TAILINGS AND MINE WASTE 2026

CIVIL AND ENVIRONMENTAL ENGINEERING
COLORADO STATE UNIVERSITY

SHORT COURSE

CONE PENETRATION AND VANE SHEAR TESTING: QUANTIFYING UNCERTAINTIES AND DEVELOPING PROTOCOLS RELATED TO VARIABLE RATES AND PARTIAL DRAINAGE

This course is offered as a collaboration of TAILENG and industry representatives from Aecom, Conetec, Freeport-McMoRan, and Geosyntec.

Date: November 8, 2026

Duration: Full-day

Information provided here is subject to change.

Objective:

This course aims to equip practitioners with advanced skills to interpret undrained soil properties from CPT and VST and address challenges in interpreting these soil properties under partially drained conditions in tailings with specific consolidation characteristics. Participants will learn how variable-rate cone penetration and vane shear testing (slow or fast) can influence in situ characterization under conditions where drainage behavior affects interpretation.

Course Summary:

Tailings often exhibit complex consolidation and drainage behavior, making the interpretation of in situ tests challenging. This full-day course focuses on understanding undrained shear strength evaluation and the implications of partial drainage during cone penetration and vane shear testing. Attendees will explore how adjusting penetration or rotation rates can improve characterization accuracy for tailings. Practical guidance will be provided on identifying conditions in which variable-rate testing enhances the interpretation of tailings. Field case studies and recent research programs will be presented to illustrate these variable-rate effects.

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Detailed Course Description:

Tailings present unique challenges for geotechnical characterization due to variable consolidation and drainage responses. The conventional interpretation of CPT and VST data assumes either fully drained or undrained conditions, which may not hold for certain tailings under standard testing protocols. This course will:

- Review fundamentals of cone penetration and vane shear testing in tailings.
- Discuss the influence of drainage and tailings consolidation properties on test interpretation.
- Examine conditions leading to partial drainage during testing and its impact on undrained strength evaluation.
- Introduce strategies and protocols for variable rate testing (slow or fast enetration/rotation) to improve characterization of tailings through cone penetration and vane shear testing.
- Provide practical examples and guidelines for applying these techniques in tailings management.

Full-Day Schedule:

1. Registration & Welcome
2. Fundamentals of CPT and VST in Tailings
3. Interpreting CPT tests under partial drainage
4. Interpreting VST under partial drainage
5. Variable Rate Testing Strategies and Challenges
6. Case study 1
7. Case study 2
8. Case study 3
9. Discussion panel

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Course Coordinator: Jorje Macedo (Associate Professor at Georgia Tech and TAILENG Chair)

Presenters:

Alfonso Cerna Diaz
PhD, PE, Senior Geotechnical Engineer

Jorge Macedo Escudero

PhD, PE, Associate Professor, Georgia Tech

Scott M. Olson

PhD, PE, Professor, University of Illinois at Urbana-Champaign

Christian Armstrong

PhD, Senior Geotechnical Engineer, Freeport-McMoRan

Marcelo Llano

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Dallas McGowan

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