

Desk-based Pre-Construction

10 Construction: Kemnal Key- (Term 1)

Pre-construction work on site



Before any practical construction can take place, some things need to be organised in an office setting.

Planning

A scaled site layout plan needs to be prepared. There needs to be a site office, storage areas for materials, temporary road access and parking for contractor vehicles. There also needs to be toilet facilities for workers and security fences so that the public cannot access the construction site. Fire precaution measures are also considered at this stage.

Programme

An accurate programme of work needs to be put together. This should detail what needs to be done, in what order and when it should be completed. A construction always has a deadline date so it is important that everything is done on time and in the correct order.



Identify 3 types of pre-construction activities and explain why these are important (6 marks).

Health and Safety

A health and safety plan needs to be put into place to keep workers safe on site. Risk assessments are written to ensure that every worker knows how to operate equipment safely.

Demolition

The site must be cleared of any vegetation and trees. Any existing structures must also be knocked down. Any existing services such as water, gas, electricity must be protected.

Setting up a site

In a project using traditional construction methods, setting up a site will include many considerations such as deciding an entrance and exit point to keep control of what goes in and out. The site will need to avoid access points on roads that are very narrow or busy and the size of the entrance will be decided by the largest item that will need to fit through it.

Sub-Structure Groundworks

Substructures are things that are constructed below ground level to support a superstructure. Superstructures are the framework of the building, the walls, floors and roofs.

A building has to be designed and constructed to fulfil certain performance requirements. It has to be strong and stable but it also needs to do other things such as resist fire and bad weather.

Loads are the various forces acting on a structure such as a building and the building needs to be strong enough to sustain certain loads such as:

DEAD LOAD

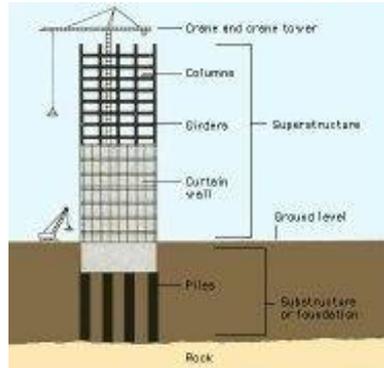
This is a load that does not move, such as the weight of the building itself

DYNAMIC LOAD

These are loads that can change during the use of the building, such as the load from people and furniture.

IMPACT

This is when something hits a part of the building or falls on it, such as a heavy object.



Hazards associated with groundworks

To construct a substructure such as the foundations for a building, the ground needs to be excavated. This means digging into the ground, usually with large JCB's, to be able to lay the foundations.

CONFINED SPACE OR COLLAPSE OF SIDES OF EXCAVATION.
Risk: Crushing/Death
Control Measures: Wearing appropriate PPE, limiting time in confined spaces, using trench supports.



GAS
Risk: Injury or Death
Control Measure: Avoiding services such as gas mains before excavating.

PRESENCE OF GROUNDWATER
Risk: Flooding or Drowning
Control Measures: Pumping out excess water

WATER PIPES/ ELECTRICITY CABLES
Risk: Injury, death or power outages.
Control Measures: Locate and protect all services before work begins

PROXIMITY OF MACHINERY
Risk: Injury or Death
Control Measures: Barriers to stop machinery from getting too close to areas with workers

Trench Support



When digging trenches for strip and mass fill foundations, the sides of the excavation need support so that the soil does not collapse, which may cause danger to construction workers. There are a variety of ways in which this can be done:



Exam Question: Sketch a diagram to show the timbering method of earthwork support for a trench. Annotate your diagram.

Foundations

A foundation is designed and constructed to safely transmit the loads of the building to the ground or sub-soil. They should be able to support the loads of the building for its entire lifespan.

The foundations should be able to withstand the dead and dynamic loads of the building.

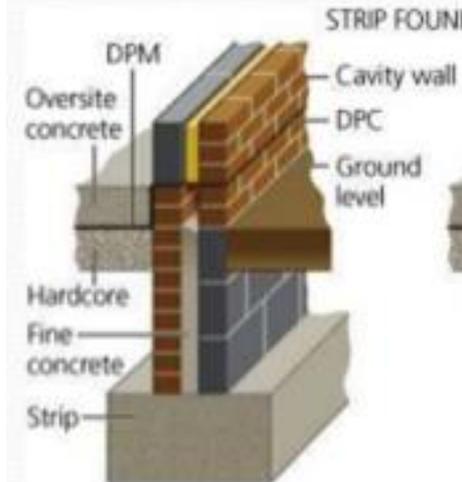


Before foundation types are decided, a number of factors regarding the structure and the site it is to be constructed on will have to be considered. These include the:

- weight of the proposed structure
- purpose of the proposed structure
- soil composition of the proposed site
- history of the proposed site
- feasibility of costs.

Strip Foundations

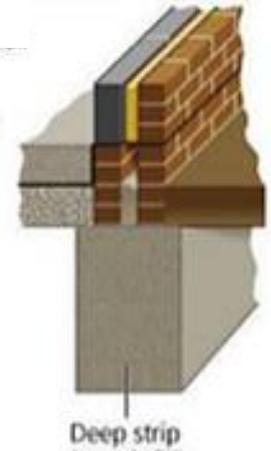
- Strip foundations are the cheapest form of foundation available to constructors.
- Strip foundations involve the digging of a trench. Concrete is then poured into the strip/trench, sometimes on top of reinforced steel grids and tapered level.
- Strip foundations can only be used on firm, good load-bearing soil, and are generally used for low rise buildings such as extensions.



Deep Strip (Mass Fill) Foundations

- Similar to a strip foundation but without the need for reinforcement bars.
- Deeper trenches can be dug and filled with concrete providing more stability.
- Because of the amount of concrete used, it is more expensive.
- The advantages are that workers do not need to go into the trench to start building the brick/blockwork, as a result, it is a faster method.

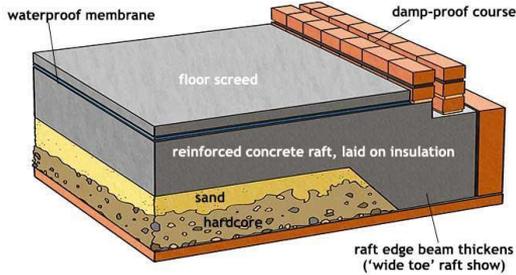
Exam Question: Outline the advantages and disadvantages of using a mass fill foundation over a strip foundation. (4 marks)



Raft Foundations

- A raft foundation is a reinforced concrete slab under the whole of a building or extension, 'floating' on the ground as a raft floats on water.
- This type of foundation spreads the load of the building over a larger area than other foundations, lowering the pressure on the ground.
- Raft foundations are suitable for ground with a poor load bearing capacity.

Using sand for example, if you were to poke your fingers into sand they would sink to a certain depth. However, if you were to hold your hand flat across the same sand, the sand would offer more resistance due to the load being applied across a greater area. This is the principal of a raft foundation.

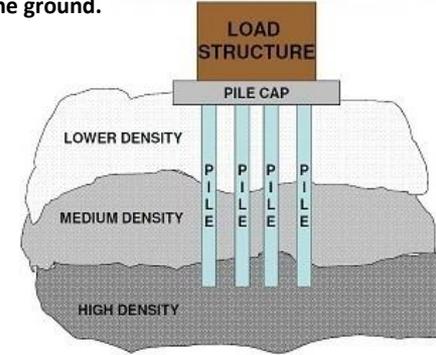


Pile Foundations

Pile foundations are used in the following situations:

- When there is a layer of weak soil at the surface. This layer cannot support the weight of the building, so the loads of the building have to bypass this layer and be transferred to the layer of stronger soil or rock that is below the weak layer.
- When a building has very heavy, concentrated loads, such as in a high rise structure, bridge, or water tank.

A pile is basically a long cylinder of a strong material such as concrete that is pushed into the ground to act as a steady support for structures built on top of it. They are expensive as large machinery is needed to drill into the ground.



Materials used in Construction- Concrete

Concrete is made up of three basic components: water, aggregate (rock, sand, or gravel) and cement. Cement, usually in powder form, acts as a binding agent when mixed with water and aggregates. Concrete needs to be tested for strength before it is used in Construction applications to make sure it can support any weight or forces acting upon it. It can be done in two ways:

Slump Testing

Slump testing checks that the ratio of water and cement in wet concrete is correct. If wet concrete loses its shape or 'slumps' too easily, the balance is not right.



Compressive Strength Testing

Compressive strength testing checks that the hardened concrete is strong enough to withstand loads. This can be done by putting it in a hydraulic press.



Materials used in Construction- Timber

Is used in structures such as the frames of buildings or roof trusses, as well as in doors and windows. The strength of various types of timber is tested. Timber is then sorted into various groups. This process is called stress grading or strength grading.



Timber strength ranges from 14 N/mm² to 70 N/mm². When it is being specified, the letter C (coniferous) means softwood and the letter D (deciduous) means hardwood. This means that timber is classified from C14 to C50 and D30 to D70. A D30 timber is a hardwood with a strength of 30 N/mm². The strength class is usually stamped on the timber.

Bricks



These are classified according to their strength and the amount of moisture that they can absorb. Bricks are usually made from clay. All bricks should have a minimum strength of 5N/mm².

Mortar



Mortar is a workable paste used to bind, fill and seal building blocks such as stones, bricks, and concrete masonry units together. Testing is done by making cubes of mortar to check how much water can pass through it, or if there are any gaps causing leakage.

Hardcore

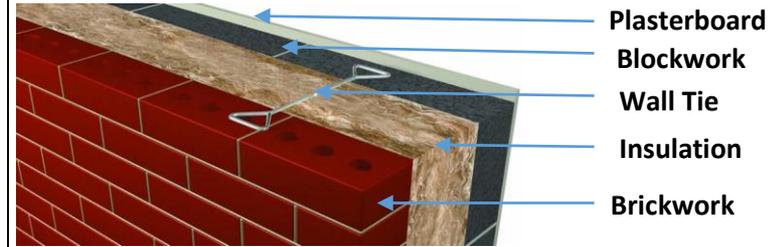


This is used to provide an even base under floors. It is a mix of gravel, sand, broken bricks and crushed concrete also known as **aggregate**. It is classified based on the size of the pieces of material in the mixture. The higher the number in the classification, the larger the pieces are.

Cavity Walls

Cavity walls are constructed as two halves, called skins or leaves. The gap between the two skins is called a cavity, which is normally filled with insulating material above ground level. Below ground level it is filled with concrete to make it both stronger and more stable.

As a cavity wall is constructed in two halves, wall ties are provided to connect these together. This makes sure the wall will stay in place and will not move. Wall ties should be provided every 900mm horizontally and every 450 mm vertically.



Practice: Sketch a diagram showing the transfer of loads from the walls into the foundations.

Compartmentation

- 30 min fire resistance
- Maintains building structure
- Allows sufficient time to escape
- Minimises destruction
- Assists firefighting



To prevent fire, heat, and smoke from spreading beyond locations of origination.

Practice: Design and annotate a ground floor plan which would utilise fire compartments.

Fire Resistant Design

The design of a building can also affect its fire resistance. Buildings are usually divided up into sections called fire compartments, so that a fire in one compartment will not affect the others. These compartments are separated by features known as fire barriers. These include fire walls and separating floors made out of concrete, door closers which stop doors being left ajar, and fire resistant doors that are steel, painted with intumescent paint. This stops the spread of fire and helps firefighters to put out a fire.

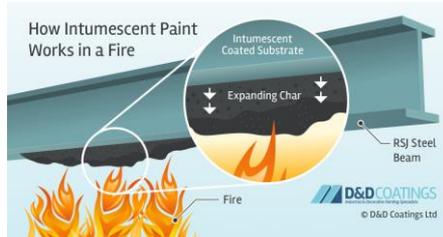
Fire Resistance- Materials

Fire-resistant buildings can save lives and damage to property. Fire resistance can even make sure a building stays standing after a fire.

When building a new structure, it can be best to build using fire-resistant materials which include:

- CONCRETE
- BLOCKWORK
- PLASTERBOARD

Exam style question: Explain what measures need to be taken to ensure that buildings are fire resistant.



Intumescent paint is a paint which swells when heated. This makes it fire resistant, as when it is heated up by fire, it expands and becomes a thicker layer on top of the painted material. This slows down the transfer of heat to the painted material.