

## PhD position

### Field investigation of an in-situ soil treatment solution for clay shrink-swell inhibition

The cycles of clay shrink-swell (CSS) are linked to the cycles of soil moisture fluctuations, themselves governed by alternating precipitation and drought periods. In France, 54% of constructions are located in areas characterised by a medium to high hazard of CSS. Structural damages to constructions caused by CSS are estimated at several hundred million euros annually, making CSS the second largest category for natural disaster compensation. In the context of climate change, the increasing occurrences of extreme meteorological events (in intensity and frequency) are likely to exacerbate the vulnerability of constructions to CSS. Managing the risk associated with CSS thus constitutes a considerable economic challenge.

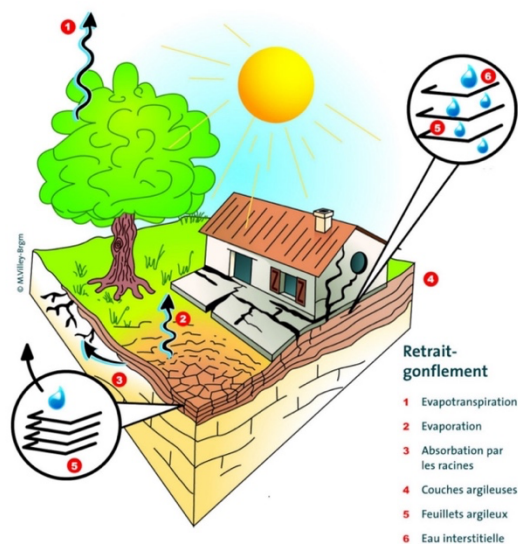


Figure 1. Clay shrink-swell mechanisms. © BRGM - M. Villey. (<https://www.georisques.gouv.fr/consulter-les-dossiers-thematiques/retrait-gonflement-des-argiles>)

This PhD subject is part of a research project funded by ADEME (French Agency for Ecological Transition), coordinated by ESTP (<https://www.estp.fr/en>) and ENPC (<https://ecoledesponts.fr/en>). The project aims to develop an in-situ soil treatment solution to inhibit the volume change of clayey soils during seasonal wetting-drying cycles. Various actions are planned: laboratory tests, field-scale experiments, and predictive numerical simulations to propose a treatment protocol considering local geological, geotechnical, and meteorological conditions.

The PhD proposal aims to develop a soil treatment solution to inhibit CSS in this context. The PhD candidate will perform field-scale experiments to investigate the influence of the soil treatment solution on the hydro-chemo-mechanical behaviour of natural expansive clays. The developed solution must meet scientific, environmental, economic, and practical requirements. In particular, the solution must significantly and durably inhibit heave and subsidence associated with soil moisture variations, be harmless for the environment, remain considerably less expensive than underpinning works, and be easy to implement.

The candidate should have graduated in geotechnics, geomechanics, or environmental engineering, have demonstrated capabilities in laboratory work, and be interested in both scientific development and its engineering applications.

*Gross salary: > 2300€/month*

*Laboratory: Laboratoire Navier (<https://navier-lab.fr>)*

*Duration: 36 months, from October 2025 to September 2028*

*Application: [https://www.abq.asso.fr/en/recruteurOffres/show/id\\_offre/126457](https://www.abq.asso.fr/en/recruteurOffres/show/id_offre/126457).*

*The selected candidates will be contacted later for an interview.*