RESEARCH BRIEF

PROJECT TITLE: **Acquisition of a Vardoulakis-Type Plane Strain Device for Advanced Testing of Soils**

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INSTITUTION: SINGLE-INSTITUTION PROJECT
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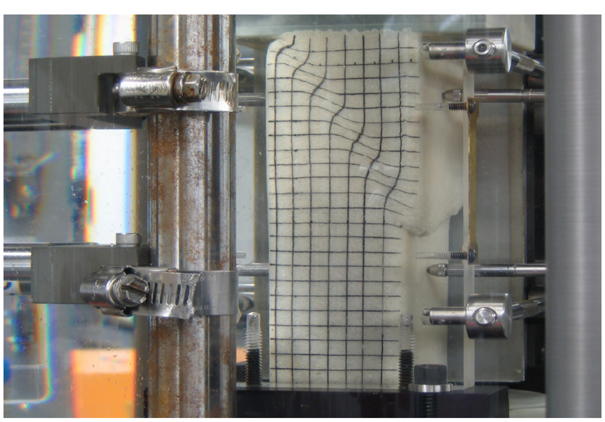
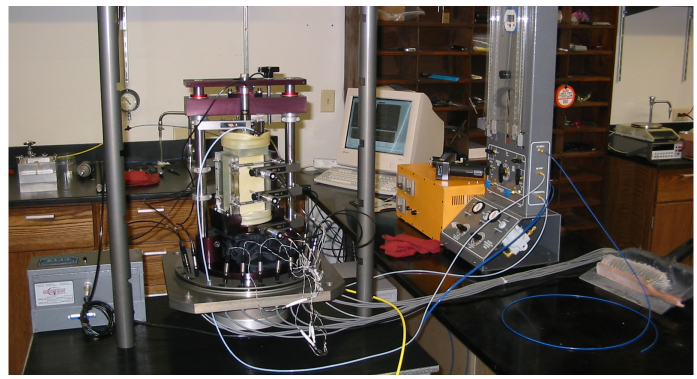
SPONSORS: THE PACIFIC NORTHWEST TRANSPORTATION CONSORTIUM, OSU

Background

It is well-known that all three principal stresses play a role in the stress-strain-strength-volume response of solids and granular materials, yet conventional triaxial compression tests and direct shear tests are typically used for the determination of design parameters for granular materials, even when field conditions may be plane strain (e.g., long embankments, retaining structures, shear zones in landslides). That is, despite the ubiquity of plane strain conditions in the field, there is a scarcity of plane strain laboratory data because there are only a few devices capable of making these measurements.

Since most laboratories lack the ability to perform plane strain (PS) compression tests, stress-strain-strength-volume parameters are typically measured in conventional triaxial compression (CTC) or direct shear (DS) and used for design, even though field conditions have not been accurately reproduced in the laboratory. This is assumed to be conservative since it is generally recognized that friction angles measured in CTC will be less than those measured in PS or that DS most closely mimics PS conditions. These simplifications do not address the effects of different pre- and post-yield responses that are observed in PS versus CTC loading or the rotation of principal stresses and significant boundary effects that are associated with DS loading. The only way to accurately model certain field conditions in the laboratory is through a PS stress path, which highlights the need for this research.





Research Project

In this work we will seek to acquire and assemble a used Vardoulakis-type plane strain device from the University of Southern California and to subsequently use it to perform PS compression tests on standard sands to confirm operability. This device will provide us an opportunity to perform research – both theoretical and applied – in an area that is relevant to the needs of the profession, particularly as applied to the interface be-tween the natural environment and our built transportation infrastructure. The device will be assembled in the OSU geotechnical engineering laboratory and outfitted with compressed air, vacuum, pressurized de-aired water, and automated data acquisition. Once assembled and functional, we will perform PS, CTC, and DS tests on standard sands at the same initial relative density and compare the response across stress paths.