

# Critical State Soil Mechanics

## 125 years of developments (a story of many dam failures)

Friday September 6, 2019  
10:30-12:00 Sweco,  
Gjörwellsgatan 22,  
Stockholm, alt via GTM

Presented by: Mike Jefferies



### Abstract

Critical state soil mechanics (CSSM) developed from practical concerns of avoiding liquefaction failures of hydraulic fill dams in the early 20th century into a theory linking a soil's void ratio to all aspects of its mechanical behaviour during the late 20th century. However, there is a widely held perception that CSSM is an 'over idealized' construct put forward by Cambridge University which has no relevance to real engineering (see [Wikipedia...](#)) – and which leads some to advocate that CSSM should not even be taught. This talk considers the development of CSSM from a historical perspective, illustrating the simplicity of the underlying ideas, and the wide range of contributors, and which leads to a proper representation of soil behaviour in a formally generalized framework using the state parameter. This generalization works, with considerable detail, for clays to sands – and including residual soils. There is particular application to liquefaction, the cause of many dam failures (from Calaveros a century ago through to the recent failures of Fundão, Cadia, and Brumadinho). It is argued a causative factor in these failures was a lack of understanding of CSSM by both the engineers of record and their reviewers.

### Speaker Biography: Mike Jefferies Consulting Engineer, Lincoln, UK

Mike is a registered Canadian professional engineer with some 40 years experience in offshore platforms, dams, ground improvement, and quantitative risk assessment. Strongly influenced in his early years by Professors Bob Gibson, Alan Bishop, and Peter Wroth, Mike has pursued an interest in theoretical soil mechanics despite working as a consulting engineer. A keynote speaker/author at international conferences on liquefaction, hydraulic fill construction, engineering mechanics, and offshore construction, Mike has published some eighty papers (with more than 5000 citations) and is co-author of the influential book *Soil Liquefaction: A Critical State Approach*. An invited contributor to *Geotechnique*, the Canadian Geotechnical Society's Fall/2012 Cross-Canada Lecturer, the 2014 Šuklje Lecturer, and the 2018 Jennings Lecturer, Mike was awarded a Telford Premium for geotechnical research in 2017.



- When:** Friday September 6, 2019. Talk from 10:30 to 12:00, followed by lunch.
- Where:** Sweco Stockholm, Gjörwellsgatan 22. The talk will also be delivered as a webinar.
- Cost:** Free (lunch will be provided for those attending in Stockholm).
- For who:** Those involved in tailings dams, hydropower embankment dams and general soft-soil engineering.
- RSVP:** August 16, 2019.  
For more information please contact Rohan Sutton ([rohan.sutton@sweco.se](mailto:rohan.sutton@sweco.se))