

Effect of the Nature of Clay and Substitution Materials on the Physico-Mechanical Properties of Compressed Earth Blocks (CEBs)

Philbert NSHIMIYIMANA^{1,2}; Adamah MESSAN¹; Luc COURARD²

¹ Laboratoire Eco-Matériaux de Construction (LEMC); Institut International d'Ingénierie de l'Eau et de l'Environnement (2iE); Rue de la Science; Ouagadougou - Burkina Faso.

² Laboratoire des Matériaux de Construction; Université de Liège (ULg); Place du 20-Août, 7-9-Liège-Belgique.

Abstract

Most African cities like Ouagadougou, the capital city of Burkina Faso (BF), records critical demand for affordable sustainable housings. Earth, being indigenous, naturally available with low energy input and able to create more jobs, is regarded an alternative building material (ABM) to cater for this need. Historically, Burkinabe have been living in earthen houses “Banco” given the harsh weather conditions and higher cost of “imported” building materials. Nevertheless, skepticism still arises about long term performance of these “local” materials. While the mechanical strength and toughness of natural fibers reinforced CEBs stabilized with cement are well understood; their hydrothermal and durability properties and onsite performance are still not fully investigated. This study questions whether clay materials from BF can be stabilized/ filled or reinforced with agro/industrial by-products to yield into CEBs with required performances. These CEBs should be able to perform well in both dry and wet conditions and keep that performance after extended time of exposure to mechanical and environmental constraints. The main aim is to add value to local clay and by-products materials and achieve CEBs able to carry a two storey building, i.e having at least 4 MPa of dry compressive strength. Firstly, different clay deposits available in the vicinity of Ouagadougou and by-products (hydrated lime, pozzolan, and fibers) for stabilization are characterized. The study of their interactions is then carried out on chemical, physical and mechanical basis. Owing to their characteristics, the potential materials are used to fabricate stabilized CEBs. The resulting CEBs are tested for improved physico-mechanical, microstructural and hydrothermal properties. Additionally, their performance in wall construction is investigated. The stabilization effect is evaluated on the basis of pozzolanic activity and fiber reinforcement. The durability study of CEBs vis-a-vis water, drying-wetting, fracture, erosion,... is carried out in the Sahelian context.

Keywords: Clay; Hydrated Lime; Pozzolans; Fibers; CEBs; Physico-mechanical Properties; Durability.

Contact: P. NSHIMIYIMANA; philbert.nshimiyimana@2ie-edu.org; pnshimiyimana@doct.ulg.ac.be

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