



STATE-DEPENDENT UNDRAINED STRENGTH ENVELOPES FOR GOLD TAILINGS FROM NORSAND SIMULATIONS

Outline

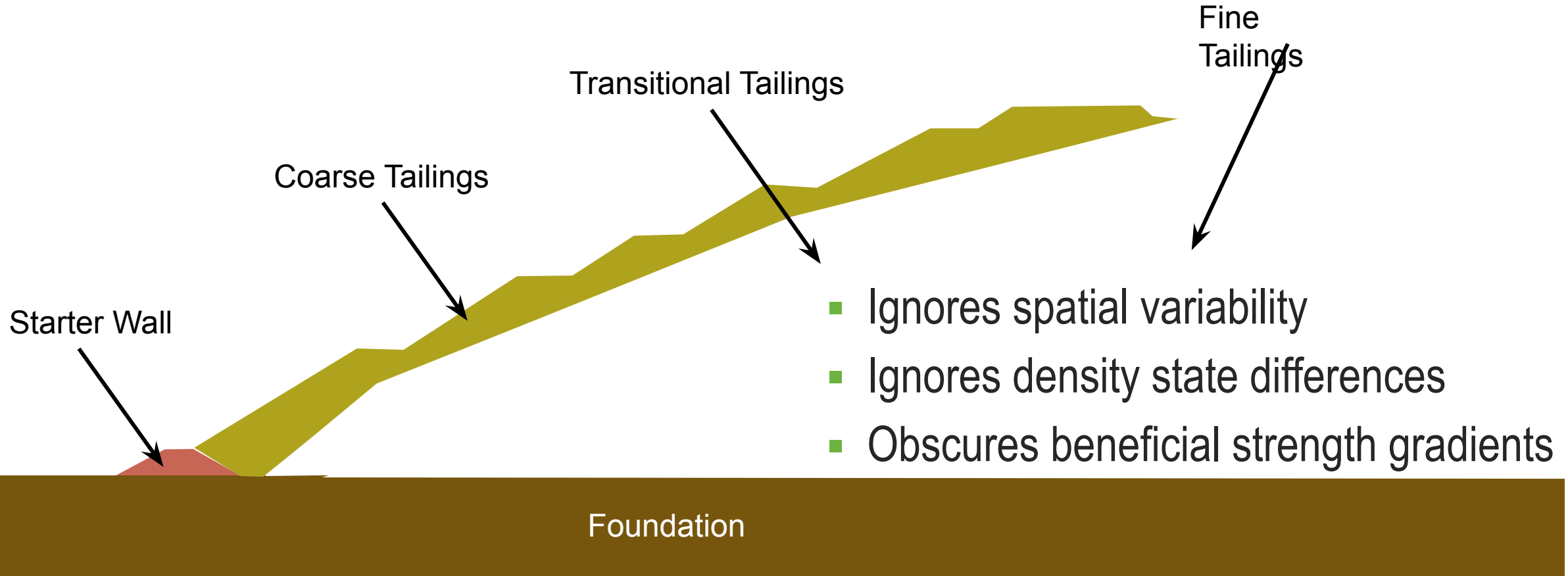
An aerial photograph of a large dam and reservoir. The reservoir is a calm, greenish-blue body of water. The dam is a long, grey concrete structure with a red-tinted top edge. In the foreground, there are lush green hills and a winding road. A semi-transparent white text box is overlaid on the left side of the image, containing the title 'Outline' and a list of topics.

The Problem
Study Overview
Field Application

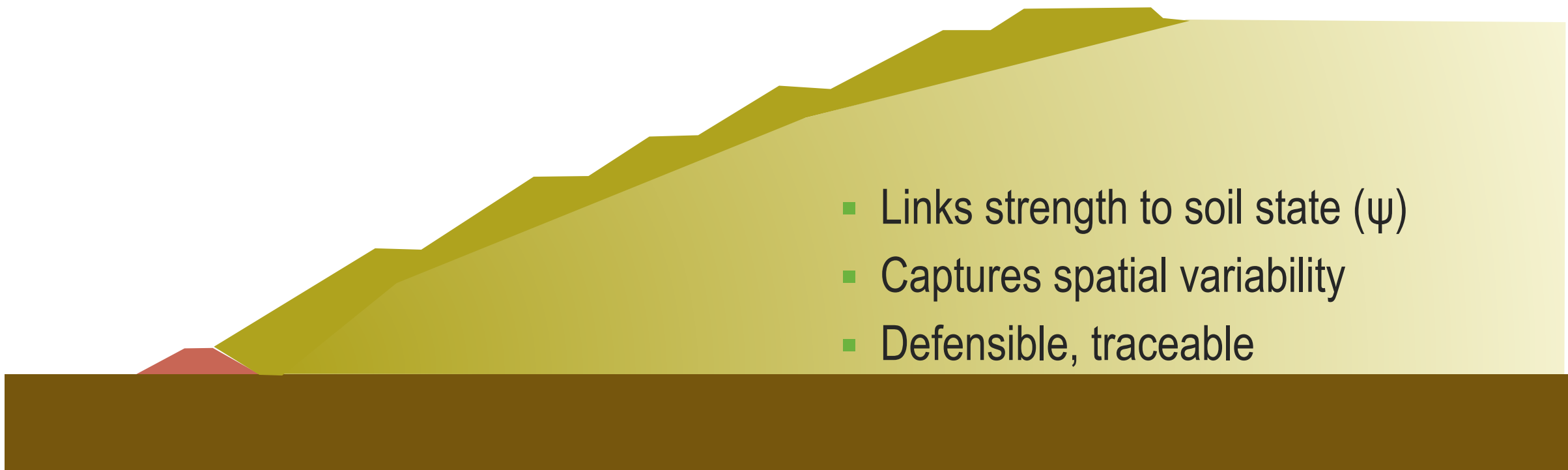
The Problem



Traditional Approach



State-Dependent Approach

- 
- Links strength to soil state (ψ)
 - Captures spatial variability
 - Defensible, traceable

Study Overview



Study Overview

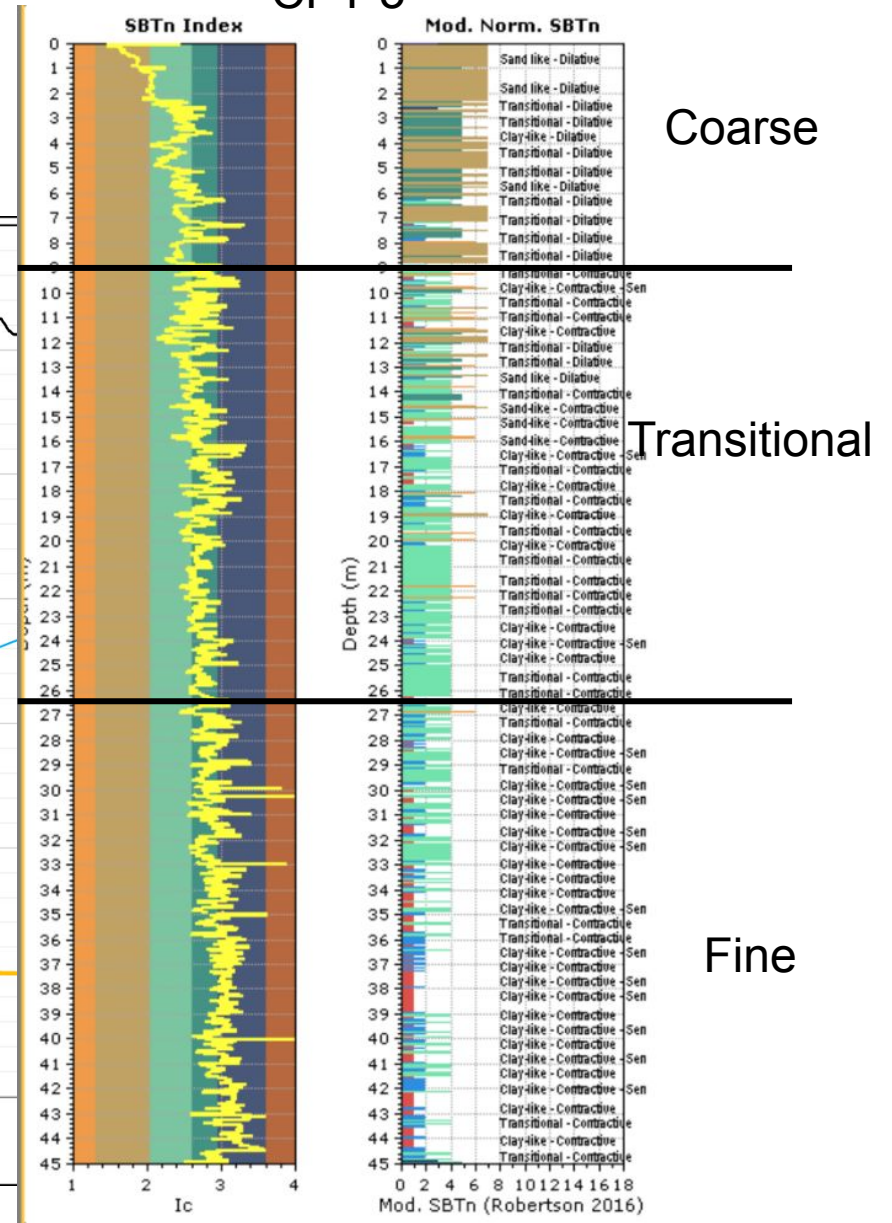
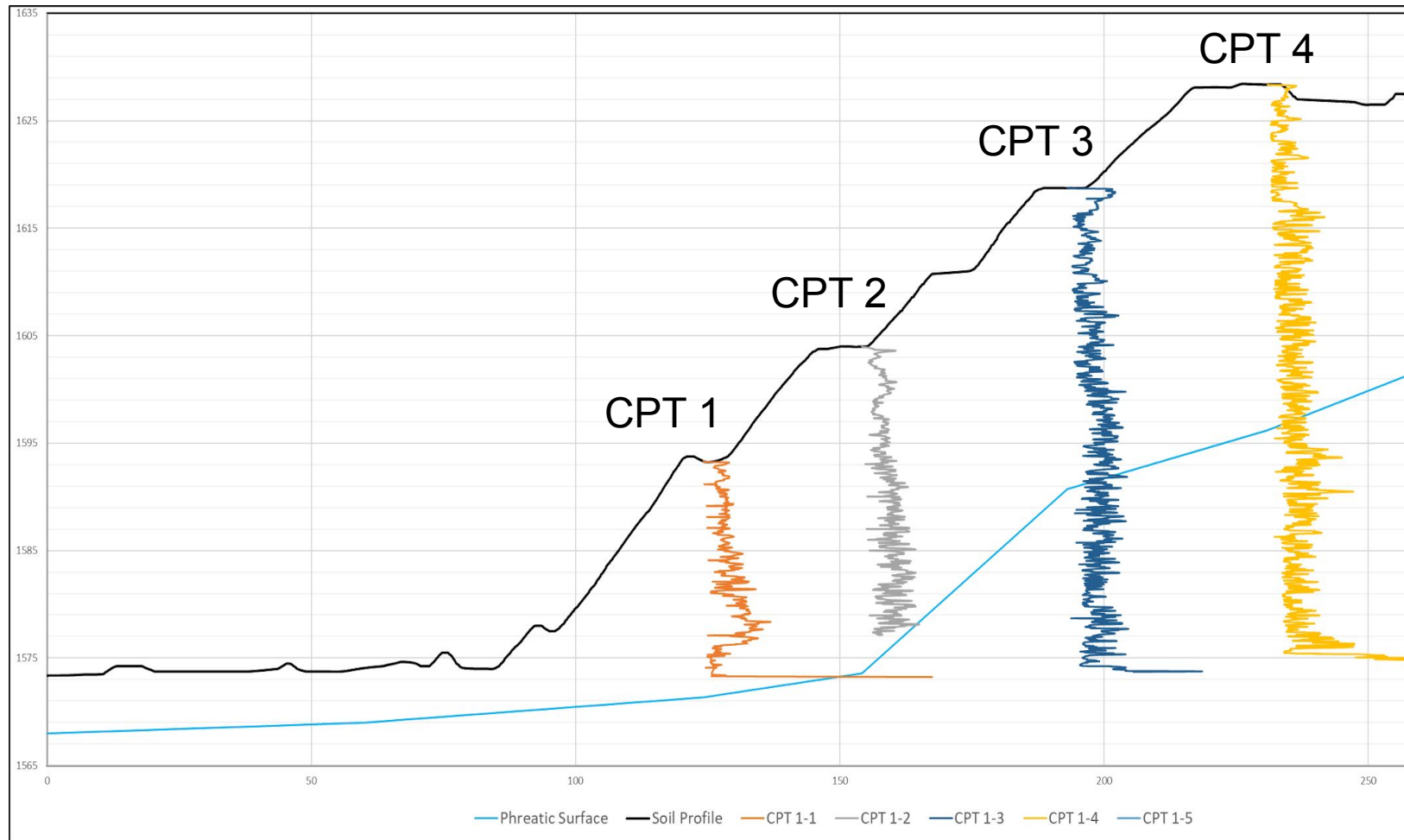
Investigation Scope

- Gold TSF, South Africa
- 86 MOSTAP samples
- 36 CPT Positions
- 8 cross-sections
- Max height: 50 m



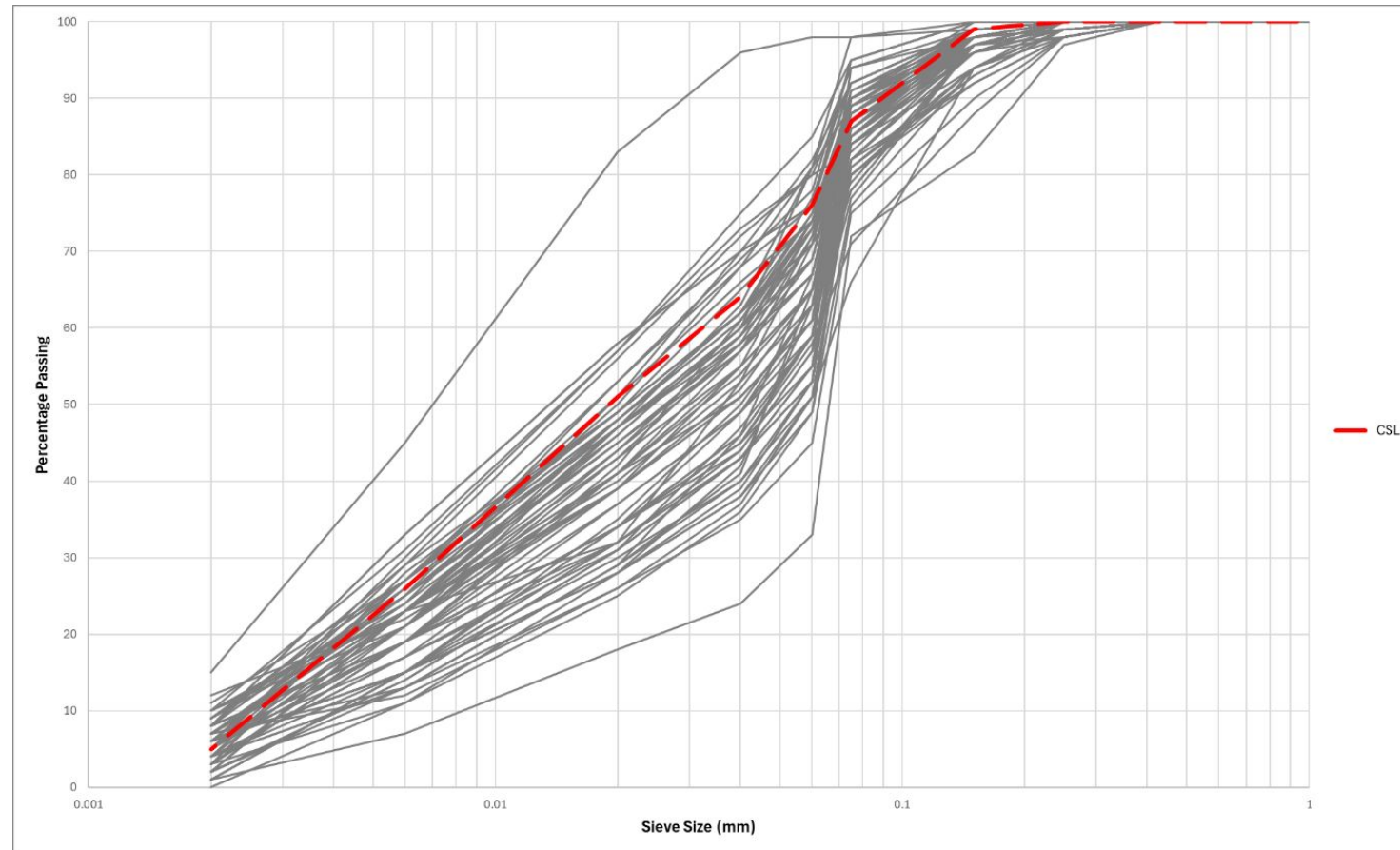
Layering

CPT Testing



Material Variability

Particle Size Distribution

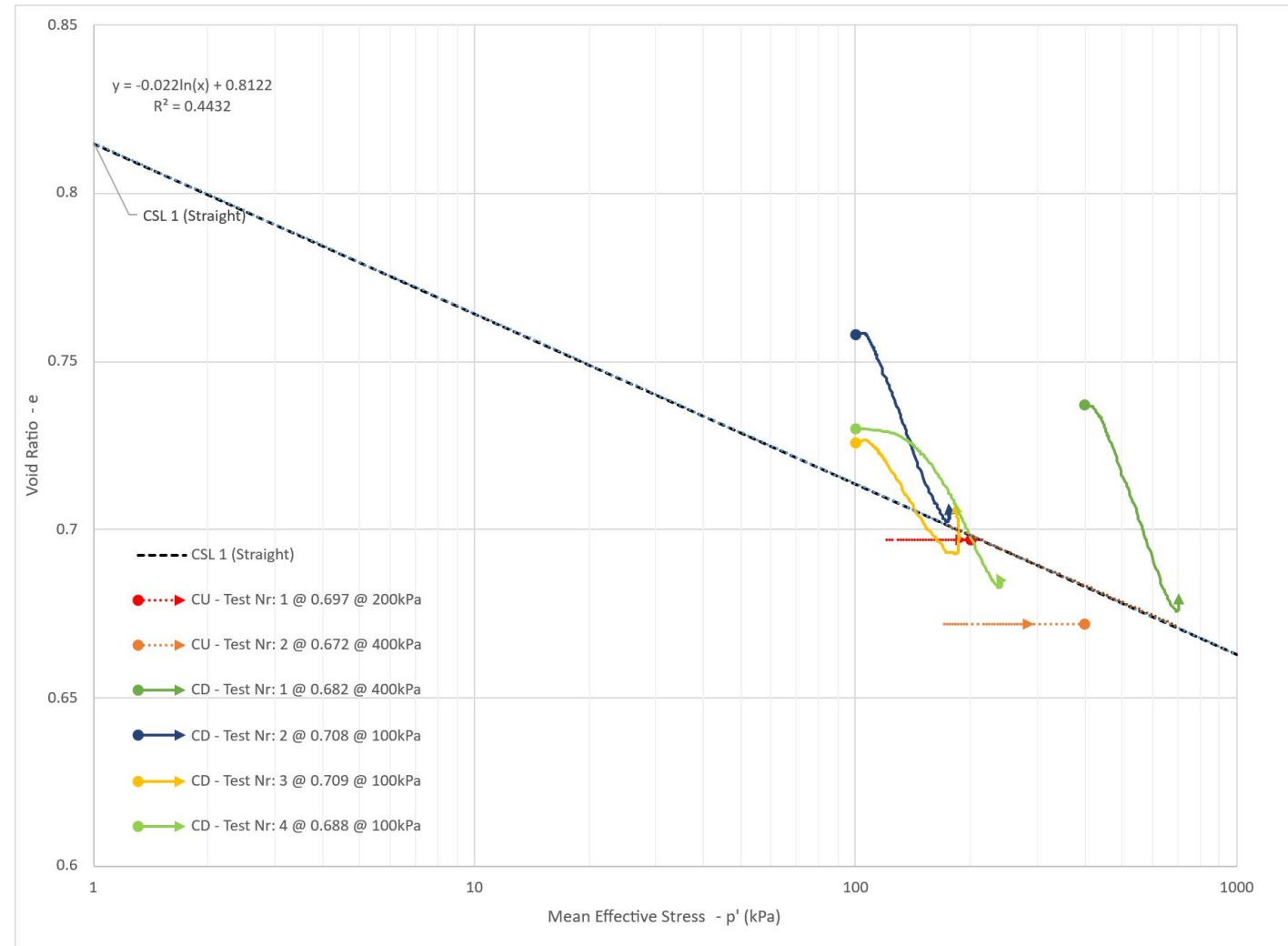


- 86 samples show variability
- Blended sample (CSL1) representative

Critical State Line

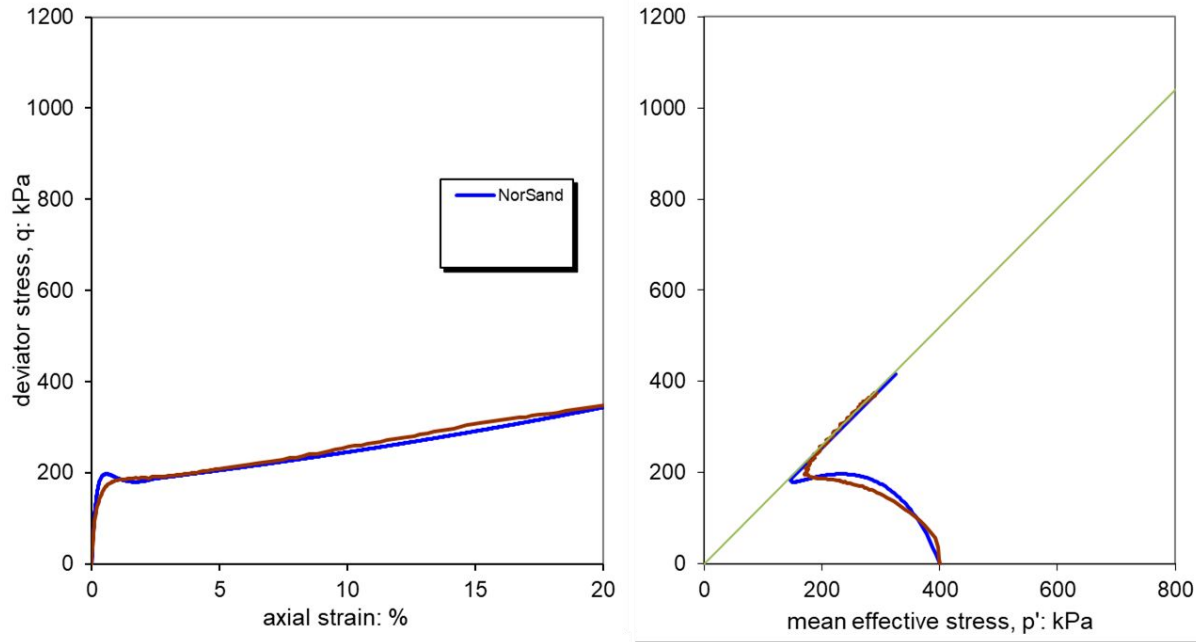
CSL Determination

- 6 triaxial tests (CU + CD)
- $\lambda = 0.065$
- $\Gamma = 0.8122$

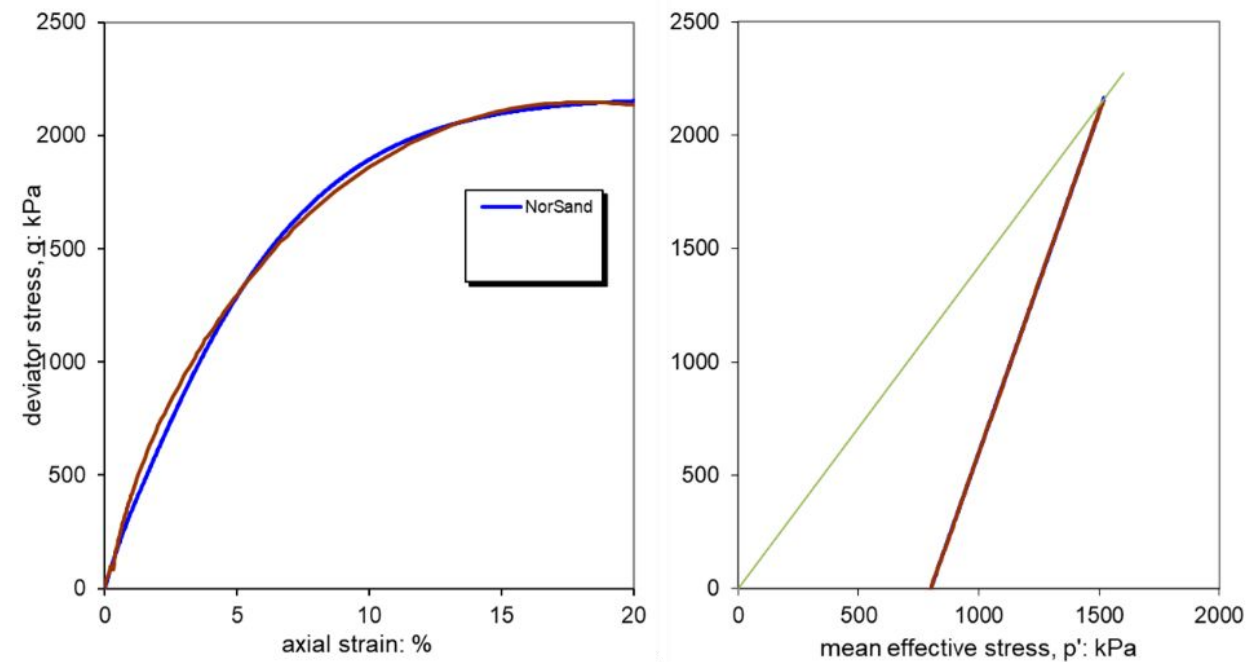


NorSand Calibration

NorSand Curve Fitting



- Close agreement

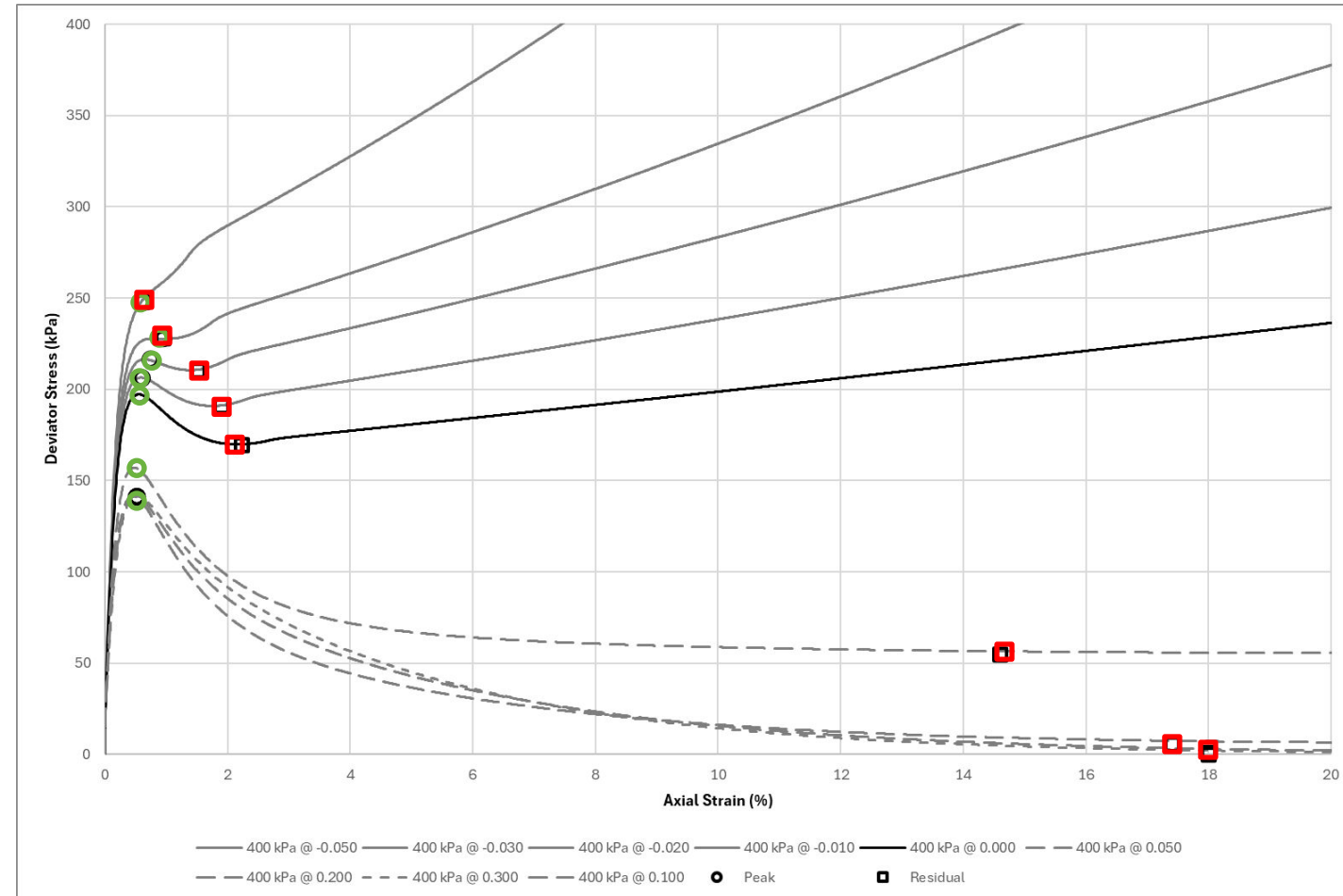


- Captures contractive behavior

NorSand Modelling

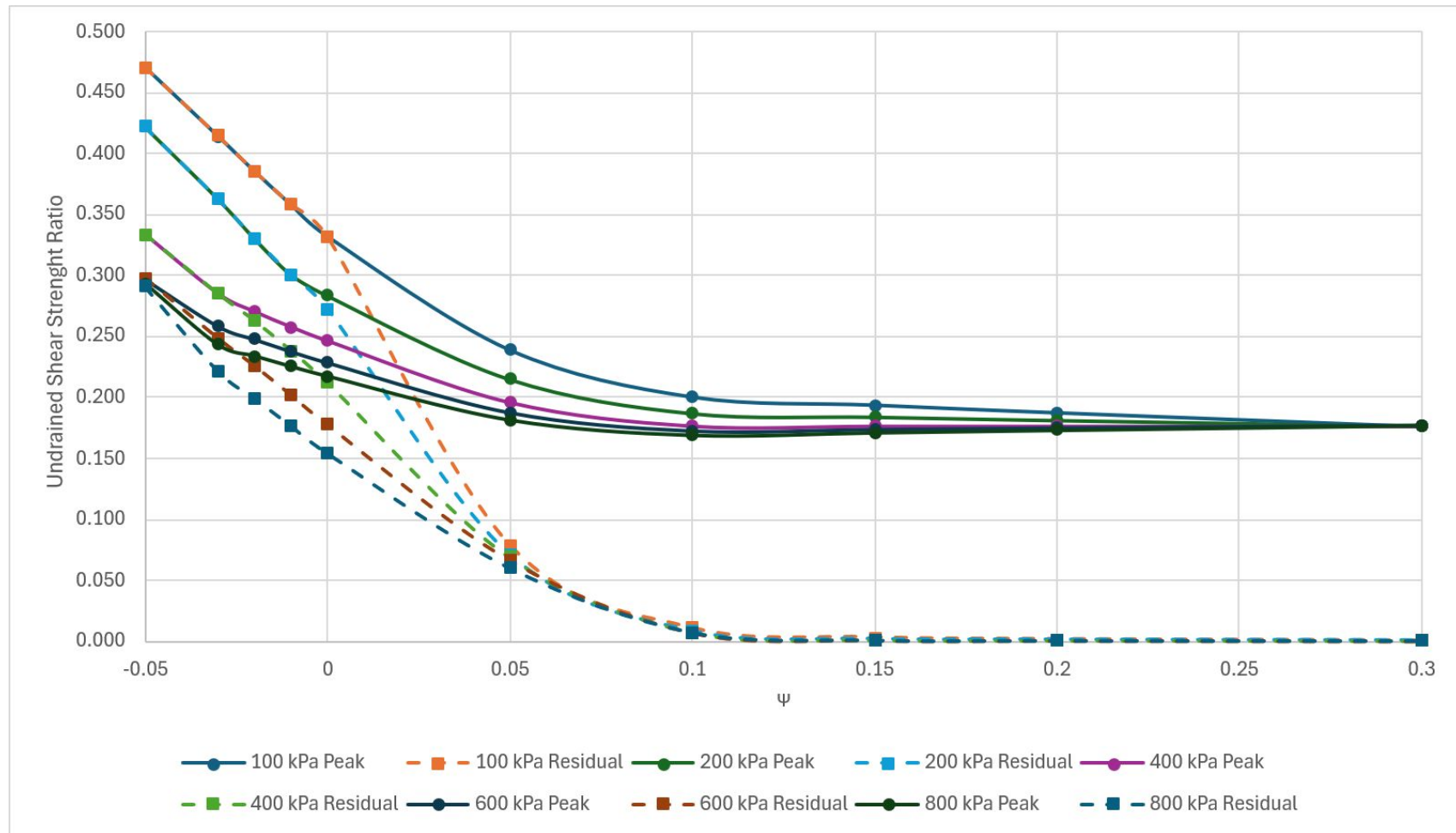
Triaxial Test Simulations

- 50 CU Tests Simulated
- Confining Stress:
 - 100, 200, 400, 600, 800 kPa
- State Parameter from:
 - $\psi = -0.05$ to $\psi = +0.30$



THE ENVELOPE

State-Dependent Strength Envelopes



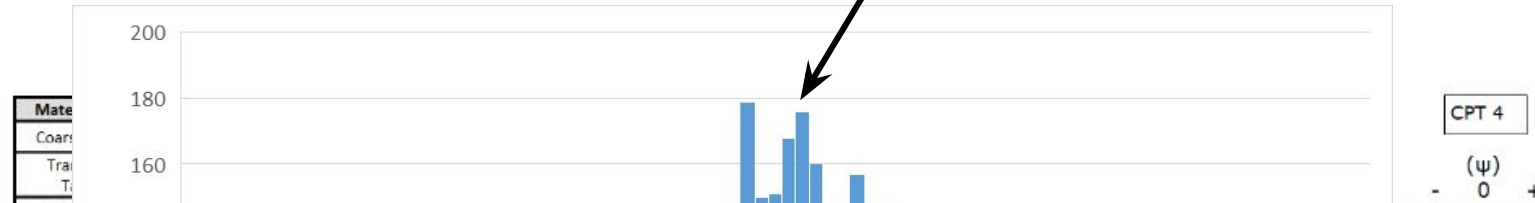
Field Application



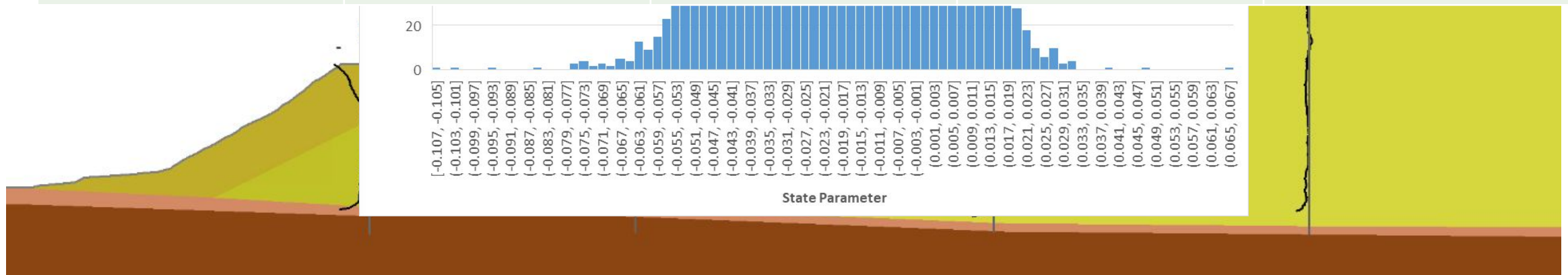
Field Application

State Parameter From CPT

$$Su/p' = 0.25$$



CPT	ψ Range		Su/p' Range	
CPT 1	-0.052	0.003	0.24	0.35
CPT 2	-0.029	0.013	0.22	0.30
CPT 3	-0.027	0.018	0.21	0.28
CPT 4	-0.018	0.029	0.20	0.25



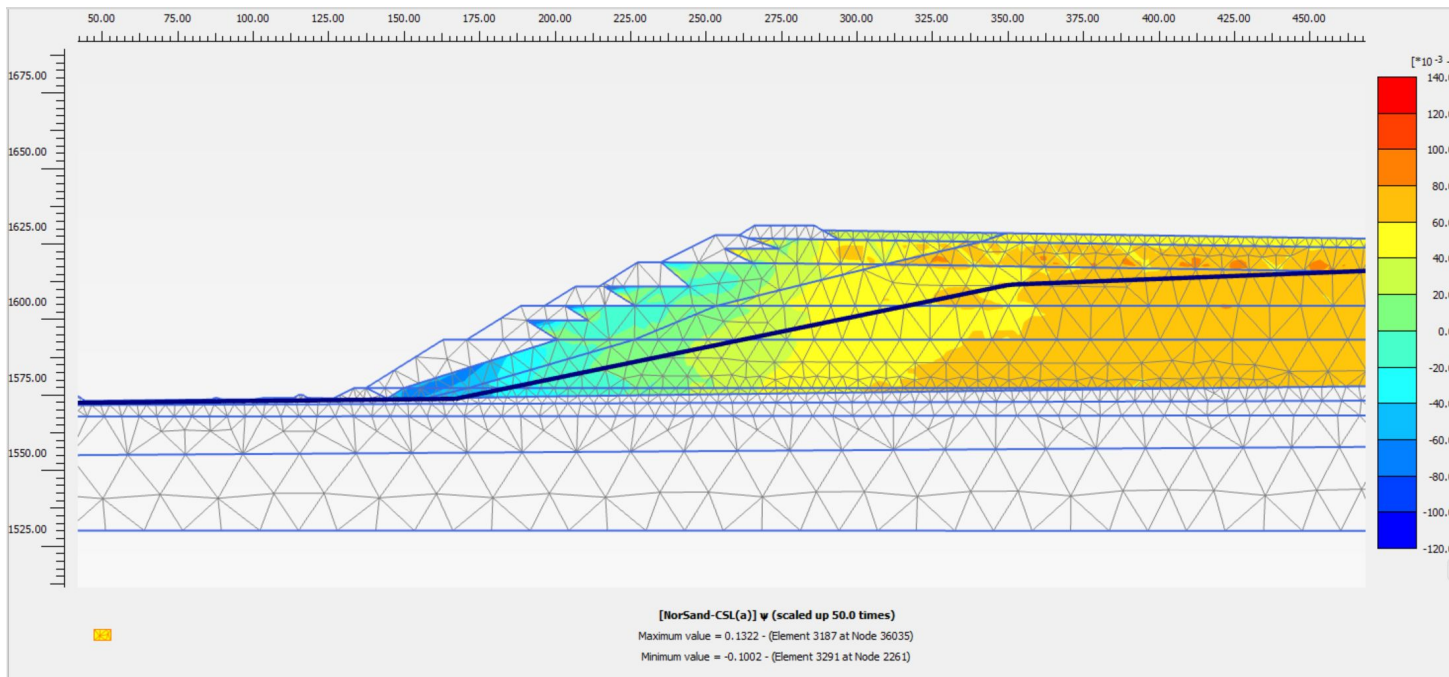
Conclusions

Traditional:

- Single value
- Ignores state

State-Dependent:

- Spatially varying soil conditions
- State-dependent envelopes:
 - $S_u/p' = f(\psi)$
- Traceable workflow from lab to field
- Result: More realistic



The background image shows a large-scale construction project in a dry, arid environment. In the foreground and middle ground, there is a massive pile of bright red soil. Several pieces of heavy machinery are visible: a yellow CAT bulldozer is in the center, a yellow roller is to its right, and a red dump truck is further back. To the left, a body of water is visible, and in the distance, there are low, scrub-covered hills under a clear blue sky.

Q&A

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