MODULE 1
CIVIL ENGINEERING & ITS SIGNIFICANCE

Civil Engineering & its Significance

Overview of Civil Engineering: Brief history of Civil Engineering, Relevance of Civil Engineering in the Infrastructural Development of Nation.

Building materials and their significance: Cement, Stones, Bricks, Aggregates, Steel, Concrete and Smart materials.

Structural Elements of a Building: Foundation, Plinth, Lintel, Sunshade, Masonry Wall, Column, Beam, Slab (Definition with simple sketches). Floor area ratio calculations and significance for a residential building.

Civil Engineering is the "**art of directing the great sources of power in nature for the use of convenience of man**"-Royal Charter of Institute of Civil Engineers London.

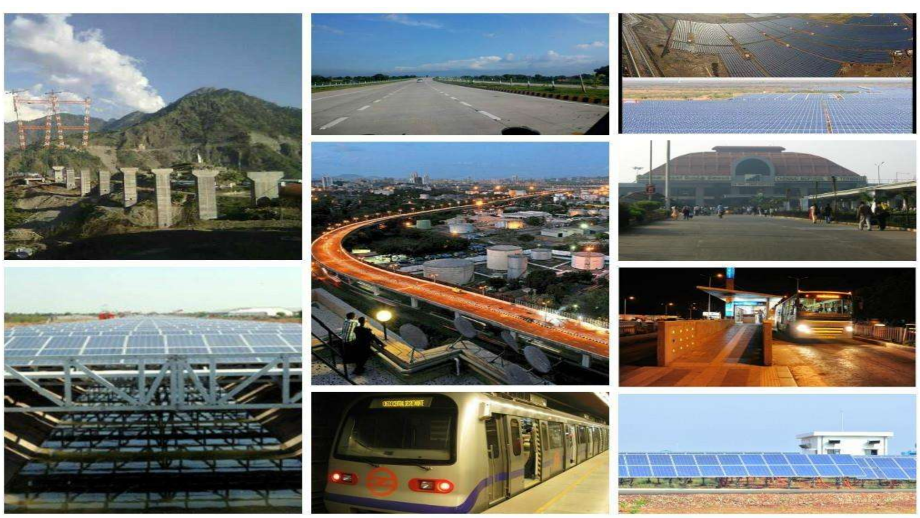
Brief history of Civil Engineering

1) **Prehistoric Era (Before 4000 BC):** Early humans constructed basic shelters using natural materials like wood and stone, marking the beginnings of civil engineering practices, though formal methods were not yet developed.
2) **Ancient Civilizations (4000 - 2000 BC):** In Mesopotamia and Ancient Egypt, the advent of agriculture led humans to settle in one place, resulting in the construction of permanent shelters and infrastructure, such as irrigation systems, while the development of the wheel and sailing improved transportation.
3) **Early Mathematical Contributions (3rd Century BC):** The work of Archimedes laid the foundation for scientific principles in civil engineering, including Archimedes' Principle related to buoyancy and inventions like the Archimedes screw for water lifting.
4) **Indian Contributions (7th Century AD)**: Brahmagupta, an Indian mathematician, utilized arithmetic for excavation volume calculations, significantly contributing to the mathematical tools used in civil engineering.
5) **Medieval Period (5th - 15th Century AD):** Advancements in structural engineering were evident in the construction of castles, cathedrals, and bridges across Europe, with innovations like the arch and the use of masonry.

6) **Renaissance and Enlightenment (15th - 18th Century)**: This period saw a revival of classical knowledge and a surge in engineering innovation, with notable figures like Leonardo da Vinci and Galileo contributing to the understanding of mechanics and materials.
7) **Industrial Revolution (18th - 19th Century)**: Major advancements in materials (e.g., steel and concrete) and construction techniques emerged, leading to the development of large infrastructure projects such as railways, bridges, and skyscrapers.
8) **20th Century:** The field of civil engineering expanded to include various sub-disciplines (e.g., environmental, geotechnical, transportation), with technological advancements like computer- aided design (CAD) transforming engineering practices.
9) **21st Century**: The emphasis is now on sustainability and smart infrastructure, integrating technology with civil engineering. Key focuses include the use of materials like smart concrete and developments in renewable energy and urban planning.

RELEVANCE OF CIVIL ENGINEERING IN THE INFRASTRUCTURAL DEVELOPMENT OF NATION.

Infrastructure can be defined as the physical and organizational structures and facilities like buildings, roads etc. needed for the operation of a society. They are required for the economic development of the country. The infrastructure requirements can be broadly grouped under the following categories: Buildings, Roads, Railways, Bridges, Airports, Dams and Canals, Electric Power Stations, Factories, Industrial Town ships.



The Role of Civil Engineering in Infrastructural Development

1) **Research and Training**: They carry out research and training programs to improve technology and practices within the field.

2) **Planning, Design, and Maintenance**: Civil engineers are responsible for planning, designing, building, supervising, operating, and maintaining infrastructural projects and systems in both public and private sectors

3) **Modern Civilization**: Civil engineering is key to modern civilization, providing essential facilities such as transportation, communication, and irrigation, which are vital for the economic development of a country.

4) **Economic Infrastructure:** Civil engineering directly contributes to economic development through the creation of essential infrastructure.

5) **Social Infrastructure**: It also plays a role in social infrastructure, encompassing education, training, social welfare, housing, and water supply, which indirectly influences economic development.

6) **Urban Planning**: Effective planning of towns and urban extensions is crucial to accommodate fast urbanization and rising land costs, prompting civil engineers to focus on vertical growth and new building technologies.

7) **Rural Development**: Civil engineers address challenges in rural areas, recognizing the need for low-cost housing to help impoverished populations secure affordable homes.

8) **Water Resources Management:** They explore various water resources to ensure a consistent water supply for urban areas and agriculture throughout the year.

9) **Transportation Facilities:** Civil engineers design and construct roadways and transportation systems, which are vital amenities for the public.

10) **Pollution Control:** An essential aspect of civil engineering is managing and controlling pollution affecting air, water, and land.

BUILDING MATERIALS AND SIGNIFICANCE

Building material is material used for construction. Many naturally occurring substances, such as clay, rocks, sand, wood, and even twigs and leaves, have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some are listed below.

CEMENT

Cement is a fine powder made from a combination of limestone, clay, and other minerals. It is a binding material used in construction to bind other materials such as sand, gravel, and water to create concrete, mortar, and other building materials. Cement is a very useful binding material in construction. The applications of cement in various fields of construction have made it a very important civil engineering material.

Uses of Cement

1. It is used in mortar for plastering, masonry work, pointing, etc.
2. It is used for making joints for drains and pipes.
3. It is used for the water-tightness of the structure.
4. It is used in concrete for laying floors, and roofs and constructing lintels, beams, stairs, pillars, etc.
5. It is used for precast pipes manufacturing, piles, fencing posts, etc.
6. It is used in the construction of important engineering structures such as bridges, culverts, dams, tunnels, lighthouses, etc.
7. It is used in the preparation of foundations, watertight floors, footpaths, etc.
8. It is employed for the construction of wells, water tanks, tennis courts, lamp posts, telephone

cabins, roads, etc.

Significance of Cement

- **Strength**: Provides essential strength and durability to concrete and mortar, ensuring structural integrity. The strength of cement varies with its grade; for example, Ordinary Portland Cement (OPC) has grades like Grade 33 with a compressive strength of 33 MPa, Grade 43 with 43 MPa, and Grade 53 with 53 MPa at 28 days
- **Stability**: Helps in forming stable foundations and supports for various constructions.
- **Versatility**: Can be used in a wide range of construction applications, from residential buildings to large infrastructure projects.
- **Longevity**: Contributes to the longevity of structures, allowing them to withstand environmental factors and loads over time.
- **Economic Impact**: Plays a vital role in the construction industry, contributing to economic development and job creation. The global cement industry was valued at approximately ₹34,20,000 crores in 2024, according to Fortune Business Insights. The industry is projected to grow to around ₹44,68,000 crores by 2032, with a compound annual growth rate (CAGR) of 4.3%.

STONE

Stone is a naturally occurring solid substance composed of minerals or mineral-like materials. Natural stones are used as building material include granite, marbles Stone is quarried or mined from the Earth's crust. It is formed through geological processes over millions of years.

Stone was one of the first materials used to make tools and buildings. It is a very sturdy material. It is less affected by weather than wood or brick. Depending on the type of rock, stone weathers away much more slowly. A stone in the river is reshaped by the water and sediment flowing around it. A stone is larger than a grain of sand, gravel or pebbles. A boulder is a large rock or stone.

SIGNIFICANCE OF STONE

- **Aesthetics:** Stones offer a rich variety of colours, textures, and patterns, enabling architects and builders to create visually appealing and unique designs that enhance the overall aesthetics of buildings.
- **Versatility:** Stones find use in both exterior and interior applications, from cladding and facades

to flooring, countertops, and decorative elements, contributing to architectural versatility.

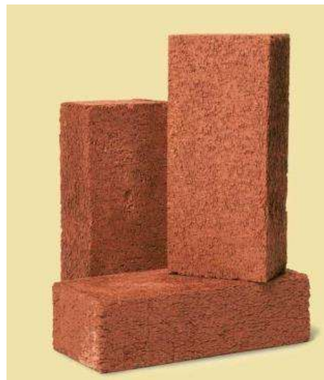
- **Low Maintenance:** Once installed correctly, stones typically require minimal maintenance upto 100 years, reducing long-term upkeep costs for building owners.
- **Fire Resistance:** Natural stones are naturally fire-resistant and do not contribute to the spread of fires, withstand high temperatures (up to around 600 °C to 700°C) maintaining building safety.
- **Sound Insulation:** Some stones, like marble and granite, possess excellent sound insulation properties, making them valuable for noise control within structures. Marble and granite typically possess a Sound Transmission Class (STC) rating of approximately **30-40**, indicating their effectiveness in sound insulation and noise control within structures
- **Environmental Sustainability:** Stones are environmentally sustainable materials, as they are abundant in nature and involve minimal energy-intensive manufacturing processes. Sourcing locally can further reduce environmental impact.
- **Energy Efficiency:** Specific stones, such as granite and marble, have thermal conductivity values ranging from **2.5 to 4.5 W/m·K**, which help regulate indoor temperatures and contribute to energy-efficient building designs..
- **Customization:** Stones can be crafted, shaped, and intricately carved to meet architectural specifications, allowing for customization and artistic expression in building designs.

Uses of Stones

1. Construction of residential and public buildings.
2. Construction of walls, columns, dams, abutments, and bridges.
3. For architectural and ornamental requirements on the structure.
4. Used for road construction and railways.
5. Used as aggregate for concrete.

BRICK

A brick is a type of construction material used to build walls, pavements and other elements in masonry construction.



SIGNIFICANCE OF BRICKS

1. **Durability and Strength**: First-class bricks are essential building materials known for their durability and strength, with compressive strength typically ranging from 3.5 MPa to 10 MPa.
2. **Thermal Insulation**: Bricks provide excellent thermal insulation, with thermal conductivity values typically ranging from 0.5 to 1.2 W/m·K (watts per meter-kelvin), helping to regulate indoor temperatures and improve energy efficiency.
3. **Fire Resistance**: Bricks are fire-resistant, capable of withstanding temperatures up to 1,000 °C (1,832 °F), enhancing safety in buildings.
4. **Aesthetic Appeal**: Available in various colors and textures, bricks offer significant aesthetic appeal, allowing for diverse architectural designs.
5. **Low Maintenance**: Bricks require low maintenance, with a lifespan of over 100 years when properly cared for.
6. **Eco-Friendly**: Made from natural materials, bricks are considered **eco-friendly**, with around **60% of the brick industry's energy** sourced from renewable resources.
7. **Sound Insulation**: They provide effective **sound insulation**; some stones, like **marble** and **granite**, possess excellent sound insulation properties, making them valuable for noise control within structures.
8. **Versatility**: Bricks are versatile and can be used in a wide range of applications, including walls, pavements, and decorative features.
9. **Cost-Effectiveness**: They offer **cost-effectiveness**, as brick structures can save homeowners about

25% in maintenance costs over **50 years** compared to other materials.

10. **Cultural Heritage**: With a history spanning thousands of years, bricks contribute to the **cultural heritage** of many regions, exemplified by ancient structures like the **Great Wall of China**

Applications of Bricks

1. Wall Construction: Used for load-bearing and non-load-bearing walls in residential and commercial buildings.
2. Pavements and Pathways: Ideal for creating durable walkways, verenda, and driveways.
3. Fireplaces and Chimneys: Commonly used in constructing fireplaces and chimney structures due to their fire resistance.
4. Retaining Walls: Employed in retaining walls to prevent soil erosion and support landscapes.
5. Decorative Features: Used in arches, facades, and other architectural details for aesthetic appeal.
6. Fences and Boundary Walls: Commonly used for building secure boundary walls and fences.

AGGREGATES

Aggregates is hard material made up of rock materials. It is the disintegration of the hard stratum of the rock. It consists of many types, that includes gravel, crushed rock, sand, recycled aggregates etc. It is used in the construction of buildings, construction of pavement surfaces, etc. Aggregates can be fine aggregate (0 to 4.5mm) or coarse aggregate (4.75 to 80mm) based on the size distribution of particles. These aggregates can be used for making concrete with the proper mixing of sand and cement. The properties of aggregates vary based on their size, affecting characteristics such as strength, workability, and density of concrete

Types of Aggregates

1. **Fine Aggregates**: Typically sourced from riverbeds, where natural processes have broken down larger rocks into finer particles (sand). This natural sand is usually washed to remove impurities and ensure consistency.
2. **Coarse Aggregates**: Usually obtained from quarry plants, where larger rocks are extracted and then crushed into various sizes. This process allows for greater control over the aggregate's size and shape, making them suitable for concrete and construction applications.

Uses of Aggregate

The uses of aggregates in concrete are:

1. Increases the volume of concrete, thus reduces the cost. Aggregates account for 60-75% of the volume of concrete and 79-85% weight of PCC.
2. To provide a rigid structure.
3. To reduce the shrinkage and cracking.
4. Concrete aggregate is used in many structures and substructures e.g. different elements of a Building, bridges, and foundations.
5. The smaller the aggregate size the greater its surface area and the more binding material (cement) will be required, resulting in a higher cost.
6. The greater the aggregate size the larger will be the voids, resulting in wastage of binding material (cement).

SIGNIFICANCE OF AGGREGATES

- Aggregates provide more strength to the concrete.
- The use of aggregates in concrete structures increases the compactness of the structures.
- The use of aggregate reduces the quantity of cement in the concrete mix.
- It also reduces the water requirement in the concrete mix.
- It reduces the shrinkage of concrete in the dry mix.
- It reduces the voids in the concrete.

STEEL

Steel is an alloy of iron, composed of carbon content ranging from 0.03% to 1.075%, and often other elements. It has high tensile strength with low cost, thus becoming a major component for the construction of buildings, infrastructure, tools, ships, automobiles, machines, appliances, and weapons. It is one of the most familiar materials in the world.

Highlights of steel

- Steel is an alloy material. Its major constituent is Iron and Carbon.
- Common alloys include steel (iron and carbon), bronze (copper and tin), brass (copper and zinc), and stainless steel (iron, chromium, and sometimes nickel or other elements).
- The main reason carbon is added to steel (in concentrations of 0.1% to 1.5%) is to **increase hardness and tensile strength**.
- Some steel grades, there may also be small amounts of other elements like manganese, silicon, nickel, chromium, and molybdenum
- for example, stainless steel has an additional 11 % chromium, making it corrosion-resistant.
- It is a material with high tensile strength
- Not only in the construction industry, but it is also used for making machinery equipment and other tools

Uses of Steel

1. As structural material in trusses, beams, etc.
2. As non-structural material for grills, doors, windows, etc.
3. In steel pipes, tanks, etc.
4. In sanitary and sewer fittings, rainwater goods, etc.
5. Corrugated sheets.
6. As reinforcement (re-bars) for concrete.

SIGNIFICANCE OF STEEL

1. **Strength**: Steel is very strong; it can handle heavy loads. For example, structural steel has a tensile strength of around **250-550MPa**, making it ideal for buildings and bridges.
2. **Durability**: Steel structures last a long time and can resist weather, fire, and pests, reducing maintenance costs.
3. **Lightweight**: Steel is strong yet lightweight, which means it can be used to create large spaces without needing thick walls or heavy foundations.
4. **Versatile**: Steel's adaptability allows it to be molded into various shapes, making it suitable for a wide range of construction applications, from structural frameworks to intricate architectural details
5. **Recyclable**: Steel can be recycled without losing its quality. About **85%** of steel is recycled, making it eco-friendly.
6. **Economic Growth**: The steel industry contributes significantly to the economy by providing jobs and supporting other industries. In India, it generates about **₹5 trillion** annually.

CONCRETE

Concrete is a composite material with Coarse aggregate, Fine aggregate, Cement, Water and Admixtures. These ingredients are mixed in a fixed proportion based on strength. This proportion governs the characteristics compressive strength of concrete.Concrete material is designed mainly to take the compressive type of load. It can be used to construct dams, bridges, foundations, etc.

Concrete mix is reinforced with steel material to resist the tensile loads. Such mixes are known as *Reinforced cement concrete*

Highlights of Concrete material

- The grade of concrete represents the compressive strength of the concrete mix.
- The compressive strength of concrete governs by the many parameters like ingredients used, amount of water and types of cement used, etc.
- Based on the strength of different mixes, it can be classified as M10, M15, M20, M25 etc., grade of concrete. Here 'M' represents the mix and these digits represent the compressive strength characteristics in MPa.
- Depending on the different grades of concrete, the use of concrete varies. A fixed proportion of ingredients are used in the concrete mix for the different grades of concrete.

Benefits of Using Concrete in Construction

- **Durability**: Concrete structures last long with minimal maintenance and resist harsh weather.
- **Strength**: High compressive strength allows concrete to support heavy loads and enhances fire safety.
- **Versatility**: Concrete can be shaped for various applications and customized with additives.
- **Cost-Effectiveness**: It is affordable and has low long-term maintenance costs.

- **Sustainability**: Concrete is recyclable, reducing waste, and its thermal mass improves energy efficiency
- **Aesthetic Flexibility**: Various finishing options provide visually appealing designs that integrate with other materials

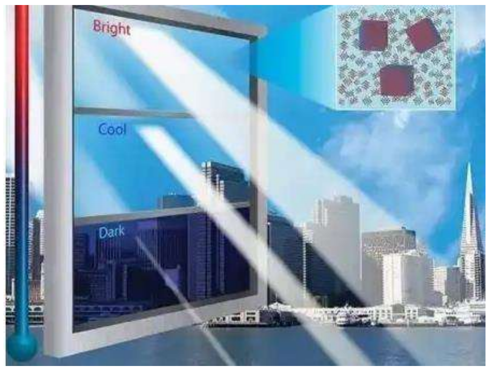
Uses of Concrete

1. Foundations: Used to create stable bases for buildings and structures, ensuring load distribution and support.
2. Beams and Columns: Essential components in the structural framework that support floors and roofs, providing strength and stability.
3. Pavements: Utilized for constructing roads, highways, and sidewalks, offering a durable surface for vehicle and pedestrian traffic.
4. Bridges: Employed to span rivers, valleys, or other obstacles, providing safe passage for vehicles and pedestrians while supporting heavy loads.
5. Dams: Constructed to control water flow, store water, and generate hydroelectric power, contributing to flood control and water supply management.
6. Water Tanks: Used to store potable water for residential, commercial, and municipal needs, ensuring reliable access to clean water.
7. Retaining Walls: Built to hold back soil, prevent erosion, and create level areas on sloped land, commonly used in landscaping and civil engineering.
8. Precast Products: Manufactured off-site, these include items like concrete pipes and panels that are assembled on-site, speeding up construction processes.
9. Curbs: Installed along road edges to define boundaries, manage water runoff, and protect sidewalks, enhancing urban infrastructure.
10. Decorative Elements: Used in architectural features like façades, sculptures, and furniture, allowing for aesthetic enhancements in design.

SMART MATERIALS

Smart materials, which also known as intelligent materials, active materials and, adoptive materials, which have the capability to respond & react to changes in their environment in a helpful and controlled way. The factors that trigger changes in the properties of smart materials can include mechanical stress or

strain, electrical or magnetic fields, as well as variations in temperature, moisture, pH, and light
They are used in civil engineering projects and contribute in increasing performance, comfortability, and energy efficiency of structure. Structures that incorporate smart materials are called as "Smart Structures".



Significance of Smart Materials

1. **Enhanced Performance**: Smart materials improve the functionality of structures by responding to environmental changes, ensuring optimal performance in various conditions.
2. **Structural Integrity**: They contribute to the safety and longevity of buildings by enabling real-time monitoring of structural health, allowing for proactive maintenance.
3. **Energy Efficiency**: Smart materials help reduce energy consumption by adapting to environmental factors, promoting sustainable building practices.
4. **Safety Enhancements**: They provide advanced safety features, such as damage detection and visual indicators of structural stress, which can prevent accidents and enhance occupant safety.
5. **Adaptability**: Smart materials can change their properties based on external stimuli, allowing for innovative design solutions and greater flexibility in construction.
6. **Environmental Impact**: By optimizing resource use and minimizing waste, smart materials support environmentally friendly construction practices.
7. **Comfort and Liability**: These materials improve indoor environments by regulating temperature, humidity, and sound levels, enhancing occupant comfort.
8. **Innovative Applications**: Smart materials open new possibilities for construction, such as self-healing concrete and shape-shifting structures, pushing the boundaries of design and engineering.

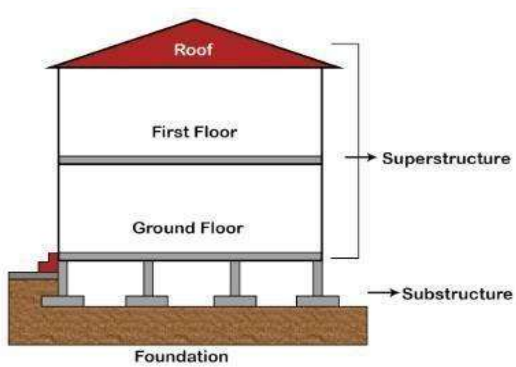
Application of Smart materials

1. Self-Healing Concrete: Used to automatically repair cracks in structures and pavements.

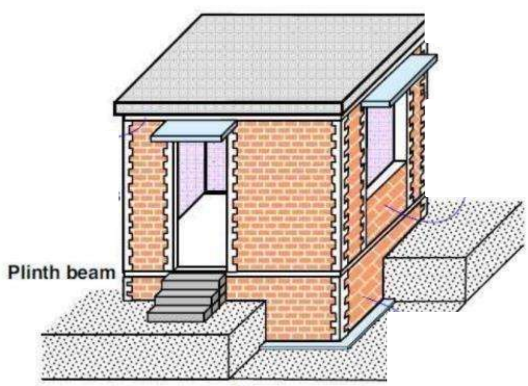
2. Shape Memory Alloys (SMA): Employed in seismic bracing systems to enhance building resilience during earthquakes.
3. Piezoelectric Materials: Integrated into structural health monitoring systems to detect stress and strain in materials.
4. Fiber-Reinforced Polymers (FRP): Used for strengthening and retrofitting concrete structures, enhancing their load-bearing capacity.
5. Phase Change Materials (PCM): Incorporated into building materials for thermal regulation, reducing energy costs.
6. Smart Coatings: Applied to structural surfaces to provide self-cleaning and corrosion-resistant properties.
7. Electroactive Polymers: Utilized in vibration dampers and actuators in buildings and bridges.
8. Smart Glass: Used in facades that can adjust transparency in response to sunlight, improving energy efficiency.
9. Hydrogel Materials: Used in soil stabilization applications and as moisture-absorbing materials in construction.
10. Thermochromic Materials: Incorporated into roofing and facades that change color based on temperature, aiding in heat regulation

STRUCTURAL ELEMENTS OF BUILDING FOUNDATION

Foundation is the lowest part of the building or the civil structure that is in direct contact with the soil which transfers loads from the structure to the soil safely. Generally, the foundation can be classified into two, namely **shallow foundation** and **deep foundation.** A shallow foundation transfers the load to a stratum present in a shallow depth. The deep foundation transfers the load to a deeper depth below the ground surface. A tall building like a skyscraper or a building constructed on very weak soil requires deep foundation. If the constructed building has the plan to extend vertically in future, then a deep foundation must be suggested.



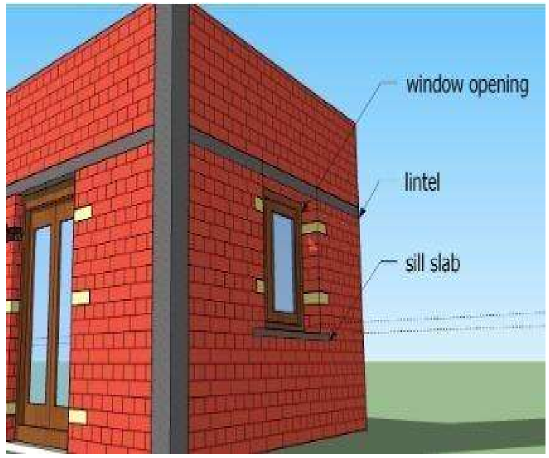
i. PLINTH



Plinth beam is a reinforced concrete beam constructed between the wall and its foundation. Plinth beam is provided to prevent the extension or propagation of cracks from the foundation into the wall above when the foundation suffers from settlement. Plinth beams distributes the load of the wall over the foundation evenly.

ii. LINTEL

A lintel is a beam placed across the top of an opening in a wall. Used above empty spaces like entrances and windows in buildings, lintels support the weight of the structures above them.



iii. CHEJJA

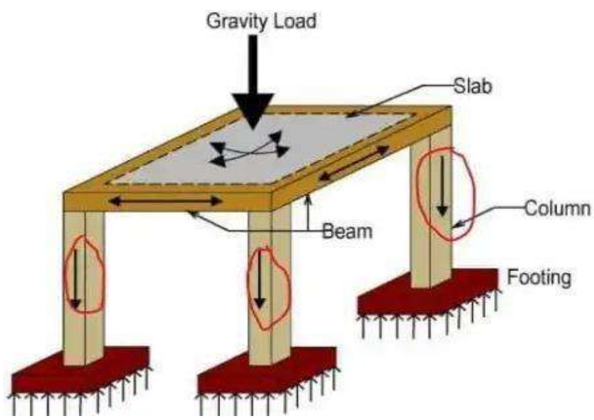
Chejja is a building component located just above the window which provides shade and prevents rain from entering the window. So, Chejja is nothing but a Sun Shade.

iv. MASONRY WALL

Masonry is used to indicate the art of building a structure in either stones or bricks. The masonry wall is built of individual blocks of materials such as stones, bricks, concrete, hollow blocks, cellular concrete and laterite, usually in horizontal courses cemented together with some form of mortar.

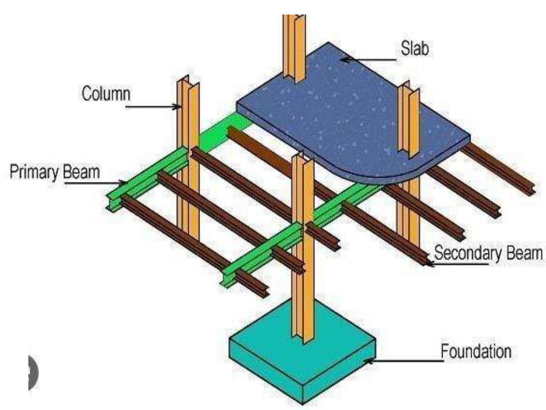
v. COLUMN

Columns in civil engineering can be defined as vertical structural elements that act as supports and primarily support axial compressive loads. They are slender members designed as a support to hold the ceiling and roof, and the weight acting on them.



vi. BEAM

A beam is a **horizontal structural member** in a building to resist the lateral loads applied to the beam's axis. The structural member which resists the forces laterally or transversely applied to the beam axis is called a **beam**.

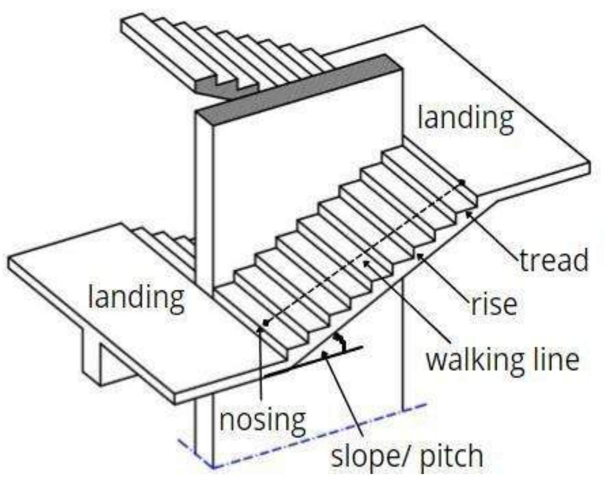


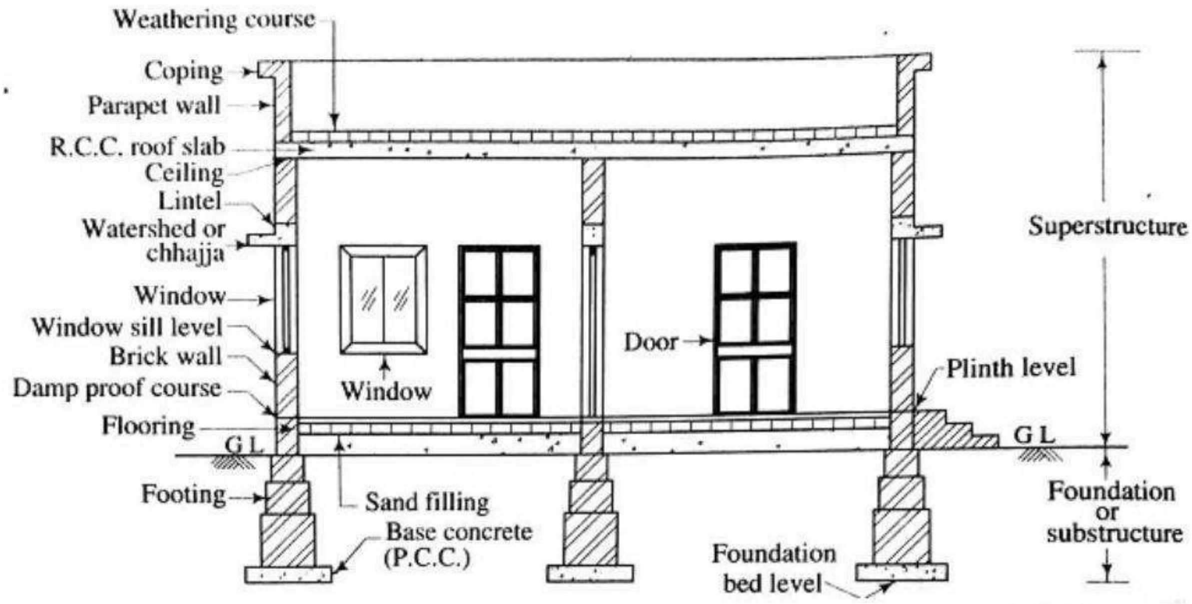
vii. SLAB

Slabs are flat, horizontal structural elements made of reinforced concrete that receive the load and transfer it through the beams to the columns and to the footings to the soil below. Slabs are used in both load-bearing structures and framed structures.

viii. STAIRCASE

Staircase is an important component of a building providing access to different floors and roof of the building. It consists of a flight of steps and one or more intermediate landing slabs between the floor levels.





Components of a building

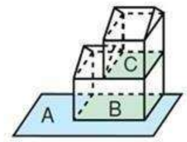
FLOOR AREA RATIO AND SIGNIFICANCE FOR A RESIDENTIAL BUILDING

The floor area ratio is the relationship between the total amount of usable floor area that a building has, or has been permitted to have, and the total area of the lot on which the building stands. FAR is expressed as a decimal number, and is derived by dividing the total floor area of the building by the total area of the lot on which building stands.

- Floor Area Ratio (FAR), also known as Floor Space Index (FSI) or Floor Area Ratio (FAR), is a zoning regulation used in urban planning and land-use management.
- Zoning regulations refer to rules and guidelines set by local governments to control the use of land within their jurisdiction.
- It is a measure of the total floor area of a building in relation to the size of the plot of land upon which it is built.
- Floor Area Ratio (FAR) tells us how much building space can be constructed on a piece of land.
- used to regulate the maximum permissible floor area that can be constructed on a given plot of land. It is calculated by dividing the total floor area of all floors of a building by the total area of the plot of land.

Formula to calculate FAR

Floor area ratio=Floor area/Site area =(B+C)/(A)



SIGNIFICANCE

The FAR value is determined by local municipal corporations, to ensure the best possible living conditions for residents in that area, keeping in mind the density of the population, availability of open spaces, environmental impact of the project and preparedness in the eventuality of a natural disaster and the value generally does not exceed 2.5.

A lot is a defined area of land, typically measured in square feet or acres, that can be owned, developed, or sold.

For example, if lot must adhere to a 0.1 FAR, then the total area of all floors in all buildings on the lot must be no more than one-tenth the area of the lot itself. In other words, if the lot was 10,000 sq. ft, then the total floor area of all floors in all buildings must not exceed 1,000 sq. ft.

The Floor-area Ratio for residential premises

SL.NO	Plot area (Sq. ft)	Max. Ground Coverage %	FAR
Low –income Group housing (Mainly for large cities & towns)			
1.	30	75	1.5
2.	30-50	75	1.5
Normal Housing (Mainly for Large, Medium and small towns)			
3	50-100	65	1.80
4	100-250	65	1.80
5	250-500	55	1.65
6	500-1000	45	1.20
7	1000-1500	40	1.00
8	1500-2250	33	1.00

PROBLEMS ON FLOOR AREA RATIO

1. Calculate FAR of a building having 2 floors built over 1200sq. ft area. The area of each floor is 600 sq. ft

   Soln:

$$\text{FAR} = \frac{\text{Buit up Area}}{\text{Plot area}}$$

$$\text{Plot area} = 1200\text{sq}\cdot\text{ft}$$

$$\begin{aligned}\text{Buit up area} &= \text{Area of GF} + \text{Area of FF}\\ &= 600 + 600\\ &= 1200\text{sqft}\end{aligned}$$

$$FAR = \frac{1200}{1200} = 1$$

2. A plot is having dimension $30\ \text{m} \times 40\ \text{m}$. A building constructed on it occupies $400\ \text{m}^2$ on ground and $350\ \text{m}^2$ on First floor. If FSI Permissible is 0,8. How much area can be constructed on Second Floor.

   Soln:
   Plot area - $30 \times 40 = 1200\ \text{m}^2$,
   FSI Permissible $= 0.8$
   Area to be constructed on second floor =?

$$\text{FSI} = \frac{\text{Built up area}}{\text{Plot area}}$$

$$\begin{aligned}\text{Built up area} &= \text{FSI} \times \text{Plot area}\\ &= 0.8 \times 1200\\ &= 960\ \text{m}^2\end{aligned}$$

$$\begin{aligned}\text{Built up area} &= \text{Area } GF + \text{Area of } FF + \text{Area of } SF\\ 960 &= 400 + 350 + \text{Area of } SF\\ \text{Area of } SF &= 960 - 400 - 350\\ &= 210\ \text{m}^2\end{aligned}$$

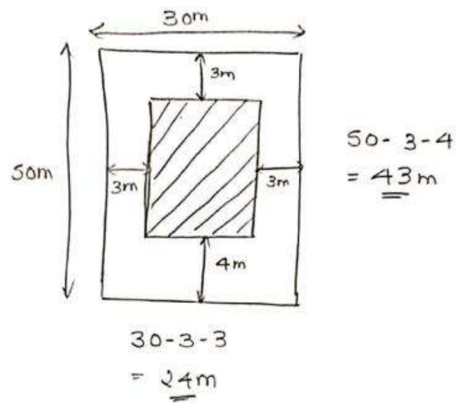
3. A building is to be constructed on a plot size $30\ \text{m} \times 50\ \text{m}$ with $G + 1$ storeys. Permissible FSI is 0.8 and front margin is 4 m g side margins are 3 m each. If maximum contruction is to be made on the ground floor, Compute the area that can be constructed on first floor.

   Solution:

$$\text{Plot area} = 30 \times 50\ \text{m} = 1500\ \text{m}^2$$

$$\text{Builtup area} = \text{Area of GF} + \text{Area of First Floor}$$

$$\text{Permissible FSI} = 0.8$$



Ground coverage/ Plinth area/Area available on ground for construction

$$= 43 \times 24 = 1032 \text{ m}^2$$

$$\text{FSI } = \frac{\text{Built up area}}{\text{plot area}}$$

$$\text{Built up area } = 0.8 \times 1500$$

$$= 1200 \text{ m}^2$$

Possible construction on first floor = Built up area - ground coverage

$$= 1200 - 1032$$

$$= 168 \text{sq} \cdot \text{ m}$$