UNIT 2 CONSTRUCTION PRACTICES

2 MARKS

1. **Why are construction joints provided (APRIL/MAY 2017)**

A **construction joint** is **provided** when concrete pouring needs to be stopped due to some reason and then is continued again later. **Construction joints** are often required at the ends of beams, slabs, tie beams etc., in such cases, for the purpose of future extension.

2. **What are slip-forms (APRIL/MAY 2017), (NOV/DEC 2015)**

Slipform construction is a construction method in which concrete is poured into a continuously moving form. Slip forming is used for tall structures (such as bridges, towers, buildings, and dams), as well as horizontal structures, such as roadways. Slip-forming enables continuous, non-interrupted, cast-in-place "flawless" (i.e. no joints) concrete structures which have superior performance characteristics

3. **Write any three materials used for joints (APRIL/MAY 2018)**

Suitable **materials** for a **joint** filler are soft wood free from knots, natural cork, cork bound with resin or rubber, and bitumen impregnated fibreboard. **The** properties required in a sealing compound vary slightly according to **the** type of **construction**

4. **What is water proofing (APRIL/MAY 2018)**

Waterproofing is the process of making an object or structure waterproof or **water-resistant** so that it remains relatively unaffected by **water** or resisting the ingress of **water** under specified conditions. Such items may be used in wet environments or underwater to specified depths

5. Define damp proof course (APRIL/MAY 2019), (NOV/DEC 2015)

Damp proofing keeps moisture out of a building where vapor barriers keep interior moisture from getting into walls. A damp-proof course (DPC) is a barrier through the structure designed to prevent moisture rising by capillary action such as through a phenomenon known as rising damp.

6. **What is the purpose of providing construction joints? (Nov/Dec2016),(APRIL/MAY 2019)**

A construction joint should also be used in cases of equipment breakdown, an unexpected shortage of materials, or bad weather, although the joint should still be worked into the jointing pattern—placed where a contraction joint was planned. If that's not possible, the odd section may later have to be removed.

7. Define damp proof course. What are its causes of dampness (Nov/Dec2016,2019)

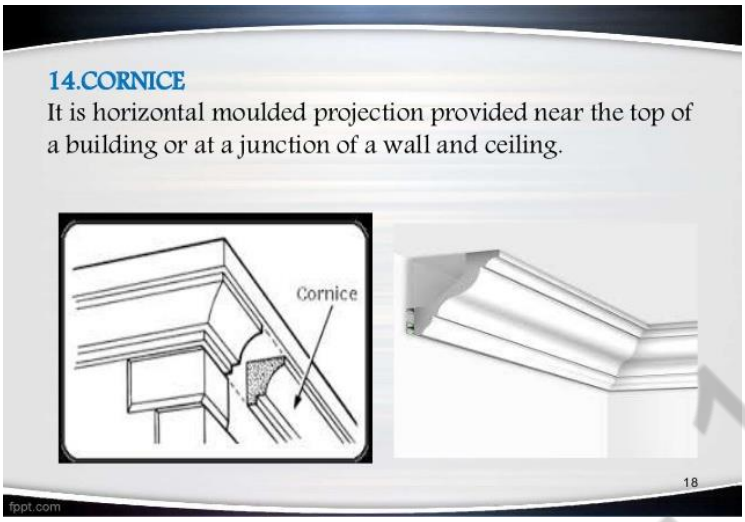
Damp prevention is the chief requirements to ensure the safety of buildings against dampness. The sources, effects, techniques and methods of damp prevention, materials used for damp-proofing (D.P.C) damp-proofing treatments in buildings, treatment of dampness are very vital.

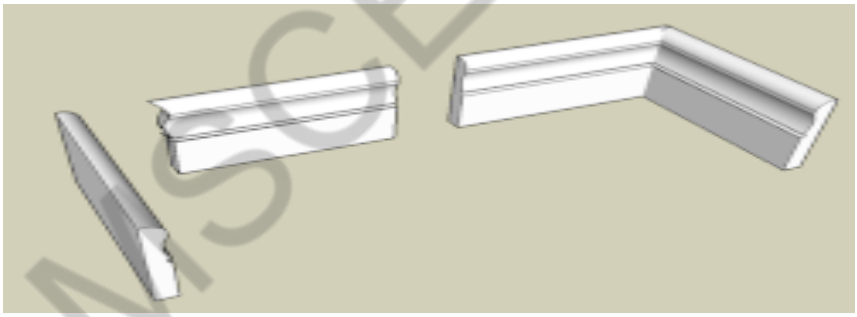
8. What is meant by scaffolding?(Nov/dec-2017)

When the height of wall or column or other structural member of a building exceeding1.5 m, temporary structures needed to support the platforms over which the work man sit and carry out the work

These temporary structures constructed very close to the wall is in the form of timber or steel frame work commonly called as scaffoldings

9. Draw a neat sketch of cornice and coping(Nov/dec-2017)





COPING

10. What are the advantages of hollow concrete block masonry (NOV/DEC 2018)

- Concrete blocks are regular in size, requiring no dressing work. Hence construction is very rapid.
- Blocks are light and therefore easy to handle.

- There is great saving in the material.
- Hollow blocks are structurally stronger than bricks.
- Thinner walls can be easily constructed, resulting in increase in the floor area.

11. What are control joints (NOV/DEC 2018)

Control Joints (often confused with expansion joints) are cuts or grooves made in concrete or asphalt at regular intervals. These joints are made at locations where there are chances of cracks or where the concentration of stresses are expected, so that when a concrete does crack, the location will be known to you. In such a way a concrete will not crack randomly but in a straight line (i.e. control joint). In other words Contraction or Control Joints are Pre-Planned Cracks. The cracks may be due to temperature variations or drying shrinkage or other reasons.

16 MARKS

1. **Compare brick masonry and stone masonry (April/May 2017)**

S.No.	Brick Masonry	Stone Masonry
1.	They are of uniform shape and size.	They are not of uniform in shape and size.
2	They are lightweight.	They are heavy in weight.
3	They do not require any dressing.	They required dressing.
4	Bricks are easily available	Stones are not easily available.

5	In bricks, laying is easy than stone masonry.	Stone laying is not easy.
6	In brickwork mortar joints are thin.	In stonework mortar joints are thick.
7	They are less watertight	They provide better water tightness.
8	They are good fire resistant than stone.	They are not good fire resistant than brickwork.
9	The cost of construction of brickwork is less.	The cost of construction of stonework is more than brickwork.
10	It is not much strong.	It is much stronger than

2. A. Explain about fire protection (April/May 2017, Nov/Dec 2015)

FIRE PROTECTION

No building material is perfectly fire proof A wider interpretation of the fire safety may be deemed to cover the following aspects Fire prevention and reduction of number of out breaks of fire Spread of fire both internally and Safe existence of any and all occupants in the event of an out breaks of fire.

Fire load

Fire load is the amount of heat in kilocalories which is liberated per square meter of floor area of any combustible parts of the building itself

The fire load is determined by multiplying the weight of all combustible materials by their calorific value and dividing the floor area under consideration

Grading of building according to fire resistance

The national building code of India (sp:7-1970) divides building in to the following four types according to the fire load the building is designed to resist

Type 1- construction all structural components have 4 hours fire resistance

Type 2 -construction all structural components have 3 fire resistance

Type 3-construction all structural components have 2 hours fire resistance

Type 4 -construction all structural components have 1hour fire resistance

General fire safety requirements for buildings

- All building and particularly building having more than one storey shall be provided with liberally designed and safe fire proof existence
- The exist shall be so placed that they are always immediately accessible and each is capable of taking all the persons on that floor a s alternative escape route
- Escape route shall be well ventilated as persons using the escapes are likely to overcome from smoke
- Fire proof door shall conform rigidly to the fire safety requirements
- Electrical and mechanical lifts while reliable undr normal condition may not always be relied on escape purpose
- Lift shafts and stairways invariably serve as flues are tunnels thus increasing the fire by increased draught
- Floors are required to withstand the effect of fire for full period stated for the particular grading
- Roofs of the various fire grades of the building shall be designed and constructed to withstand the effect of fire for the maximum period

3. **b. acoustic protection (April/May 2017, Nov/Dec 2015)**

Building acoustics is the science of controlling noise in buildings. This includes the minimization of noise transmission from one space to another and the control of the characteristics of sound within spaces themselves.

Building acoustics are an important consideration in the design, operation and construction of most buildings, and can have a significant impact on health and wellbeing, communication and productivity. They can be particularly significant in spaces such as concert halls, recording studios, lecture theatres, and so on, where the quality of sound and its intelligibility are very important.

Building acoustics can be influenced by:

- The geometry and volume of a space.
- The sound absorption, transmission and reflection characteristics of surfaces enclosing the space and within the space.
- The sound absorption, transmission and reflection characteristics of materials separating spaces.
- The generation of sound inside or outside the space.
- Airborne sound transmission.
- Impact noise.

Characteristics of sound

Sound intensity is measured in Decibels (dB). This is a logarithmic scale in which an increase of 10 dB gives an apparent doubling of loudness.

Sound pitch is measured in Hertz (Hz), the standard unit for the measurement for frequency. The audible range of sound for humans is typically from 20 Hz to 20,000 Hz, although, through ageing and exposure to loud sounds the upper limit will generally decrease.

As well as intensity and frequency, sound also transmits information. For example, music or speech, transmit information which people may perceive differently from other sounds.

Reverberation time

The 'reverberation time' of a space changes the way the space 'sounds' and can affect the intelligibility acoustic information. A high reverberation time can make a room sound muffled, loud and noisy. Rooms designed for speech typically have a low reverberation time, whereas a higher reverberation time can add depth, richness and warmth to music.

The reverberation time of a room is defined as the time it takes for sound to decay by 60 dB after an abrupt termination. It is linked to the total quantity of soft treatments and the volume of the room.

See Reverberation time for more information.

Sound absorption

Sound absorption is the loss of sound energy when sound waves come into contact with an absorbent material such as ceilings, walls, floors and other objects, as a result of which, the sound is not reflected back into the space. Acoustic absorption can be used to reduce reverberation times.

Absorbent materials are sometimes categorized from A to E, where A is highly absorbent and E is almost fully reflective.

Sound absorbers can be divided into three main categories:

- Porous absorbents, such as fibrous materials or open-celled foam.
- Resonance absorbents, which consist of a mechanical or acoustic oscillation system, such as membrane absorbers.
- Single absorbers such as tables, chairs or other objects.

Sound insulation

Sound transmission paths can be interrupted by sound insulation and by blocking air paths. The sound insulation of a single leaf of a material is governed by its mass, stiffening and damping.

The sound insulation across a good conventional, lightweight, office to office construction is typically in the order of 45 dB Dw. This means that if the sound level in the source room is around 65 dB (a typical level for speech), the sound level in the adjacent room, the receiver room, will be approximately 20 dB (barely audible).

If sound levels are increased in the source room however, to 75 dB (raised voice), sound levels within the adjacent room will also increase to around 30 dB (audible). Sound insulation therefore describes the level of sound lost across a partition and not the level of sound within an adjacent room.

3.A. What are masonry structures? Discuss bonded wall? (APRIL/MAY 2018)

Masonry structures are those **structures** which are built from individual units laid in and bound together by mortar. ... The common materials of **masonry** construction are bricks, stones, marble, granite, travertine, limestone, cast stone, concrete block, glass block, stucco and tile.

Bonding may be achieved by overlapping alternate courses (rows or layers) in brickwork, by using metal ties, and by inserting units vertically so they join adjacent courses. A **bond** course of headers (units laid with their ends toward the face of the **wall**) can be used to **bond** exterior masonry to backing masonry.

b. what is the function of roof?

A **roof** is the uppermost part of a building whose main **function** is to enclose the space and to protect the same from the effects of weather elements such as rain, wind, sun, heat and snow. A good **roof** is just as essential as a safe foundation.

c. describe any two types of scaffolding

SCAFFOLDING

When the height of wall or column or other structural member of a building exceeding1.5 m, temporary structures needed to support the platforms over which the work man sit and carry o the work

These temporary structures constructed very close to the wall is in the form of timber or steel frame work commonly called as scaffoldings

Components of scaffoldings Ledgers

Braces

- Put logs
- Transoms
- Boarding
- Guard rail
- Toe board

Types of scaffoldings

- Single scaffolding or brick layer scaffolding
- Double scaffoldings or masons scaffoldings
- Cantilever or needle scaffoldings
- Suspended scaffoldings
- Trestle scaffolding
- Steel scaffolding

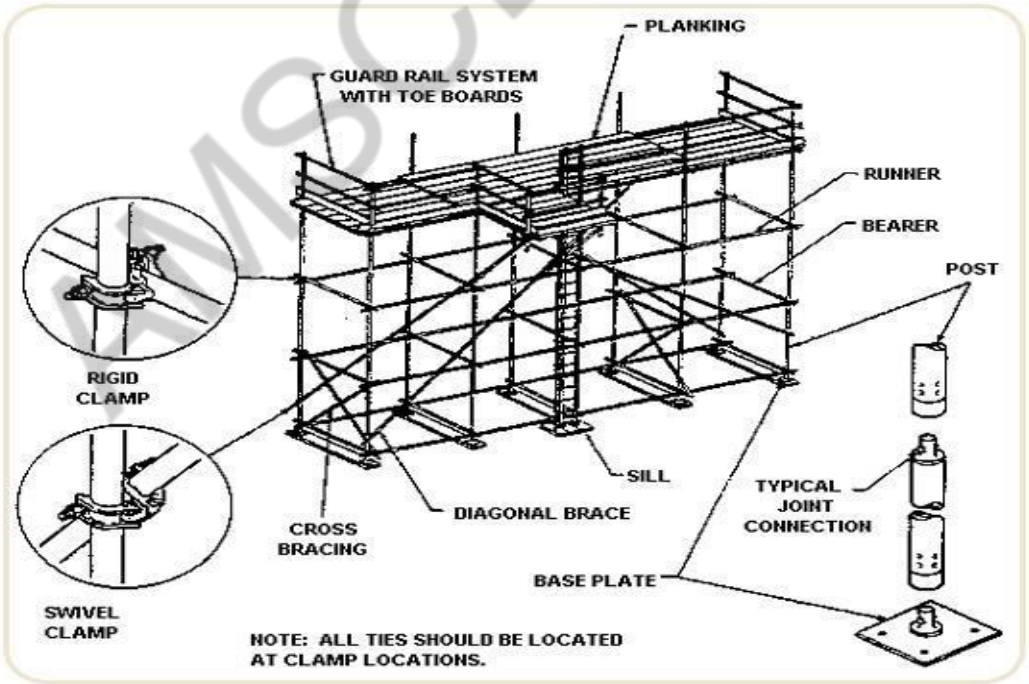
- Patented scaffoldings

Single scaffoldings

- This consists of a single frame work of standards, legers, put logs etc
- Constructed parallel to the wall at a distance of about 1.2 meters
- The standards are placed at a distance of 2to2.5m interval
- Ledger connected with the standards

Double are masons

Put logs or connected with one end on the ledgers and other end at the holes of the wall at an interval of1.2 to 1.5 m interval



- It is very difficult to put holes in walls to m support putlogs in stone masonry
- In the case strong scaffolding is used consisting of two rows of scaffolding
- The first row placed 20 to 30 cm away from the wall the other frame will 1m distance from the first one
- Put logs are the supported on both the supports, rakers and cross braces are provided to make the scaffolding more strong
- It also called as independent scaffoldings

Cantilever or needle scaffolding

- Cantilever supports can be used under following circumctances
- Ground is week to support standards
- Construction of the upper part of the wall is to be carried out
- It is required to keep the ground near wall free for traffic etc i

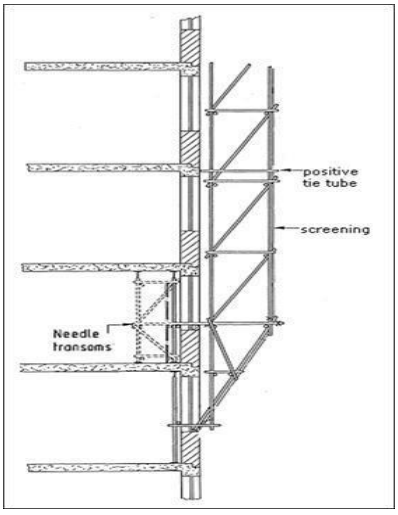
It has two types

Single Frame

The standards are supported on series of needle taken out through opening or through holes

Double frame

The needles are projecting beams are strutted inside the floors



4. a. Write short notes on damp proof course (APRIL/MAY 2018)

A **damp-proof course** (**DPC**) is a horizontal barrier in a wall designed to resist moisture rising through the structure by capillary action - a phenomenon known as rising **damp**. **DPC** is used to stop dampness in buildings. In theory, due to capillary movement of water, water rises from the earth to the building.

b. write short notes on building foundations

FOUNDATION

The foundation is he lower portion of the building, usually located below the ground level, which transmit the load of super structure to sub soil

Functions of foundation

- Reduction of load intensity
- Even distribution of load
- Provision of level surface
- Lateral stability

- Safety against undermining
- Protection against soil movements

Types of foundation

- Shallow foundation
- Deep foundation

Shallow foundation

If the depth of foundation is less than or equal to width of foundation it is called as shallow foundation

Types of shallow foundation

- Spread footing
- Combined footing
- Strap footing
- Mat foundation

c. difference between scaffolding, shuttering and framework

Scaffolding, formwork can be permanent or temporary mouldings or casings, used to support wet concrete until it is hard enough to support its own weight. In a nutshell, formwork is required for concrete structures such as columns, walls and concrete slabs, whereas scaffolding is used for access around a building.

SCAFFOLDING:

Scaffolding is a temporary framework having platforms at different level of a structure which enables the masons/labor for working at the height. They are usually used for activities such as plastering, painting, brickwork at heights etc.

SHUTTERING/FORMWORK:

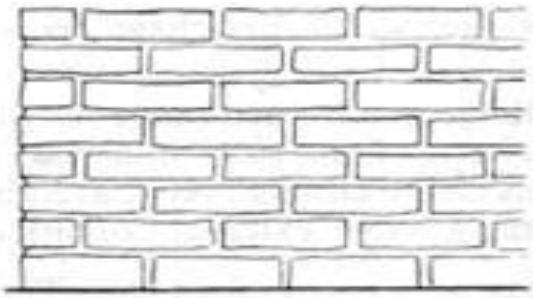
Formwork is a temporary structure used as a mold in which fresh concrete are poured to cast the members of the structure at the site. It is also known as false work or shuttering. In the context of concrete construction, the false work supports the shuttering molds for example column sides, beam sides, slab side, wall side etc.

Framework:

Part of the formwork which supports the horizontal surface is called centering for example slab bottom, beam bottom etc.

5. Describe different types of bond in brick masonry? Explain in detail. (April/May 2019,Nov/Dec2015, Nov/Dec2016)

Stretcher bond



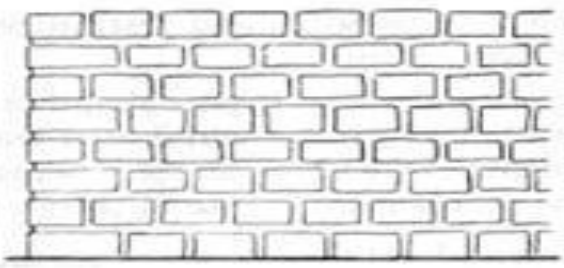
STRETCHING BOND.

The length of the brick its along with the face of the wall. This pattern which have thickness of half brick. For higher thickness walls, this practicable.

Header bond

The width of the bricks are thus along the direction of the wall.

This pattern is used only when the thickness of the wall is equal to one brick. This is also suitable for the construction of curved wall and footings for better load distributions.



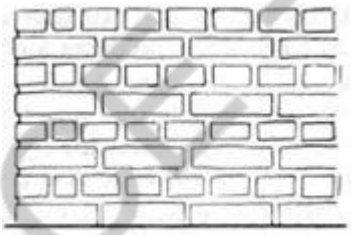
HEADING BOND.

English bond

1. It is the most commonly used method this bond is considered to be the strongest.
2. This bond consists of alternate course of stretchers and headers. It is necessary to place queen closers after the first header in the heading course for breaking the joints vertically.
3. Alternative courses will show either headers or stretchers in elevation

4.Every alternative header comes centrally over the joint between two stretchers in course in below

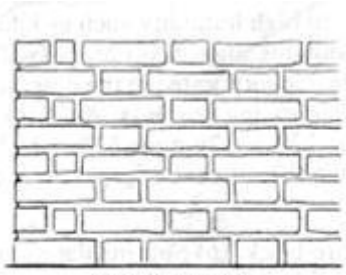
5.Since the number of vertical joint in the header course twice the number of vertical joints in stretcher course, the joints in the header course are made thinner than the joints in the stretcher course.



ENGLISH BOND.

Flemish bond

In this type of course is comprised of alternative headers and stretchers are laid to each course. This bond is better in appearance than the English Bond.



FLEMISH BOND.

Facing bond

This bond is used where the bricks of different thickness are to be used in the facing and backing of the wall

The nominal thickness of facing brick is 10 cm and that of backing bricks is 9 cm the header course tis provided at a vertical interval of 90 cm

Dutch Bond

This type of bond is a modified form of English Bond. The corners of the wall provided with Dutch bond are quite strong.

The alternate courses in this type of bond are headers and stretchers.

Raking Bond.

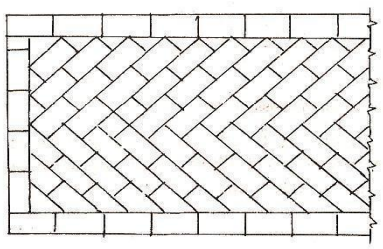
In this type of bond alternate couses are placed in different directions to get maximum strength in the wall.

The raking courses are laid at certain intervals along the height of the wall in very thick walls having number of headers more than the numbers of stretchers in between facing and backing.

The raking bond can be classified as two types. Herring bone bond. Diagonal bond.

Herring Bone bond.

In this bond, the bricks are places at an angle of 45^0 from the central line in both the directions. This type of bond is used in case of walls having thickness more than four bricks or for paving, etc.



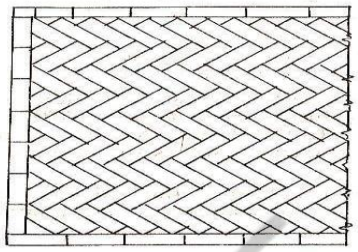
Plan showing arrangement of bricks in Herring-bone bond.

Diagonal Bond

In this type of bond bricks are laid at every fifth or seventh course along the height of the wall. Internal placing of the bricks is made in one direction only at certain angle , after the face bricks are laid.

Zigzag Bond

This type of bond is very much similar to herring bone bond. The only difference in this type of bond is that the bricks are laid in zigzag way. This method is generally useful for paving the brick floor**.**



Zig-Zag Bond - Plan

6. **What is meant by scaffolding? Mention its components and types. (April/May 2019,Nov/Dec 2011,Nov/Dec2014)**

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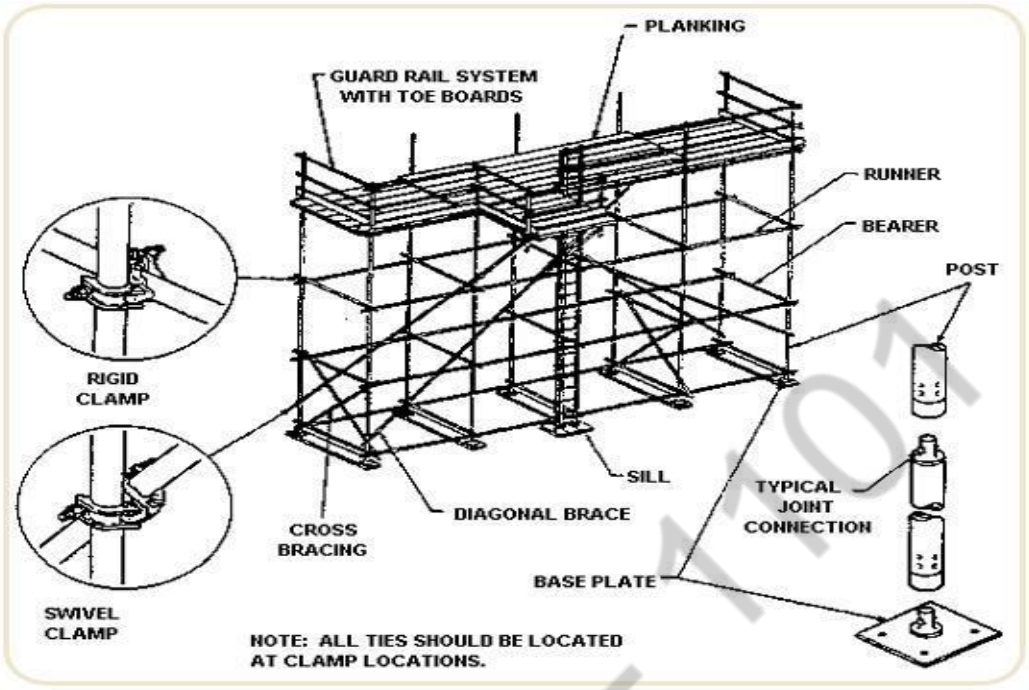

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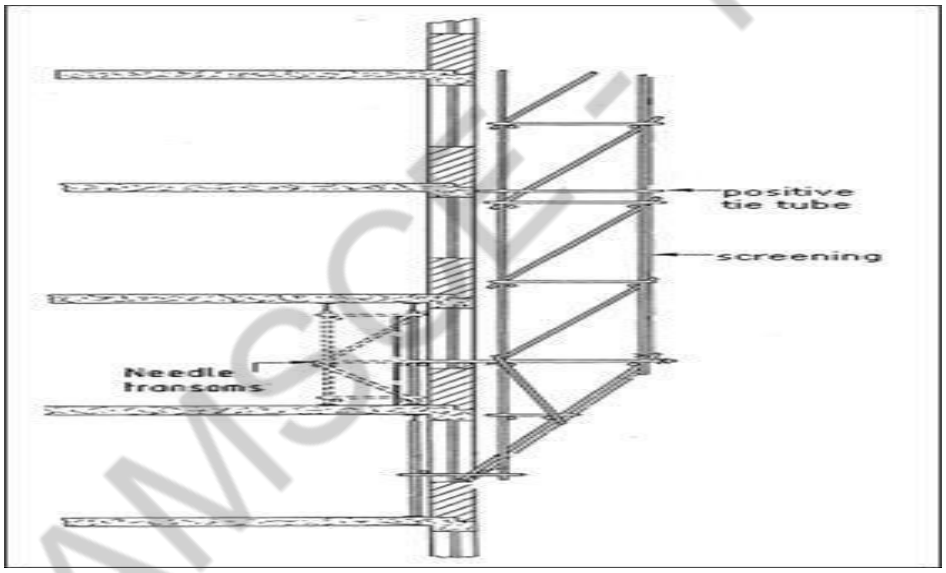


Suspended scaffolding

It is the light weight scaffolding used for repair works such as pointing, painting etc

The working platforms are suspended from roofs by means of wire ropes or chains etc

Trestle scaffolding

Such type of scaffoldings are used for painting and repairing work inside the room up to a height of 5m

The working platform is supported over the top of movable contrivances such as tripods ladders etc

Steel scaffolding

Steel scaffolding is practically similar to the timber scaffolding, here wooden members are replaced by steel couplets are fittings

Such scaffolding can be erected and dismantled rapidly

It has a greater strength and greater durability

Patented scaffolding

Many patented scaffolding made of steel are available in the market

Thos scaffoldings are equipped with special couplings frames etc

7. **Explain the different types of stone masonry with neat sketches. (Nov/Dec2017,May/June2012,May/June2013,Nov/Dec2013, Nov/Dec2015)**

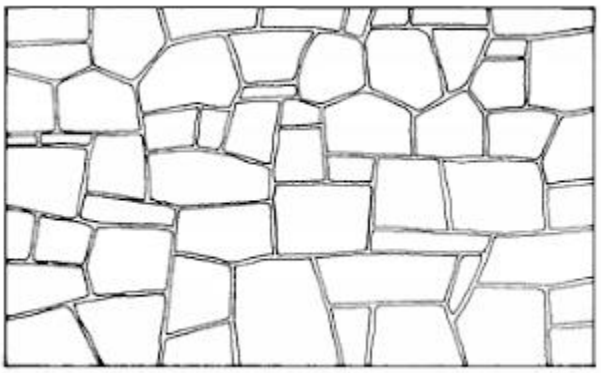
Stone is hard non-metallic mineral matter of which rock is made of. It has no definite shape but it is mixture of two or more minerals bonded together. It has been used for construction since ancient time. Masonry is building of structures from individual units which are often laid and bound together using mortar. So when the stone is used as a unit with other materials as mortar then it is called stone masonry.

Types of stone masonry:

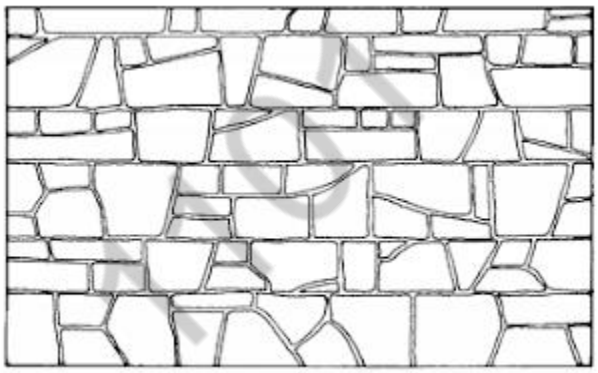
A) Rubble Masonry:

In Rubble masonry the stones used are either undressed or comparatively roughly dressed. The masonry has wide joints since stones of irregular shapes are used.

i) Random rubble



Random Rubble



Coursed Rubble

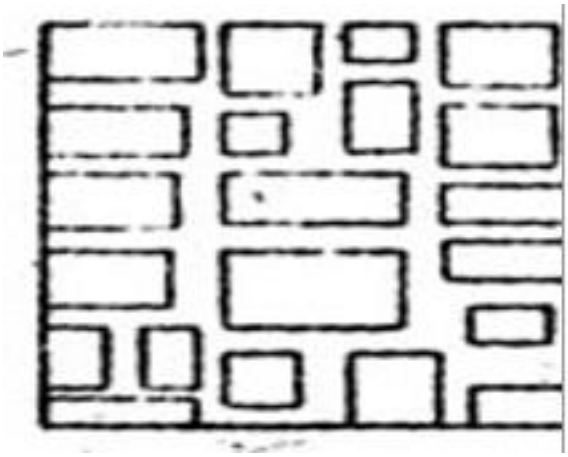
a. Un-coursed (Random Rubble)

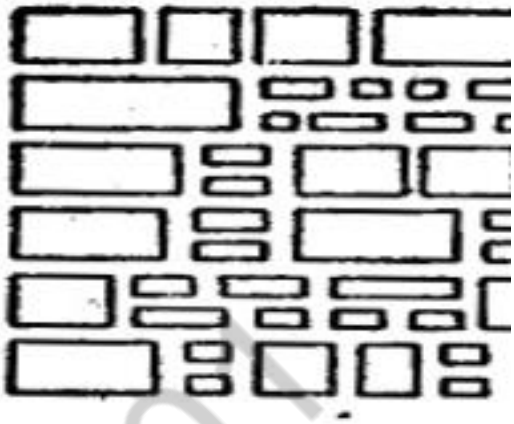
It is the roughest and the cheapest form of stone walling. Since stones are not uniform shape and size, they are arranged with great care so as to distribute pressure over maximum area and at the same time avoid long vertical joints.

b. Built to course (Coursed Rubble)

It is similar to un-coursed except that the work is roughly levelled up to form courses 30-45 cm thick and not less than 15 cm.

ii) Square rubble





a. Un-coursed

Stones having straight beds and sides are arranged in irregular pattern to give good appearance and avoid the formation of long, continuous joints.

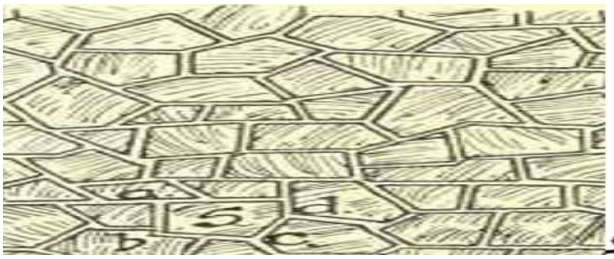
b. Built to Course

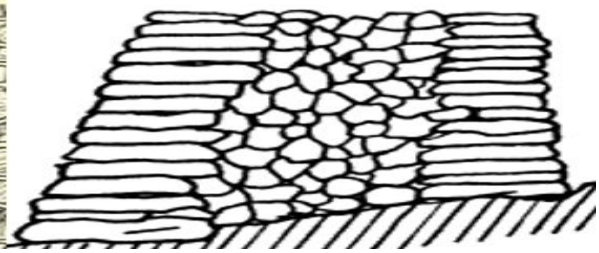
Stones having straight bed and sides are levelled up to form courses of varying depth.

c. Regular Course

Stones having straight beds and sides are levelled up to form courses of varying depth but the height of stones in each course, is the same.

iii) Miscellaneous type





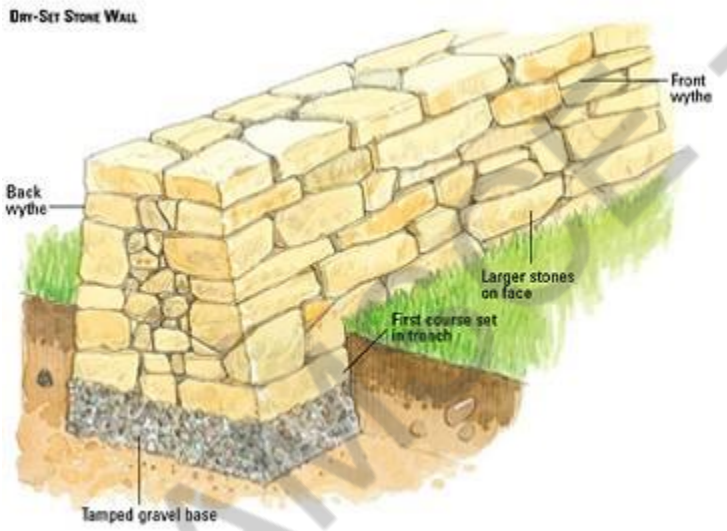
a. **Polygonal rubble masonry**

In this type, stone is hammer finished on face to an irregular polygonal shape. If stones are roughly shaped to form rough fitting, such a work is called rough picked form and if they are carefully shaped to form close fitting then it is called close-picked form.

b. Flint rubble masonry

In this type, flints or cobbles which vary in width and thickness from 7.5 cm to 15 cm and length from 15 cm to 30 cm are used. The stones are extremely hard but brittle. Strength of such walls can be increased using lacing course of thing long stones or bricks at 1 to 2 m vertical intervals.

iv) Dry rubble masonry

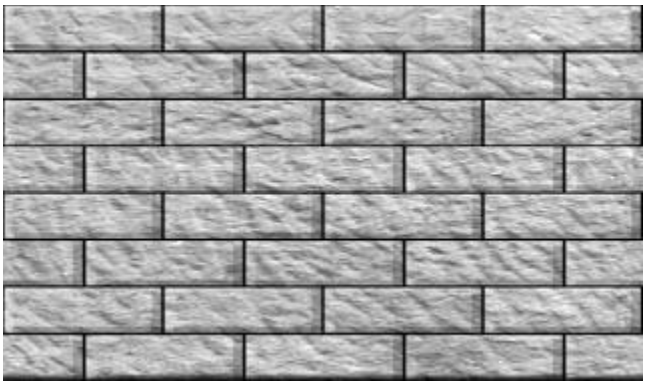


In this masonry, mortar is not used in the joints, so it is the cheapest but requires more skill in construction. It is mostly used for non-load bearing walls like compound walls.

B) Ashlar Masonry:

In this masonry, square or rectangular blocks that are used are dressed and have extremely fine bed and end joints.

i) Ashlar fine tooled



It is the finest stone masonry. The bed, joints and faces of the stones are chisel dressed to remove all unevenness and obtain perfectly horizontal and vertical joints.

ii) Ashlar rough tooled

The beds and sides are finely chisel dressed but the exposed face is dressed by rough tooling.

iii) Ashlar rock faced

The exposed face of the stones is not dressed but is kept as such to give rough facing.

iv) Ashlar chamfered

It is special type of ashlar rock faced in which the strip provided around the perimeter of the exposed face is chamfered at an angle of 45 degree to a depth of 25 mm.

v) Ashlar block in course

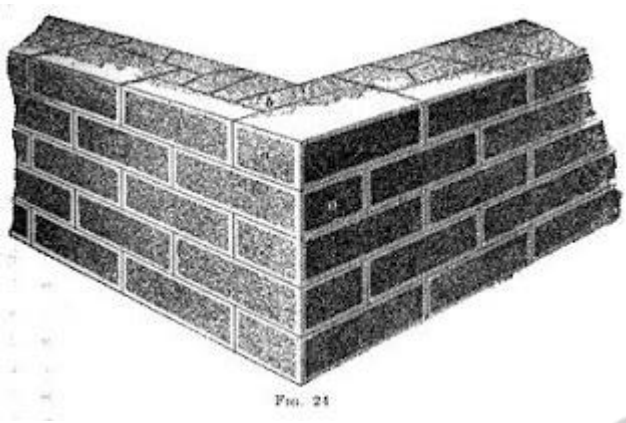


FIG. 24

It is an intermediate between ashlar and rubble masonry. Faces of each stone are hammer dressed but the vertical joints are not as straight and fine as in ashlar masonry.

vi) Ashlar facing

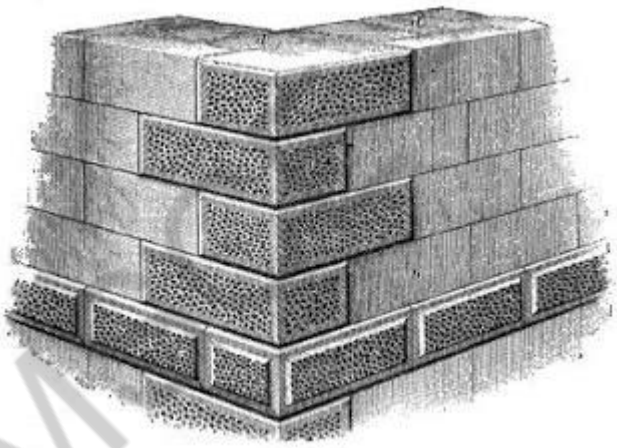


FIG. 26

It is provided along with brick or concrete block to give better appearance. The exposed faces of the stone are rough tooled and chamfered

8. **Explain the different types of joints used in construction building**. (**Nov/Dec2016)**

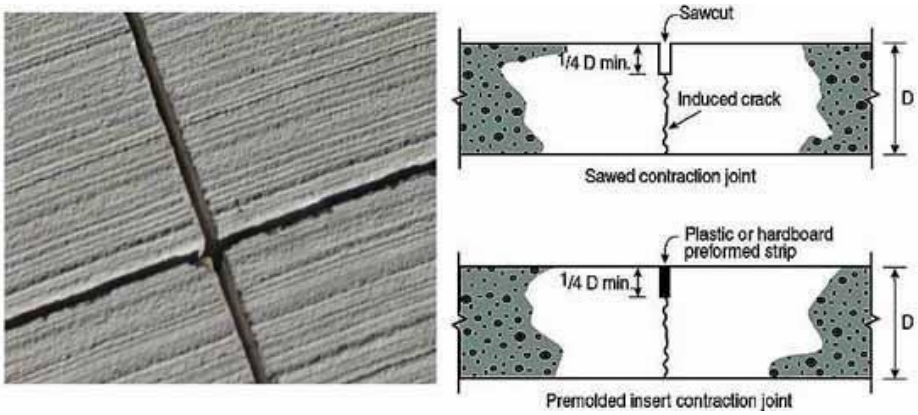
Contraction Joints or Control Joints

Control Joints (often confused with expansion joints) are cuts or grooves made in concrete or asphalt at regular intervals. These joints are made at locations where there are chances of cracks or where the concentration of stresses are expected, so that when a concrete does crack, the location will be known to you. In such a way a concrete will not crack randomly but in a straight line (i.e. control joint). In other words Contraction or Control Joints are Pre-Planned Cracks. The cracks may be due to temperature variations or drying shrinkage or other reasons.

Joints depth should be 25% of the depth of the slab. For instance a 4" thick slab should have 1" deep cut. Joints Interval (taken in feet) should not be more than 2 - 3 times the slab thickness (in inches). Let say a 6" slab should have joints 2 x 6=12 to 3 x 6 = 18 feet apart. For fresh concrete grooving tools are used while saw is used for hardened concrete.

The joints introduced in concrete structures to localize shrinkage movements are known as **contraction joints.** The contraction joints are in the form of separations or planes of weakness.

The function of these joints is to localize shrinkage movements which would otherwise lead unsightly cracks.



Construction Joints

- The joints provided at locations where construction stops for any reason and when their location does not coincide with that of expansion or contraction joints are called construction joints.
- These joints are constructed in a similar manner as contraction joints but these joints are not intended to accommodate movement due to contraction.
- Every effort should be made to prevent movement occurring at such joints. However, extra care may be taken to obtain a good bond between abutting sections of concrete
- Since, cracks frequently develop at these joints as a result of stresses arising from variations in temperature, moisture content or loading, therefore, it is most desirable that construction joints should coincide with expansion or contraction joints wherever possible.
- The function of these joints is to simplify the construction of a structure.
- Construction joints in floor should be located in the middle of spans of slabs, beams or girders unless a beam intersects the girder at this point in which case the joints in the girders are provided at a distance equal to twice the width of beam.
- Adequate provision should be made for shear by use of inclined reinforcement.
- Joints in column should be made at the underside of the floor.

Unintentional provision may occur due to

- Unexpected shortage of material
- Equipment Failure
- Bad weather.

9. **Explain the sequence of activities and co- ordination in construction.(NOV/DEC 2017)**

Sequence of activities and construction co-ordination

Planning

- Planning is considered as a precondition measures before attending any development program
- Particularly planning is more important in the following area
- When the funds available are limited the total requirement is much higher

Sequence of operation

- It is always desirable to divide large projects into several construction stages
- For prepare progress of construction each stage may be constructed under separate contraction It should be carried out in the proper method and arrangement
- Before starting to construct the structure we must go for the sequence of operation in the project it is better way o arrange the labour material and equipment

Following are the sequence of operation in a highway project

- Site clearance
- Earth work for laying embankment
- Construction of drainage works
- Construction of pavement structures Installation of light poles and road signal

MARKING, SETTING OUT OF FOUNDATION

Setting out is the process of laying down the excavation lines and centre lines on the ground before excavation is started after the foundation design is done

- For setting out the foundation of a small building the centre line of the longest outer wall of the building is first marked on the ground by stretching a string between wooden or mild steel pegs driven at the ends
- Two pegs one on either from the central peg are driven at the each end of the line

- Each peg is equidistant from the central peg and the distance between the outer pegs
- corresponds to the width of foundation trench to be excavated. Each peg may be projected about 25 to 50 mm above ground level may be driven at a distance of 2m from the edge of excavation
- When the string is stretched joining the corresponding pegs at the two extremities of the line the boundary of the trench to be excavated can be marked on the ground with dry lime powders
- A right angle can be set out b forming 3, 4 and 5 units long
- The centre line of the other wall which is perpendicular to the long wall can be marked by setting out right angles
- All the specifications are made by tape or prismatic compass may be used for setting out right angles
- Similarly outer lines of the foundation trench of each cross wall can be set out
- For big project reference pillars of masonry is constructed first, these pillars may be about 20cm thick and 15cm wider than the width of the foundation

EXCAVATION

Excavation of foundation can be done by manually or with the help of special mechanical equipments

Manually it can be done by the help of following equipments

- Spade
- Phawrah
- Pick axe
- Crowbar
- Rammer
- Boning rod

- Sledgehammer
- Basket
- Iron pan
- line and pins

Mechanically the excavation can be done by the help of following machineries

- Boom bucket dipper handle
- Trench
- Chain mounted buckets

- Raking cut
  - Vertical cut

10. Explain in detail the slip form technique used in construction. (NOV/DEC 2018)

Slip form

Slip form is similar in nature and application to jump form, but the formwork is raised vertically in a continuous process. It is a method of vertically extruding a reinforced concrete section and is suitable for construction of core walls in high-rise structures – lift shafts, stair shafts, towers, etc. It is a self-contained formwork system and can require little crane time during construction.

This is a formwork system which can be used to form any regular shape or core. The formwork rises continuously, at a rate of about 300mm per hour, supporting itself on the core and not relying on support or access from other parts of the building or permanent works.

Commonly, the formwork has three platforms. The upper platform acts as a storage and distribution area while the middle platform, which is the main working platform, is at the top of the poured concrete level. The lower platform provides access for concrete finishing.

Benefits

- Careful planning of construction process can achieve high production rates
- Slip form does not require the crane to move upwards, minimizing crane use.
- Since the formwork operates independently, formation of the core in advance of the rest of the structure takes it off the critical path – enhancing main structure stability.
- Availability of the different working platforms in the formwork system allows the exposed concrete at the bottom of the rising formwork to be finished, making it an integral part of the construction process.
- Certain formwork systems permit construction of tapered cores and towers.
- Slip form systems require a small but highly skilled workforce on site.

Safety

- Working platforms, guard rails, ladders and wind shields are normally built into the completed system.
- Less congested construction site due to minimal scaffolding and temporary works.
- Completed formwork assembly is robust.
  - Strength of concrete in the wall below must be closely controlled to achieve stability during operation.

- Site operatives can quickly become familiar with health and safety aspects of their job
  - High levels of planning and control mean that health and safety are normally addressed from the beginning of the work.

Other considerations

- This formwork is more economical for buildings more than seven storeys high.
- Little flexibility for change once continuous concreting has begun therefore extensive planning and special detailing are needed.
- Setting rate of the concrete had to be constantly monitored to ensure that it is matched with the speed at which the forms are raised.
- The structure being slip formed should have significant dimensions in both major axes to ensure stability of the system.
- Standby plant and equipment should be available though cold jointing may occasionally

  be necessary.

Slipform construction is a method for building large towers or bridges from concrete. The name refers to the moving form the concrete is poured into, which moves along the project as the previously poured concrete hardens behind it. The technique has also been applied to road construction. The technique was in use by the early 20th century for building silos and grain elevators. Vertical slip form relies on the quick-setting properties of concrete requiring a balance between early strength gain and workability. Concrete needs to be workable enough to be placed to the formwork and strong enough to develop early strength so that the form can slip upwards without any disturbance to the freshly placed concrete.

A notable use of the method was the Skylon Tower in Niagara Falls, Ontario, which was completed in 1965. The technique was soon utilized to build the Inco Super stack in Sudbury, Ontario and the CN Tower in Toronto. It is the most common method for construction of tall buildings in Australia.

From foundation to rooftop of even the very tallest projects, with the system‟s hydraulic jacks, installing steel reinforcement and pouring concrete become much easier and faster, plus can be more efficiently controlled to assure the highest quality finished cement

structure. SLIPFORM technology virtually eliminates unnecessary waste and hazards, making this construction system even more efficient and economical.

- SLIPFORM saves investment
- SLIPFORM saves time
- SLIPFORM saves labor
- SLIPFORM is safety

11. Explain construction of two level underground parking using top down construction method(NOV/DEC 2018)

Conventionally, buildings with underground basements are built by bottom-up method where sub-structure and super-structure floors are constructed sequentially from the bottom of the sub-structure or lowest level of basement to the top of the super-structure. Though this conventional method, also called as bottom-up method, is simple in both design and construction, it is not feasible for the gigantic projects with limited construction time and/or with site constraints. Top-down construction method as the name implies, is a construction method, which builds the permanent structure members of the basement along with the excavation from the top to the bottom. Top-down method is mainly used for two types of urban structures, tall buildings with deep basements and underground structures such as car parks, underpasses and subway stations. In this case the basement floors are constructed as the excavation progresses. The top/down method has been used for deep excavation projects where tieback installation was not feasible and soil movements had to be minimized. Top-down construction method which provides the significant saving of the overall construction time has been adopted for some major projects where time factor is of primary importance. The sequence construction begins with retaining wall installation and then load-bearing elements that will carry the future super-structure. The basement columns (typically steel beams) are constructed before any excavation takes place and rest on the load bearing elements. These load bearing elements are typically concrete barrettes constructed under slurry (or caissons).

PROCEDURE

The typical construction procedure of top down construction is as follows

- Construct the retaining wall.
- Construct piles. Place the steel columns or stanchions where the piles are constructed.
- Proceed to the first stage of excavation.
- Cast the floor slab of first basement level
- Begin to construct the superstructure
- Proceed to the second stage of excavation; cast the floor slab of the second basement level.
- Repeat the same procedure till the desired depth is reached
- Construct the foundation slab and ground beams, etc. Complete the basement
- Keep constructing the superstructure till it gets finished.

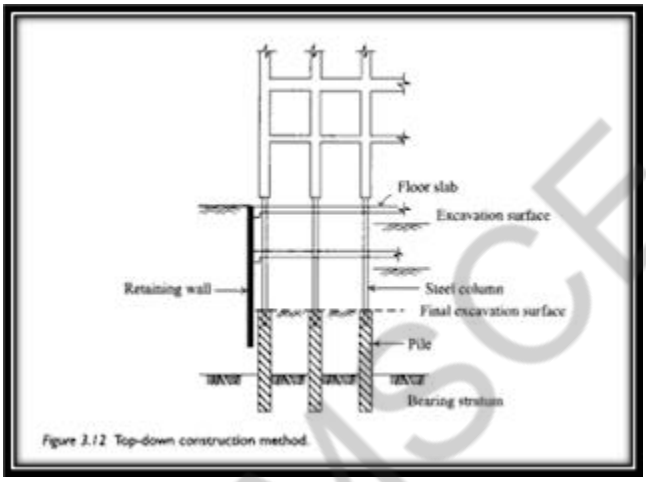
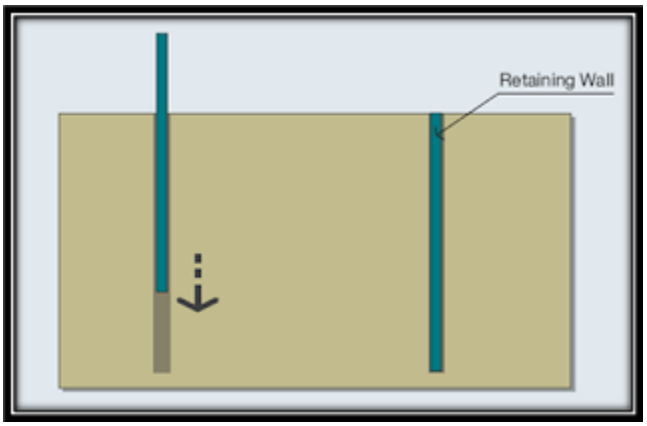


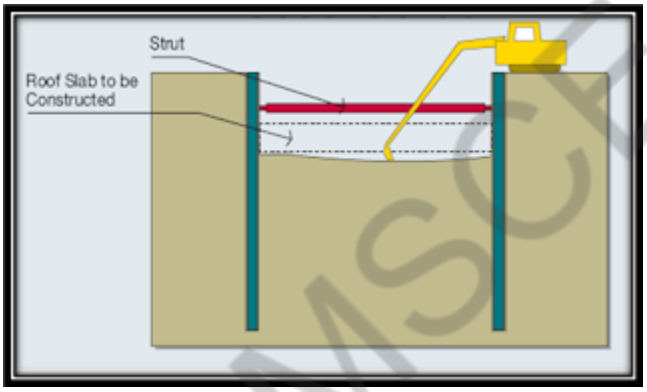
Figure 3.12 Top-down construction method.

INSTALLATION OF RETAINING WALL



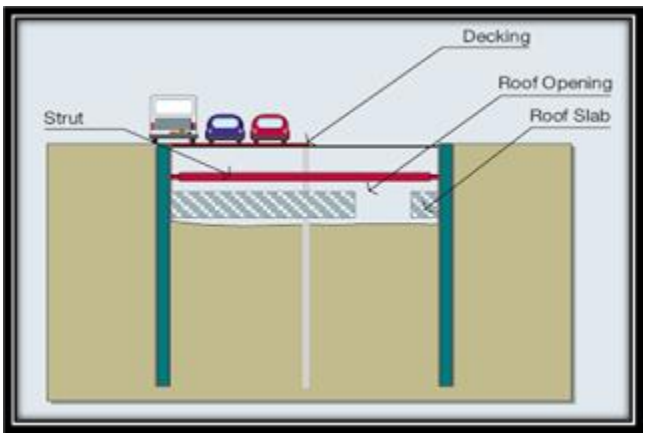
The underground retaining wall which is usually a diaphragm wall, is installed before excavation commences.

Excavation and installation of steel strut



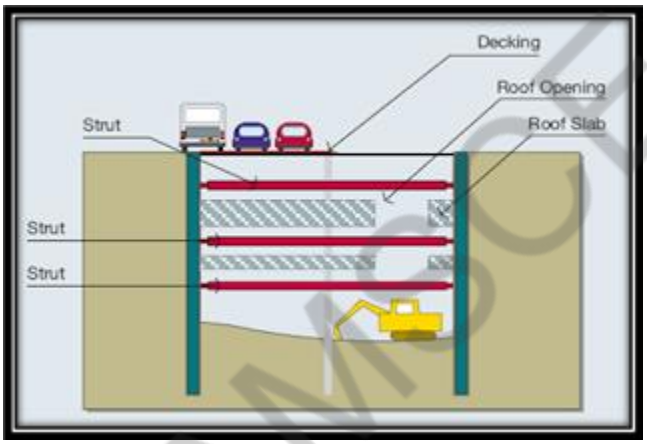
The soil is excavated just below roof slab level of the underground structure. Struts are installed to support the retaining walls, which in turn support the soil at the sides

Construction of underground structure



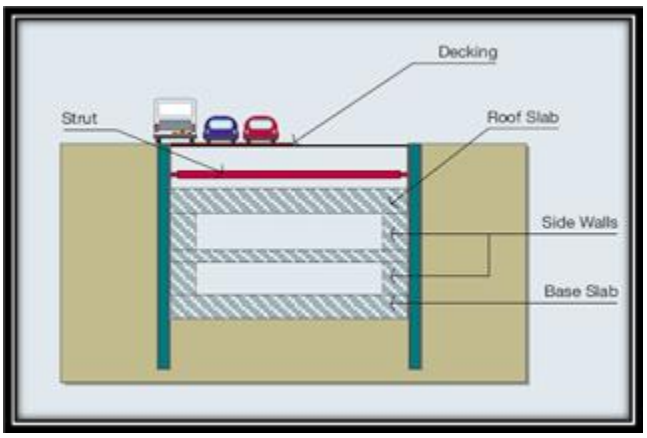
The roof slab is constructed, with access openings provided on the slab for works to proceed downwards. The roof slabs not only provides a massive support across the .

Construction of underground structure



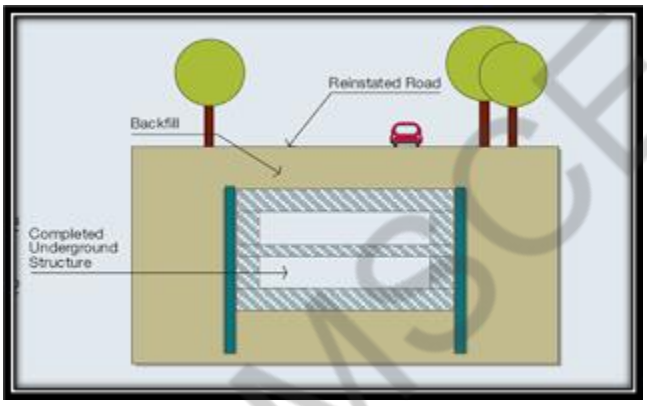
The next level of slab is constructed, and this process progresses downwards till the base slab is completed

Construction of underground structure



The side walls are constructed upwards, followed by removal of the intermediate struts. The access openings on the roof slab are then sealed.

Backfilling and reinstatement



After the underground structure is completed, the soil is backfilled to the top strut level before the strut is removed. This is followed by completely backfilling the top of the underground structure and finally reinstating the surface areas.