

Raw Earth-based Building Materials: an Exploration on Mechanical Behavior of Florida Soil-based Adobes

Monica Parlato and Simona Porto

Di3A - University of Catania

Abstract

Raw earth, with wood and stone, has a place among the oldest building materials used in the world. Nowadays, on a circular economic context, researchers' interest in raw earth-based building materials has been growing because they are highly available and environmentally friendly. The use of this traditional material has positive environmental consequences, especially in traditional rural building reuse and in rural landscape preservation. In fact, raw earth is locally available and totally recyclable and, thanks to its perfect integration into the landscape, it improves site visual perception. Often, in order to increase mechanical performances and durability of earth materials additives and/or chemical stabilizer agents (i.e., Portland cement) are used to produce raw earth-based building components. This production process reduces the environmental sustainability of the base material and causes a relevant increase on the embodied energy. This research work aimed at investigating how to improve the mix-design of earth-based building materials in order to increase their mechanical properties without addition of chemical agents. A physical stabilization was performed on an original texture soil, through the addition of different particle sizes. Mechanical tests have been carried out on five different soil mixes by changing soil composition, aggregates, and water. Specimens realized with the mix-design 5 showed best results of flexural and compressive strength values with 1.65 MPa and 6.74 MPa, respectively. Mix 3 obtained the lower linear shrinkage rate (6.04%). Since raw earth-based materials are highly sensitive to soil composition and aggregates, the attempt of this study is to obtain a repeatable process to produce semi-industrial adobes by the optimization and control of different natural materials (i.e., soils, aggregates, and water).

Keywords: raw earth building components, physical stabilization, mechanical tests, circular economy, sustainability

Acknowledgments: Prof. Massimo Cuomo responsible of the Material Testing Lab of the University of Catania (DICAR) where mechanical tests were performed; the research group thanks Guglielmino Group (Misterbianco - Ct) for sample preparation.