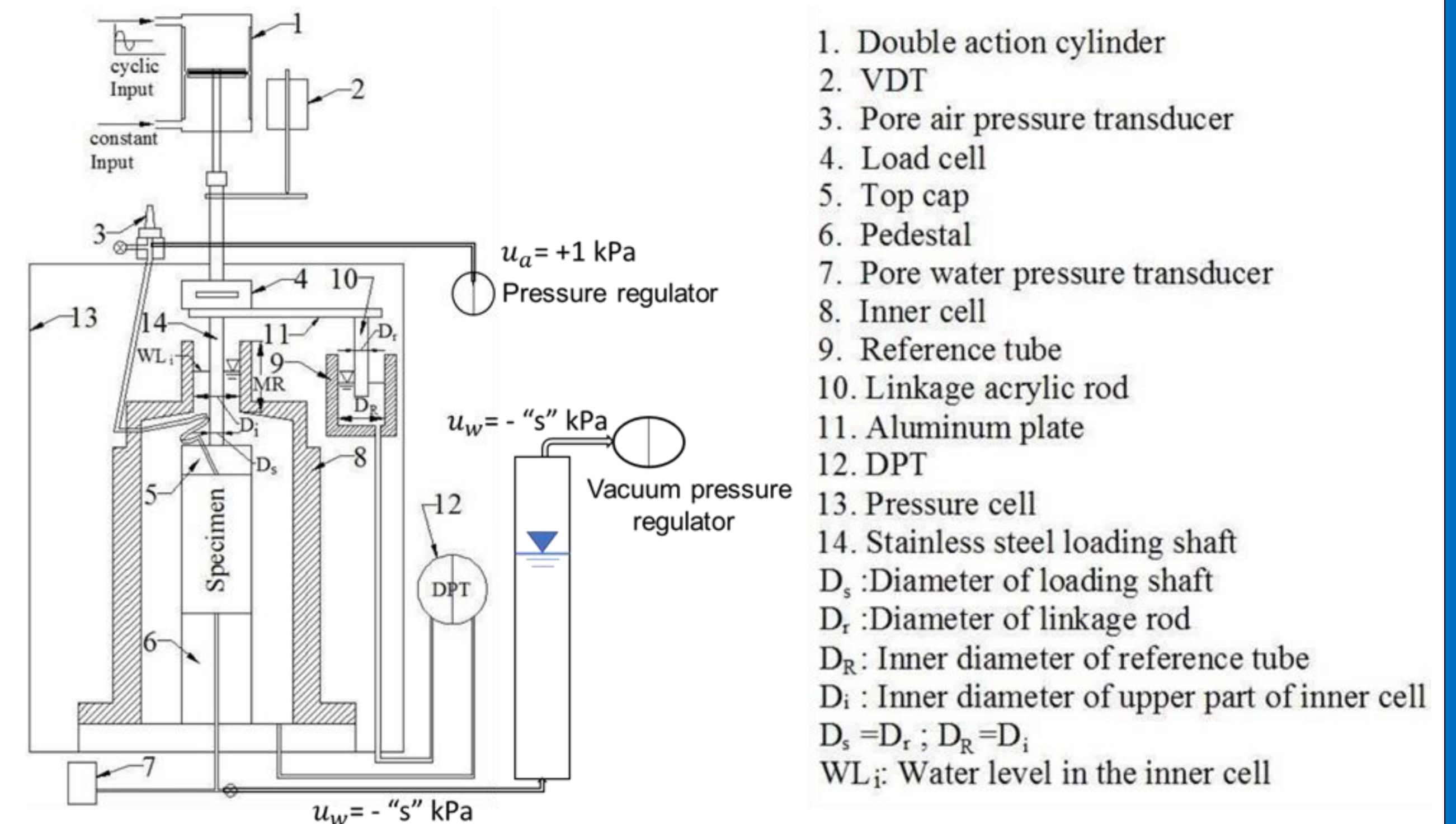
Testing apparatus and methodology

To understand the deformation behaviour of the soil –

- Suction-controlled drained cyclic triaxial tests were conducted.
- Linkage double cell triaxial apparatus was used to conduct these tests as it has the ability to measure/control the suction during cyclic loading.



Variation of axial stress during test

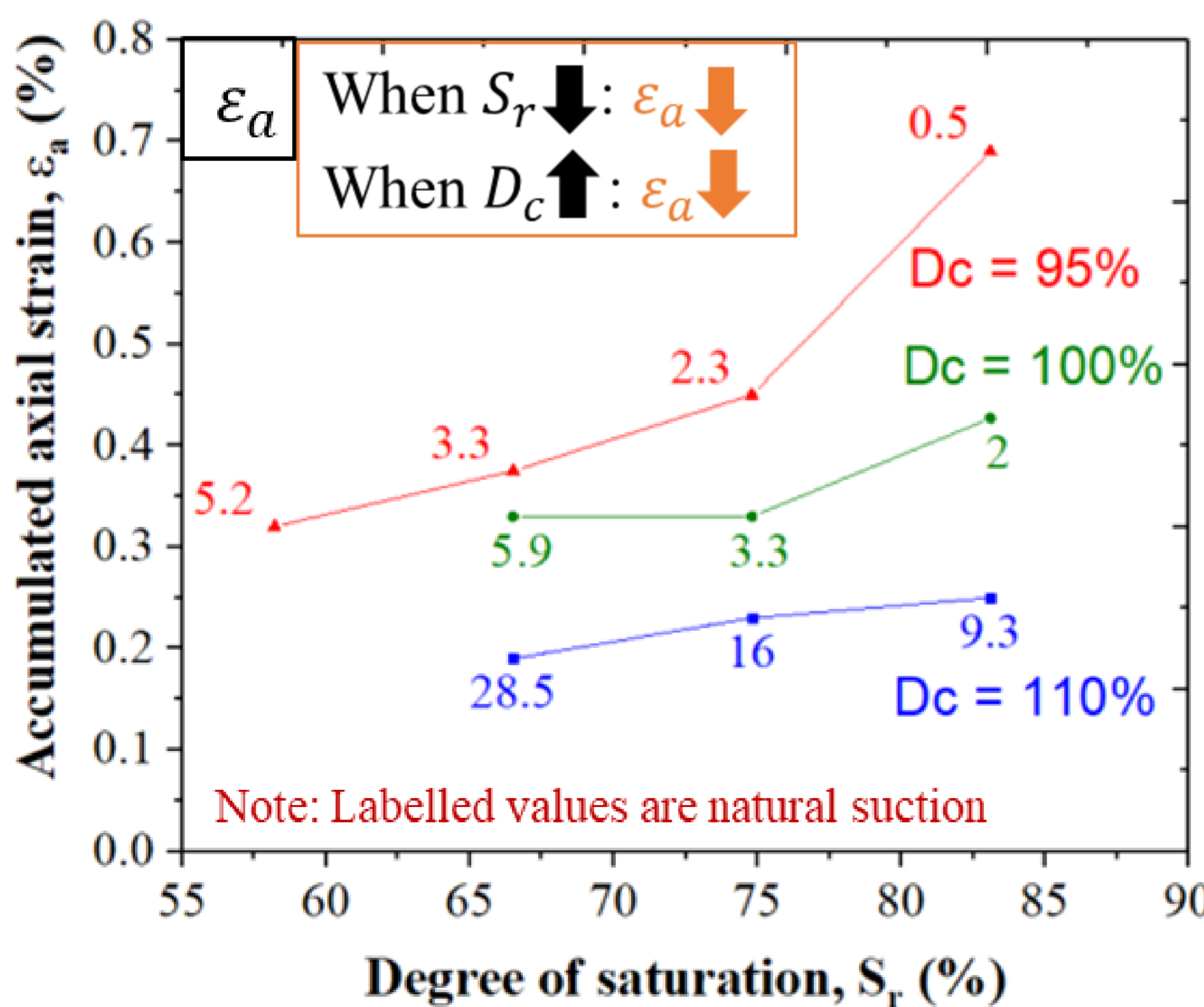


Linkage double cell triaxial apparatus

Evaluation of Accumulated axial strain (ϵ_a)

Effect of compaction and saturation on ϵ_a

- Accumulated axial strain during cyclic loading by varying the compaction and saturation is evaluated.
- Relationship between the accumulated axial strain and natural suction in unsaturated conditions is investigated.

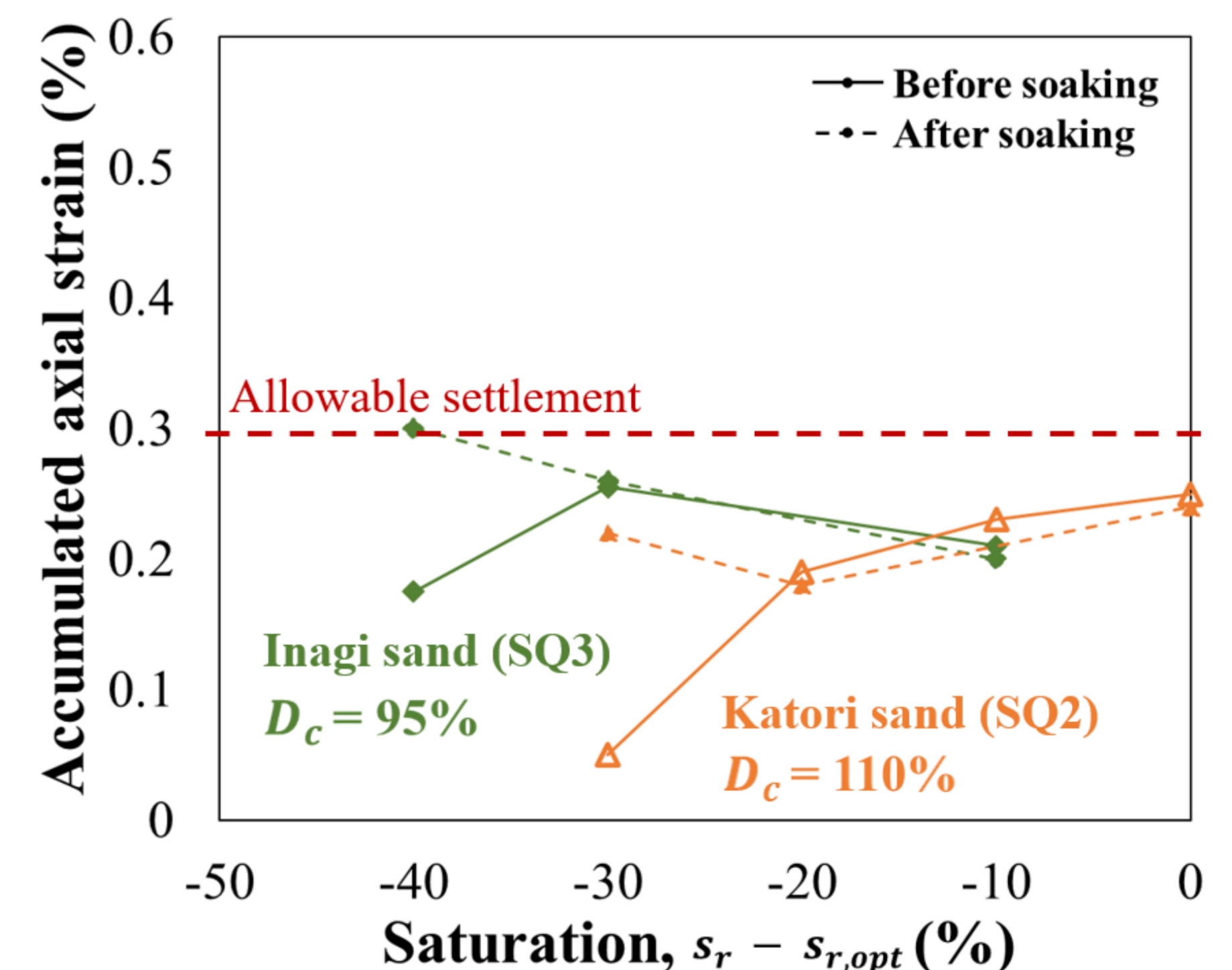
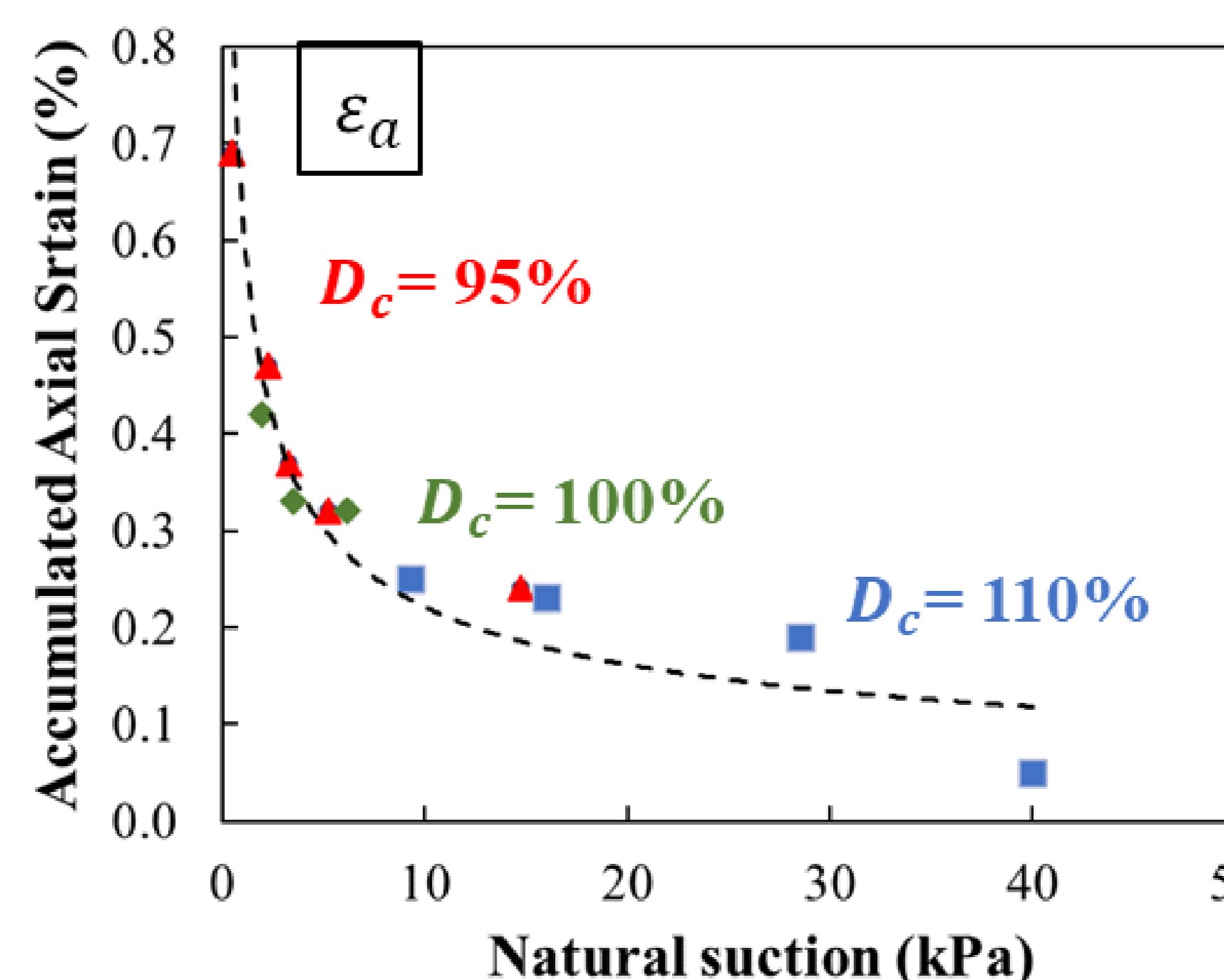


Variation of accumulated axial strain with respect to the compaction, saturation and natural suction.

Effect of fines content on ϵ_a

- Allowable settlement for slab track on railway embankment, taking into account the current testing conditions and serviceability criteria, was found to be less than 0.33%.
- Variation of accumulated axial strain for different fines content was investigated and compared it with the allowable settlement criteria.

Effect of suction on ϵ_a



Variation of accumulated axial strain with respect to the normalized saturation before soaking (unsaturated) and after soaking for the soils with different fines content.

- ✓ Positive effect of suction on accumulated axial strain was confirmed in unsaturated conditions.
- ✓ Negative effect of suction on accumulated axial strain at low saturation after soaking was clearly observed.
- ✓ Increase in accumulated axial strain was significantly seen with increase in fines content.

Requirements for utilization of low-grade material (Katori sand):

- Increase in compaction (D_c)
- Precise control of water content (W_c) considering the positive effect of suction in unsaturated conditions and by avoiding negative effect of suction while soaking.