

**Title: Reuse of TBM excavated conditioned fine grained soils**

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### **Proposal**

One of the crucial issues for the sustainability of large infrastructures is the supply of raw materials and its relevant impact on carbon footprint, with the exploitation of supply and disposal sites. The zero-waste objective can contribute to the sustainability through valorisation and reuse of materials not suitable for construction purposes in the perspective of circular economy.

The research aims to investigate the reuse of fine-grained soils from EPBM (Earth Pressure Balance Method) tunnelling. The mixture of excavated soil, water and conditioning agents (polymers and surfactants) from EPB excavations is potentially an important source of material to be reused. In order to assess the suitability of conditioned excavated soil for subsequent treatments, the experimental research aims to study the nature and the effects of the interactions between polymers (anionic and cationic) and clay minerals. A parametric study will be carried out with reference to different clay minerals and polymers normally used in tunnelling. The upscaling of laboratory results will be assessed by means of in situ measurements on treated and conditioned excavated soil, placed and compacted to form an experimental embankment.

### **Research Program**

The following aspects will be investigated during the PhD project:

- a) **Multiscale analysis of clay mineral-polymer interaction**, by means of mineralogical tests (X-ray diffraction analysis, X-ray fluorescence, thermogravimetric analysis), microstructural investigations (scanning electron microscopy, mercury intrusion porosimetry), physical characterisation (particle size distribution, plasticity, reactivity to lime) and hydro-mechanical tests (water retention, compressibility, shear strength) on laboratory-prepared mixtures.
- b) **Suitability of conditioned excavation soils for treatment**, through the study of conditioned soil mixtures treated with traditional (lime and/or cement) or non-traditional (alkaline-activated binders) binders
- c) **Analysis of the characteristics of conditioned in-situ treated soils**; this phase will be developed with leader companies in the field of infrastructure construction by setting up a test site, consisting of an experimental embankment of treated and conditioned soil, placed and compacted. The embankment is properly

equipped to monitor the relevant parameters showing the ongoing chemical and physical evolution of the treated soil over time.

Funds:

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Scientific Collaborations

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