

Yield behavior of Leighton Buzzard sand in a hollow cylinder apparatus

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Introduction

The yield behavior of Leighton Buzzard sand was studied under generalized stress conditions using a hollow cylinder apparatus. Different segments of yield surfaces were determined from identically prepared sand specimens.

Yield criteria

The experimental yield data was compared with theoretical values predicted by the Matsuoka-Nakai and Lade yield criteria to establish whether the criteria are suitable for predicting the onset of yielding in sand under generalized stress conditions.

Matsuoka-Nakai

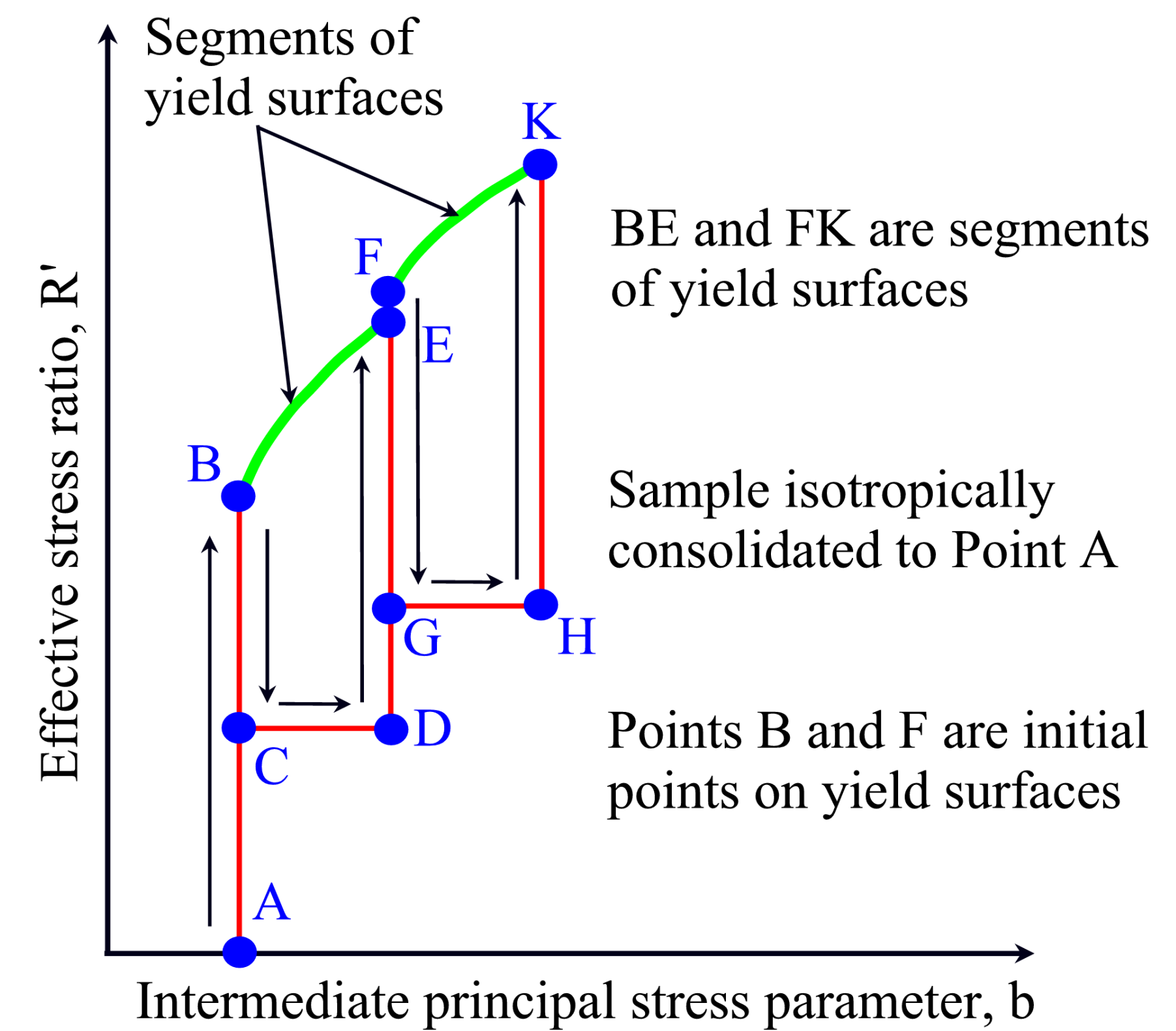
$$\frac{J_1 J_2}{J_3} = \text{Constant}$$

Lade

$$\frac{J_1^3}{J_3} = \text{Constant}$$

where J_1, J_2 and J_3 are the first, second and third effective stress invariants, respectively.

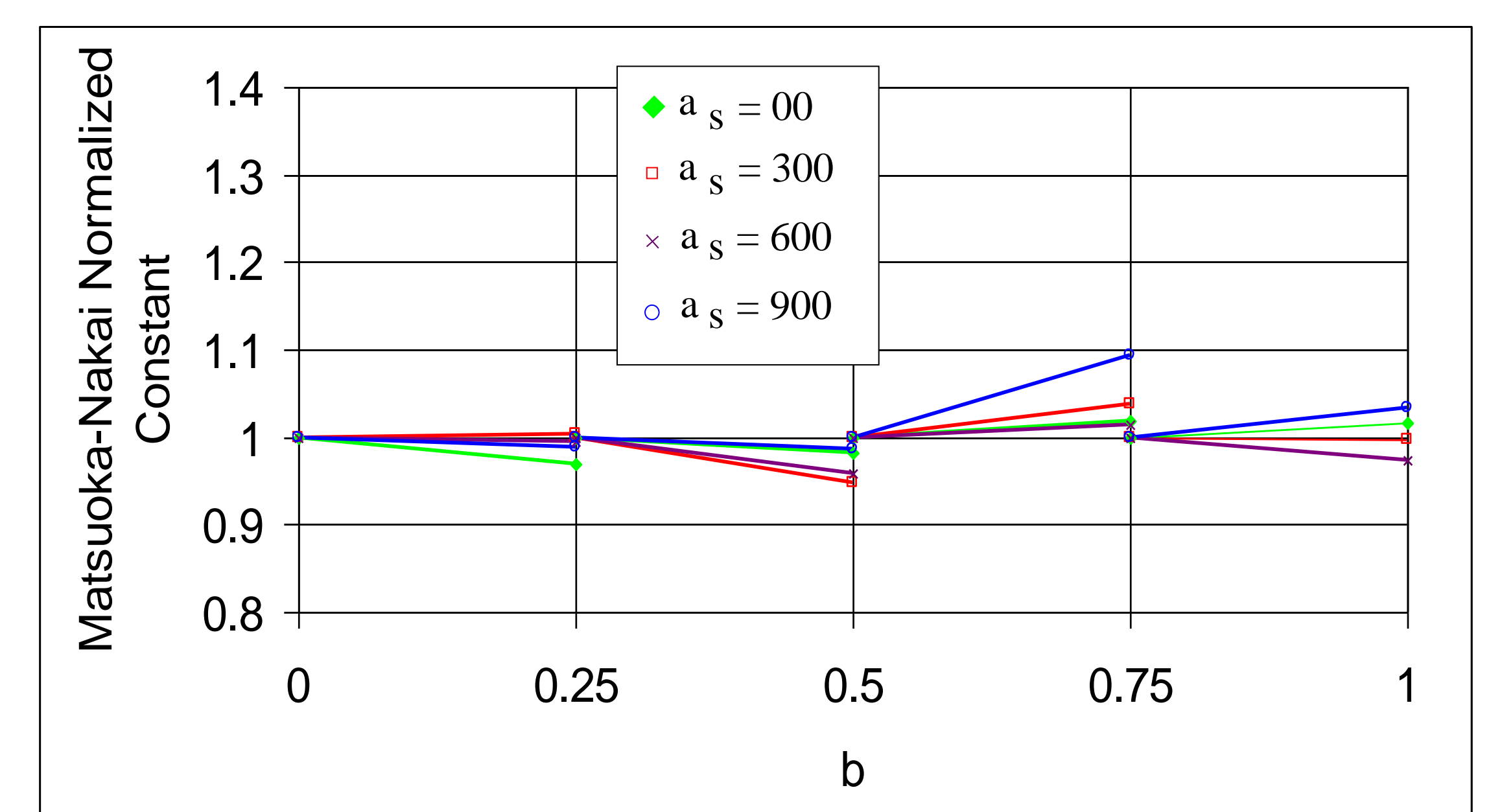
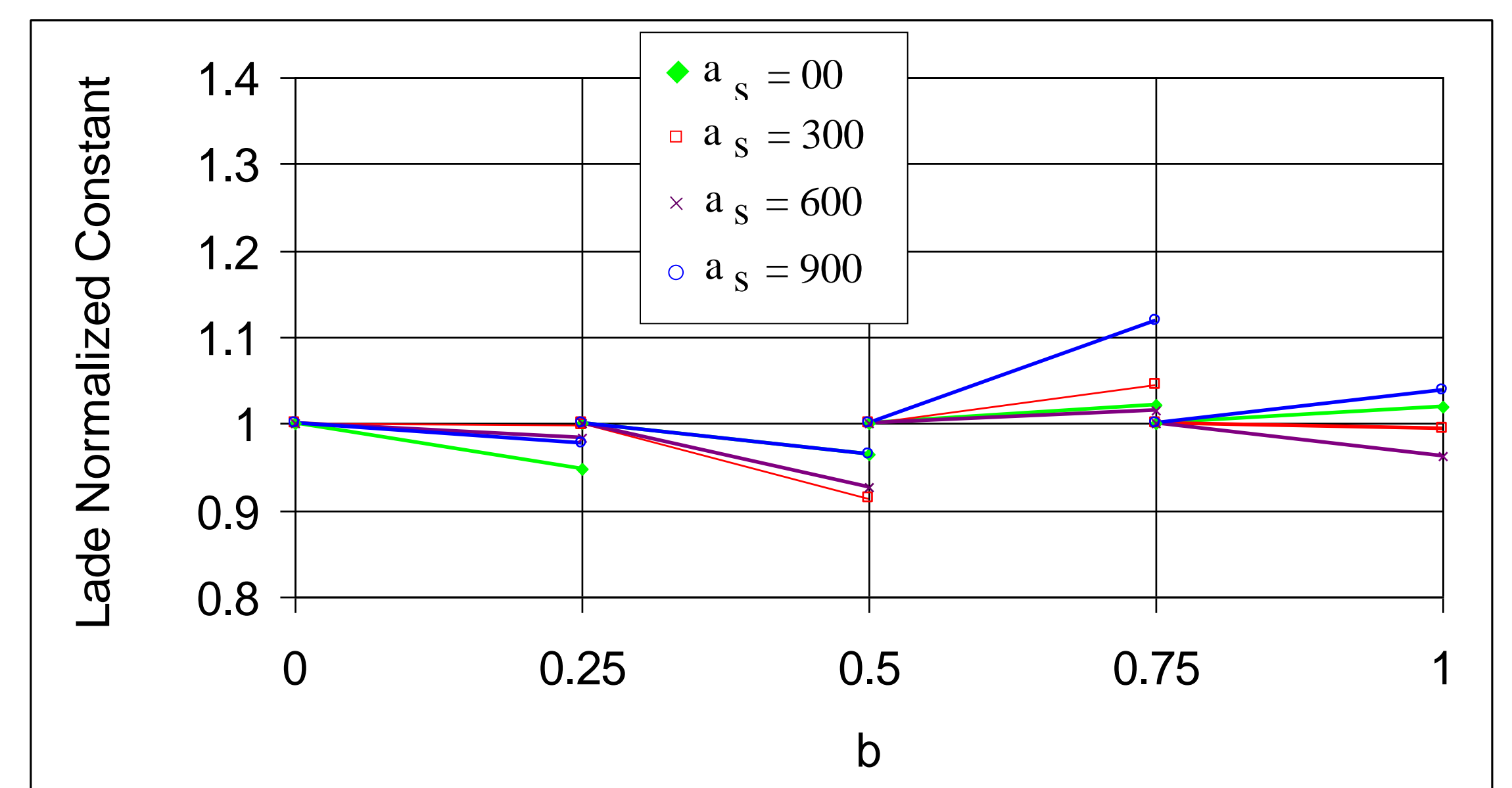
Stress paths used to identify segments of yield surfaces



Leighton Buzzard sand

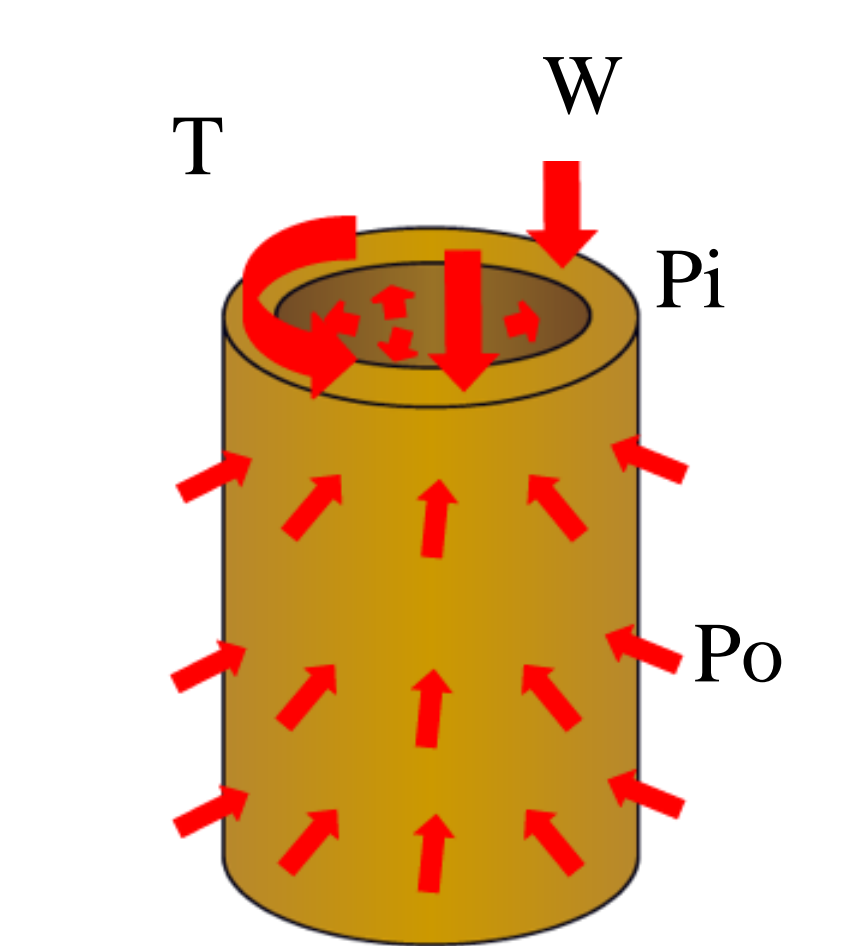
Property	Coefficient of uniformity	Coefficient of curvature	Mean particle diameter, D_{50} (mm)	Specific gravity	Maximum void ratio	Minimum void ratio
Value	1.32	0.96	0.52	2.64	0.77	0.50

Experimental data

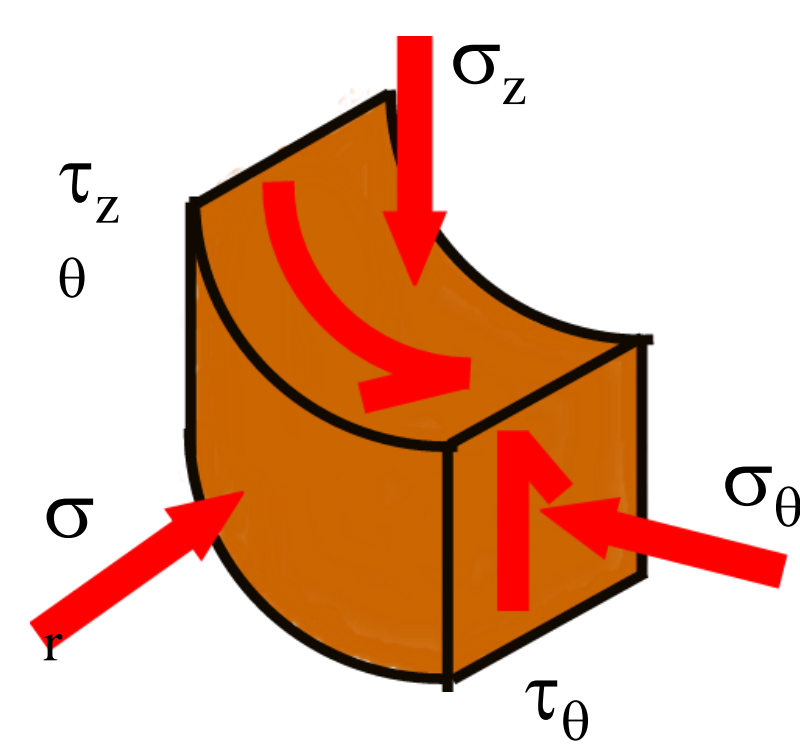


Experimental data expressed in terms of Matsuoka-Nakai and Lade yield criteria

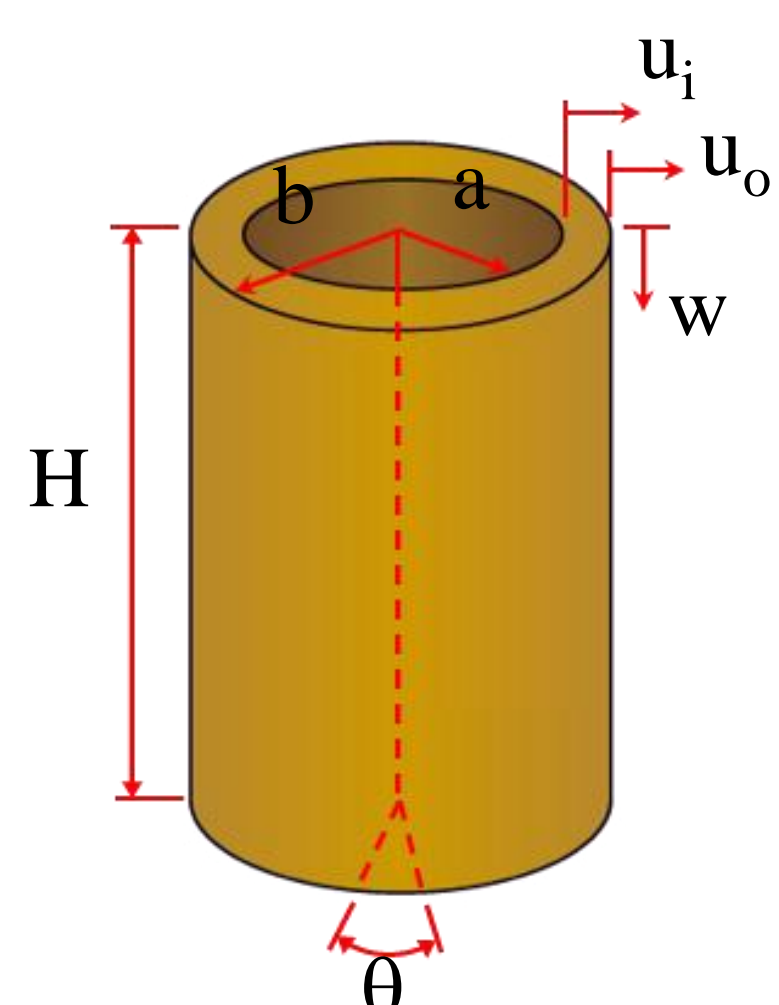
Stress and deformation in test specimen



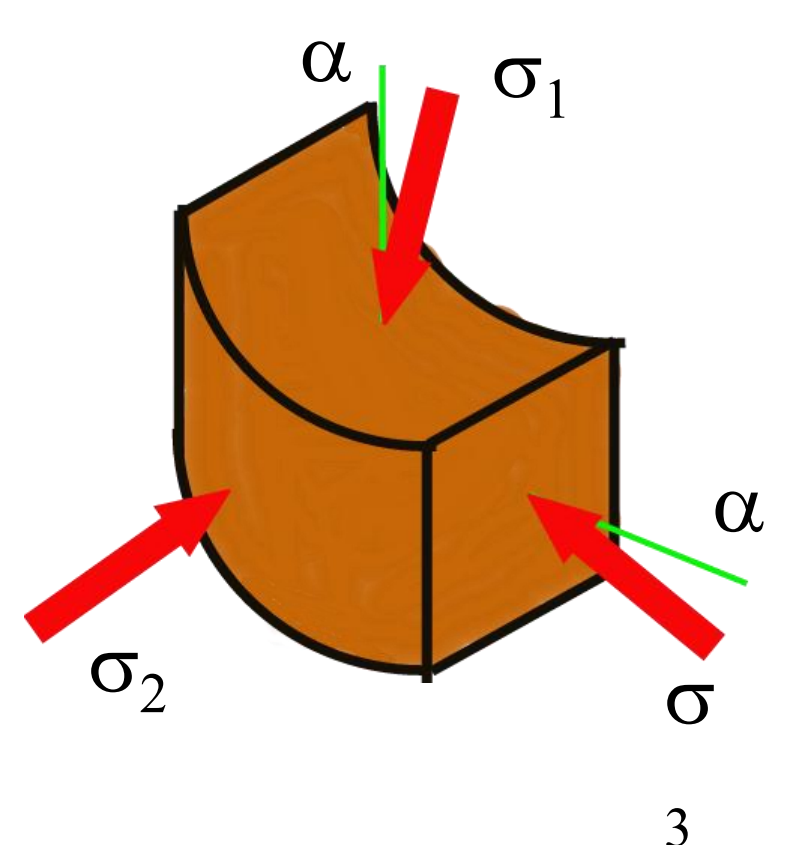
Applied surface tractions



Normal stresses



Dimensions and measured deflections



Principal stresses

Conclusions

- Stress paths successfully identify segments of different yield surfaces in generalized stress space from tests on identically prepared specimens in a hollow cylinder apparatus.
- The Matsuoka-Nakai and Lade yield criteria both adequately predict the onset of yielding under generalized stress conditions.
- The experimental yield surfaces indicate that the yield predictions are predominately independent of the rotation of the major principal stress during the initial consolidation stage.