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* Foundation :-

A foundation is a structural element that transfer loads from a building or structure to the earth, provide a solid base for support it is a critical component of a building design. Insuring stability, safety and durability.

↳ Purposes of foundation :-

- (i) Transfer load
- (ii) provide stability
- (iii) support
- (iv) prevent soil settlement
- (v) protection against factor

* Classification of foundation :-

(i) shallow foundation :-

- a) isolated footing
- b) spread footing
- c) combine footing
- d) slab footing
- e) raft footing

2.1 Deep foundation :-

- a. Pile foundation and its types
- b. Caisson foundation

(i) Shallow foundation :-

A shallow foundation is a type foundation that transferred loads to the soil at a relatively shallow depth typically less than 2 m.

(a) isolated footing :-

An isolated footing is a type of shallow foundation that consist of a single footing that support are single column or load.

(b) spread footing :-

A spread footing is a type of a shallow foundation that consist of a footing that spread out from the column or wall to distribute the load.

(c) Combine footing :-

A combine footing is a type of shallow foundation that consist two

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or more footing that is connected to support multiple column or loads.

(d) Mat foundation :-

A mat foundation is a type of shallow foundation that consists of a thick, solid slab of concrete that covers the entire footprint of the building.

↳ Applications :-

(i) Residential building :-

Shallow foundations are commonly used for residential buildings such as single family homes and apartments.

(ii) Commercial building :-

Shallow foundations can be used for commercial buildings such as office buildings and retail stores.

(iii) Industrial building :-

Shallow foundations can be used for industrial buildings such as warehouses and manufacturing buildings.

Q. Deep foundation :-

A deep foundation is a type of foundation that extends below a shallow soil layers to transfer loads to a deeper, more stable soil or rock layer.

* Types of deep foundation :-

(i) Piles are long, slender columns made of concrete, steel or timber that are driven into the ground to transfer load.

Piers foundation :-

Piers are deep foundation that consist of a column shafted that exchanges from the footing to the bearing layer.

* Caisson foundation :-

Caisson Caisson are water type chamber made of concrete or steel that are sunk into the ground from a deep foundation.

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* Application :

(i) High rise building :

Deep foundation are costing use for highrise buildings, where are load are heavier and soil condition must be less stable.

(ii) Large Commercial building :-

Deep foundation can be use for large commercial building such as shopping centre or office building.

(iii) Industrial facilities :-

Deep foundation can be use for industrial facilities such as power plant manufacturing facilities.

(iv) Bridge construction :-

Where the loads are heavy and soil condition must be less stable.

* Site clearance :

Site clearance refers to the process preparing a construction site for building by removing any obstructions or existing structure the load of site clearance to create a safe and level surface for construction for beings.

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* Steps in site clearance :

- (i) sites inspection
- (ii) Removal of debris
- (iii) Demolition
- (iv) excavation
- (v) grading
- (vi) Environmental remediation
- (vii) Final inspection

* Process of general and deep excavation :-

↳ General excavation :-

- (i) site preparation
- (ii) marking the excavation area
- (iii) Removing top soil
- (iv) Excavation
- (v) hauling away debris
- (vi) Grading
- (vii) Compaction

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* Deep excavation :-

- (i) Building and blasting
- (ii) mechanical excavation
- (iii) Gurnal boring machine
- (iv) cut and covered

* Necessity of shoring :-

Shoring is a necessity component of excavation of construction project insure the stability and safety site.

↳ Necessity :-

- (i) Prevent collabs
- (ii) insure stability
- (iii) Protect adjacent structure
- (iv) Prevent soil erosion
- (v) Provide safety
- (vi) Facilities construction
- (vii) Meets regulatory requirement.

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* Soil Nailing :- Soil nailing is a technique used to stabilize and reinforce soil slopes. It involves excavation and retaining wall in the soil installing nails on roads in the soil to provide additional support and prevent soil movement.

* strutting :- (steel, concrete, timber) strutting refers to the use of horizontal and inclined structural members (struts) to provide additional support and stability to a foundation, wall or other structural element.

* Benefits of strutting :-

- (i) Improve stability
- (ii) Reduce settlement
- (iii) Load Increase load capacity.
- (iv) Cross effective

* Common Application :-

- a) Building foundation
- b) Bridge foundation
- c) Retaining foundation

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dy Foundation repairs

* Excavation :
Excavation is the process of removing soil, rock and other materials from a site to create hole or cavity for construction, mining or other purposes.

* Types of excavation :

- (i) Open excavation
- (ii) trenching excavation
- (iii) Shaft excavation
- (iv) Tunnel excavation

* Application of excavation :

- (i) construction
- (ii) Mining
- (iii) Infrastructure
- (iv) Archaeological excavation

* Equipment use in excavation :

- (i) Backhoe
- (ii) excavators
- (iii) Bulldozers Bulldozers
- (iv) Drilling rigs

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* Process of Dewatering :- Dewatering is the process of removing water from a construction site or other excavation create a dry and stable working environment.

↳ Pre Dewatering activities :-

- (i) site investigation
- (ii) Dewatering Plan
- (iii) Permitting

↳ Dewatering Methods :-

(i) Well Point dewatering

This involves installation a series of well, known as well point along the perimeter of the excavation. Water is pumping from the well to create a cone of depression, allowing excavation to proceed.

(ii) Deep well dewatering :-

This involves drilling well to excess and pumped on ground water. This method is obtained used for large excavation or where the water

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is deeper.

(iii) Eductor dewatering :- This involves using the high velocity to create a vacuum that cross water out of the soil. This method is obtained used for smaller excavation or in area with low probability of soil.

(iv) Sump Pumping :- This involves installing a sump pumping in the excavation to remove water that accumulated.

* Purpose of Anti-termite treatment :- The primary purpose of anti termite is to prevent termite infestation and damage to building structures and other wooden material. Termites are social insect that treat cellulose based material such as wood and can cause significant damage building and other structures.

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* Objectives of ^{Anti} termite treatment :-

- (i) Prevention :-
Prevent termite infestation and damage to building and structure
- (ii) Protection :-
Protection wooden material such as lumber, plywood from termite damage
- (iii) Control :-
control existing termite infestation and prevent further damage.
- (iv) Elimination & Elimination.

* Chemical Used for Anti-termite :-

- (i) Chlorpyrifos :- A broad insecticide used to control termites.
- (ii) Fipronil :- (insecticide and pest)
- (iii) Bifenthrin "

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* Layout Method :-

- (i) Wood treatment
- (ii) trenching
- (iii) Drilling
- (iv) spraying
- (v) foaming

* Foundation in black cotton soil :- Black

cotton is a type of expansive soil that cause significant problems for foundation due to its high shrink / swell potential.

* Challenges of building on black cotton soil :-

- (i) expansive nature
- (ii) Low bearing capacity
- (iii) High settlement.

* Causes :-

(i) High water table :-

A high water table can cause the BCS to expand, leading to foundation movement & damage.

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(i) Rainfall and flooding :- Excessive rainfall & flooding can cause the bcs to expand, leading to foundation movement & damage.

(ii) Poor drainage :- Poor drainage can cause water to accumulated around a foundation leading to expansion bcs and foundation damage.

(iii) Soil erosion :- Soil erosion can cause the bcs become unstable, leading to foundation movement and damage.

(iv) Poor maintenance :- Poor maintenance of a structure and its foundation can lead to foundation failure.

(v) Natural disaster

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* Preventive measure :-

(i) Pre construction measure :-

- (a) soil investigation
- (b) soil stabilization
- (c) foundation design

(ii) Construction measure :-

- (a) Deep foundation
- (b) Raft foundation
- (c) Pile
- (d) soil reinforcement

(iii) Construction method :-

- (a) Regular inspection
- (b) Maintenance
- (c) Water management
- (d) Tree control

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* Plinth Beam :-

A plinth beam is a horizontal beam that is constructed at plinth level. The level at which the foundation meets the super structure) of a building it is typically made of reinforced concrete and its design to transfer the load from the super structure to the foundation.

↳ Functions of Plinth beam :

(i) Load transfer :-

The Plinth beam transfer the load from the super structure to the foundation, helping to distribute the weight evenly.

(ii) Structure integrity :-

The plinth beam provide structural integrity to the building by tying together to foundation, wall and super structure.

(iii) Prevents settlement :-

The Plinth beam helps to prevent settlement of the foundation by distributing the load evenly.

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(i) Provide a level surface :-

The plinth beam provides a level surface for the construction of the superstructure.

* Types of Plinth beam :-

- (i) Reinforced concrete Plinth Beam
- (ii) Steel Plinth Beam
- (iii) Composite Plinth beam

* Grade Beam :-

A grade beam is a type of foundation element that is used to distribute load from a building or structure to the soil typically a horizontal beam that is constructed at near the grade level. (The level of surrounding soil).

* Purposes of grade Beam :-

(i) Load distribution :-

A grade beam distribute loads from the building or structure to the soil, helping to prevent settlement or movement.

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(ii) soil erosion :-

A grade beam provides support to the soil, helping to prevent erosion or settlement.

(iii) Foundation stability :-

A grade beam helps to stabilize the foundation preventing movement or shifting.

* Types of grade beam :-

(i) Reinforced Concrete GIB

(ii) Steel grade Beam

(iii) Composite GIB

Super Structure column beam and their suitability for different structure :-

⇒ Columns and beams are two fundamental component of building structure. Suitability depends on various factor, including the type of structure, loads, environment and architectural design.

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c) Columns :-

Columns are vertical structure elements that transmit loads from the super structure to the foundation they are suitable for high rise building :-

Columns are ideal for high rise buildings as can support every loads and transfer them to the foundation.

(ii) Heavy industrial structure :-

Columns are suitable for heavy industrial structure, such as power plant factories and ware house.

(iii) Long - span - structure :-

Columns can be used to support long span structure such as bridge, auditorium and stadium.

(iv) Long - bearing - wall :-

Columns can use to support long bearing walls in case bear the wall is subjective to heavy loads.

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* Beams :-

Beams are horizontal or sloping structural element support that load from the super structure they are suitable for.

i) Residential buildings :-

Beams are commonly used in residential buildings such as house, apartment.

ii) Commercial buildings :-

Beams are suitable for commercial building such as office building, shopping centre and restaurant, restaurant.

iii) Roof structure :-

Beam are often used in roof structure such as flat roof, pitched and domed roof.

iv) Floor structure :-

Beam can be use to support floor structure such as floor beam & floor slab.

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* Suitability for different structure :

(i) Steel Structure :-

Steel columns at beam as
suitable for steel structure such as steel
framed building bridges and industrial structure.

(ii) Concrete Structure :-

Concrete columns and beams are
suitable for concrete structure such as concrete
buildings bridge and foundation.

(iii) Wooden Structure :-

Wooden columns and beams are
suitable for wooden structure such as
building and houses.

(iv) Composite structure :-

Composite column and beams
made from a combination of materials
such as steel and concrete such as
composite buildings industrial structure and
bridges.

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#. LOAD BEARING WALL :

- A load bearing wall is a wall that support away of a building of structure, including the roof floor wall.
- Load bearing wall are an essential for of a building structural system and play a crucial role in maintaining the building stability & integrity.

*. Types of load building wall :

(i) Solid load bearing wall :

Solid load building wall are made of a single material such as concrete or masonry.

(ii) Cavity load bearing wall :

Cavity load bearing wall consist of wythes (layer) of masonry or concrete separated by a

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(i) Panelized load bearing wall :-

Panelized load bearing wall consist of be pre-fabricated panel made of material such as wood, steel concrete

(ii) Insulated load bearing wall :-

Insulated load bearing wall consist of a load bearing wall with insulation installed in the cavity or within the wall itself.

* Non-load bearing wall :-

A wall non-load bearing wall, also known as partial wall that does not support load from the building structure such as the roof, floor and other wall.

- Non-load bearing wall are typically use to device space within a building provide privacy and enhance the aesthetic appeal of the interior.

* Types of non-load bearing wall :

↳ Partition wall :

Partition wall are non-load bearing wall that divide spaces within a building.

↳ Dry-wall Partition :

Dry wall partition are non-load bearing wall made of dry wall panel

↳ Glass partition :

Glass partition are made of glass panels.

↳ Metal Stud Partition :

Metal stud partition are made of metal studs and dry wall panels.

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* Framed structure :

A framed structure is a type of building construction that used a skeletal frame work of beams and columns to support the building loads. The frame is typically made of material such as steel, concrete wood & its design to transfer load from the building floor wall & roof to the foundation.

* Types of framed structures :

(i) Simple frame :

A basic frame structure with columns and beams that support loads.

(ii) Portal frame :

A frame structure with columns and beams that form a portal shape.

(iii) Rigid frame :

A frame structure with rigid connections between columns and beams.

(iv) Braced frame :

A frame structure with diagonal bracing that provides additional stability.

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* Advantages of frame structure :-

(i) Flexibility :-

Frame structures can be designed to accommodate various building shapes and sizes.

(ii) Strength :-

Frame structures can support heavy loads and withstand natural disasters.

(iii) Durability :-

Frame structures can last for many years with minimal maintenance.

(iv) Cost-effective :-

Frame structures can be more cost-effective than other building methods.

* Disadvantages of frame structure :-

(i) Limited load capacity :-

Frame structure may not be able to support extremely heavy loads.

(ii) Vulnerability to earthquakes :-

Frame structure may be vulnerable to earthquake damage if not designed

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With seismic activity in mind.

(iii) Fire risk :

Frame structures made of combustible materials may be at a risk of fire damage.

(iv) Aesthetics :

Frame structure may not be as visually appealing as other building methods.

* Components of Frame structure :

(i) Columns :

Vertical element that transfer loads from the building to the foundation.

(ii) Beams :

Horizontal element that span between columns and support loads from floors and roofs.

(iii) Floor beams :

Beams that support roof loads and span between columns.

(iv) Roof beams :-

Beams that support roof loads and span between columns.

(v) Foundation :-

The base of the building that transfers load to the ground.

* Main structure of masonry work :-

(i) Structural attribute :-

Strength masonry work provide high compressive strength, making it suitable for load bearing application.

(ii) Durability :-

Masonry work can last for centuries with minimal maintainance.

(iii) Stability :-

Stability masonry work provides stability to the structure, external process like event and earthquake.

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* Functional attributes :-

(i) Thermal Mass :- Masonry work provide thermal mass, helping to regulate indoor temperature and reduce energy.

(ii) Acoustic Insulation :-

Masonry work can provide acoustic insulation, reducing noise transmission and creating a quieter indoor environment.

(iii) Fire resistance :-

Masonry work non-combustible provide fire resistance and reduce the risk of fire spread.

* Sustainability attributes :-

i. Sustainable material

ii. Low maintenance

iii. Long life span

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Technique used in masonry work :-

* Preparation techniques :

- (i) Cleaning and preparing a surface of wall or foundation to insure a strong bond between the masonry units.
- (ii) Laying out the wall insure it is level, plumb and square.
- (iii) Mixing and preparing Mortar to the correct consistency and Proportion.

* Masonry Construction technique :

- (i) Running bond :-
A technique where each of masonry unit is staggered to create a strong and suitable wall.
- (ii) Stretcher bond :-
A technique where each course of masonry unit is laid with the long side of the facing out ward.

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(iii) Header bond :

A technique where each course of masonry unit is laid with the short side of the unit facing out ward.

Major

(iv) English bond :

A technique where each course of masonry unit is laid with alternating header and stretcher.

(v) Flemish bond :

A technique where each course of masonry unit is laid with alternating header and stretcher with the centre over the stretcher.

* Finishing Technique :

(i) Pointing

(ii) Grouting

(iii) Cleaning and silling.

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* Types of masonry works and their suitability

a. Stone Masonry :

Made from natural stone and mortar.

- Suitable for load bearing wall, exterior wall and decorative features.

- Durable fire resistance and static look.

b. Brick masonry :

- Made from bricks and mortar

- Suitable for load bearing wall exterior wall foundation wall

- Durable fire resistance and cost effective

#. Concrete = fine aggregate (sand) + coarse aggregate + water.

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* concrete block and their types :

→ concrete block :

Concrete blocks type of a building material made from concrete it is a mixture of cement, sand, cast aggregate and water.

(i) Solid concrete blocks :

These blocks are made from a single piece of a concrete and a solid throughout. They are often used for load bearing wall and foundation.

(ii) Hollow concrete blocks :

These block have a hollow core, which makes them lighter and more insulating they are often used for non-load bearing wall and partition.

(iii) Cellular concrete blocks :

These block have a cellular structure, which makes them light weight and insulating. They are often used for building wall and partition.

(iv) Aerated concrete blocks :

These blocks are made from a mixture of cement, sand and aerating agent which makes them light weight and insulating. They are often used for building wall and partition.

(v) Paving concrete blocks :

These blocks are made from a mixture of cement, sand and coarse aggregate and a design for paving road sides walk and outdoor surface.

(vi) Retaining wall concrete blocks :

These blocks are design for retaining wall and are often used for engineering project.

(vii) Decorative concrete blocks :

These blocks are made from a mixture of cement, sand and coarse aggregate and a design for decorative purpose and architectural features.

* Partition wall and its type based of material :-

A Partition wall is a non load bearing wall that is used to divide a building or room into separate area. Partition typically used to create separate spaces for different activities such as office, classroom, livingroom.

↳ Types of partition wall :-

→ Brick Partition wall :-

Made from bricks and mortar these wall are durable and can be load bearing.

→ Concrete block partition wall :-

Made from concrete block and mortar these block are durable and can be load bearing.

→ Glass partition wall :-

Made from glass panells and frames these wall are used to create transparent and translucent division.

→ Metal stud partition wall :-

Wall made from metal studs, that wall are light weight and easy to installed.

→ Wooden partition wall :

Made from wooden studs and pannels, these wall are durable and can be used to create decorative division.

→ Acoustic Partition wall :

Made from sound absorbing material such as acoustic pannel and sound proofing material these wall are used to reduce noise level.

→ Modular Partition wall :

Made from pre-fabricated modules these wall are easy to install and can be estamized to meet specific needs.

* Dry wall construction structural glazing :