

Under the pile. Understanding subsurface dynamics of historical cities through geophysical models interpretation

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Braga is one of the oldest cities of the Iberian NW and as of so, the research team's studying the city's historical core for the past 40 years is often confronted with the unpredictability factor laying beneath an urban site with such a long construction history. In fact, Braga keeps redesigning its urban structure over itself on for the past 2000 years, leaving us with a research object filled with an impressive set of construction footprints from the various planning decisions that were taken in the city along its historical path. Aiming for a predicting understanding of the subsoil, we have used near surface geophysics as an effort of minimizing the areas of intervention for traditional archaeological survey techniques. The Seminário de Santiago integrated geophysical survey is an example of the difficulties of interpreting geophysical models in very complex subsurface scenarios. This geophysical survey was planned in order to aid the requalification project being designed for this set of historical buildings, that are estimated to date back to the 16th century, and that were built over one of the main urban arteries of both roman and medieval layers of Braga. We have used both GPR as well as ERT methods for the geophysical survey, but for the purpose of this article, we will focus in the use of the ERT alone.

For the interpretation of the geophysical models we've cross-referenced the dense knowledge existing over the building's construction phases with the complex geophysical data collected, using mathematical processing and volume-based visualization techniques, resorting to the use of Res2Inv[©], Paraview[©] and Voxler[®] software's. At the same time we tried to pinpoint the noise caused by the past 30 year's infrastructural interventions regarding the replacement of the building's water and sanitation systems and for which we had no design plants, regardless of its recent occurring. The deep impact of this replacement actions revealed by the archaeological trenches, which location was selected from the results of the geophysical models interpretation, revealed to be our main unpredictability factor and, paradoxically, one of its principal results, as it will allow us to be more interpretation efficient in future geophysical surveys in the historical core. As for so, at the present we are designing an integrated geophysical research programme that will hold Braga's historical subsurface as it's open lab, aiming to develop a tool not only for archeologists and geophysicists, but also and foremost to help the city planners to design more informed, efficient and sustainable urban plans for Braga, as the city is very much alive and continually keeps on adding new layers to its urban structure.