Development of optimized compressed earth blocks based on circular economy concepts

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CONSTRUCTION PRODUCT WITH SUSTAINABLE POTENTIAL IS BEING DEVELOPED BY MIT PORTUGAL PROGRAM (MPP) PhD STUDENT

COMPRESSED EARTH BLOCKS (CEBs) INCORPORATING CONSTRUCTION AND DEMOLITION WASTE (CDW) ARE PRODUCED IN THE ALENTEJO REGION AND TESTED AT THE UNIVERSITY OF MINHO

With the growing concern in adopting more sustainable technical solutions, interest in earth as a construction material has been renewed. This work has as main objective to evaluate the mechanical behavior of CEBs from the incorporation of waste and industrial by-products without neglecting their thermal performance and durability. In this context, the incorporation of CDW will be studied in order to contribute to the implementation of the circular economy in the construction sector.

Earth Construction:
One of the oldest building materials of mankind

Earth-based construction has lower environmental impact (low processing technology, less energy consumption and 100% reusable local material) and contributes to the passive performance of buildings: its thermal inertia is suitable for warm and temperate climates.

Compressed Earth Block:
The most accepted earth building technique in modern society

- ✓ **Better production control**
- ✓ **Improved mechanical and durability properties**

CDW vs. Circular Economy:
Challenge or opportunity?

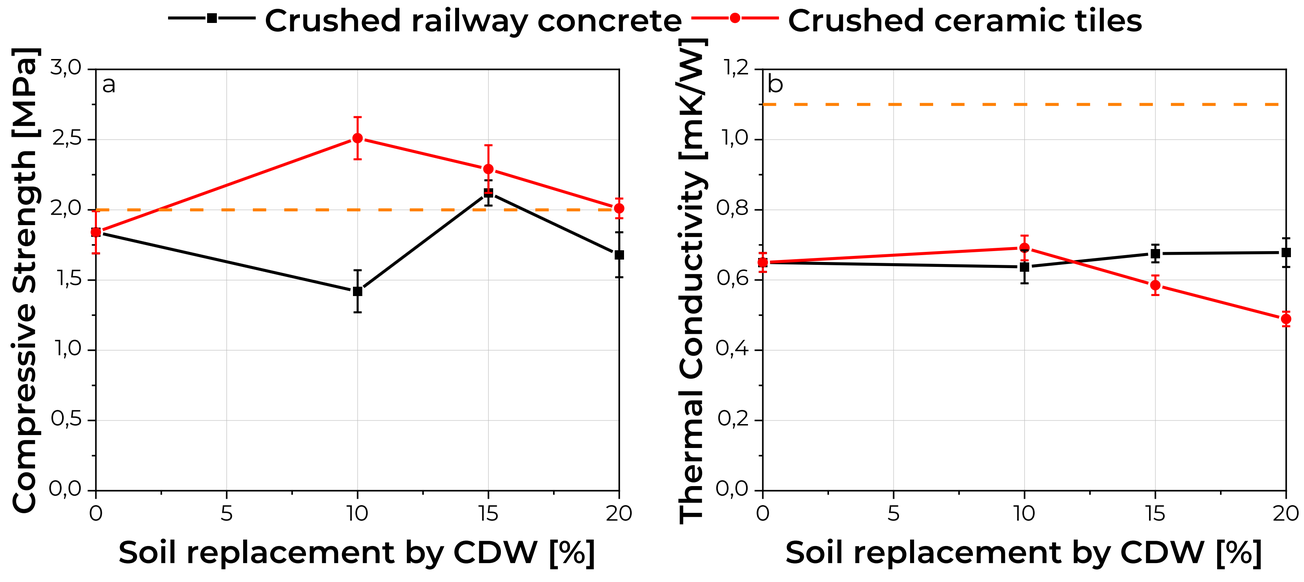
Due to the increasing volume of CDW generated and its associated environmental impacts, the construction industry needs to implement new and better construction strategies, mainly focused on the waste issue. In this scenario, the circular economy model emerges.

It proposes that waste from one industry serve as recycled raw material for another or for the industry itself, developing products that keep the materials in the production cycle.

Can CDW partially replace soil in earth building materials?

Results obtained in preliminary tests indicate that replacing soil with CDW in CEBs has the potential to improve their mechanical behavior, while not compromising their thermal and durability characteristics. Two types of waste were incorporated into the earth mixtures: railway concrete and ceramic tiles, and both reached higher compressive strength values than the control samples.

Meanwhile, the thermal conductivity results remained within the same order of magnitude, without significant differences. The next phases of the study involve the life cycle assessment (LCA) of the environmental and economic performance of the products developed, within the expectation of developing sustainable CEBs for application on the interior walls of buildings.



Compressive Strength (a) and Thermal Conductivity (b) of the CDW-based CEBs vs. Soil replacement by CDW. The horizontal lines indicate the minimum compressive strength recommended by the literature (a) and the reference value of thermal conductivity for CEBs according to the Portuguese standard (b).

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