Hydro-mechanical simulation in a deep excavation in Boom Clay

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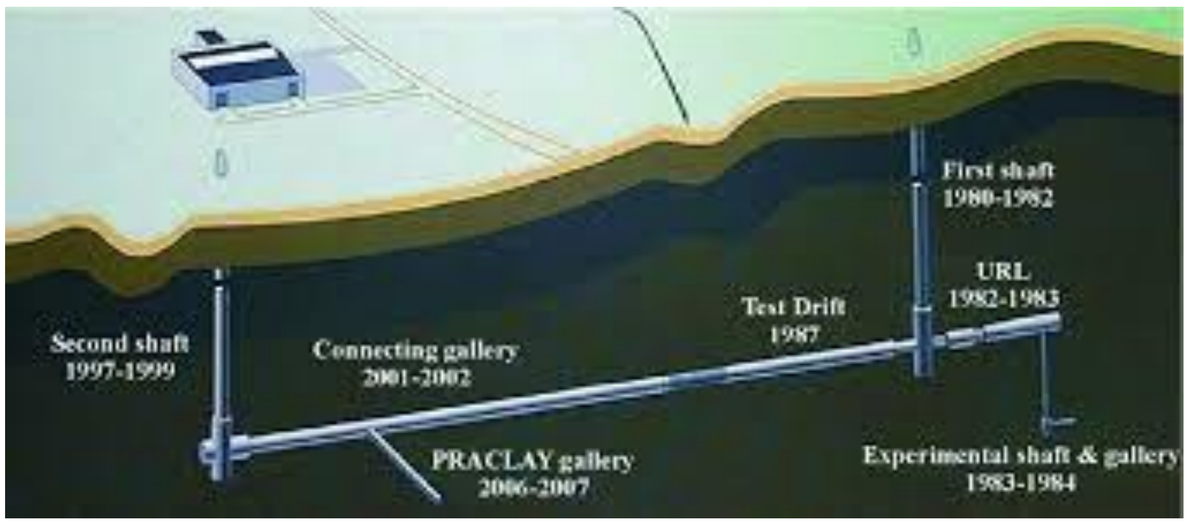
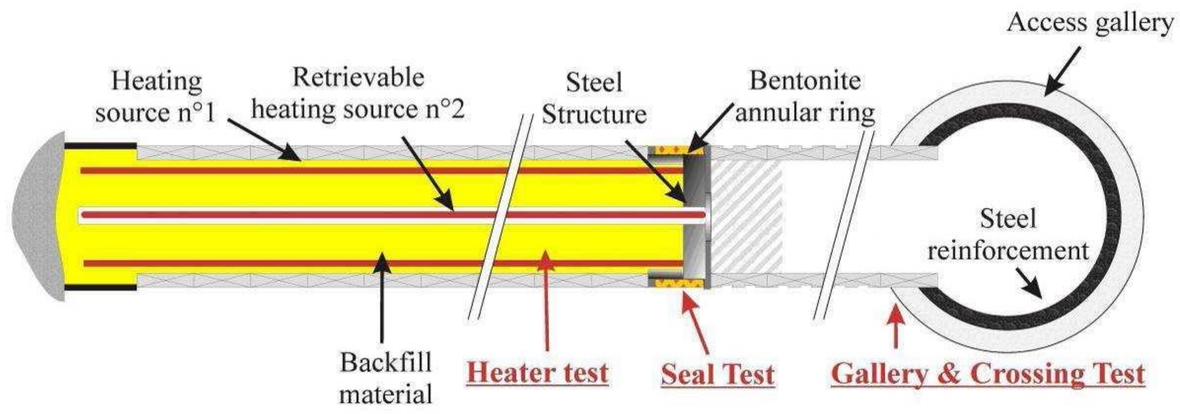
Context

Underground Research Facility HADES at Mol:



The PRACLAY Gallery:



Constitutive model (ACC2)

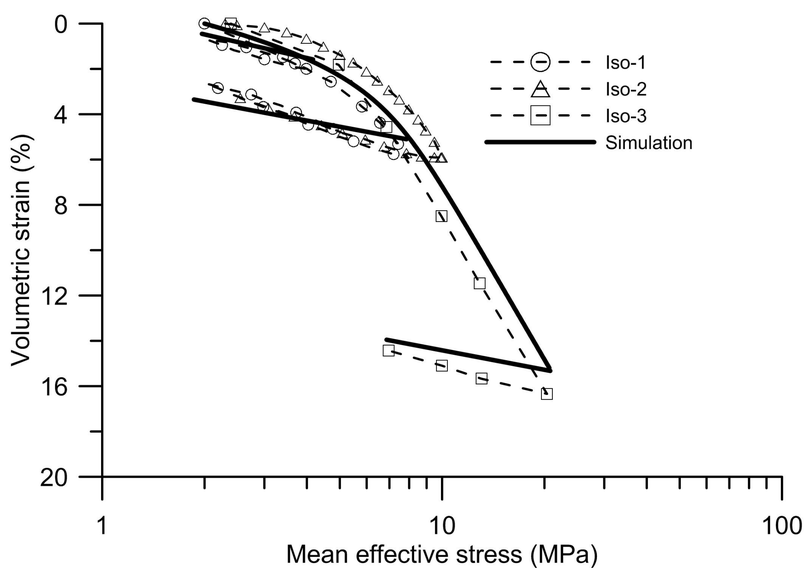
Main characteristics:

-Limited elastic zone

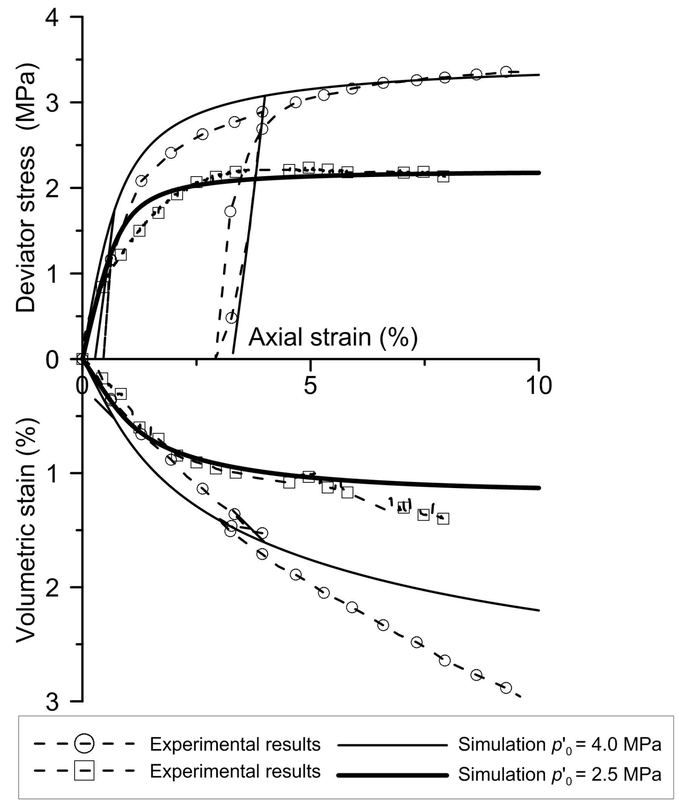
-Smooth elasto-plastic transition

-Non-associated flow rule

Isotropic tests :



Drained triaxial tests :



2D plane strain modeling

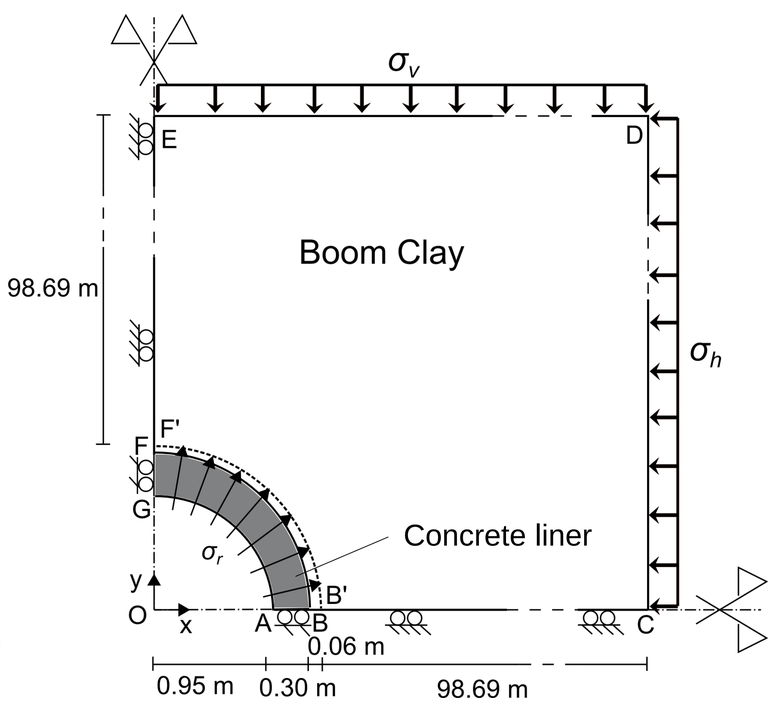
-Fully saturated: p_w = 2.2 MPa

-σ_v = 4.5 MPa, σ_h = 4.04 MPa

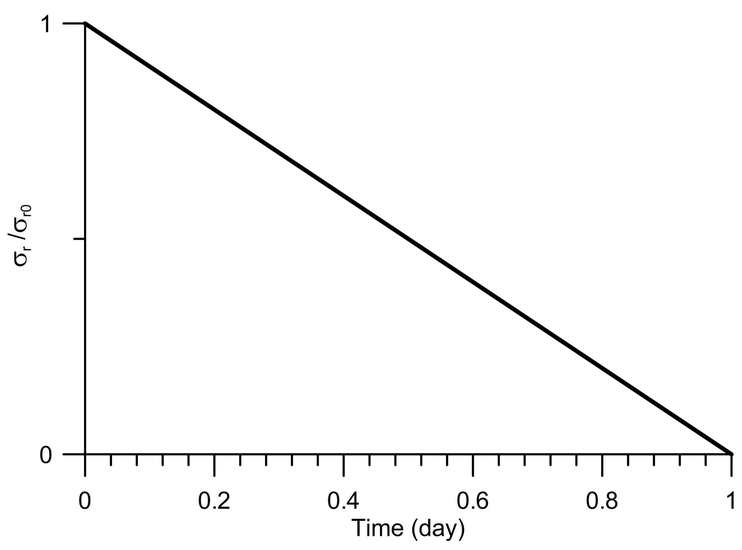
-Coefficient of earth pressure at rest: K_0 = 0.8

-All the boundaries are impervious

-Intrinsic permeability: $k_h = 2\,k_v$



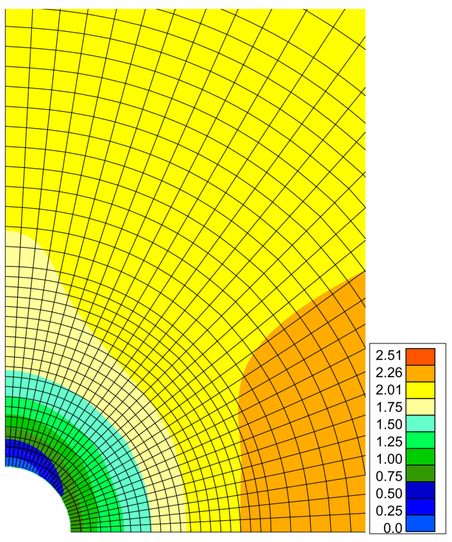
Stress relaxation of σ_r for the excavation:



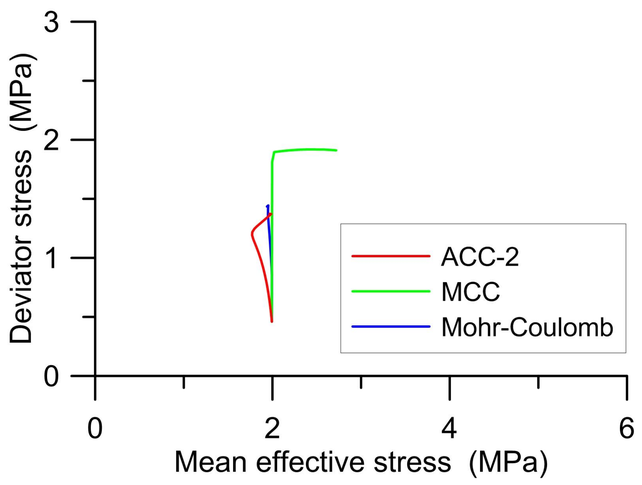
Results

-The pore pressure obtained with ACC-2 is quantitatively closer to the in-situ measurements than the results obtained with the MCC and Mohr-Coulomb models, indicating the importance to consider the smooth transition between elasto and plasticity with limited elastic zone of the clay.

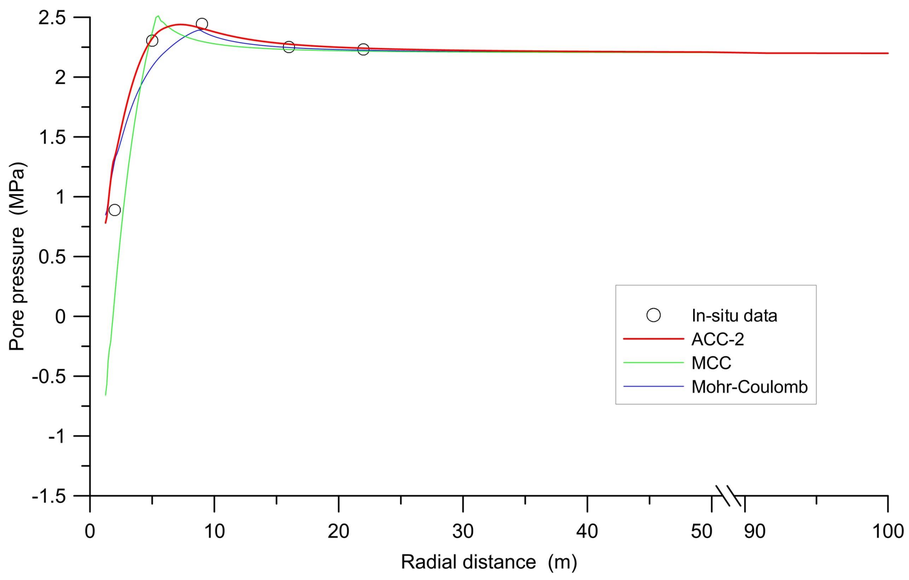
Pore pressure near excavation wall using ACC-2 (10mx10 m):



Effective stress paths of the element on point B':



Comparison of the pore pressure along horizontal profile (BC) at the end of the excavation using ACC-2, MCC and Mohr-Coulomb:



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[2] R. Charlier, R. Chambon, F. Collin, A. Dizier, S. Fauriel, B. François, J. Fokkens, B. Garitte, A. Gens, P. Gerard, et al. Timodaz report: Deliverable d13–simulation of lab and in situ tests. 2010.
[3] P.Y. Hong. Development and explicit integration of a thermo-mechanical model for saturated clays. PhD Thesis, Universite Paris-Est, France 2013.

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Study realised for: