# ***Foundations***

- Foundations form the major part of a buildings substructure (along with the rising walls, hardcore and ground floors)
- Once the substructure is complete the building is out of the ground and the superstructure (above damp-proof course level) can be built.
- As a major function of foundations is to support the buildings structure, it is vital that it be built on firm footings.
- Firm footings are not found near the grounds surface, therefore excavations need to be carried out to find a firm footing.

***CLEARING THE SITE***

- TREES AND VEGETATION:
    - Trees planted near buildings can cause unequal settlement because the roots extract moisture from the soil. This causes soil around the tree roots to shrink.
    - Retain trees if possible. As well as adding character, the presence of trees maintains the water table at a lower level than if they were not present

## *Top Soil*

•Top layer of soil about 350mm deep

•Easy to compress therefore unsuitable for building on

•Remove and stockpile for garden,etc.

### *Subsoil Types*

•There are four major subsoil (soil remaining once topsoil is removed) types

•Each is different with its own characteristics, the most important characteristic being its BEARING CAPACITY

•Bearing capacity (capability) refers to the weight that the subsoil can support without movement occurring.

•Some initial movement called settlement is allowed during and immediately after construction.

- There are four types:
    - Rock
    - Coarse-grained non-cohesive soils
    - Fine-grained cohesive soils
    - Peat and made-up ground

## PRINCIPLES OF FOUNDATION DESIGN

Based on soil type and the purpose of the building, a suitable foundation can be designed and constructed.

- All foundations must be:
    - Able to safely sustain and transmit to the ground the combined dead and live loads so as not to cause any settlement in any part of the building
    - Constructed to avoid damage by swelling, shrinkage or freezing of the subsoil
    - Strong enough to prevent downward vertical loads shearing through the foundation at the point of application
    - Able to withstand attack from corrosive elements in the soil, e.g. sulphates

**LOADS TO BE CARRIED BY FOUNDATIONS**

- The loads supported by a foundation are made up of:
    - The Dead Load – combined weight of substructure, superstructure, all constructional elements and finishes
    - The Superimposed Load – weight of occupants, furniture, moveable goods and even snow resting on the roof
    - The Wind Load – force that wind blowing from any direction at a likely maximum velocity, will exert on the building

### ***Concrete***

- Concrete is the material which is vital for a foundations structure.

- Concrete as we know it now consists of:
    - Cement
    - Aggregate (coarse and fine) (about 80% of mix)
        - Coarse – gravels, crushed stone – must be clean
        - Fine – must pass through 5mm sieve, e.g. sand
    - Water

## ***Why we use concrete?***

•Very strong in compression

•When cement is mixed with water a chemical reaction known as hydration takes place.

•The resulting paste coats the surface of the aggregates and binds them together.

•The binding is achieved by the progressive setting and hardening of the mix

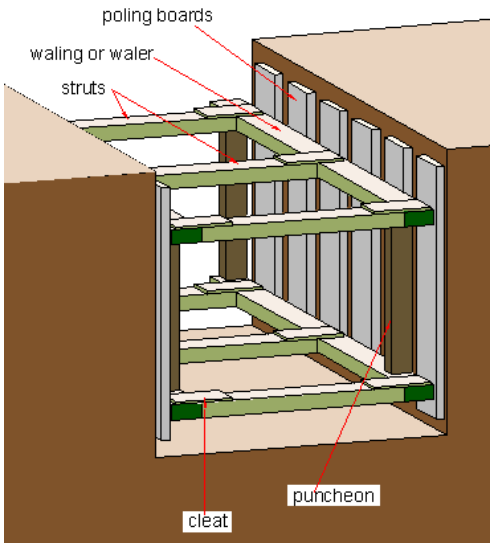
## ***Settlement***

- Settlement results from:
    - Consolidation of soil
    - Cohesive soils bulging
    - Removal of water from soil
    - Plastic flow of soil from under the building
    - Soil erosion by wind or water
    - Foundation design must allow settlement to occur evenly to avoid straining or cracking

TOPSOIL – EASILY COMPRESSED SOIL 150MM-300MM DEEP AT TOP OF SOIL LAYERS.

ONCE THE TOPSOIL HAS BEEN EXCAVATED A FIRM LEVEL FOOTING IS FOUND FOR THE ENTIRE AREA. FROM HERE THE EXCAVATIONS FOR PLACING THE FOUNDATIONS CAN BE CARRIED OUT.

- This is done by using site rails and boning rods
- Sight Rails allow sighting to be done, and consist of LEVEL PEGS DRIVEN INTO THE GROUND. They are placed OUTSIDE THE PROPOSED AREA OF EXCAVATION SO AS NOT TO OBSTRUCT THE WORK.
- Should be high enough above ground to allow for sighting
- Helps to keep excavations IN LINE.




POLING BOARDS -Up to 2m long with 200mm x 38mm cross section. They are place against the side walls of the excavation VERTICALLY.

WAiLINGS - HORIZONTALLY placed boards of cross section 150mm x 50mm, which support the poling boards

STRUTS - HORIZONTAL members cross section 100mm x 100mm which press the wailings against the poling boards. Struts should be placed up to 2m apart to allow work continue

***Problem of water in the excavation***

- Water is found at some levels in all soils. This level is known as the standing water table.
- Excavating below this will result in water seeping into the excavation, thereby interfering with the work by obscuring the views of the bottom of the excavation, causing side walls to erode and resulting sloppy material making excavation difficult.
- Rainfall may also result in filling the excavation with water.

**Solution:**

•Water is pumped away from the lowest point of the excavation, usually a shallow pit called a sump.

•This process is called dewatering

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# ***Types of Foundations***

- The three fundamental principles of foundation design involve:
    - The foundation bearing down on suitable subsoil. The strip foundation is the most common solution to this scenario
    - The foundation obtaining its strength from friction with the surrounding earth. Pile foundations are an example of this principle
    - The foundation floats on the surface of poor to good soil as exemplified in raft foundations

•Based on these principles there are four main types of foundation:

•Strip

•Raft

•Pile

•Pad

## ***Four types of strip foundations***

- There are four types of strip foundations:
    - Traditional strip foundation
    - Stepped strip foundation
    - Wide strip foundation
    - Deep strip foundation

## ***Traditional strip foundation***

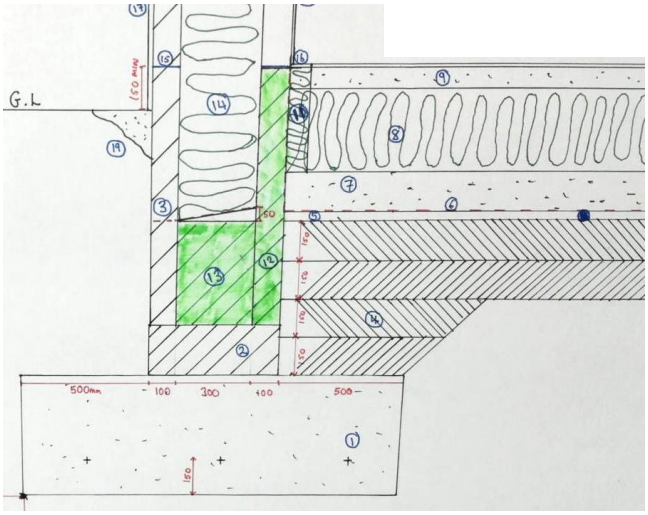
•A continuous strip of reinforced concrete resting on the soil

•Depth and width must be suitable for soil type and building load

•Walls are placed centrally on foundation

•Strip foundations are used on average to good bearing capacity soils

•Not suitable for very soft clay, silt, or peat, or badly made-up ground.

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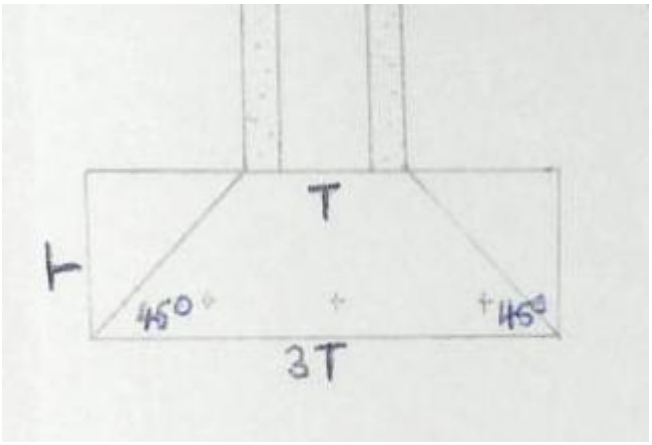
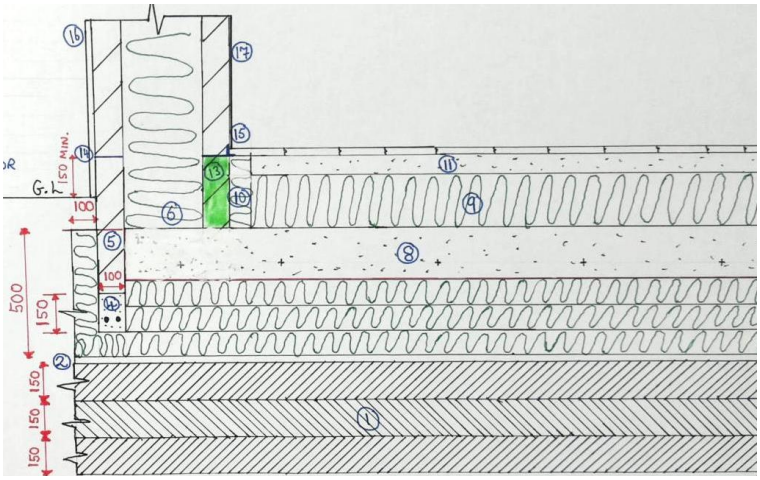
- The concrete thickness must not be less than the amount by which it projects from the base of the wall.
- This is as when a strip foundation is compressed between the wall and the subsoil, a weak foundation will tend to crack at an angle of 45 degrees.
- If the thickness of the strip is at least equal to the amount it projects from the wall then the bearing of the strip is not affected




***<u>Raft Foundation</u>***

The ISOQUICK foundation is basically an insulated raft former; it wraps the entire raft foundation in insulation to eliminate any thermal bridges.




The ISOQUICK system was developed in Germany and has been granted Passivhaus approval; as a result it has become very popular in Ireland. Unlike the Viking House or Supergrund System, this doesn't have a perimeter ring beam; instead it relies on an entire 'slab' of high strength EPS 300 throughout. This system is constructed from Peripor (EPS 300 Moulding) modules that join together, resulting in all round insulation; eliminating thermal bridging (ability to achieve a U value up to 0.1 W/m2K) and protecting the structure from moisture.