

LECTURE NOTE

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ADVANCED CONSTRUCTION TECHNIQUES & EQUIPMENTS



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UNIT-I

1. Definition of pile

The load is transmitted to the soil by driving long vertical members of either timber or concrete or steel called piles.

2. Uses of piles

The live load and dead load coming from the structure is very heavy and its distribution is non-uniform.

The sub soil water table is so high that it can be easily affect the other foundations.

3. LOAD BEARING PILE

The pile which transfers the load from the structure to soil bed of hard stratum is known as load bearing pile.

4. NON-LOAD BEARING PILE

The pile which is not meant for carrying any vertical load but they are driven on the ground either for separating members or stopping seepage of water is known as Non load bearing pile.

5. BEARING PILE (OR) SUSTAINING PILE

The super structure load is transferred through water (or) soft soil directly to a suitable hard stratum below certain depth called bearing pile.

6. FRICTION PILE:

When loose soil extends to a great depth and it is not possible to rest the bottom end of the pile on the hard stratum the super structure load is transferred by the piles through friction developed between the surrounding soil and the surface of the piles. Such a pile is called friction pile.

7. TYPES OF CEMENT CONCRETE PILE

- i) Cast-in-situ piles ii)
Pre cast concrete pile

8.ADVANTAGES OF CAST-IN-SITU CONCRETE PILES:

- There is less wastage of materials as the pile of desired length is only constructed.
- The stresses of handling and driving are completely eliminated and hence no extra reinforcement is provided on such counts.

9.PRE CAST CONCRETE PILES

The pre cast concrete piles are manufactured in factories and then driven in to the ground at the place required. They are square, octagonal or round in cross section.

10.WHAT ARE THE ADVANTAGES OF PRE-CAST CONCRETE PILES

The reinforcement is maintained in the correct position.

The best quality of concrete can be produced for the casting of piles with little care.

11.CLASSIFICATION OF SHEET PILES.

Concrete sheet piles

Steel sheet piles

Timber sheet piles.

12.PILE CAP

Pile caps are provided to a single pile or group of pile to protect the head of piles and also maintain the proper alignment of pile.

13.PILE SHOE

Pile shoes provided at the tips of piles to facilitate the process of driving piles through hard strata. They are made of cast iron or steel plates.

14.METHOD OF PILE LOAD TESTS.

Cyclic load method.

Constant rate of penetration method
Housel's method.

Method of equilibrium.

Each method will now be briefly described.

15.PILE DRIVING

The process of forcing a pile into the ground without any excavation is known as Pile driving . The pile should be driven vertically.

16.PILE FRAME

The frame should be 10 to 25m height and easily transportable. The pile frame consists of a platform on which engine, winches etc, are fitted.

17.PILE HAMMER

Drop hammers
Single acting steam hammers.
Double-acting steam hammers Differential
acting steam hammers.
Diesel hammers.
Vibratory hammers.

18.CAUSES OF FAILURES OF PILES.

Absence of statistical data regarding the nature of strata through which piles are to be driven.
Actual load coming on the pile being more than the designed load.
Attack by insects, etc, on wooden piles, causing there by decay of timber piles.

19.ADMIXTURES

Admixtures are the materials, other than cement, water and aggregate which are added in the preparation of concrete before or during mixing. Admixtures otherwise called additives are used to modify the properties of ordinary concrete to make it more suitable for any situation.

20.CLASSIFICATION OF ADMIXTURES

Work ability agents
Accelerators
Retarders
Water repelling agents
Air entraining agents

21.Accelerators

Accelerating admixtures are added to concrete to increase the rate of early strength development in concrete. However is should not be used in prestressed concrete because of possible steel corrosion of prestressed steel.

22.RETARDERS.

Retarder is an admixture that slows down the chemical process of hydration so that the concrete remains plastic and workable for a longer time. Mostly commonly known retarder is Calcium sulphate. Common sugar is one of the most effective retarding agents.

23.LIGHT WEIGHT CONCRETE.

One of the disadvantage of conventional concrete is the high self weight of concrete density of normal concrete is in the order of 2200 to 2600 kg/m³.

24.LIGHT WEIGHT AGGREGATES

Light weight aggregates can be classified into two categories namely natural light weight aggregates and artificial light weight aggregates.

25.GUNTING (or) SHORT CRETE

Short Crete is motor or very fine concrete deposited by getting it with high velocity on to a prepared surface. In different concrete the name of short Crete are different names such as Blastcrete, Blowcrete, Guncrete, Jct-crete, Nucreat, Pneucrete, Spraycrete, Torkrete and etc., the principle is same.

26.GUNTING

Guniting also known as a dry process shotcrete uses air pressure to convey dry materials from machine through hose to nozzle where water is added.

27.TENDON

A stretched element used in a concrete member of structure to impart prestress to the concrete. Generally high tensile wires, bars cables or strands are used as tendons.

28.PRE-TENSIONING

A method of prestressing concrete in which the tendons are tensioned before the concrete is placed. In this method, the prestress is imparted to concrete by bond between steel and concrete.

29.POST-TENSIONING

A method of prestressing concrete by tensioning the tendons against hardened concrete. In this method the prestress is imparted to concrete to concrete by bearing.

30.METHODS OF PRESTRESSING

Pre tensioned method
Post tensioned method

31.SYSTEM OF PRESTRESSING

Freyssinet system

Magnet balton system

Lee-McCall system

32.TYPES OF POLYMER CONCRETE

Polymer impregnated concrete (PIC)

Polymer cement concrete (PCC)

Polymer concrete (PC)

Partially impregnated and surface coated polymer concrete.

UNIT-II

1.PRE FABRICATED SYSTEM

Prefabrication is the practice of assembling components of a structure in a factory or other manufacturing site, and transporting complete assemblies or sub-assemblies to the construction site where the structure is to be located.

2.ADVANTAGES AND DISADVANTAGES OF PREFABRICATION SYSTEM

ADVANTAGES

Self-supporting readymade components are used, so the need for formwork, shuttering and scaffolding is greatly reduced.

Construction time is reduced and buildings are completed sooner, allowing an earlier return of the capital invested.

3.DISADVANTAGES:

Leaks can form at joints in prefabricated components.

Transportation costs may be higher for voluminous of which they are made, which can often be packed more efficiently.

4.PREFABRICATED BUILDING

This is a type of building that consists of several factory built components or units that are assembled on-site to complete the unit.

5.MODULE

Module is a unit of size used in dimensional co-ordination, where unit is the building material formed as a simple article with all three dimensions specified complete in it but intended to be a part of a compound unit or complete building. Examples are brick block, tile etc.

6.COMPOSITE MEMBERS

These are structural members comprising prefabricated structural units of steel, prestressed concrete or reinforced concrete and cast-in-situ concrete connected together in such a manner that they act monolithically.

7.MODULAR COORDINATION SYSTEM

Modular coordination is the new procedure for integrating the size of the building materials and components so that the assembly may be simplified as per the basic module. $M=10$. It is the technique dimension system.

8.PLANNING MODULES GRID

A rectangular co-ordinate reference system in which the distance between consecutive lines is the basic, module or multimodule. This multimodule may differ for each of the two dimensions of the grid.

9.MODULE FOR COMPONENTS

Flooring scheme, Beams, Columns, Walls, Stair case, Lintel, Sunshade. **10.WALLS**

Thickness-the nominal thickness of the walls shall be in multiples of $M/4$.

11.PRE FABRICATION METHODS

- Intensified usage of spaces
- Straight and simple walling scheme
- Limited sizes and numbers of components.
- Limited opening in bearing wall

12.TYPES OF PREFABRICATED BUILDING

- Open prefab system
- Partial prefab open system
- Full prefab system
- Large panel prefab system

13.LOAD BEARING WALL TYPE

- Cross wall system
- Longitudinal wall system

14.FEASIBILITY

The feasibility of a joint shall be determined by its load-carrying capacity in the particular situation in which the joint is to function.

15.PRACTICABILITY

Practicability of joint shall be determined by the amount and the type of the material required in construction; cost of material, fabrication and erection and the time for fabrication and erection.

16.SERVICEABILITY

Serviceability shall be determined by the joints, expected behavior to repeated or possible over loading and exposure to climatic or chemical conditions.

17.REQUIREMENTS OF AN IDEAL STRUCTURAL JOINT

It shall be capable of being designed to Transfer the imposed load and moments with a known of margin of safety

It shall accommodate the tolerances in elements.

18.PROCESS OF PREFABRICATION

Main process

Auxiliary process

Subsidiary process

19.STAGES OF PRECASTING

The various stages of precasting can be classified as in Table 1 on the basics of the machine complexes required for the various stages. This permits mechanized and rationalization of work in various stages.

20.MOULD

Moulds for the manufacture of precast elements may be of steel, timber, concrete and plastic or a combination method.

21.CURING

The curing of the prefabricated elements can be effected by the normal methods of curing by sprinkling water and keeping the elements moist.

22.STEAM CURING

The steam curing of concrete products shall take place under tarpaulin in tents, under hoods, under chambers in tunnels or in special autoclaves. The steam shall have a uniform quality throughout the length of the member.

23.PREFABRICATION METHODS

Individual methods

Battery form method
Tilting mould method
Flow line production method
Extrusion method

24.HANDLING ARRANGEMENT

Lifting and handling positions shall be clearly defined particularly where these sections are critical. Special facilities such as bolt holes or projecting loops shall be provided in the units and full instructions supplied for handling.

25.TRANSPORT

Transport of precast elements inside the factory and site of erection is of considerable importance not only from the point of view of economy but also from the point of view design and efficient management.

26.ERECTION

In the erection of elements all the following items of work are meant to be included. Slinging of precast elements.trying up of erection ropes connecting to erection hooks.

27.EQUIPMENTS OF PREFABRICATED.

Concrete mixing machines
Concrete vibrating machines
Bar straightening, bending and welding machines to make reinforcement cages.

UNIT III

FIRE PROTECTION IN BUILDINGS AND EARTH QUAKE RESISTING CONSTRUCTION

ONE MARK:

1. Causes and Effects of Fire: □ Smoking in unauthorized places and disregarding carelessly the lighted ends of the cigarettes and matches.
 - Heating and cooking equipment.

- Children playing with matches.
- Open flames and sparks.

2. Fire Hazards

- The fire hazards are of the following three types
- Exposure hazard
- Internal hazard
- Personal hazard

3. Fire resisting properties of common building materials

- Stone
- Brick
- Timber
- Cast-iron
- Glass
- Steel □ Wrought iron
- Aluminum

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Asbestos Cement

- Concrete

4. Fire Protection system

- Automatic sprinkler system
- Carbon dioxide system
- Dry chemical system
- Foam system

5. Strong room □ This type of construction is adopted to protect important documents, wealth, currency notes etc ., from fire and from thieves.

6. Fire extinguishing system □ Depending upon the importance of the building from the view point of a fire, suitable arrangements are to be made for extinguishing of fire.

7. Earthquake

- Earth quakes are one of the most devastating forces in nature.
- Vibration of earth surface, cause by seismic waves coming from a source of disturbance inside the earth is known as earth quake.

8. Earth s crust □ An earth quake is the vibration , sometimes violent , of earth surface that follows a release of energy in Earth s crust

9. Causes of Earthquake

- Earthquake are mainly caused by

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- Tectonic activity
- Volcanic activity □ Land slides and rock falls
- Rock bursting in a mine
- Nuclear explosions

10. Focus

- In an earthquake the wave emanate from a finite area of rock.
- However , the point from which the waves first emanate or where the fault movement starts is called the earthquake focus or hypocenter

11. Epi focus / Epi centre □ The point on the ground surface just above the focus called epi center.

12. Seismograph □ This is an instrument that records earthquake ground motion in a particular direction as a function of time.

13. Seism scope □ This is the simple seismograph that records earthquake ground motion on a plate without time marks.

- Thus it enables one to find out the peak motion but not the time history of ground motion.

14. Seismometer

A seismograph consists of a pendulum (sensor), a recording system and a chronograph.

The pendulum or sensor part of the seismograph is called seismometer.

- 15. Seismogram** □ It is a record, i.e ., time versus amplitude ,of ground motion recorded by seismograph .
- 16. Seismic forces** □ Earthquake consists of various forms of waves originating at centre of disturbance and causing horizontal and vertical ground movements or vibrations.
- The movement is complicated due to forced and superimposed vibrations.
- 17. Expansion joints** □ The expansion joints are provided in slabs wherever considered essential to prevent local cracking.

UNIT IV

MAINTENANCE AND REHABILITATION OF BUILDINGS

ONE MARK.

1. Demolition of buildings
 - Demolition means dismantling, razing, destroying or wrecking any building or structure or any part thereof by pre-planned and controlled methods.
2. Trusses
 - Under normal circumstances, hinged or pin-jointed structures are braced structures.
 - Temporary supports shall be provided if bracings are removed.
3. Catch Plat Form.
 - Catch Platform is a temporary structure erected on top of the covered walkway or underneath the structures that are being demolished including, but not limited to, balconies and

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cantilevered structures for the purpose of catching and retaining debris and to protect the area beneath such structures being demolished.

4. Repairs to building.

- Repair is the technical aspect of rehabilitation
- It refers to modification of a structure partly or wholly which is damaged in appearance or serviceability

5. Cracks.

- Occurrence of cracks in building is quite common.
- They develop in a building component whenever stress in the component exceeds its strength.

6. Hair Crack.

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Hair cracks are barely visible to naked eye.

They are about 0.01 mm in width.

These occur as due to the usual causes like internal or external stresses

7. Structural Crack

- Structural cracks may arise due to various reasons such as incorrect design, over loading of the structural components or other similar factors.
- Examples of structural cracks are: cracks in foundation walls, beam, columns, slabs etc.,

8. R.C.C Beams or Pillars.

- R.C.C columns undergo shortening due to elastic deformation and creep resulting in vertical cracks appearing at the junction of column with masonry as shown.

9. Repairs.

- The repair of concrete structures may vary between a cosmetic treatment and a total replacement.
- An appropriate repair method can be selected depending upon the cause and extent of damage, importance of the structural element and its location.

10. Stage of concrete repair.

- Removal of damaged concrete.
- Pretreatment of surface and reinforcement.
- Application of repair material.

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- Restoring the integrity of individual section and strengthening of structure as a whole.

11. What are methods of repair?

- On observation crack can be of the following types:

Dormant cracks

Active cracks

Growing cracks

12. What is dormant cracks

- Dormant cracks are caused by some event in the past for e.g. drying shrinkage which is not expected to recur.
- They may remain constant and may be repaired by filling them with a rigid material.

13. What is active cracks

- Active cracks do not remain constant in width, but open and close as the structure is loaded, or due to thermal and hydra changes in the concrete.

14. What is growing cracks

- Growing cracks increase in width either due to continuous settlement in foundation or reinforcement corrosion.

15. What are repair depending on the above type of cracks

- Resin injection
- Routing and sealing
- Stitching

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- External stressing
- Bonding
- Blanketing
- Overlays □ Dry pack
- Vacuum impregnation
- Polymer impregnation
- Autogenously healing
- Flexible sealing

Drilling and plugging

Bandaging

Coating

- Grinding
- Sand blasting
- Resurfacing
- Acid etching
- Caulking

16. What is mechanical demolition

- Mechanical demolition generally involves the use of large machinery with attachment to dismantle the building from outside.

17. Name some materials used for filling cracks

- Structural epoxy pouring resin for cracks over 15mm wide.

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- Epoxy primer and epoxy moldable putty for fine to medium cracks i.e. hairline to 15mm wide.
- Premixed cement concrete or mortars.
- Polymer modified mortars and concrete.

18. What is rehabilitation

- Rehabilitation of buildings is the process of restoring i.e. bringing back the partly damage or affected structure to service level, it once had and now lost.

