

PhD Research Position (Nancy, France) Long term behavior of soils stabilized with lime / cement

A fully funded PhD scholarship for 3 years at the Université de Lorraine (F) is available to start in October 2019. This work will be accomplished in cooperation with the Universidade Federal do Rio Grande do Sul in Brazil.

Waste-geomaterials generated by construction and mining activities represent more than 50% of the total waste generated in Europe, corresponding to 1.5 billion tons of excavated geomaterials that are landfilled while at the same time virgin soil and rock resources are extracted and used by the same infrastructure projects. The fundamental goal of this thesis is to contribute to the development of strategies and tools for the valorisation of waste-geomaterials, and thus to turn a waste into a valued durable construction material.

An important concern is the need, at the design stage, to foresee possible alteration of the performance of the improved material in the construction due to exposure to climatic conditions (wetting/drying, freezing/thawing, etc.), or to the requirements of the structure itself (leaching in earth dams, oxidation in tailings, etc.). The first goal of the PhD will be to identify the key mechanisms which control the durability of properties of upgraded waste-geomaterials, with explicit consideration of climatic and site conditions.

Adapted tools to design new geostructures with upgraded waste geomaterials are lacking. Such tools must be able to consider complex coupled mechanisms between chemical, hydraulic and mechanical processes, to take into account specific site / climatic conditions for assessing the long-term behaviour of the geostructure to be built. The second objective will be to develop and release a comprehensive modelling and design tool intended to allow the reuse of waste-geomaterials in the construction of various types of geostructures.

PhD works will be of experimental and numerical nature, relying on state-of-the-art laboratory equipment and strong numerical modelling resources.

Candidates should own Master Degree in civil or geotechnical engineering at the beginning of the research project (October 2019), and have a strong interest in mechanics of geomaterials.

The candidate will spend 24 months of the PhD in France, and 12 months in Brazil (periods to be defined). The candidate will be hosted by Prof. N. Consoli who will be a member of the supervisory committee of the thesis.

Knowledge of the French / Portuguese language is not mandatory, and the thesis could be written in English.

Conditions

Starting date : October 2019 for a duration of three years

Net Salary \approx 1500 € per month over 36 months

Additional funding : 2000 € per month for the mobility period in Brazil (over 12 months).

Partner n°1 : LEMTA <https://lemta.univ-lorraine.fr/>

Université de Lorraine : <http://welcome.univ-lorraine.fr/en>

Partner n°2 : Universidade Federal do Rio Grande do Sul (Brazil)

<http://www.ufrgs.br/english/home>

How to apply ?

Send before the 30 April 2019 a CV (2 pages max), if available a copy of the Master thesis (pdf file, internet link, etc.) and the name of one referee to both supervisors:

Olivier Cuisinier

Associate Professor, HDR

Olivier.Cuisinier@univ-lorraine.fr

Phone: (+33) 3 72 74 43 45

Adel Abdallah

Associate Professor

Adel.Abdallah@univ-lorraine.fr

Phone : Phone: (+33) 3 72 74 43 44

List of references

- Consoli, N.C., da Silva, K., Filho, S., Rivoire, A.B., 2017. Compacted clay-industrial wastes blends: Long term performance under extreme freeze-thaw and wet-dry conditions. *Appl. Clay Sci.* 146, 404–410. <https://doi.org/10.1016/j.clay.2017.06.032>
- Consoli, N.C., Quiñónez Samaniego, R.A., González, L.E., Bittar, E.J., Cuisinier, O., 2018. Impact of Severe Climate Conditions on Loss of Mass, Strength, and Stiffness of Compacted Fine-Grained Soils–Portland Cement Blends. *J. Mater. Civ. Eng.* 30, 04018174. [https://doi.org/10.1061/\(ASCE\)MT.1943-5533.0002392](https://doi.org/10.1061/(ASCE)MT.1943-5533.0002392)
- Consoli Nilo Cesar, Cruz Rodrigo Caberlon, da Fonseca António Viana, Coop Matthew Richard, 2012. Influence of Cement-Voids Ratio on Stress-Dilatancy Behavior of Artificially Cemented Sand. *J. Geotech. Geoenvironmental Eng.* 138, 100–109. [https://doi.org/10.1061/\(ASCE\)GT.1943-5606.0000565](https://doi.org/10.1061/(ASCE)GT.1943-5606.0000565)
- Consoli Nilo Cesar, Viana da Fonseca António, Cruz Rodrigo Caberlon, Heineck Karla Salvagni, 2009. Fundamental Parameters for the Stiffness and Strength Control of Artificially Cemented Sand. *J. Geotech. Geoenvironmental Eng.* 135, 1347–1353. [https://doi.org/10.1061/\(ASCE\)GT.1943-5606.0000008](https://doi.org/10.1061/(ASCE)GT.1943-5606.0000008)
- Cuisinier, O., Auriol, J.-C.C., Le Borgne, T., Deneele, D., 2011. Microstructure and hydraulic conductivity of a compacted lime-treated soil. *Eng. Geol.* 123, 187–193. <https://doi.org/10.1016/j.enggeo.2011.07.010>
- Cuisinier, O., Javadi, A.A., Ahangar-Asr, A., Masrouri, F., 2013. Identification of coupling parameters between shear strength behaviour of compacted soils and chemical's effects with an evolutionary-based data mining technique. *Comput. Geotech.* 48, 107–116. <https://doi.org/10.1016/j.compgeo.2012.10.005>
- Cuisinier, O., Stoltz, G., Masrouri, F., 2014. Long-term behavior of lime-treated clayey soil exposed to successive drying and wetting, in: *Geotechnical Special Publication*. pp. 4146–4155. <https://doi.org/10.1061/9780784413272.403>
- Robin, V., Cuisinier, O., Masrouri, F., Javadi, A.A., 2014. Chemo-mechanical modelling of lime treated soils. *Appl. Clay Sci.* 95, 211–219. <https://doi.org/10.1016/j.clay.2014.04.015>
- Stoltz, G., Cuisinier, O., Masrouri, F., 2014. Weathering of a lime-treated clayey soil by drying and wetting cycles. *Eng. Geol.* 181, 281–289. <https://doi.org/10.1016/j.enggeo.2014.08.013>