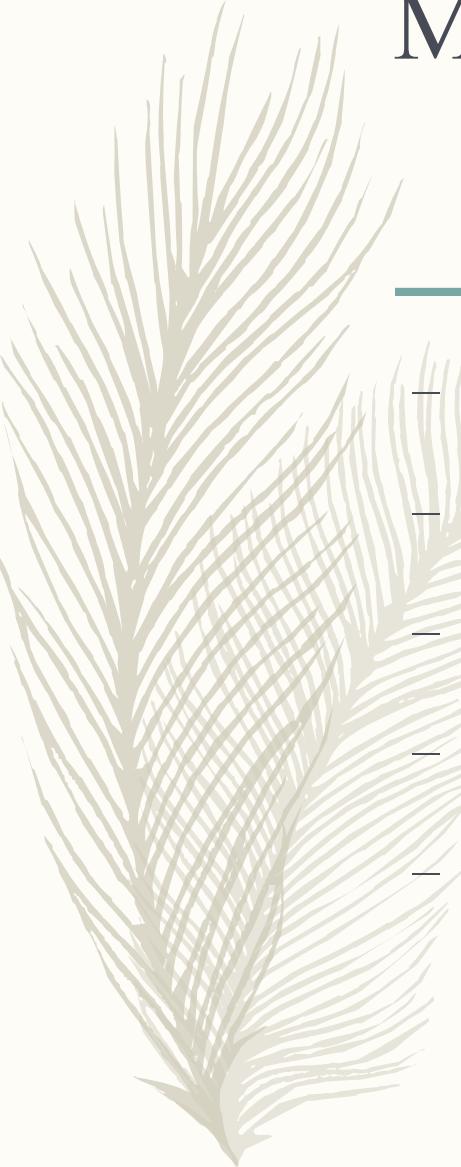


Basic Civil Engineering



Module 1

- General Introduction to Civil Engineering
- Brief introduction to major disciplines of Civil Engineering
- Introduction to buildings
- Building rules and regulations
- Building area



Module 2

- Surveying
- Construction materials
- Cement concrete
- Steel
- Modern construction materials



Module 3

- Building Construction
- Brick masonry
- Roofs and floors
- Basic infrastructure services
- Green buildings



General Introduction to Civil Engineering

- Civil engineering is an art
- Build the quality of life
- Enduring monuments and legacies
- Deals with the construction Activities

HISTORY

- Origin – Egypt
- John Smeaton (1724-1792) and Smeatonian Society of Civil Engineers
- 1818 Institution Of Civil Engineers in London
- American Society of Civil Engineers (ASCE)

Infrastructural development

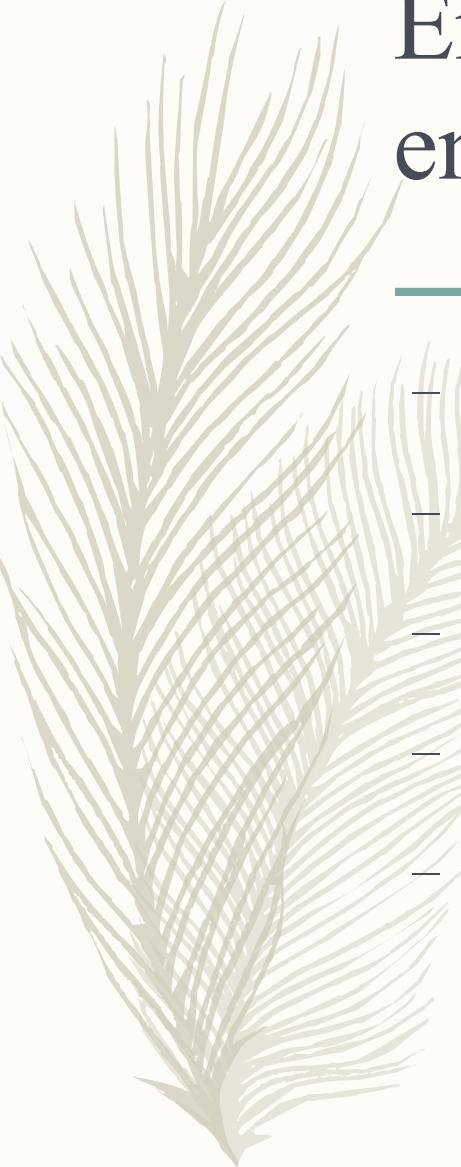
- Involves fundamental structures that are required for the functioning of a community & society.
- Roads, water supply, sewers, electrical grids, telecommunications, renewable energy, water sources identification & boring (wells), purification systems for clean water, hazard waste management and so on.
- less space and more efficiency

Role of Civil Engineering activities

- Planning of towns
- Vertical growth in cities.
- Low cost housing
- Ensure water supply
- Roadways and transportation facilities
- Controlling pollution

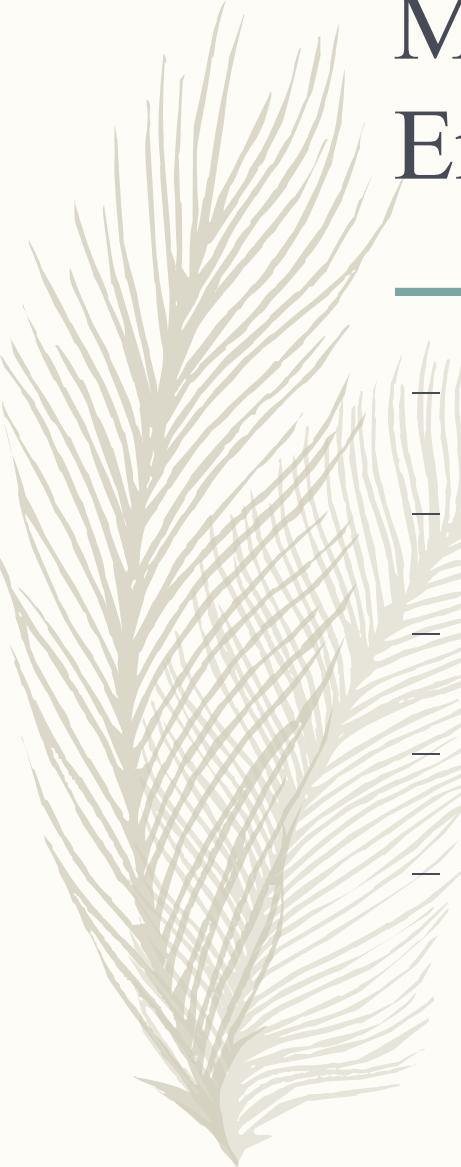
The impact of infrastructural development

- Provide protection from drought, famine, flood, etc.
- Improved irrigation facilities
- Better sewage system
- Improved education facilities
- Improvement in transportation and communication
- Generation of electricity from natural resources



Ensuring the safety of built environment.

- Installations to met safety standards
- Safety lapses
- Specific Safety remarks
- Warning Instructions
- Maintenance Schedule



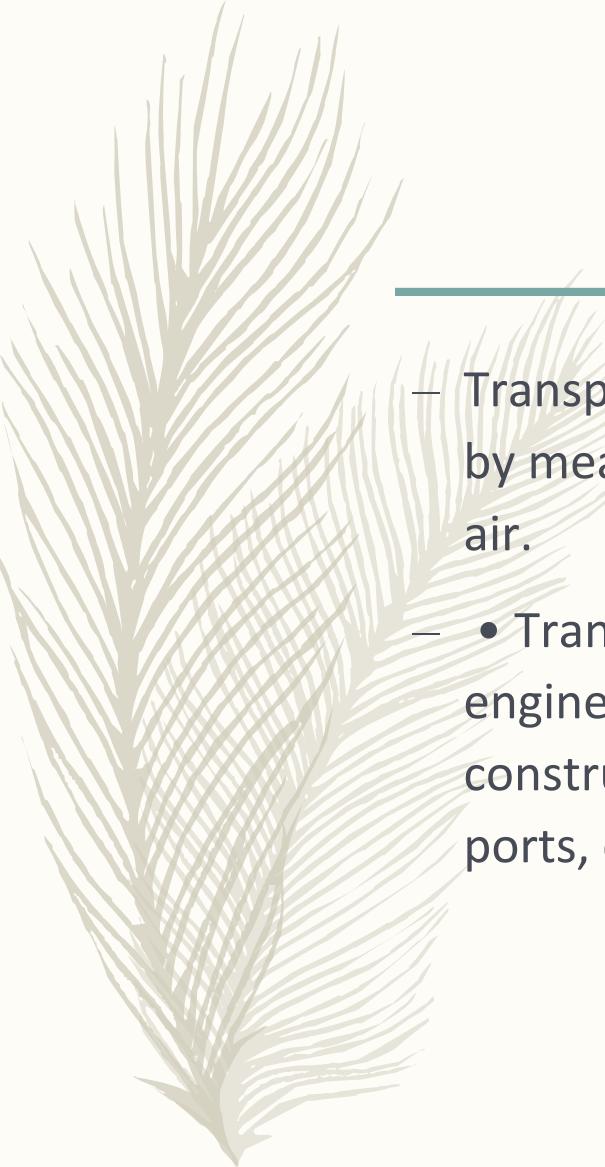
Major disciplines of Civil Engineering

- Transportation Engineering
- Structural Engineering
- Geo-technical Engineering
- Water Resources Engineering
- Environmental Engineering.



TRANSPORTATION ENGINEERING



- 
-
- Transportation means movement of Passengers and goods by means of vehicles on land, ship on water and aircrafts in air.
 - • Transportation Engineering is that branch of Civil engineering which deals with planning, designing and construction of roads, bridges, railways, tunnels, harbours, ports, docks, runways and airports.

Structural Engineering

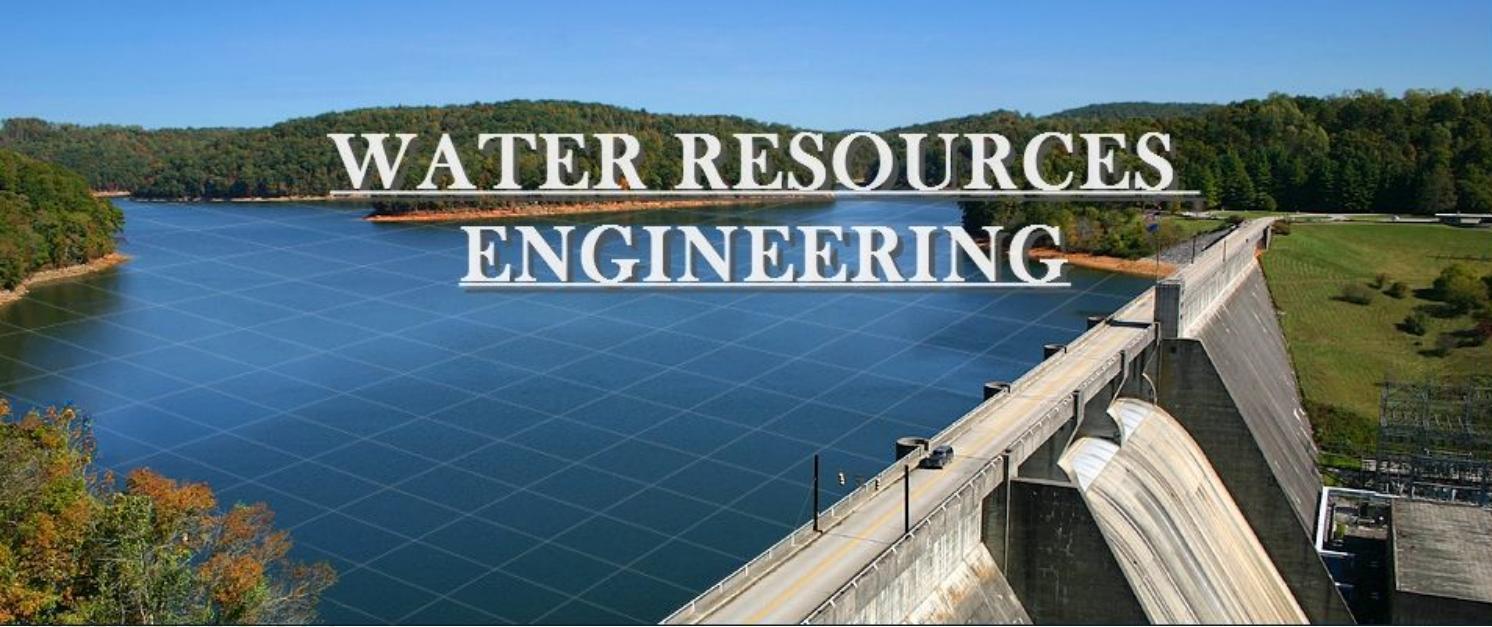


- This Branch of civil engineering deals with structural analysis and design of structures.
- • Structural analysis is done to calculate stresses in structural components, on the basis of loads, acting on structures.
- • Sections of structural elements like beams, columns, slabs, etc. are designed.
- Structural analysis requires much calculation, hence advanced computing software's are used to carry out structural analysis and design.

Geo-technical Engineering



- Geotechnical engineering is that field of civil engineering which deals with soil investigation and design of proper foundations of structures.
- • Soil investigation includes collection and testing of soil samples.
- • Geotechnical engineering includes measurement of soil Parameters and safe bearing capacity.
- • It also includes construction and design of simple foundations, pile foundations, well foundations, caissons, coffer dams, construction of foundation of dams, construction of tunnels, sub base of road, earthen dams, earth related constructions.



WATER RESOURCES ENGINEERING

- Water resource engineering means measurements, utilization and development of water resources for agriculture, municipal and power generation purpose.
- It mainly includes irrigation engineering, design of hydraulic structures like dams, canals etc.
- • Water resource engineering deals with planning designing and developing water resources by constructing several hydraulic structures like dams, barrages, hydropower stations, canal and pipe networks etc

Environmental Engineering



- Environmental Engineering deals with pollution control and public health engineering. Different types of pollutions are water, air, noise and other pollution.
- • Environmental engineering includes design, construction and maintenance of water treatment plant, waste water treatment plant, water distribution network and sewerage system,
- it also deals with solid waste management in towns and cities

Introduction to buildings



TYPES OF BUILDINGS

- Classification based on occupancy

- Group A: Residential

- Group B: Educational

- Group C: Institutional

- Group D: Assembly

- Group E: Business

- Group F: Mercantile

- Group G: Industrial

- Group H: Storage

- Group J: Hazardous



GROUP A : RESIDENTIAL

- Buildings in which sleeping accommodation provided for normal residential purposes with or without cooking or dining or both facilities, except any building classified under Group C.

Group B: Educational

- Buildings used for school, college, other training institutions for day- care purposes involving assembly for instruction, education or recreation for not less than 20 students.
- Residential accommodation provided in school/ institution are classified as sub-division A-3.



Group C: Institutional

- Any building or part thereof, which is used for purposes, such as medical or other treatment or care of persons suffering from physical or mental illness, disease or infirmity;
- cares of infants, convalescents or aged persons and for penal or correctional detention in which the liberty of inmates is restricted.

Group D: Assembly

- Any building or part of building, where number of persons not less than 50 congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes.
- Eg: theatres, assembly hall, museum, gymnasiums, restaurants, places for worships etc



Group E: Business

- Any building or part of a building, used for transaction of business (other than that covered by building in group F, for keeping accounts and records and similar purposes).
- Barber shops, beauty parlours are included in this group.



Group F: Mercantile

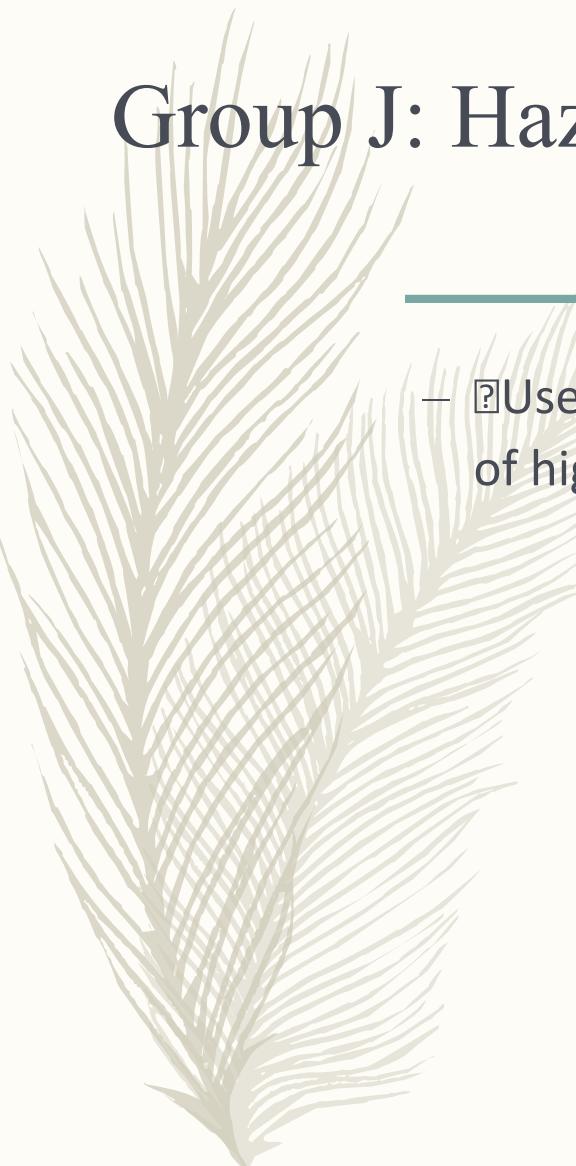
- Any building or part of a building, used as shops, stores, market, for display and sale of merchandise, either wholesale or retail

Group G: Industrial

- Any building or part of a building or structure, in which products or materials of all kinds and properties are fabricated, assembled, manufactured or processed.
- Assembly plants, industrial laboratories, dry cleaning plants, power plants generating units, pumping stations, fumigation chambers, laundries, building or structures in gas plants, etc.

Group H: Storage

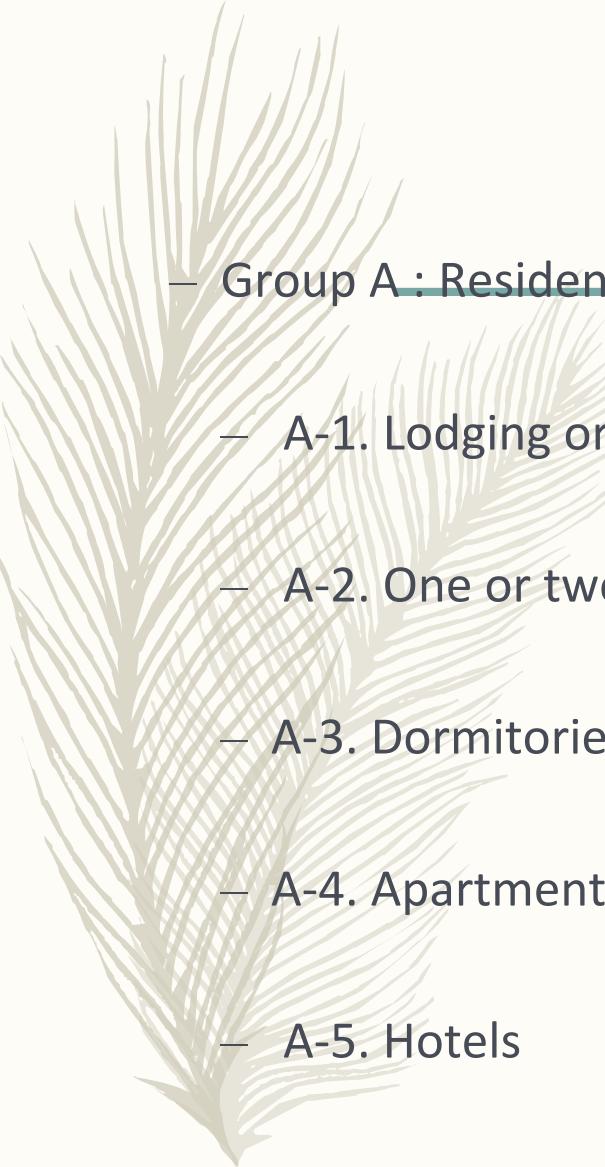
- Any building or a part of a building used primarily for or the storage or sheltering (including servicing, processing, or repairing incidental to storage) of goods, wares or merchandise (except that those involve highly combustible or explosive products or materials) vehicles or animals.
- Warehouses, cold storage, grain elevators, freight depots, barns, transit sheds, storehouse, garage, hangers etc



Group J: Hazardous

- Used for the storage, handling, manufacture or processing of highly combustible explosive materials

SUB-CLASSIFICATION OF BUILDINGS

- 
- Group A : Residential

 - A-1. Lodging or rooming houses
 - A-2. One or two-family private dwellings
 - A-3. Dormitories
 - A-4. Apartment houses (flats)
 - A-5. Hotels
 - A-6. Hotels (starred)



Group B : Educational Buildings

- B-1. Schools up to Secondary
- Level B-2. All others / training centres



Group C: Institutional Buildings

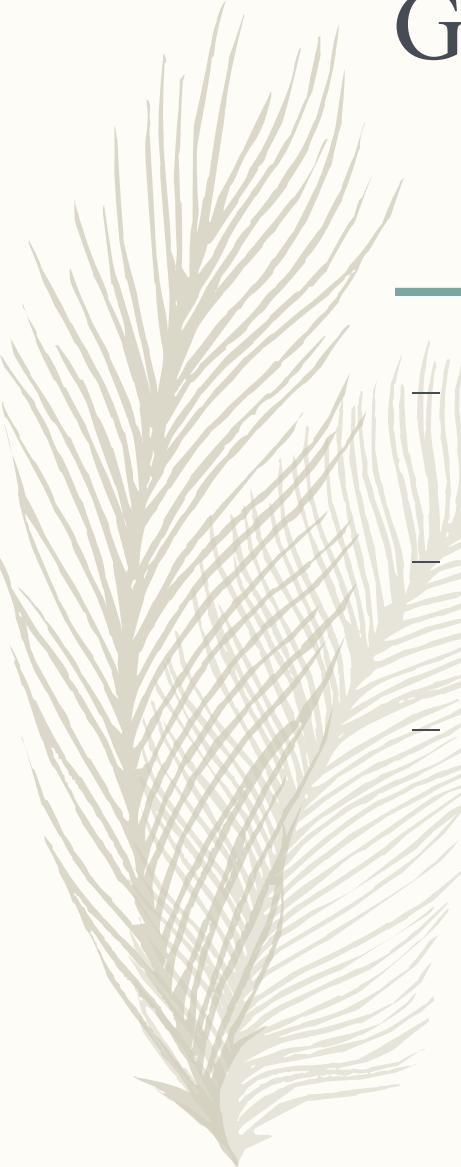
- C-1. Hospitals and Sanatoria
- C-2. Custodial Institutions
- C-3. Penal and Mental Institutions

Group D : Assembly Buildings

- D-1. Buildings having a theatrical or motion picture or any other stage and fixed seats or over 1,000 persons.
- D-2. Buildings having a theatrical or motion picture or any other stage and fixed seats up to 1,000 persons.
- D-3. Buildings without a permanent stage having accommodation for 300 or more persons but no permanent seating arrangement.
- D-4. Buildings without a permanent stage having accommodation for less than 300 persons with no permanent seating arrangement.
- D-5. All other structures including temporary structures designed for assembly of people not covered by sub-divisions D-1 to D-4, at ground level.
- D-6. Buildings having mixed occupancies providing facilities such as shopping, cinema theatres and restaurants.
- D-7. All other structures, elevated or underground, for assembly of people not covered by sub-divisions D-1 to D-6

Group E : Business Buildings

- E-1. Offices, banks, professional establishments, like offices of architects, engineers, doctors, lawyers and police stations.
- E-2. Laboratories, research establishments, libraries and test houses.
- E-3. Computer installations
- E-4. Telephone exchanges
- E-5. Broadcasting stations and T.V. stations.



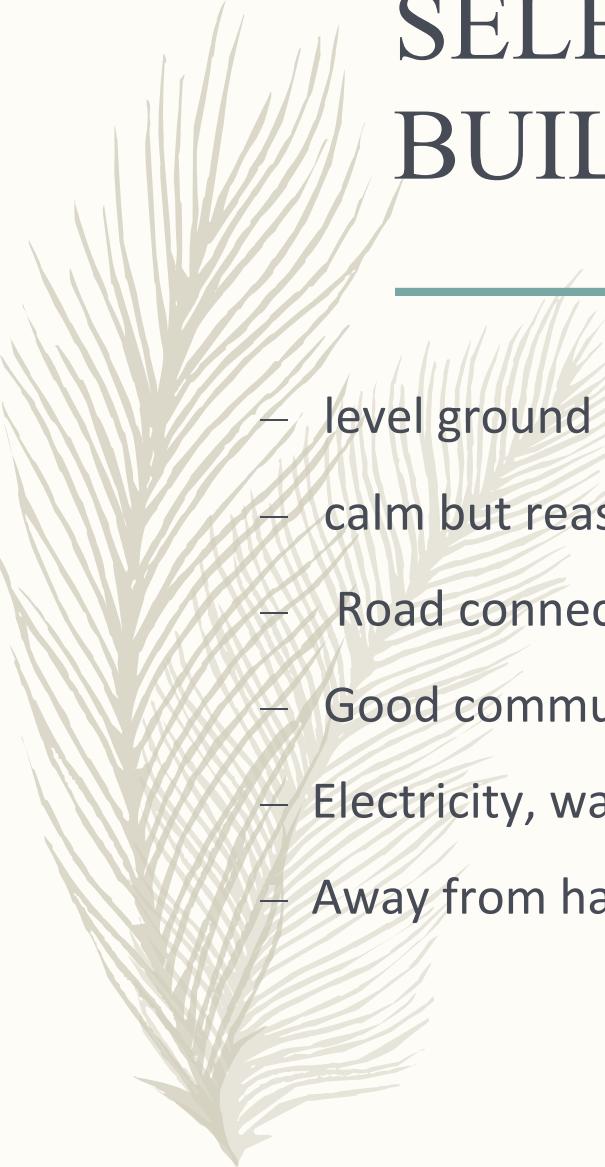
Group F : Mercantile Buildings

- F-1. Shops, stores, departmental stores markets with area up to 500 m².
- F-2. Shops, stores, departmental stores markets with area more than 500 m².
- F-3. Underground shopping centres, storage and service facilities incidental to the sale of merchandise and located in the same building shall be included under this group



Group G : Industrial Buildings

- G-1. Buildings used for low hazard industries.
- G-2. Buildings used for moderate hazard industries.
- G-3. Buildings used for high hazard industries.

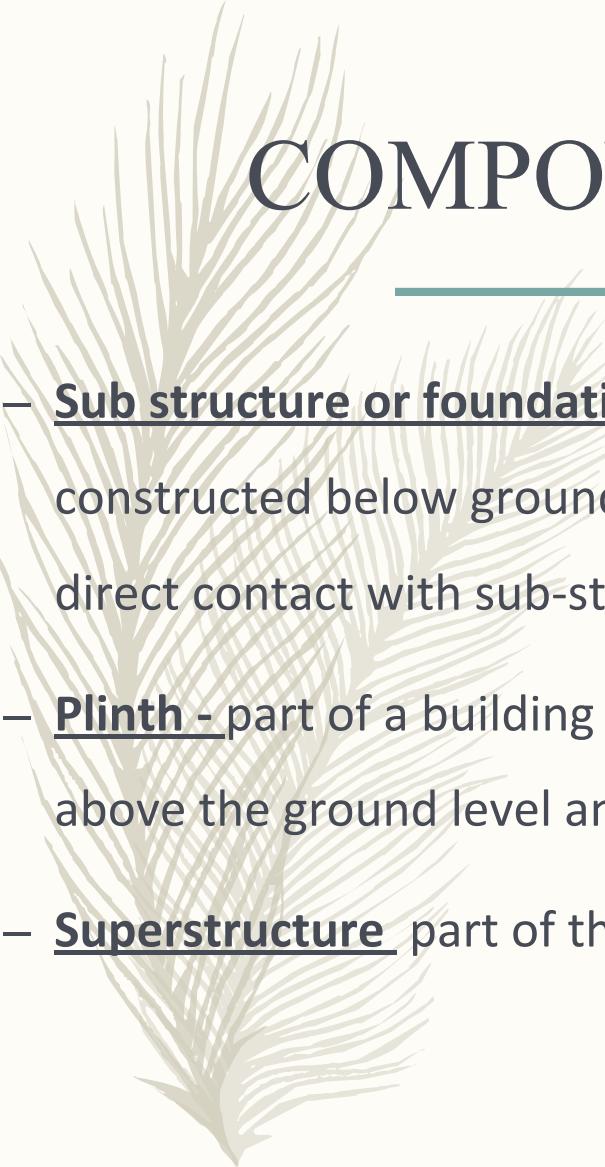


SELECTION OF SITE FOR BUILDINGS

- level ground with good quality of soil
- calm but reasonably developed location
- Road connectivity- and other modes of transport
- Good communication facilities
- Electricity, water and sewer lines should be available
- Away from hazardous industries

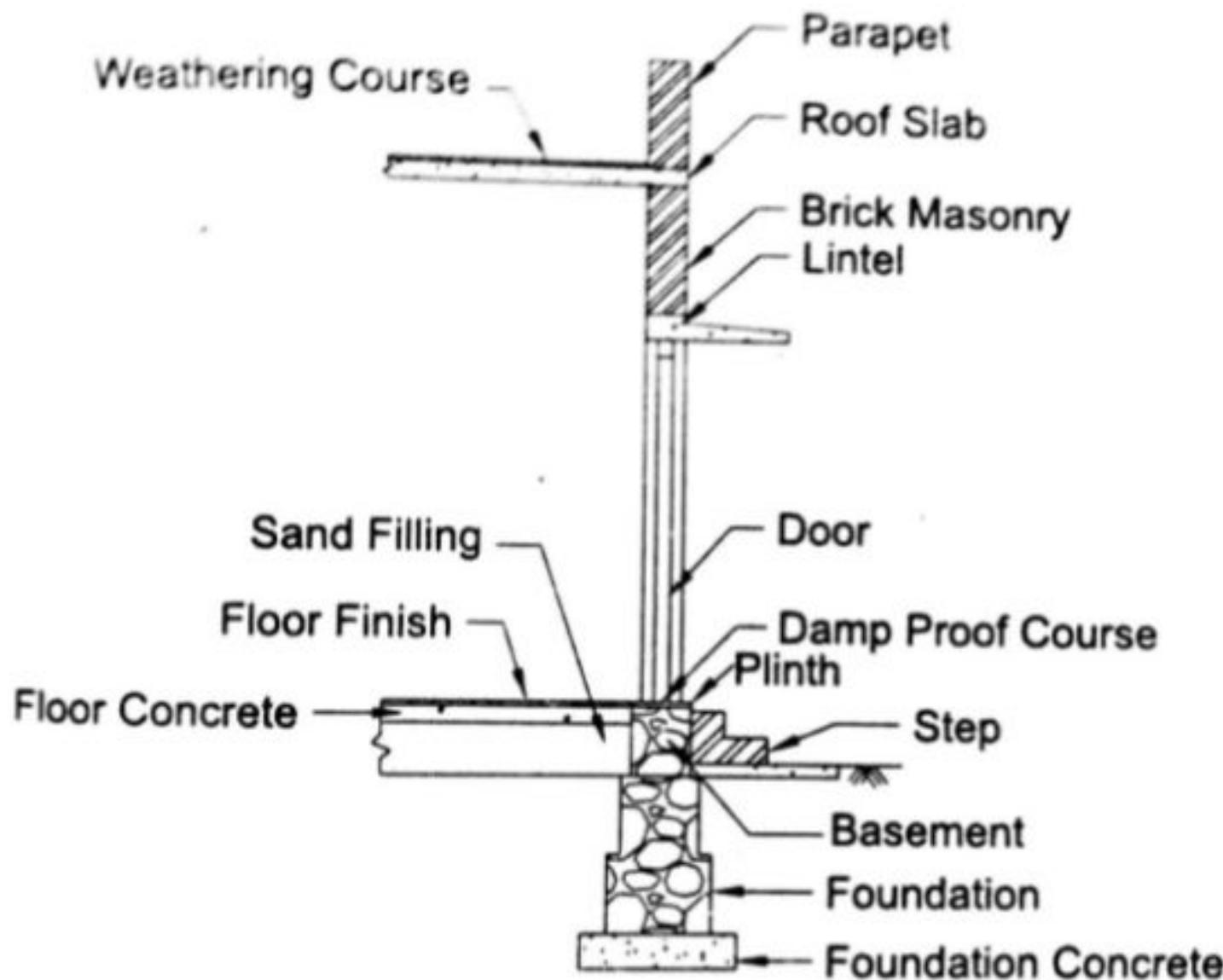
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- Flood prone areas, water logged areas and reclaimed land should be avoided
 - Good natural ventilation and lighting
 - The amenities like schools, recreation centers, shopping centers and hospitals should be there
 - Drainage properties
 - Regular shape with sufficient frontage

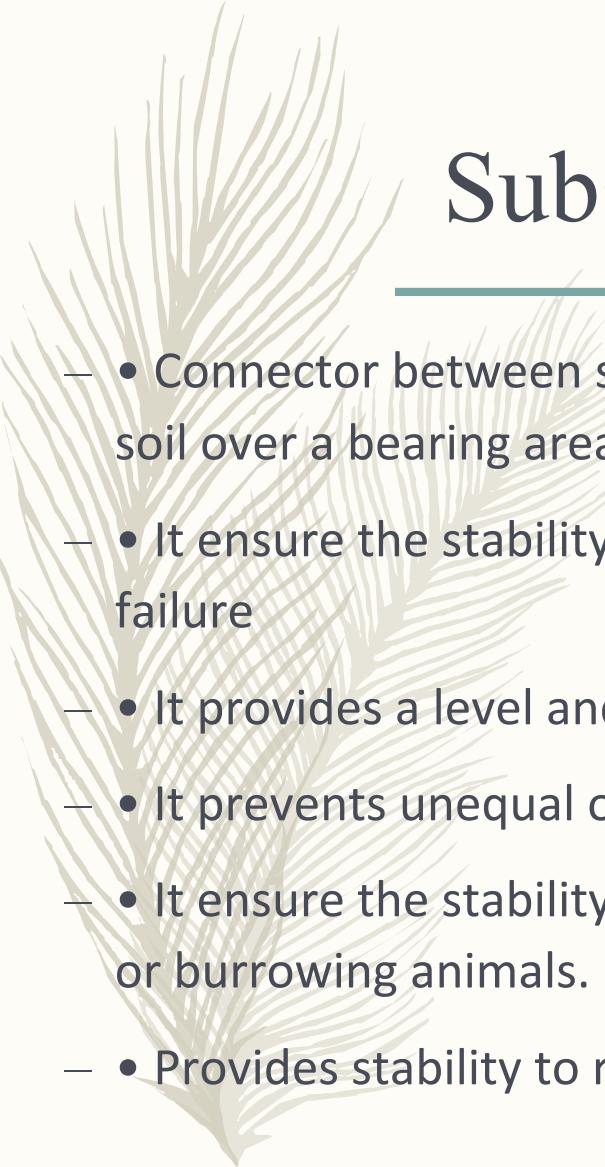
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- The area must be sufficient for present and future development
 - The places prone to air and water pollution should be avoided
 - Proper ownership and other legal matters have to be checked before buying a site
 - The type of land use recommended at proposed site should be checked with local authorities



COMPONENTS OF A BUILDING

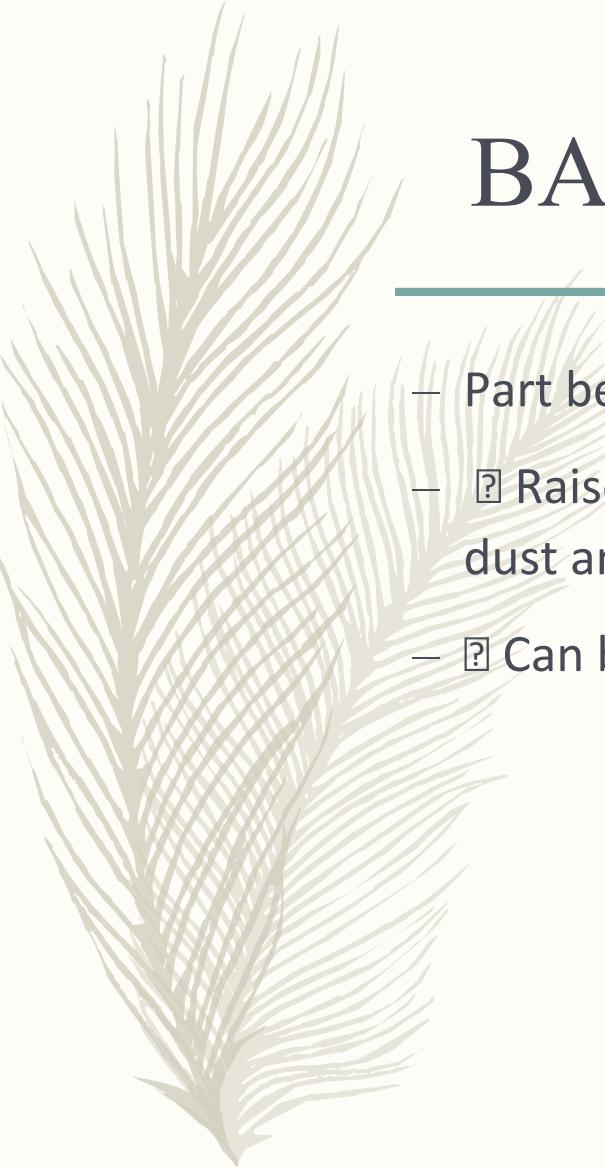
- **Sub structure or foundation** - part of a building constructed below ground level and which is in direct contact with sub-strata and transmits all the loads to the soil
- **Plinth** - part of a building above the ground level and up to the floor level immediately above the ground
- **Superstructure** part of the building constructed above the plinth level





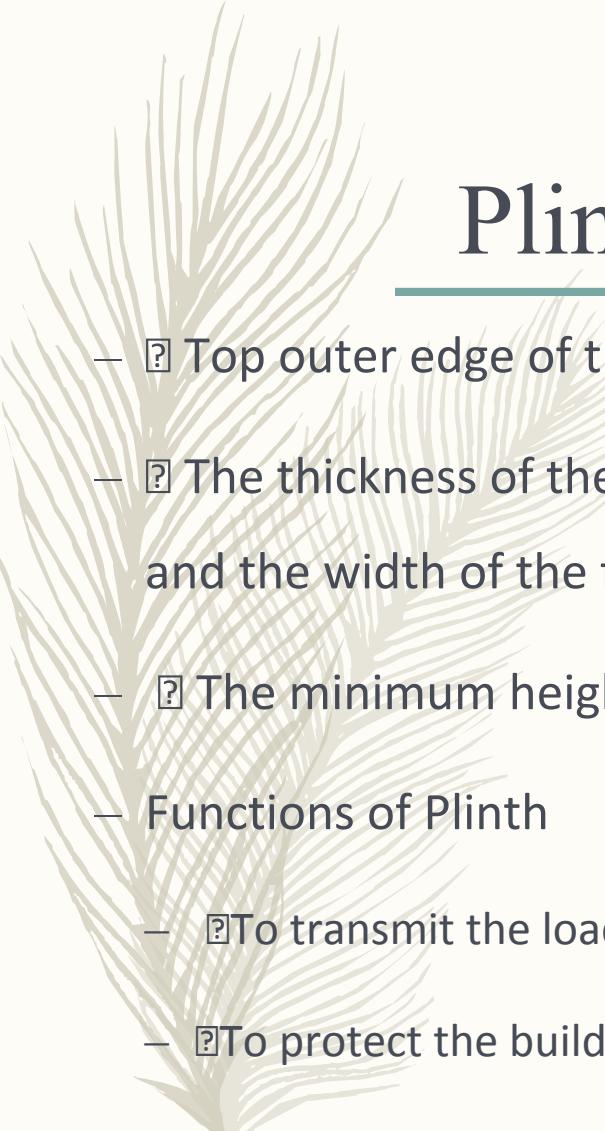
Substructure or foundation

- • Connector between structure and Earth!! • Transfers the load on structure to soil over a bearing area
- • It ensure the stability of the building against sliding, overturning and shear failure
- • It provides a level and firm surface for the construction of superstructure.
- • It prevents unequal or differential settlement of the structure.
- • It ensure the stability of the building against undermining due to floodwater or burrowing animals.
- • Provides stability to resist force due to wind, earthquake etc.



BASEMENT

- Part between ground level and floor level
- ⓘ Raises the floor above ground, to protect it from rain, dust and insects
- ⓘ Can be used as storage space too

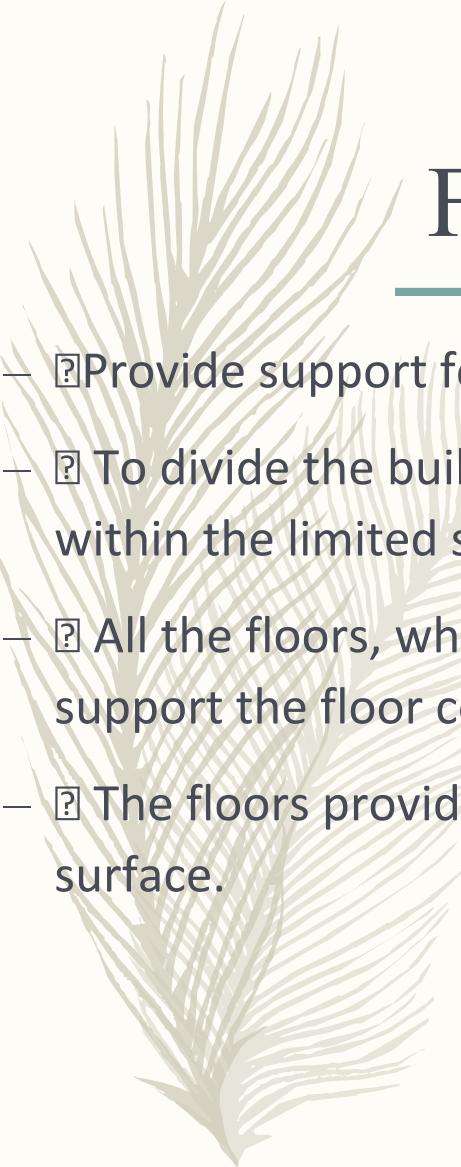


Plinth

- ☰ Top outer edge of the basement around the building
- ☰ The thickness of the plinth wall depends upon the weight of the superstructure and the width of the foundation concrete.
- ☰ The minimum height of the plinth is usually kept as not less than 45cm.
- Functions of Plinth
 - ☰ To transmit the load of the superstructure to the foundation.
 - ☰ To protect the building from dampness or moisture.
 - ☰ To enhance the architectural appearance of the building.

DAMP PROOF COURSE

- Laid at Plinth level
- To prevent moisture rise from foundation to walls
- Cement mortar mixed with crude oil/ water proofing agent/ or damp proof membranes



FLOORS

- ☐ Provide support for occupants, furniture, and equipments
- ☐ To divide the building into different levels for creating more accommodation within the limited space
- ☐ All the floors, whether basement, ground or upper should be strong enough to support the floor covering and other superimposed loads
- ☐ The floors provide a clean, smooth, impervious, durable and wear- resisting surface.



WALLS

- The main function of walls is to divide the space into different rooms.
- • Walls support the loads from the roof/ upper floors to the foundations.
- • Piers or pillars are thickened sections of the walls placed at intervals to carry the concentrated loads.
- • It should be stable against overturning by lateral forces.
- • The external walls should provide sufficient resistance against weathering agencies like sun, wind, rain and snow.
- • Walls should have sufficient heat and sound insulation.
- • Walls should provide sufficient privacy and security against burglary.



DOORS AND WINDOWS

- Doors - serve as a connecting link between internal parts and to allow free movement to the outside of the building.
- Windows - proper ventilation and lighting and their number should be determined according to the requirements.
- Strong enough to resist the adverse effects of weather.
- They should not be affected by white ants and the moisture penetration as this will reduce the strength and durability
- They should offer sufficient privacy without inconvenience or trouble and security against theft



BEAMS, LINTELS & SUNSHADES

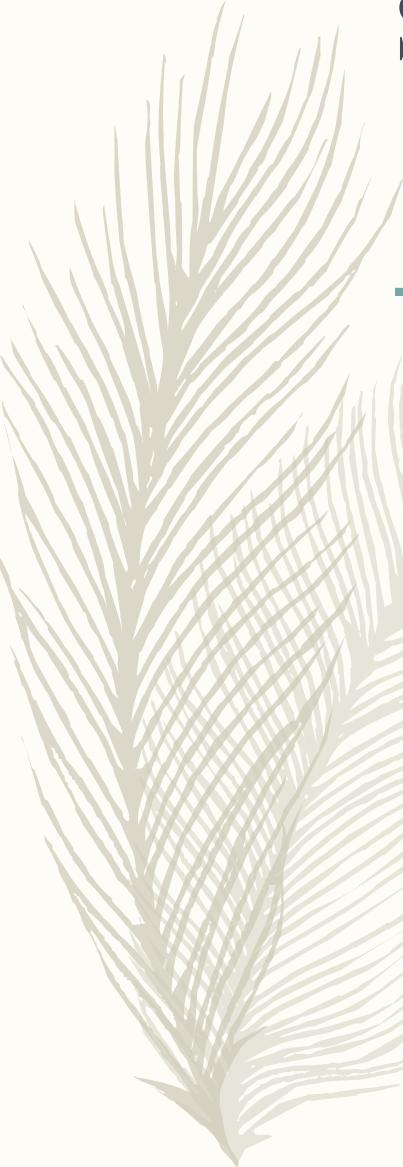
- Beam is a horizontal structural member, which carries floor slab or roof.
- Lintel is a beam that supports the masonry work over openings in the walls.
- Sunshade - projection provided outside a building above the doors and windows to prevent direct sunlight and rains to the rooms.
- Window sills are provided to between the bottom of the window frame and the wall below to protect the wall from ware and tear.



ROOFS

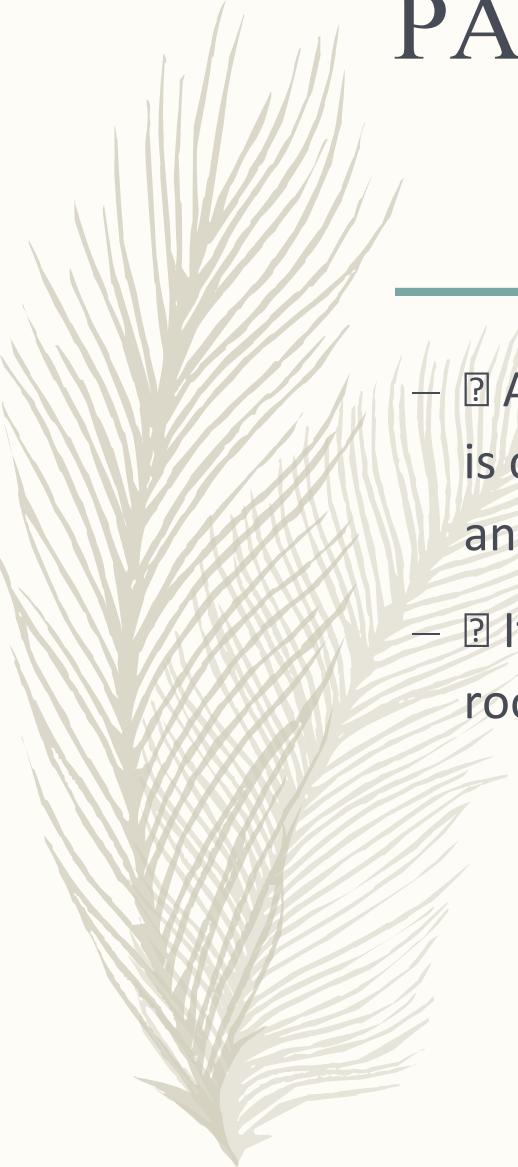
- A roof is the uppermost part of a building whose main functions is to enclose the space and to protect the same from the effects of weather elements.
- ☰Flat or sloped or curved
- ☰Concrete, clay tile, asbestos, iron sheets ,steel truss, timber
- ☰Should be strong against effects of wind, sun , rain
- ☰Drainage

- 
-
- ☑ The roof structure should be strong and stable enough to take up the anticipated loads safely.
 - ☑ The roof covering should have adequate resistance to resist the effects of weather elements.
 - ☑ The roof should provide adequate insulation against heat
 - ☑ The roof should have adequate insulation against sound from external sources.
 - ☑ Should offer an adequate degree of fire resistance



STEPS & STAIRS

- Steps are provided for access to the building
- ☰A stair is a structure consisting of a number of steps leading from one floor to another
- ☰Location of stairs in all types residential and public buildings should be such as afford the easiest and quickest service possible to the building
- ☰The main function of the stairs is firstly to provide a means of communication between the various floors
- ☰Secondly, it also acts as an escape from the upper floors in the event of fire



PARAPET

- ☰ A short masonry wall built on top of the roof of a building is called parapet. It serves as an enclosure above the roof and as an element for good appearance.
- ☰ It is the layer provided over the roof slab to protect the roof from weathering agencies like sunlight, rain and wind

BUILDING RULES

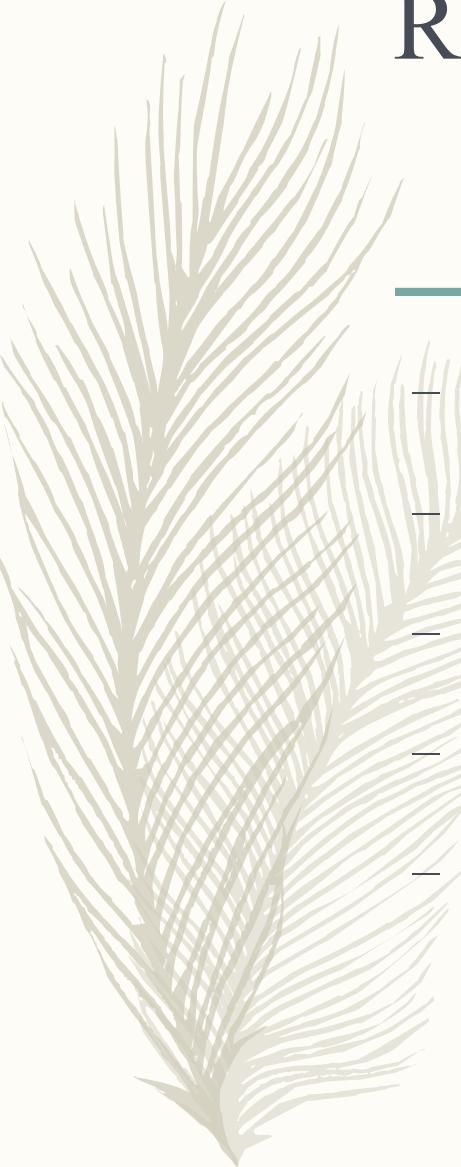




National Building Code(NBC)

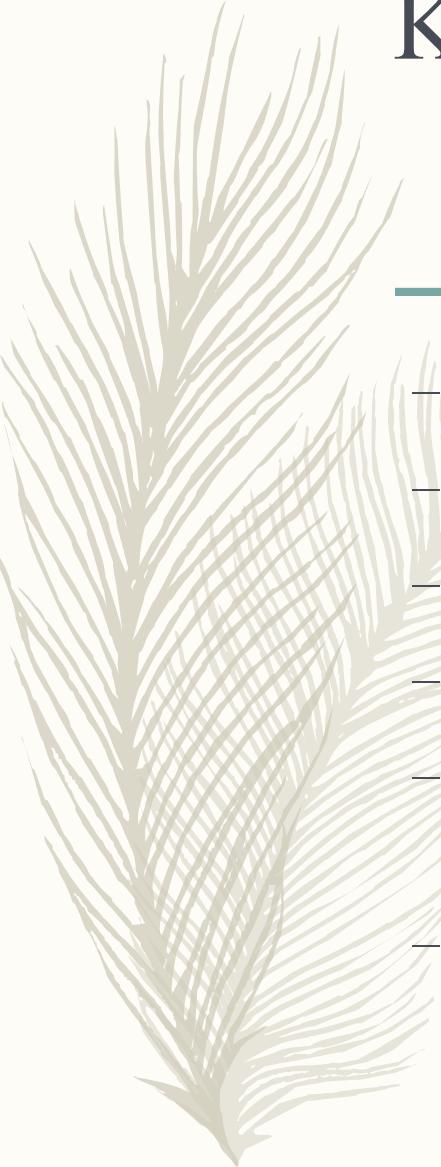
- National Building Code is prepared to unify the building regulations throughout the country.
- NBC is prepared by Bureau of Indian Standards (BIS).
- First version is published in 1970
- This is revised in 1983
- Later this edition was again revised to current one in 2005.
- Now this code has 11 parts

- Part 0 : Integral Approach
- Part 1 : Definitions
- Part 2 : Administration
- Part 3 : Development Control Rules & General Building Requirements
- Part 4 : Fire & Safety
- Part 5 : Building Materials
- Part 6 : Structural Design
- Part 7 : Constructional Practices & Safety
- Part 8 : Building Services
- Part 9 : Plumbing Services
- Part 10 : Landscaping: Signs & Outdoor Display Structures



Relevance of NBC

- Development and building planning
- Structural Design aspects
- Construction and asset/facility management
- Building services
- Public services and solid waste management



Kerala Building Rules

- Building regulations are framed based on NBC guidelines
- Framed based on various aspects
- Ensure quality and safety in construction
- Providing legal basis to authorized constructions
- Kerala state building rules were first introduced in 1964 later revised in 1984 and 1999
- KMBR -1999 and KPBR -2011



COASTAL REGULATION ZONE (CRZ)

- Imposed restrictions on Construction activities for
 - Ensuring livelihood securities
 - To conserve and protect
 - Sustainable development
- Applicability
 - Coastal regulation zone is the boundary from the high tide line up to 500m in the land -ward side.
 - Area between the low and high tide line.
 - In the case of rivers, creeks and backwaters, the distance from the high tide level shall apply to both sides and this distance shall not be less than 100 meters or the width of the creek, river or backwater whichever is less.



Classification

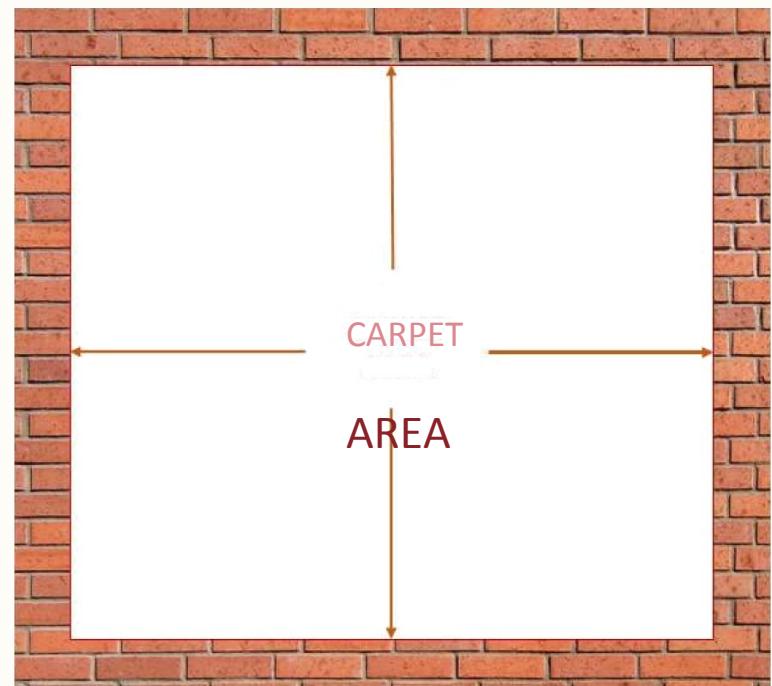
- CRZ-I : Areas that are ecologically sensitive and important
- CRZ II :The areas that have already been developed up to or close to the shoreline.
- CRZ III :Areas that are relatively undisturbed and those which do not belong to either Category-I or II.
- CRZ IV : Coastal stretches in the Andaman and Nicobar, Lakshadweep and small islands except those designated as CRZ-I, CRZ-II or CRZ-III.

BUILDING AREAS

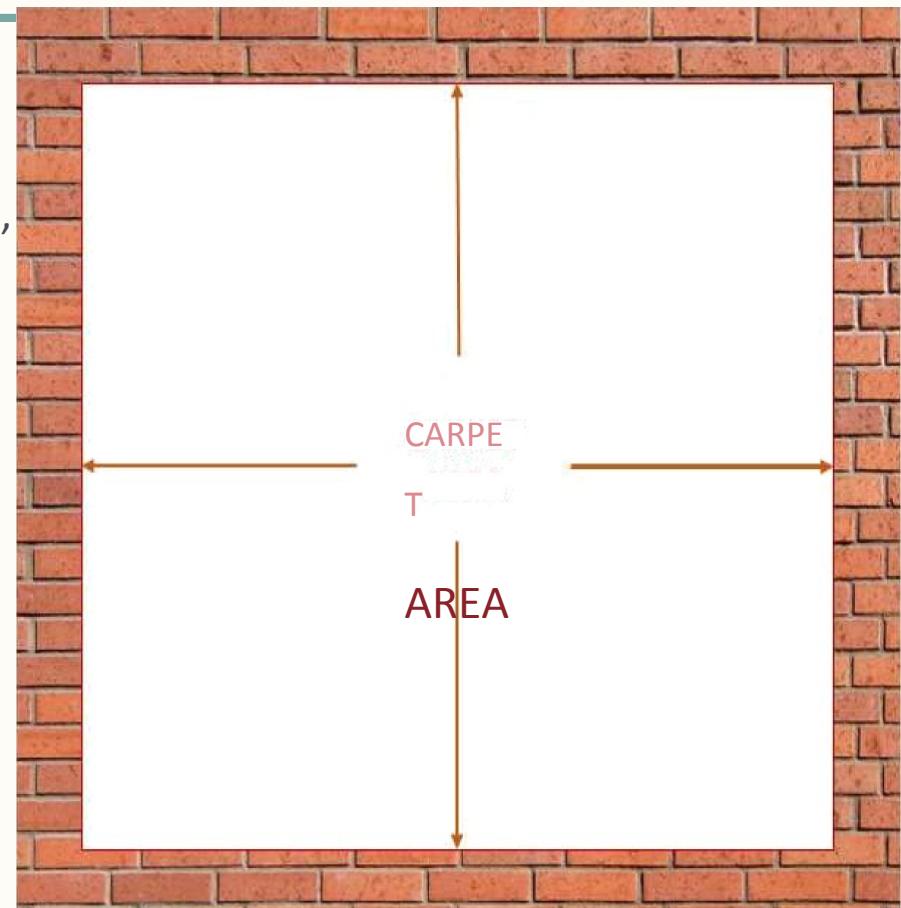


CARPET AREA

- The area available for use within an apartment *excluding* the area occupied by the walls is called carpet area.
- In other words, carpet area is measured from wall—to- wall within the apartment and translates into the actual floor area which you can carpet.

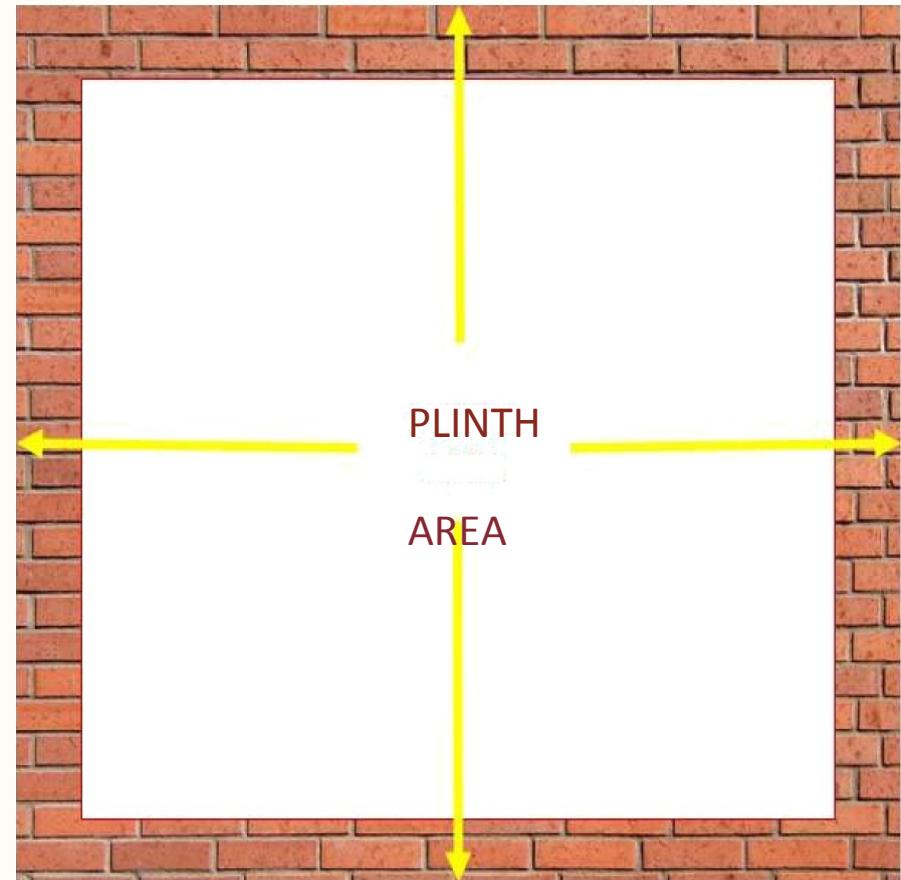


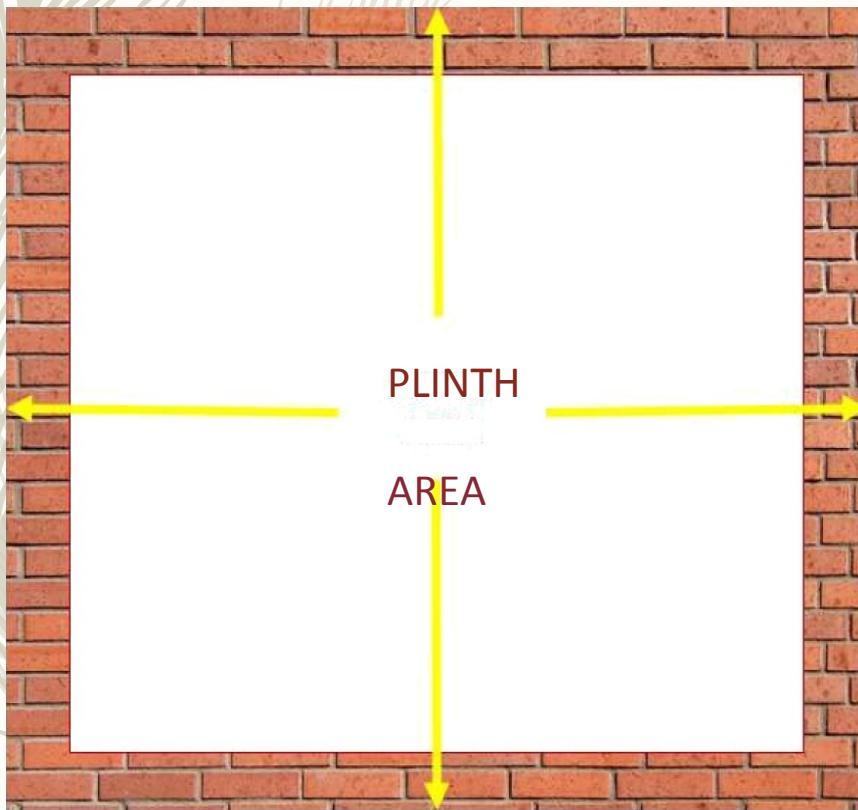
- Areas Included
 - All rooms — living room, bedrooms, dining room, dressing room, other rooms
 - **Kitchen and bathrooms**
 - Stores and balconies
- Areas Not Included
 - External and internal walls
 - Common areas (lobbies, **gateway, etc.**)



Plinth area

- Also called built-up area, plinth area is the entire area occupied by the apartment, including the area occupied by the internal and external walls of the apartment. Usually,
- .it is 10% to 20% more than the carpet area.

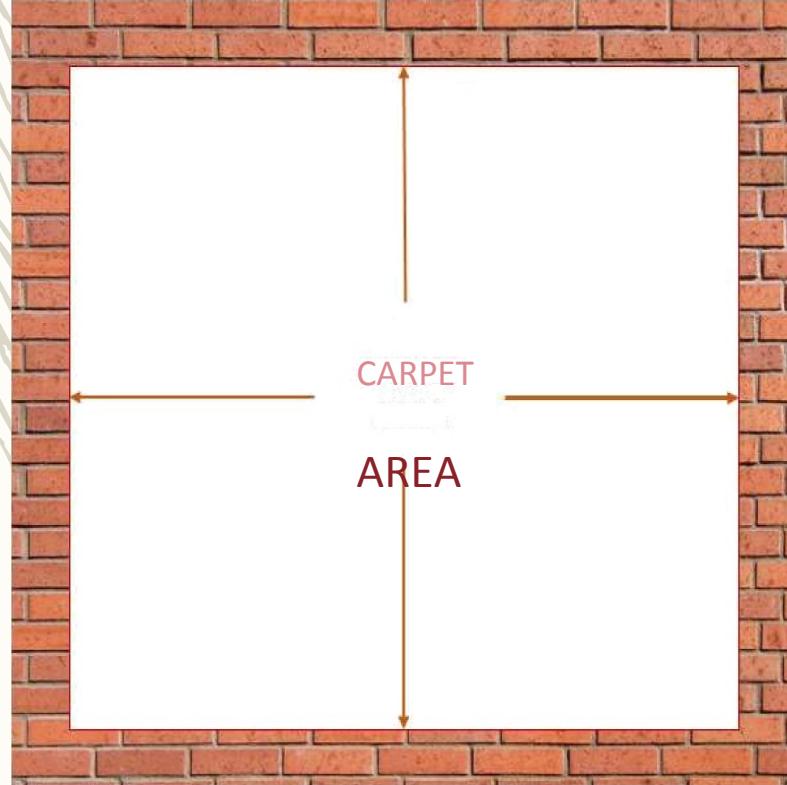




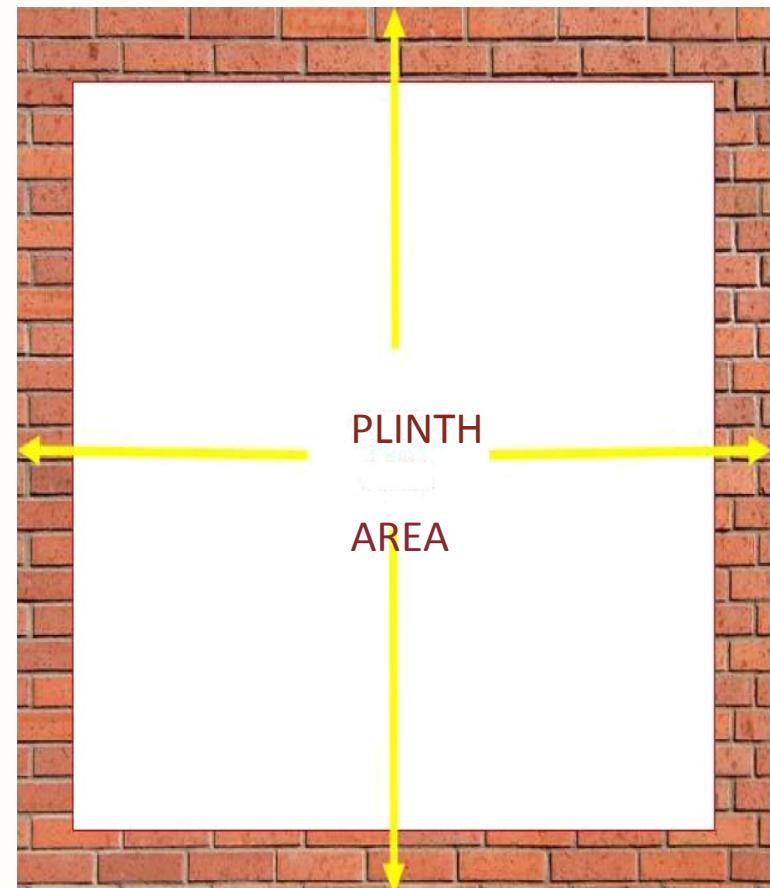
- Area Included
 - Entire carpet area
 - Internal and external walls
 - Utility ducts within walls of the unit
- Areas Not Included
 - Common areas (lobbies, gateway, etc.)

Difference between carpet Area and Plinth Area

— Actual floor area inside apartment.



— Entire area occupied by the apartment



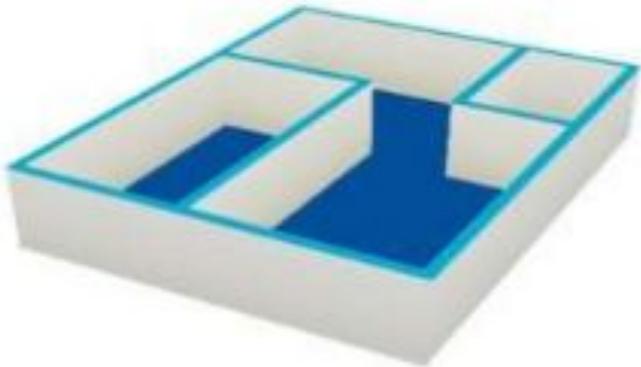
- 
-
- Plot area : The area enclosed between plot boundaries
 - Covered area : It is the ground covered above plinth. Area occupied by compound wall, gardens, wells etc. are not included in the covered area.
 - Built up area : Area covered by all floors in the building and stair case, shafts is excluded from this area
 - Floor area : It is the usable covered area of the building at any floor

Includes	Excludes
Doors and other openings	Plaster along walls (<300 m ²)
Internal pillar and supports	Fire places projecting beyond face of the wall
Plaster along walls (>300 m ²)	

Covered Area

■ Carpet Area + ■ Wall

Actual area under the roof
+ walls, pillars & balconies

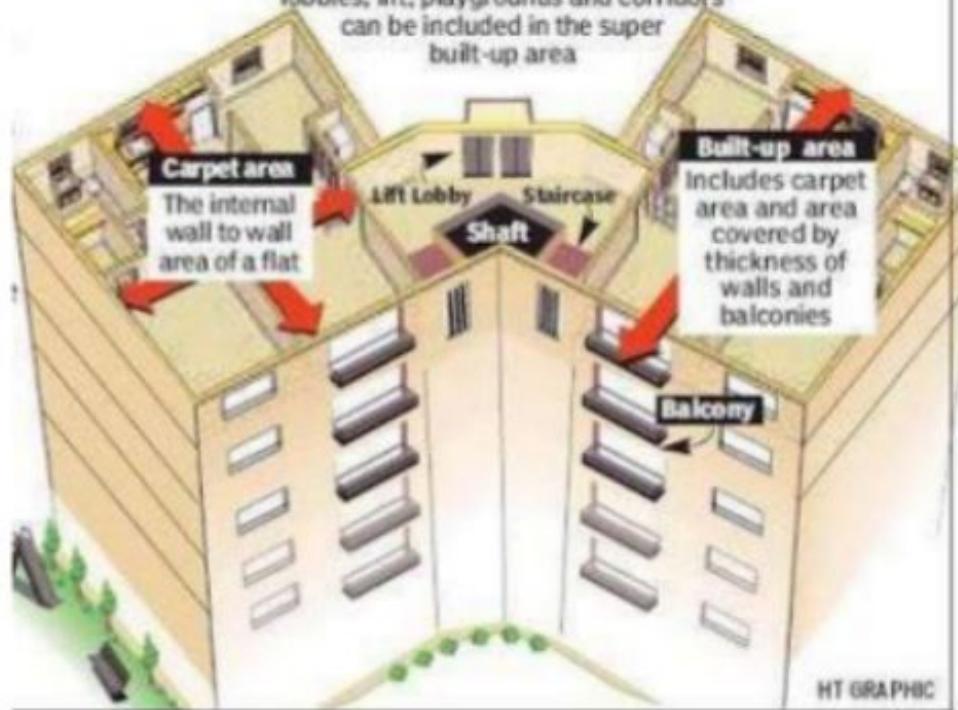


– 10% more than carpet

ATES

Super built-up area

Common areas and facilities like staircases, lobbies, lift, playgrounds and corridors can be included in the super built-up area



FLOOR AREA RATIO (FAR)

- It is the ratio of Total built up area for the building (taken together) to the total plot area.
- $\text{FAR} = \frac{\text{Total Floor area of the floors}}{\text{Plot area}}$