MUD
... a building material

Sixth Semester B.Arch.
6S-A-2 Construction Technology & Materials –VI
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MUD..

- Mud as a construction material has been extensively used since Neolithic times.
- Mud construction is mainly found in places which are
    - relatively dry and
    - have mud in abundance

WE PREJUDICED?

Why isn't mud considered modern?
Is it true that mud is not as strong as cement and steel?
Are concrete and steel perceived to be better simply because they are seen to be the result of modern scientific and technological processes?
Is this a problem of mud itself or is this merely a problem of the modern mind?

SOIL SOURCE

Mud required for building can be taken from the plot itself.
The soil is collected after depth of 60cms only.
As the top layer is full of organic matter, it isn't used.
Below it is sand and clay which are dug out in heaps.
Do not use hard rock.
Soil to be used should be devoid of organic matter.
Top should be replaced after excavating.

SOIL TYPE

Gravel: Small pieces of stone varying from the size of a pea to that of an egg.

Sand: Similar small pieces of stone (usually quartz), which are small but each grain, is visible to the eye.

Silt: The same as sand except that it is so fine that you cannot see individual grains.

Clay: Soils that stick when wet - but very hard when completely dry.

Organic Soil: Soil mainly composed of rotting, decomposing organic matters such as leaves, plants and vegetable matter. It is spongy when wet, usually smells of decaying matter, is dark in colour and usually damp.

SOIL USABILITY

Gravel: Alone is of no use for mud wall building - the tiny lumps of stone have nothing to bind them together.

Sand: Similar to gravel, it is of no use for wall making by itself - but if mixed with clay, it is the ideal mud wall building soil.

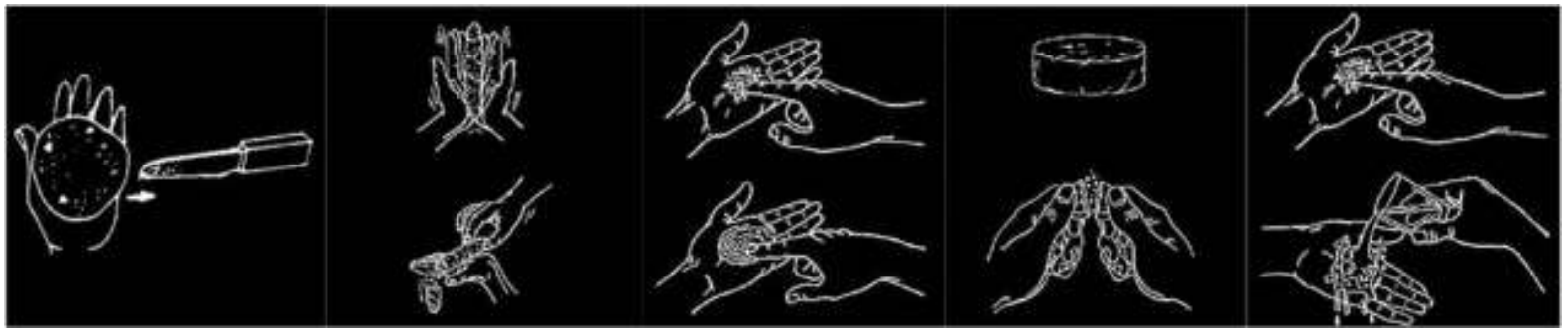
Silt: By itself is also no good for building walls. It will hold together but is not strong. Furthermore, it will not compact so it is also of no use for pressed blocks or rammed earthwork.

Clay: Can be rammed or compressed but in drying out they often shrink. During the monsoon they get damp and expand again and crack form.

Organic Soils: Are mainly useless for wall building.

TESTS

- **There are two kinds of tests:**
  - Field tests
    - Colour tests
    - Touch and smell test
    - Biscuit test
    - Hand wash test
    - Cigar test
    - Adhesion test
  - Lab tests
    - Sieve test
    - Sedimentation test



COLOUR TEST

Procedure

Observe the colour of soil.

Interpretation

Deep yellow, orange and red, ranging to deep browns indicate iron content which is good as building mud.

Greyish or dull brown, ranging to dirty white indicates more clay.

Dull brown with slightly greenish colour indicates organic soil.

TOUCH & SMELL

Procedure

Rub small quantity of dry soil on palm to feel its texture.

Moisten the soil and rub again.

Interpretation

Soil that feels course when dry but sticky when wet contains lumps of clay.

Soil that feels course when dry but gritty when wet contains sand.

Soil that feels course when dry but little gritty when wet contains silt.

If the wet soil gives off musty smell then it contains organic matter.

BISCUIT TEST

Procedure

Make a smooth paste from the soil removing all gravels.

Mould it into a biscuit of 3cm diameter and 1cm height.

Leave it to dry and observer for shrinkages or cracks.

Break the biscuit to noting how hard it is.

Interpretation

If biscuit cracks or leaves gap from the mould then it contains more clay.

If its very hard to break then soil contains more clay.

If it breaks easily and can be crumpled between finger then it has good sand-clay proportion.

If breaks and reduce to powder then the soil has more sand or silt.

HAND WASH TEST

Procedure

Play with wet soil till your hands get thoroughly dirty.

Wash your hands to see how difficult it is to clean.

Interpretation

If hands get cleaned quickly, then soil contains more sand.

If it takes little time to clean and feels like flour then soil contains more silt.

If it feels soapy or slippery and takes time to clean then soil contains more clay.

CIGAR TEST

Procedure

Make a smooth paste from the soil removing all gravels.

Roll it on palm to make a cigar.

Slowly push it outside your palm.

Measure the length at which it breaks.

Interpretation

Length below 5cm - too much sand.

Length above 15cm - too much clay.

Length between 5cm to 15cm - good mixture of sand and clay.

ADHESION TEST

Procedure

Make ball out of wet soil.

Pierce a knife into it and remove.

Observer the knife after removing.

Interpretation

If little soil sticks on the knife then it has more silt.

If lot of soil sticks on the knife then it has more clay.

If the knife is clean after removal than the soil has more sand.

SIEVE TEST

Procedure

Pass soil from series of standard sieves set on top of on another with finest sieve at bottom.

Observer the soil collected in each sieve.

Interpretation

Silt will be collected in lowermost sieve.

Gravels will be collected on top.

Sand and lumps of clay will be collected in intermediate sieves

SEDIMENTATION TEST

Procedure

Take a transparent cylindrical bottle or jar of 1Lt. Capacity.

Fill it with ¼ soil and ¾ water.

Shake well and allow it to settle for 30 min.

Interpretation

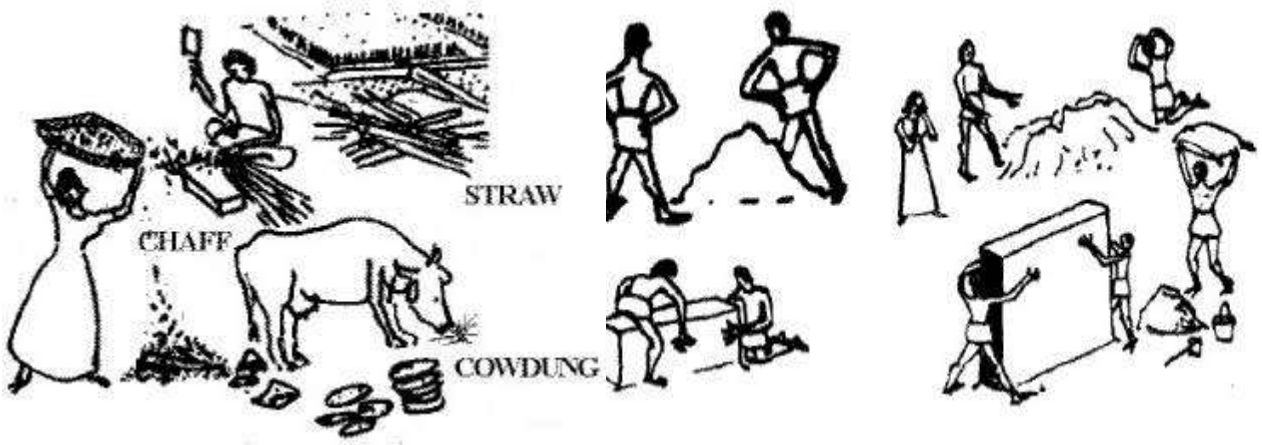
Coarse gravels will be settled at bottom, followed by sand, silt and clay on top.

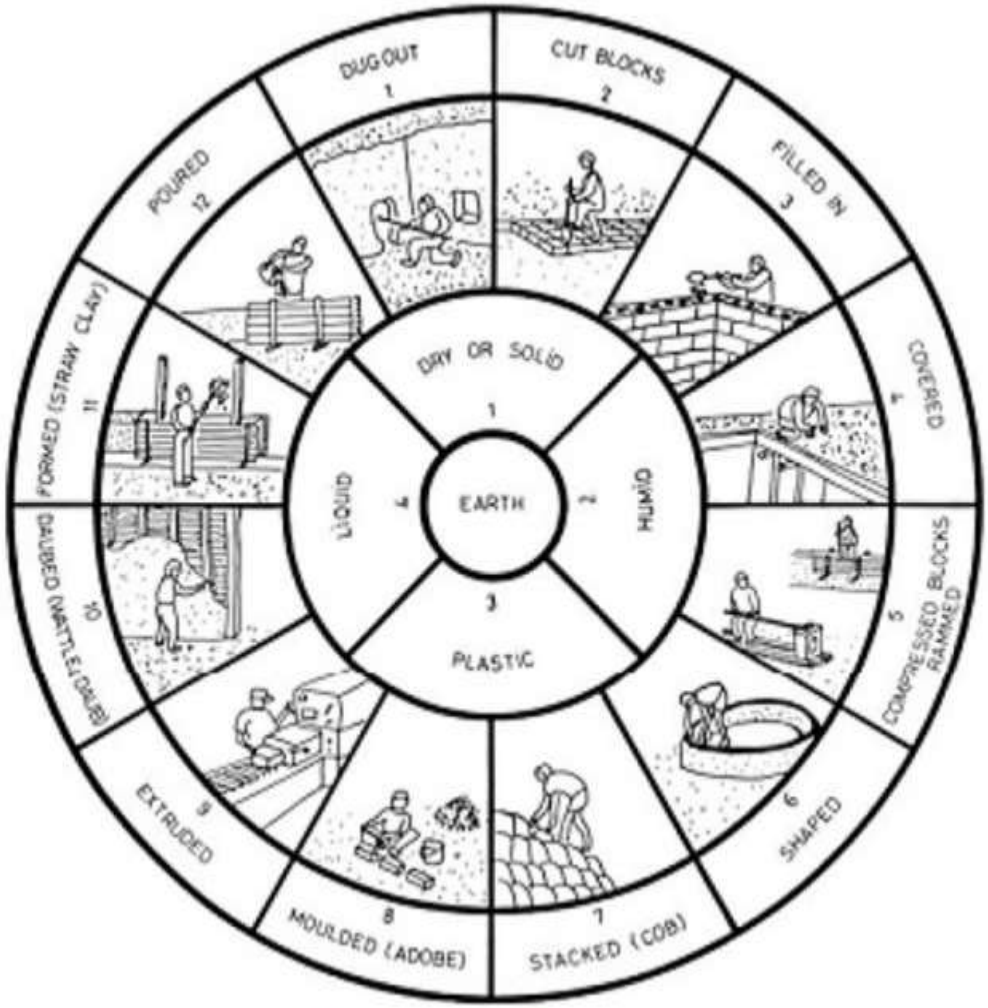
Measuring the layers will give us the approximate proportions of each content.

STABILISERS

- When the available soil is not suitable enough for construction then the soil can be used by manipulating its composition by adding suitable stabilizers.
  - Stabilizing enhances the given property of the soil type.
  - Increase Tensile and Shear strength.
  - Reduce shrinkage.

- Most common and effective stabiliser is Soil itself.
- Cement, is the best example of a modern contemporary stabiliser.
- Various other indigenous stabilisers include
  - Straw
  - Plant Juices
  - Gum Arabic
  - Sugar Or Molasses
  - Cow Dung
  - Animal Urine
  - Tannic Acid
  - Oil





The 12 main earth techniques

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SYSTEMS OF BUILDING

- COB is good for anything except height. It is particularly good for curved or round walls.
- PISE OR RAMMED EARTH is strong and ideal for solid, squat, single storey houses.
- ADOBE or SUN DRIED BRICKS can easily cope with two storey houses.
- PRESSED BRICKS smooth and very strong and can build three storey.
- WATTLE & DAUB is elegant and fine for Seismic Zones.

The end!!!