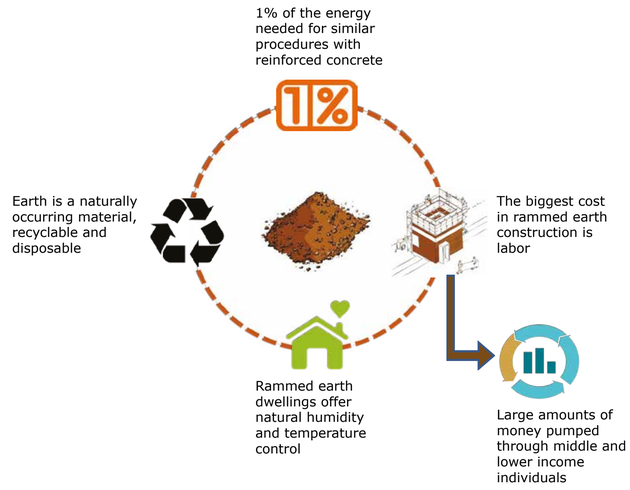
RAMMED EARTH CONSTRUCTION IN THE EAST MEDITERRANEAN REGION

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” (Earth Architecture, Ronald Rael) made up some 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.

Alhambra Palace
Granada, Spain
Age: 1,200 years
(Ecofriendlysask.ca, 2019)

Great Wall of China
Jiayuguan, Gansu
Age: 2,000 years
(Geiger, 2019)



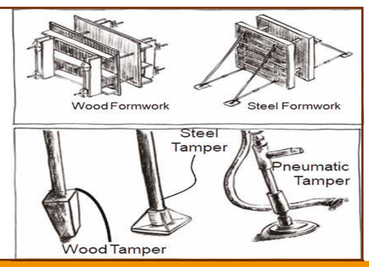
MATERIALS

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.

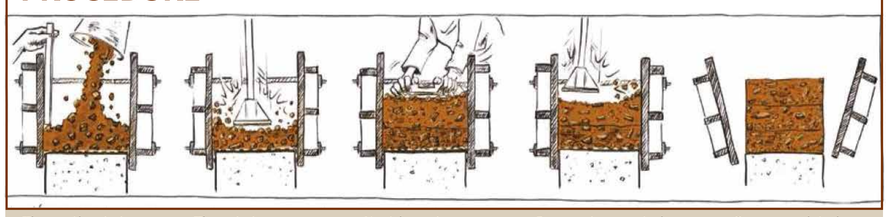
Too much of a plastic clay may result in large cracks in the walls, too little and there is not enough cohesion

TOOLS AND FORMWORK

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



PROCEDURE



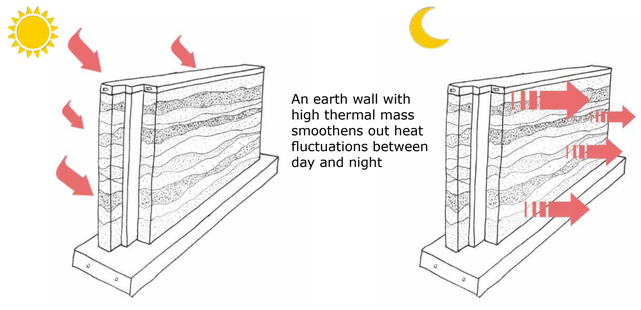
The earth mix is dumped into the formwork and spread, forming a loose layer between 15 and 20 cm.

The mix is compacted by hand using a manual (steel/ wood) or pneumatic tamper.

Next layer is dumped, spread and compacted.

Process is repeated until the total height is reached.

Once completed, the formwork can be immediately removed.
Walls are generally at least 40 cm thick.



RAMMED EARTH TODAY PROMISES TO FILL A GAP IN BUILDING NEEDS AS IT REQUIRES NO PROCESSING AND PRODUCES MINIMAL HARM TO THE ENVIRONMENT

I N I T I A T I V E

As no real knowledge of rammed earth is available in Lebanon or its vicinity, an initiative to redevelop the technology in the region was taken by free-lance architects and the American University of Beirut, composed of:

- Aram Yeretzian, *Assistant Professor of Architecture and Civil Engineering at AUB.*
- Mounir Mabsout, Professor of *Civil/Structural Engineering (CEE) Laboratories at AUB.*
- Helmi El Khatib, *Manager of Civil and Environmental Engineering (CEE) Laboratories at AUB.*
- Elie AlKareh, *Graduate Student, Masters in Civil Engineering at AUB.*
- Angelle Keserwani & Jose-Pascal Zeidan, Architects, external “community” expert partners, on volunteer basis.

The aim is to develop research and practice concerning the construction methods of rammed earth. The study includes the examination of possible mixes, the erection of model walls for initial assessment, and then full-scale constructed rooms applications, and providing a comprehensive rammed earth building guidebook. The project is tailored to the needs and capacities of Lebanon and the Mediterranean region and aims to introduce this method as a viable option in the construction market.

Work in progress

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

Monitoring

The walls are to be instrumented with soil humidity 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.

Social Inclusion

While work is ongoing, vulnerable population’s experience and living constraints are taken into account.
Information is integrated into the development process, making sure that set objectives are on point and accomplished.

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.
- How to identify a good material and what tests are required.
- 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.

CURRENT WALLS AND CONTRUCTION PROCESS AT AREC, AUB, BEKAA

Mixing Earth

Formwork

Pouring and Tampering

Polishing

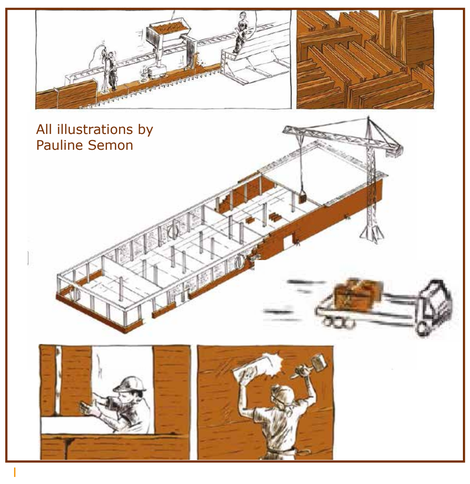
Inspection

Walls Completed

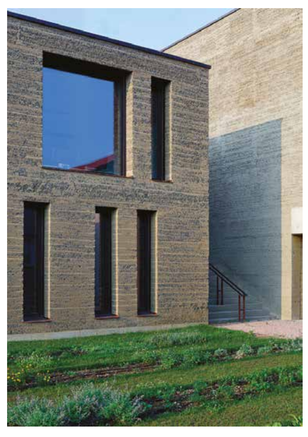
A P P L I C A B I L I T Y

POTENTIAL DEVELOPMENTS One of the project’s objectives is to provide an option in construction materials that is both wanted and attainable by people of all classes and social backgrounds. This means the complexity, scalability, 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 shacks.

Pre-fabricated wall sections for large projects



Mezzana Agricultural College,
Coldrerio, Architect: Martin Rauch
(Rauch, Kapfinger and Sauer, n.d.)



Sihlhölzli Sports Complex,
Zurich Architect: Martin Rauch (Rauch, Kapfinger and Sauer, n.d.)

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!

Cash Diversion

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 viable functions, 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.

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