**RAMMED EARTH CONSTRUCTION**

**BACKGROUND** Rammed earth construction is fundamentally the use of raw earth, with little to no additives, as a building material. The man made equivalent of sedimentary rock (Rae, 2019) made up of the first homes that humankind lived in after coming out of the caves 12,000 years ago (Sustainable Building with Earth, Schroeder). With time, the technology spread throughout the world, and with simple tools, mankind was able to build rock-hard structures, merging earth walls with the landscape around it, creating wonders in the world we live in.

**MATERIALS**

A rammed earth mix is generally made up of clay, silt, sand and gravel, the proportions of which depend mostly on clay content and plasticity.

**TOOLS AND FORMWORK**

A spectrum of tools ranging from dirt cheap to expensive can be used to build with rammed earth, which allows for a control of the cost and finish of the final product.

**PROCEDURE**

1. The mix of a good material can vary depending on the texture of the clay used, where it is from and if it contains organic matter. Monitoring

   The walls are to be instrumented with soil moisture and temperature sensors, to better understand the thermal behavior and water diffusivity inside the walls. These sensors have been set up with a data, making sure all fluctuations are tracked and measured.

2. Social Inclusion

   While work is ongoing, vulnerable individuals' experiences and living constraints are taken into account. Information is integrated into the development process, making sure that set objectives are on point and accomplished.

3. Work in progress

   Currently the team is experimenting to optimize the earth material mixes and construction methods for all the model walls in two different and distinct sites: one in Advancing Research Enabling Communities (AREC) center of AUB located in the Bekaa valley region in Lebanon with arid/desert-like climate (work complete), and another on AUB campus in Beirut with warm and humid climate.

4. Guidebook

   A guidebook for rammed earth construction in the Mediterranean region is planned to be published, teaching anyone who would like to build using rammed earth, the proper planning and construction methods required to achieve such a task. Introduction and literature review.

   Benefits and drawbacks.

   What a rammed earth mix is made of and what additives can enhance its characteristics.

   Architectural and engineering design considerations.

   Construction methods, on-site workability and maintenance.

   Case study detailing constructed walls.

**APPLICATION**

**POTENTIAL DEVELOPMENTS**

One of the project's objectives is to provide an option in construction materials that is both well-attained and favorable by people of all classes and social backgrounds. This means the simplicity, capability, and finishing, among other characteristics of the buildings, need to be able to vary depending on project requirements. This is done using the wide array of tools and equipment usable to build rammed earth structures, allowing cost and finish to be manipulated in order to suit a large spectrum of projects that could range from villas to storage sheds.

**APPLICABILITY**

**DISPLACED POPULATIONS**

With the major rise of conflicts over the last decade in the Middle East, millions of people have found themselves evacuated and on the move. Abandoning their destroyed homes in search of a safer place to survive, refugees face two problems, immediate short-term resettlement and delayed (hopefully not by much) long term reconstruction. Both uses need to provide minimum living requirements, and they need to be built efficiently and cheaply.

The ease of adaptation of rammed earth construction, coupled with the guidebook the team plans on publishing, aim to give back some power to these destroyed communities. There won't have to be any reliance on large companies or governmental entities. With basic tools and minimal investments, small teams can build a great deal!

**DISPLACEMENT**

Temporary camps are usually made up of tents that cost upwards of 1,250$ (BetterShelter.org, 2019). Adopting rammed earth construction as an alternative to textile tents means refugees themselves could be trained to build their own houses from the soil they have temporarily settled. On top of that refugees would be paid for their labor the amount that was supposed to buy them their tents, shifting the flow of money from million dollar industries to the people that need it the most.

The recyclability of earth means after refugees have left, the entire camp, if not to be used for other purposes, can be easily "deconstructed" and its earth material brought to the ground with minimal disturbance to the surrounding, and thus minimizing the chance of clash with different policies concerning refugee settlements.

---

Research co-sponsored & supported by: SDG Grant by Global Compact Network Lebanon (GCNL), and CEE Department, MSFEA, AUB