

## Application of MPM for the prediction of retrogressive failure in sensitive clay slopes

Retrogressive failures in sensitive soils are characterized by intricate mechanisms, including strain localization, formation of shear bands, remolded soil movement, and continued landslide progression. The strain-softening behavior of sensitive clays is fundamental to these complex failure mechanisms. Addressing these challenges necessitates advanced numerical tools combined with an appropriate constitutive soil model capable of handling large deformation issues. The material point method offers a continuum description of material flow with its Eulerian-Lagrangian approach, positioning it as particularly suited for large deformation failure analysis. Past research has proven MPM's ability to capture shear band formation in retrogressive spread failures. This study employs a strain-softening constitutive model within the MPM framework to anticipate the post-failure retrogression and runout of sensitive clay landslides. The constitutive soil model, tailored to the large deformation behavior of eastern Canadian sensitive clays, aims to depict the strain-softening nature of such soils accurately. After calibration of the model using Direct Simple Shear tests, predictions were made for the Saint-Luc-de-Vincennes landslide of 2016 in Quebec, Canada. The results effectively encapsulated the landslide's dual nature, being both a flow slide and a spread. While there was a noteworthy alignment with field observations, the findings also highlighted the scopes for improvement in the numerical simulation.