

MATERIAL L2 (TOPIC 3) SOIL AND EARTH AS A FOUNDATION AND BUILDING MATERIAL

WHAT IS A SOIL – soil is a mixture of particles , mainly from weathered rock , that are smaller than 2.5 mm.

THE CONSTITUTION OF SOIL IS MADE UP OF THE FOLLOWING ELEMENTS.

- water, and gas
- clay and silt
- sand and gravel
- loam

DIFFERENCES BETWEEN CLAY AND SILT

- ▶ **SILT-** silt hardens when it dries. it is quite easy to break up in its dry state. when wet, silt is not very mouldable or plastic.
- ▶ **CLAY-become** very hard when it dries and is not easy to break up in its state. When clay is wet becomes mouldable or plastic.
- ▶ **ATTERBERG BEG LIMINTS** –is a common set of tests applied to a very fine materials such as clay and silt

REASONS WHY SILT IS NOT COMMONLY USED AS A CONSTRUCTION MATERIAL

- ▶ Silt shows very little cohesion.
- ▶ Silt shows weak bearing capacity.
- ▶ Silt shows low resistance to shear.

FOUNDATION - are structural elements that support the load(mass)of the structure, and transfer the load to the underlying soil.

TYPES OF FOUNDATIONS

1 STRIP FOUNDATION – a strip of concrete under a foundation wall carrying a uniformly distributed load.

2 PAD FOUNDATION - are rectangular or square reinforced concrete bases that support the load from columns or ground beams.

3 RAFT FOUNDATION - is a reinforced concrete slab with down-stand beams along the edge.

4 PILE FOUNDATION – a series of columns constructed or inserted into the ground to transmit loads to a lower level of subsoil.

THE ARE TWO PROBLEMS TO BE AWARE OF WITH CLAY SOIL WHEN WORKING WITH FOUNDATIONS

1 CLAY IS EXTREMELY FINE AND TENDS TO HOLD WATER.WHEN FOUNDATION IS BUILT ON CLAY AND THE FOUNDATION BEARS A LOAD, SETTLEMENT CAN TAKE PLACE OVER A NUMBER OF MONTHS OR EVEN YEARS.

2 if the clay is an active clay that responds to changes in moisture content by shrinking or expanding, it can cause the foundation to move. this, in turn, could cause cracks in any walls supported by the foundation.

POSSIBLE SOLUTION FOR BUILDING FOUNDATION ON CLAY SOIL

- ▶ If you can afford the expense , lay foundation at least 1m below the surface of the clay.
- ▶ Reinforce the perimeter strip footing with steel.
- ▶ Articulate the superstructure of the building at strategic places.
- ▶ Use a shallow raft foundation.

POSSIBLE SOLUTION FOR BUILDING FOUNDATIONS ON SOFT CLAY

- ▶ If the height of a building makes it unstable because the building is top, heavy, use piles or, if necessary, even raking piles.
- ▶ If the building has a low centre of gravity (is not liable to topple over), a raft foundation or even wide strip footing could be considered if the clay is not active.

POSSIBLE SOLUTIONS FOR BUILDING FOUNDATIONS ON COLLAPSING SOILS

- ▶ Wet the collapsible soil before construction and compact the soil by using an impact roller
- ▶ Use wider foundations or raft foundation to decrease the pressure on the soil
- ▶ Found deeper down by using piles

SANDY SOILS

Sandy soil does not usually pose a problem when laying a foundation. the only problem to be aware of is when the foundation is on steeply sloping site.

SOIL COMPACTION

SOIL COMPACTION –soil compaction is a process that forces the soil particles closer together . this means that the voids or spaces in the soil are reduced.

THE EFFECT OF COMPACTION ON THE MECHANICAL AND PHYSICAL PROPERTIES OF SOIL

- can bear more weight.
- will not compress further when built upon.
- will absorb water less easily .
- it become more dense.
- It decreases the amount of settlement under a heavy loads.

TYPES OF COMPACTION EQUIPMENT

- ▶ **Hand tampers** - are hand-operated tools consisting of handle with a weight attached.
- ▶ **Impact tampers** - are hand-held mechanical compacting machines that bounce up and down on the soil, compacting the soil.
- ▶ **Plate vibrators** - have a large smooth drum that has three or four sides with rounded corner.
- ▶ **Vibrating roller** - are usually articulated machine with large vibrating roller on the front.
- ▶ **Impact roller** - have drums that are more or less square or triangular, with rounded corners.
- ▶ **Rubber tyre-roller** - have two rows of pneumatic wheels in tandem.
- ▶ **Smooth-wheel roller** - are self propelled rollers that often have a large drum at the front that can be steered.
- ▶ **Sheep-foot roller**-are towed rollers, usually with one large drum.

Problem that may occurs in an around buildings if soil is not properly compacted

- ▶ Foundation can settle and crack.
- ▶ Concrete slab and floors can break and tilt.
- ▶ Sewerage and water pipes can bend or break as the building settle.
- ▶ Basements in marshy soil can crack and leak.

THE THICKNESS OF THE LAYER OF MATERIAL TO BE COMPACTED WILL DEPEND ON

- the type of soil
- its moisture content
- the equipment used.

TYPES OF TRADITIONAL BUILDING TECHNIQUES

- ▶ **WATTLE** – is the upright posts or sticks, with twigs or softer tree branches woven in between in lattice form. daub is a mixture of clay, mud and straw that is plastered onto the wattle and left to dry to form a wall.
- ▶ **RAMMED EARTH** – is a soil that has been compacted into a shape or form to ensure that the earth is compacted enough as it will crumble away if it is not.

ADVANTAGES OF USING RAMMED EARTH

- ▶ It needs minimal handling of the material.
- ▶ No mortar is required,