Vernacular Architecture

BUILDING WITH RAMMED EARTH

Workshop

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Rammed Earth Workshop

That was held in Cairo on 8th - 9th April, 2016

Designed By: Ehab Medhat

BUILDING WITH RAMMED EARTH

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Background

In April 2016, The department of Architecture Engineering and Environmental Design, Arab Academy for Science Technology and Maritime Transport, Cairo branch hosted a design-built workshop titled "Building with Rammed Earth". The workshop involved students from Cairo, Alexandria and Smart Village campuses. It primarily aimed at introducing students to concepts, applications and techniques of building with rammed earth. In order to realize this objective, workshop lectures Dr. Marwa Dabayeh and Arch. Ahmed Abd El-Gawad have first introduced students to theoretical background of building with rammed earth, then developed a hands-on design/build experience, in which students have designed and constructed an urban seating prototype that is entirely made of natural rammed earth.

VERNACULAR ARCHITECTURE

Form Follows Earth!

In spite of the 40°C temperature that day, but it was a really nice experience to build directly from earth, testing the power of materiality as a tool to create an environmental design. In fact, getting rid of the unsustainable blocks in Egypt and the concrete invasion is considered now as an aim for all the REAL architects and the interested in the ecofriendly design. Actually, following the steps of Hassan Fathy, the Egyptian architect and the Middle East's father of sustainable architecture, when he said "Build your architecture from what is beneath your feet" is now taking a new way. I can assure from my experience about Rammed Earth that it is a really helpful practical tool to anatomize with our hand an environmental design and construction neither by theoretical reading nor by a shallow knowledge.

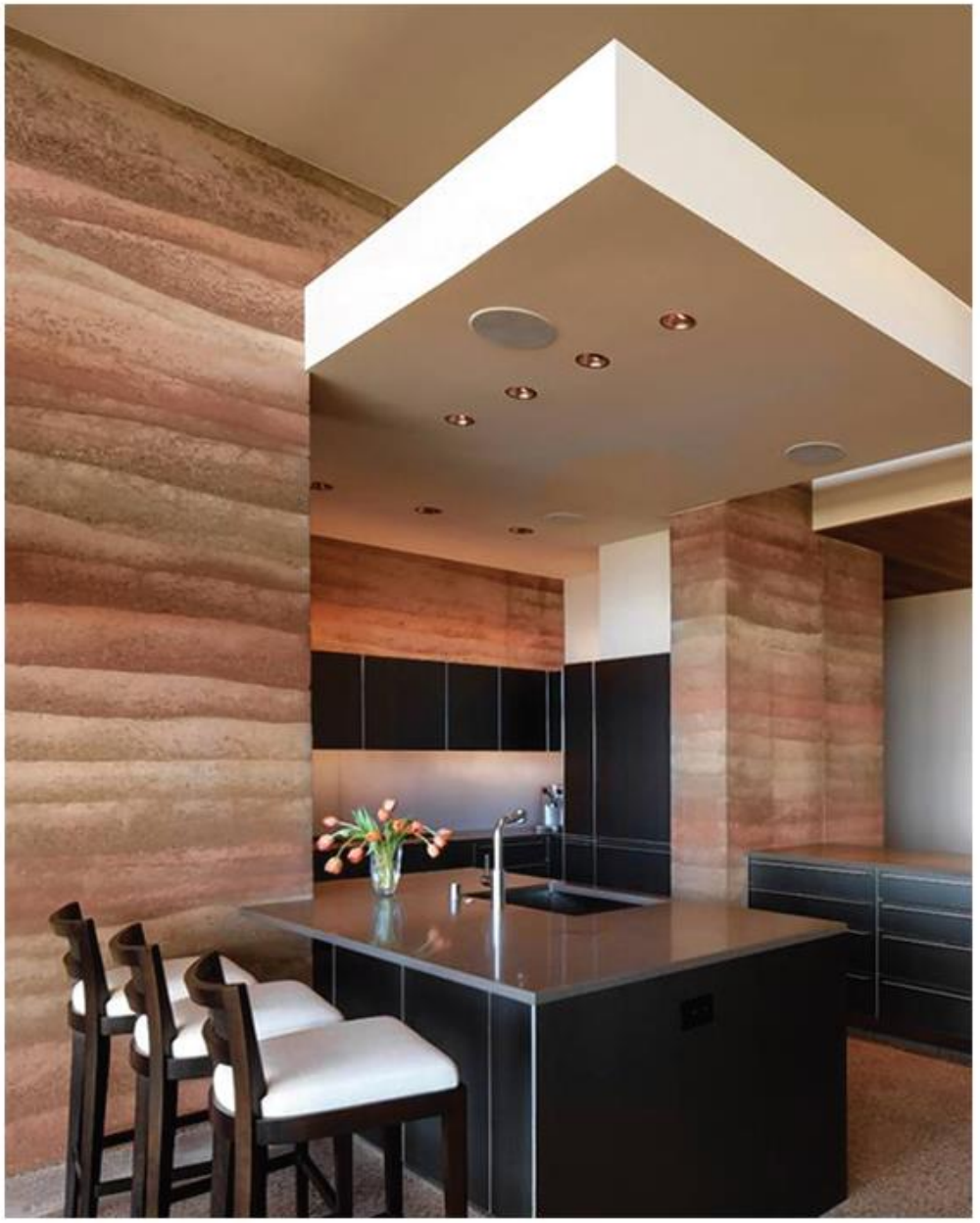
Nowadays, Le Corbusier's "Towards a new architecture" is going to be rammed!"

Rammed earth

is an ancient type of earth architecture that became popular during the last couple of years as an approach to maximize the efficient use of natural resources instead of manufactured building materials (like RC), also to seek a more sustainable building materials and construction methods.

It is a technique for building walls, foundations, and floors using natural raw materials such as stone, clay, sand, chalk, lime or gravel. It is simply based on compacting soil between vertical formwork boards, which are then removed leaving a mass soil wall.

Usually this technique is used in regions whose soil composition is unsuitable to make sun dried clay bricks.



RAMMED EARTH

Advantages

-Ramming requires little water, an important consideration in dry climates.
-They require few other resources like aggregates or additives to improve their properties.
- Earth can be recycled, It has many mawterials that can easy and agreeable to work.
- Earth Materials haves good insulating properties if built with high thermal mass especially for hot climate.
- Good for noise reduction and sound insulation.
- Earth doesn't burn, so rammed earth walls are flame resistant.
- Load bearing, which reduces the need for structural supports, therefore reducing building costs. Standard 400mm thick rammed earth walls can be used as load bearing in constructions up to four stories high.

Limitations:

- It is labor-intensive to build, which makes them moderately costly.

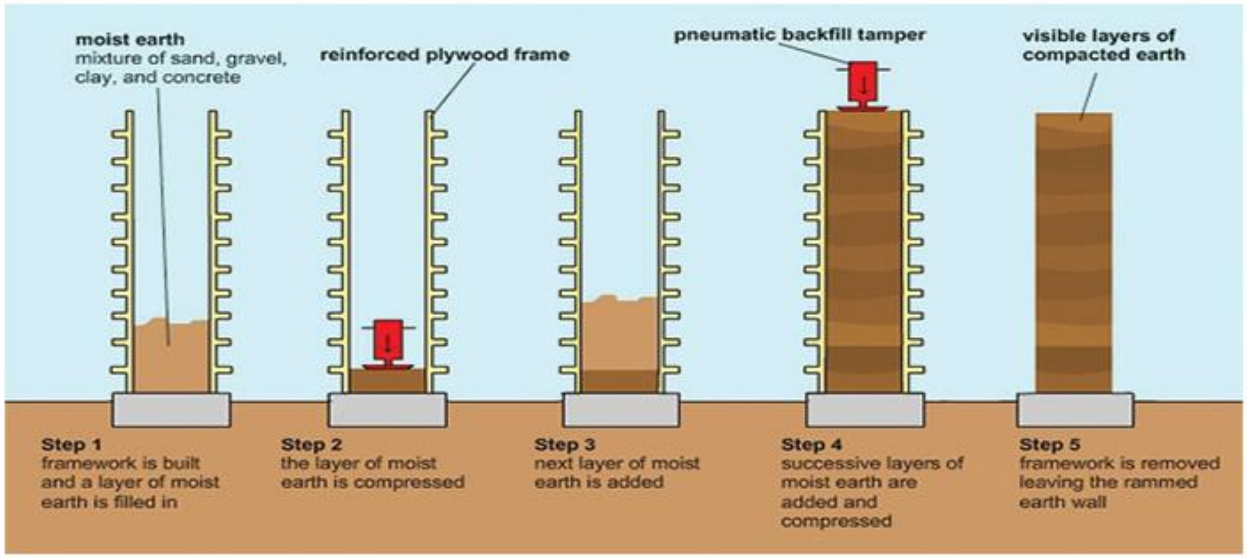
- Some degree of carpentry skills are needed to build the formwork.

- The ramming itself requires hard physical work.

DAY ONE

1- Background and Precedents Lecture:

At first students were introduced and oriented to rammed architecture. What is rammed earth, why rammed earth, how to build with rammed earth, benefits of building with such techniques.
Then students began soil testing. Generally a progression of field tests ought to be led utilizing a specimen from the site taken from a depth of 0.5 meter, to ensure that the surface organic materials are not included.



2- The drop test

A modest bunch of un-sieved soil is taken, saturated and made into a ball, which was held close by and left to dry for a couple of minutes before dropping it. If the ball is broken into few lumps, that means that it's a decent blend. The drop test gives a sign of the measure of water expected to accomplish versatility.

3- The jar test:

That is to get a thought of the proportion of coarse to fine particles in the soil. 66% of a container is filled by soil taken from the site, and water was added to fill the bottle. The container is shaken till all the soil particles are suspended then it is left to settle for a couple of hours. As the water cleared, you can see the arrangement of various soil layers isolated by obvious unmistakable lines. The sand layer regularly settles at the base as its particles are heavier, then layers of sediment and soil remains constant.

4- Mixing Process:

Then students did the soil mixing techniques. Students tried mixing different proportions of sand, gravel, clay and water and either compacting, filling or pressing the mixture until we reached to optimum proportions which is (2.5 gravel, 2 course sand and 2.5 clay) and compacting technique of the material.

The mixture had to be turned over while water is sprinkled to ensure that all the particles will be moistened. Generally speaking water forms 10%-15% of the mixture

Testing the optimum durability, and the result of the multiple trials and errors students did.

5- Formwork procedures:

Then students did the form work preparing for building the bench which is used as a temporary support during soil compaction. Bricks as a base for the bench (foundation)

DAY TWO

1- Materials and Techniques:

First there was a lecture intruducing intarnational examples for buildings using earth materials and techniques. then students were showen some examples of the work done by the instructor in Luxor and other buildings and workshops done by them.

2. Construction process

Ground Levelling

Applying materials

Mixing materials

3- The five mixtures were made with the optimum ratio that is 2.5 gravel, 2 course sand and 2.5 clay.

4- Water were added to each mixture 10%-15% of the mixture.

5- Then one mixture at a time is added in the framework, then each layer is compressed carefully until the layer is levelled.
Some organic coloured materials were added to the mixture to give it an artistic view. Then this layer of Colored mixture is also compressed.

RAMMED EARTH WORKSHOP OUTCOME

Workshop Participants

Workshop Final Product

RAMMED EARTH WORKSHOP OUTCOME

Workshop Participants

BUILDING WITH RAMMED EARTH

Workshop

Workshop Tutors:

Dr. Marwa Dabayeh Arch. Ahmed Abd El-Gawad

Workshop Participants:

Cairo Campus:

1- Bassel M. Shaalan.
2- Hakim Salama.
3- Rinade Essam.
4- Reham Sherif Zamzam.
5- Salma Yehia.
6- Omar Khaled El-Sharkawy.
7- Marc Emad Nassri.
8- Nada M. Abd El-Magid.
9- Perihan Hossam .
10- Hadeel Hossam.
11- Weam Magdy.

Alexandria Campus:

1- Mohamed Ismail Abd Allah.
2- Mohamed Ashraf Shahin.
3- Rana Gamal El-Din Mohamed.
4- Rana Ahmed El-Badri.
5- Yasmina Ahmed Abbas.
6- Yasmine Mohamed Ali.

Smart Village Campus:

1- El-Hassan Tayel.
2- Mohamed Salah Ahmed.

AAST STUDENTS' OPINION

It was a very beneficial experience, I was able to learn and understand old building construction techniques I had no idea about. It was very interesting although the working conditions were hard because of the weather. Building with our own hands and being able to know how to test the soil and how to construct a framework and how to know the perfect mixture for construction are experiences that I was glad to attend in this workshop.

Nada Attia
Cairo campus

Although this condensed workshop was really tiring and took over my weekend, it was worth it. I think it is important for architecture students to learn to build with all available materials and with different techniques, so they would come up with the optimum solution for every building they design. I am looking forward to know further environmentally friendly techniques and determine what would be the best for my countries climate and available materials.

Salma Yehia
Cairo campus

My opinion of rammed earth, changed completely. The view I had of it, was not good. now I am thinking of construction of my own house with a Rammed earth technique. I love it because it is eco-friendly and more over it is locally available materiel.

Hadeel Hossam
Cairo campus

The workshop was held in Cairo for two days, the first day started with basic principles and lectures about the rammed-earth architecture, its benefits to environment and its economical benefits. We spent most of the first day going through the principles and practice of assembling framework and choosing the perfect mixture of soils. the second day we started to cast the mixture founded in the first day to build our bench. and it worked! we built 15m2 bench in a day, by hand, with 20 participants!!

Rana Elbadri
Alexandria campus

I believe that this workshop introduced me to a new construction method that depends on the availabe materials respecting the users' needs as well as its ability to adapt to different environments with a low budget, making it suitable and affordable for every one, with the minimum technology. Hands-on exeprience, the best way to learn about something, it was better for me than the theoretical part of the workshop, making it more clear and fun especialy with friends.
Despite the bad weather of those two days, I am glad I had this opportunity.

Yasmine Moussa
Alexandria campus

The workshop was mainly based on building with earth materials (mud, sand, gravel, etc). What I learned in this workshop was the proportions of mixing the materials and to give the required stuff for building ... We also learned about sunbathing of the materials to strengthen up with no wastes like carbon mono and dioxide. Then we learned how to stack them in order to build with rammed earth materials.

Hassan Tayel
Smart Village campus

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