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Earth Construction Durability: In-Service Deterioration of Compressed and Stabilized Earth Block (CSEB) Housing in Algeria

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1 Introduction

Among the eco-friendly building materials, the Stabilized and Compressed Earth Block (CSEB) is considered the most promising. Hence, improving the sustainability of this material deserves more attention and study. If the durability at the scale of the unit and the structural element in CSEB, the scientific literature is prolific, it is not the same for constructions in the field with this material. Regular monitoring of CSEB building in the aim to assess the durability of the materials has received little formal research. The returns are generally based on a review or reported after a large building degradation or collapse. For instance, the document elaborated by Arandara and Jayasinghe (2007) on the durability of the CSEB construction gives prominent insight. This appraisal shows that the pathologies identified are mainly due to climatic factors, in particular, heavy rainfall and wind. It has been observed the appearance of water absorption by capillarity caused by the inappropriate stabilization of the earth blocks. In addition, more erosion of the walls composed with the weakly stabilized block was noticed. Based on previous experience, in 1949, India launched a program of construction of several hundred housing units (Bangalore), in which earth blocks manually compressed and stabilized with 5% of the cement was used. Some of these houses are still occupied to this day. Certain blocks from the demolished buildings were found to have a wet compressive strength of the order of 1.5 MPa. On the African continent, the survey reported by Oppong and Badu (2012) revealed that the walls (built with CSEB) exhibit considerable damages due to their exposure to high water absorption in Ghana. The recurring cycles of wetting/drying have inevitably caused their cracking alterations. Moreover, the blocks have been found to have low tensile strength and abrasion. In Uganda, where the projected housing backlog by the year 2000 was estimated at 3 million dwellings, an inventory of CSEB structures has been achieved by Kerali (2017). The author confirmed that in humid tropical areas, rainfall and temperature variations can adversely affect the performance of a block exposed to the elements.

The present work deals with a unique in-service valuation of CSEB structures in Algeria. The inspection tries to bring out the impact of long time exposure under different and opposite climate and micro-seismic contexts.

2 Results

Ageing-related pathologies observed in stabilized earth constructions (CSEB) in the coastal northern region are mainly caused by weather element. Water (rain, humidity) is considered as the main cause of damage. For instance, the abundant rain in the northern region has three main effects:

i) The direct and repeated impact of the violent rain alters the surface of the external elements and causes a crumbling,

ii) The flow of rainwater on a surface (runoff phenomenon) causes surface erosion of the blocks which thereby provokes detachment of render,

iii) The splashing and infiltration generated by the indirect and repeated impact of rain on the ground, awning, exterior pavement, salient or re-entrant elements, followed by weathering, crumbling and digging.

For the southern region, the investigation has ultimately identified very little pathologies due to exposure to climate, characterized by very low rainfall. The most common defects observed included: surface roughening, erosion and surface pitting.

3 Conclusions and Contribution

In this contribution, an evaluation of the in-service earth housing degradation in Algeria is reported. From the analysis of the degradations unveiled by this in-field investigation, some recommendations to improve the durability of the CSEB constructions are made:

- Cleaning walls affected by fouling and biological colonization.
- Checking the correct drainage of rainwater (avoid stagnation of water) to provide a good circulation and evacuation of the collected rainwater.
- Elevating the base, putting a sufficient roof overhang or installing an anti-capillary barrier especially in the North region.
- Resorting to the earth construction guide in the selection of the soil nature and the process of stabilization.

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