

MODULE I

Credits: To whomsoever that has taken the effort to put together this document in a simple and easy to comprehend form.

Topics as per syllabus

- Relevance of Civil Engineering in the overall infrastructural development of the country.
- Responsibility of an engineer in ensuring the safety of built environment.
- Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.
- Types of buildings, selection of site for buildings, components of a residential building and their functions.
- Building rules and regulations: Relevance of NBC, KBR & CRZ norms
- Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

References

- **BASIC CIVIL ENGINEERING –SHIBU NALPAT**
- **BASIC CIVIL ENGINEERING – B C PUNMIA**
- **BASICS OF CIVIL ENGINEERING - DR.SWARNALATHA**
- **ENGINEERING MATERIALS- RANGWALA**
- **BASIC CIVIL ENGINEERING- GOPI. S**

Civil Engineering :DEFINITION

- The art of directing the great sources of power in nature for the use and convenience of man
 - A professional engineering discipline that deals with:
 - design
 - construction
 - maintenance
- of the infrastructure including works like roads, bridges, canals, dams, and buildings.

Civil Structures...



Civil Structures...



Civil Structures...



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Relevance of Civil engineering in the Infrastructural Development

INFRASTRUCTURE

- Infrastructure is the frame work of supporting system consisting of transportation ,energy, communication, irrigation facilities etc for the economic development of a country
- Typical technical structures such as
 - ✓ roads & bridges
 - ✓ tunnels
 - ✓ water supply & sewers
 - ✓ electrical grids
 - ✓ telecommunication

***MAJOR IMPACTS OF
INFRASTRUCTURAL DEVELOPMENT
ON THE COUNTRY***

- ✓ Increase in food production
- ✓ Protection from calamities like drought, famine, flood
- ✓ Healthy and comfortable housing facility & AFFORDABLE HOUSING
- ✓ Safe domestic and industrial water supply
- ✓ Safe and scientific waste disposal
- ✓ Improvement in communication and transportation
- ✓ Generation of electricity from nuclear, hydel, thermal, solar or wind energy
- ✓ Improved wealth, prosperity, standard of living
- ✓ Overall growth of a nation

- *importance of civil engineering on infrastructural development of India*
- A civil engineer has to conceive plan, estimate, get approval, & maintain all civil engineering infrastructure activities.
- Civil engineer has very important role in the development of following infrastructures:
- 1.town and city planning
 - 2.Build tanks dams to exploit water resources
 - 3.purify water and supply water to needy areas like houses, schools etc
 4. Provide good drainage system and purification plants
 - 5.Provide and maintain communication systems like roads, railways, airports etc
 - 6.Monitor land,water and air pollution and take measures to control them

ROLE OF CIVIL ENGINEERS IN INFRASTRUCTURAL DEVELOPMENT ON THE COUNTRY

Construction of

1. **ROADS**



2. **RAILS**



HOUSIN

3. AFFORDABLE HOUSING



COMMERCIAL

5.COMMERCIAL BUILDINGS



DAMS

6.



7.HARBOURS

HARBOU

8.



INDUSTRIAL BUILDINGS

9.



REBUILDING

10.

REHABILITATION

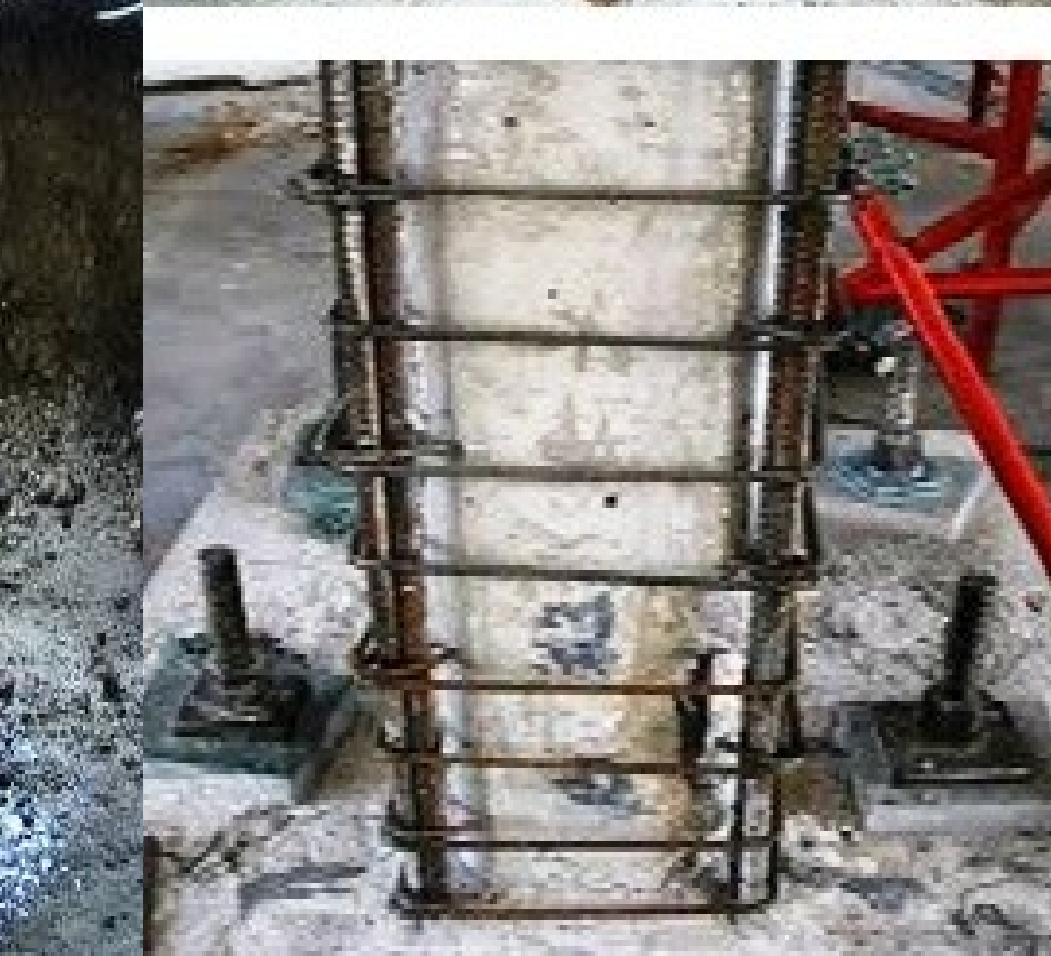


repairing

12.



^{14.} **RETROFITTING**



Providing water supply

15.



Domestic

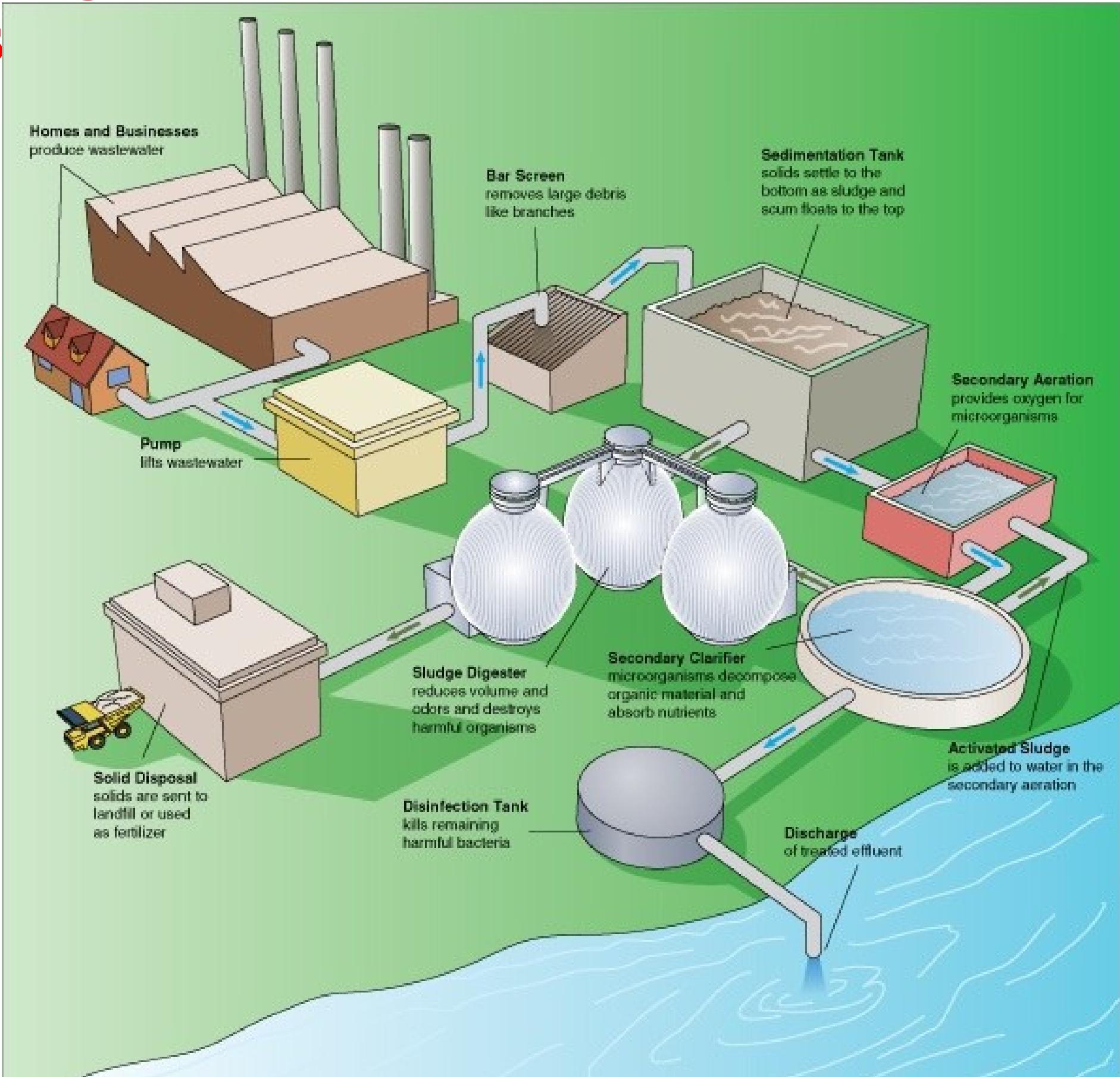


Agricultural



Industrial

Providing secure waste dispos



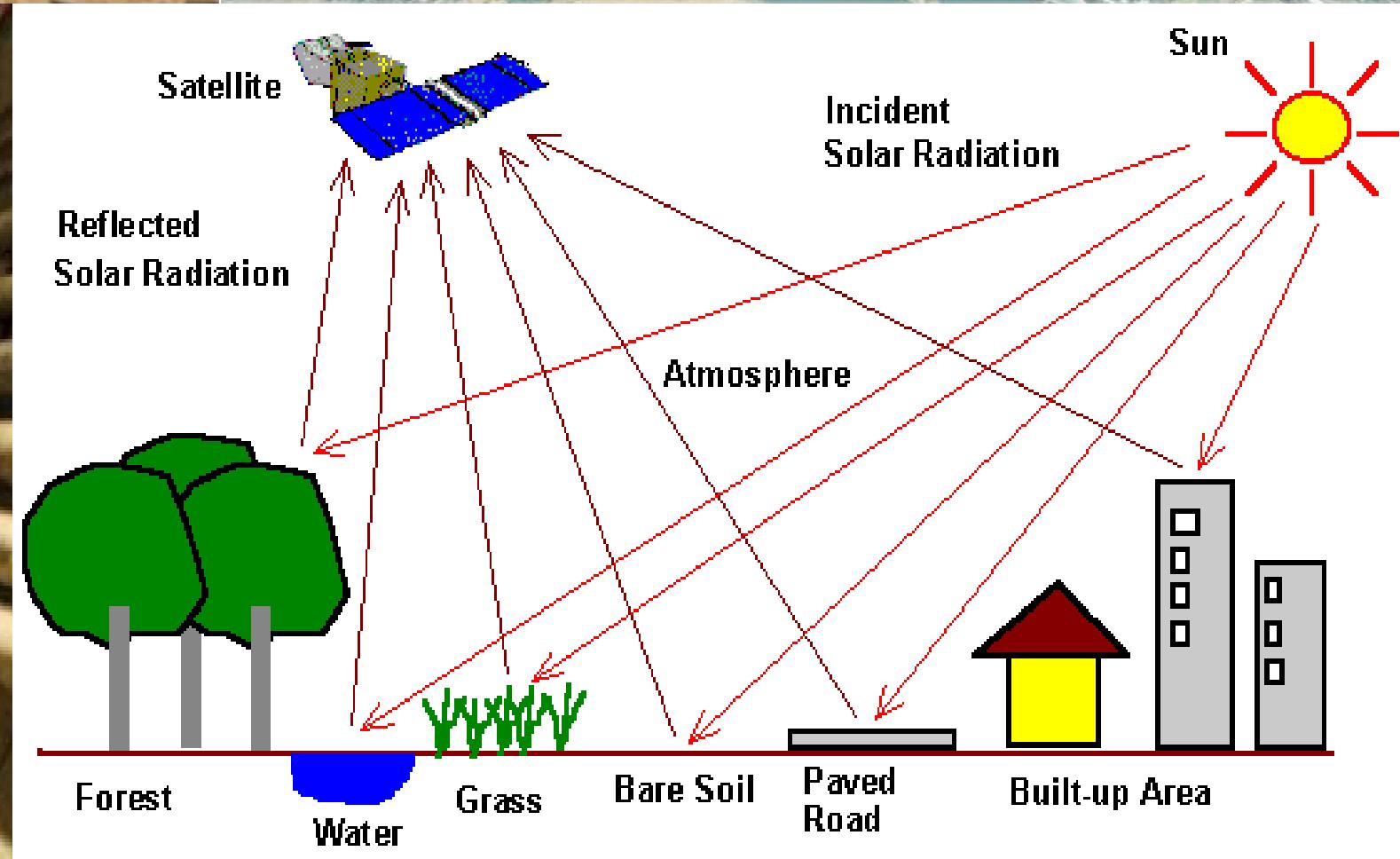
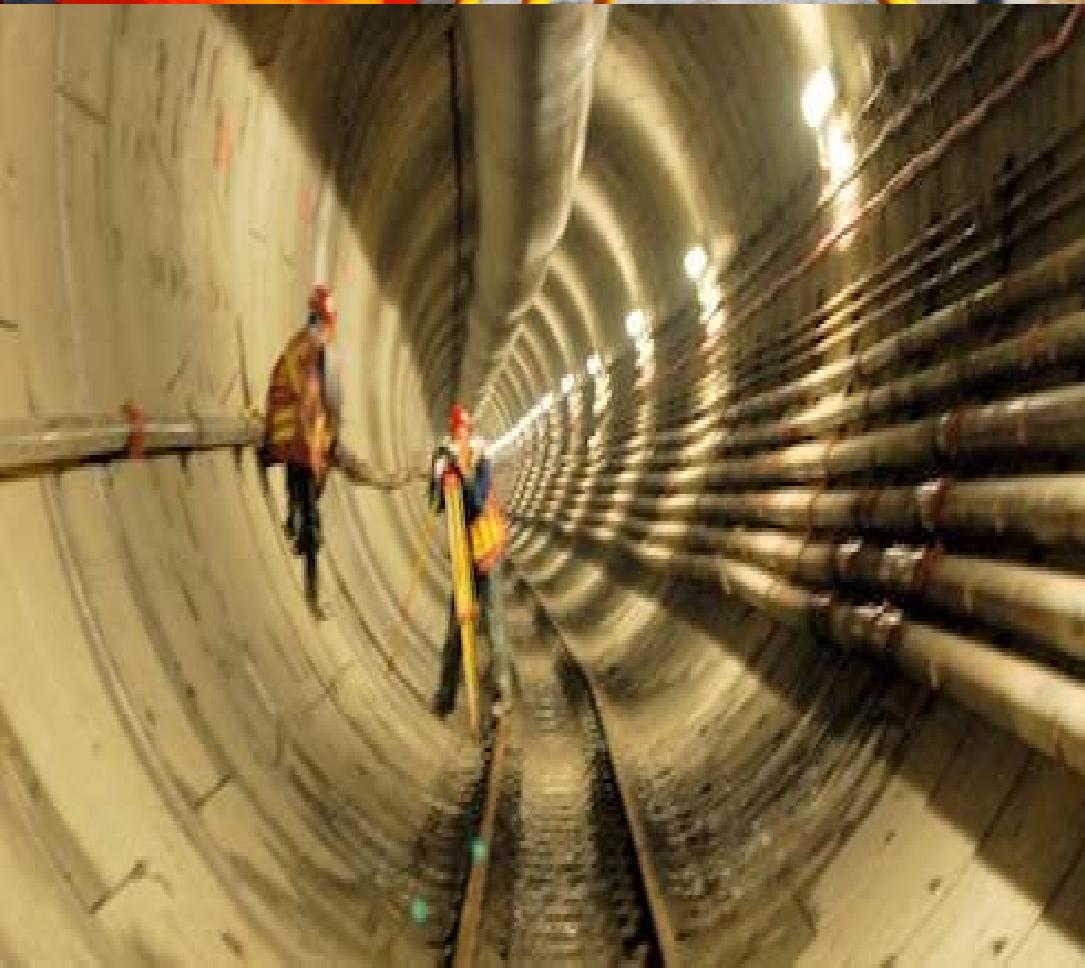
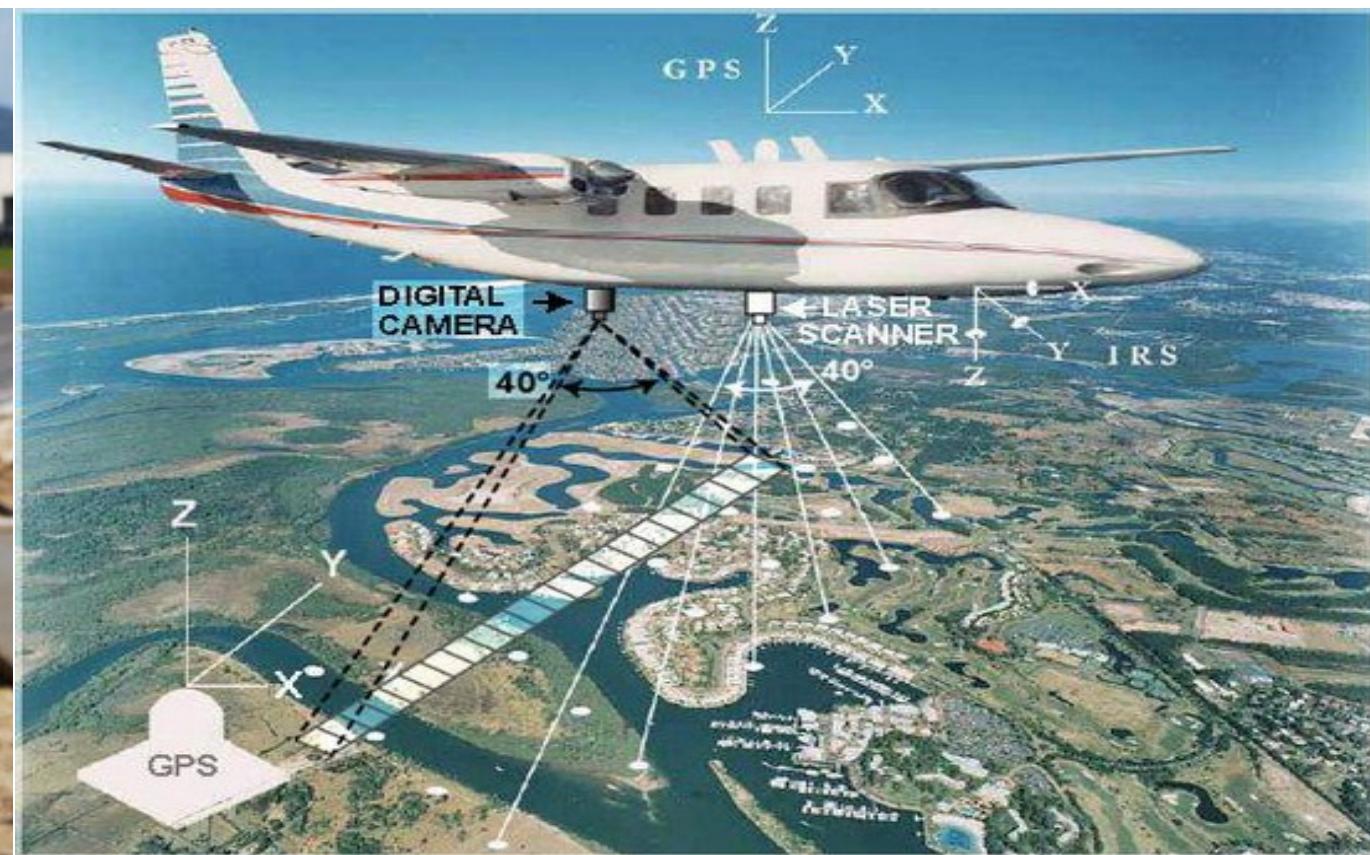
Disciplines of civil engineering

- Surveying and levelling
- Building planning and construction
- *Structural engineering*
- *Geo technical engineering*
- *Water resource engineering*
- *Transportation engineering*
- *Environmental engineering*
- Town planning
- Coastal engineering

SURVEYING & LEVELLING



REMOTE SENSING



SURVEYING & LEVELLING

- Surveying includes measurements of distances and angles in horizontal & vertical planes, while leveling is the measurement of heights in vertical plane. Chain, compass, level and theodolite are the instruments used for surveying.
- Surveying fixes the relative positions of different points on the basis of surface of earth. It also includes measurements of areas and volumes. Basic aim of surveying is to prepare a map of the area to some scale.

BUILDING PLANNING & CONSTRUCTION



Building planning and construction

- Construction is the process of constructing a building or infrastructure
- Involves planning, execution, transportation of materials etc

Construction ENGINEERING & management



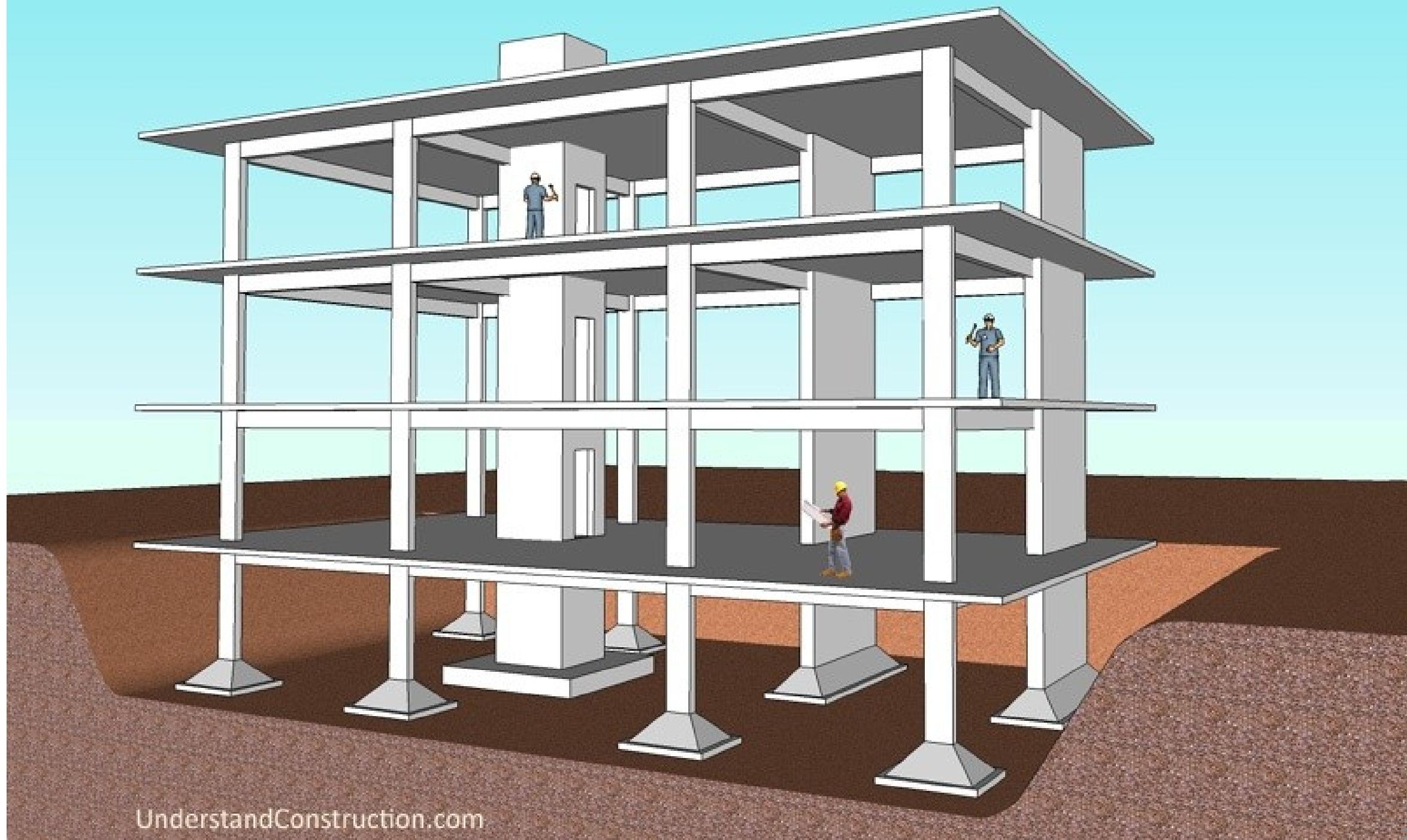
Structural engineering



STRUCTURAL ENGINEERING

Concrete Frame Structures

UnderstandConstruction.com



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.

GEOTECHNICAL ENGINEERING



GEOTECHNICAL ENGINEERING



GEOTECHNICAL 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.

TRANSPORTATION ENGINEERING



TRANSPORTATION ENGINEERING



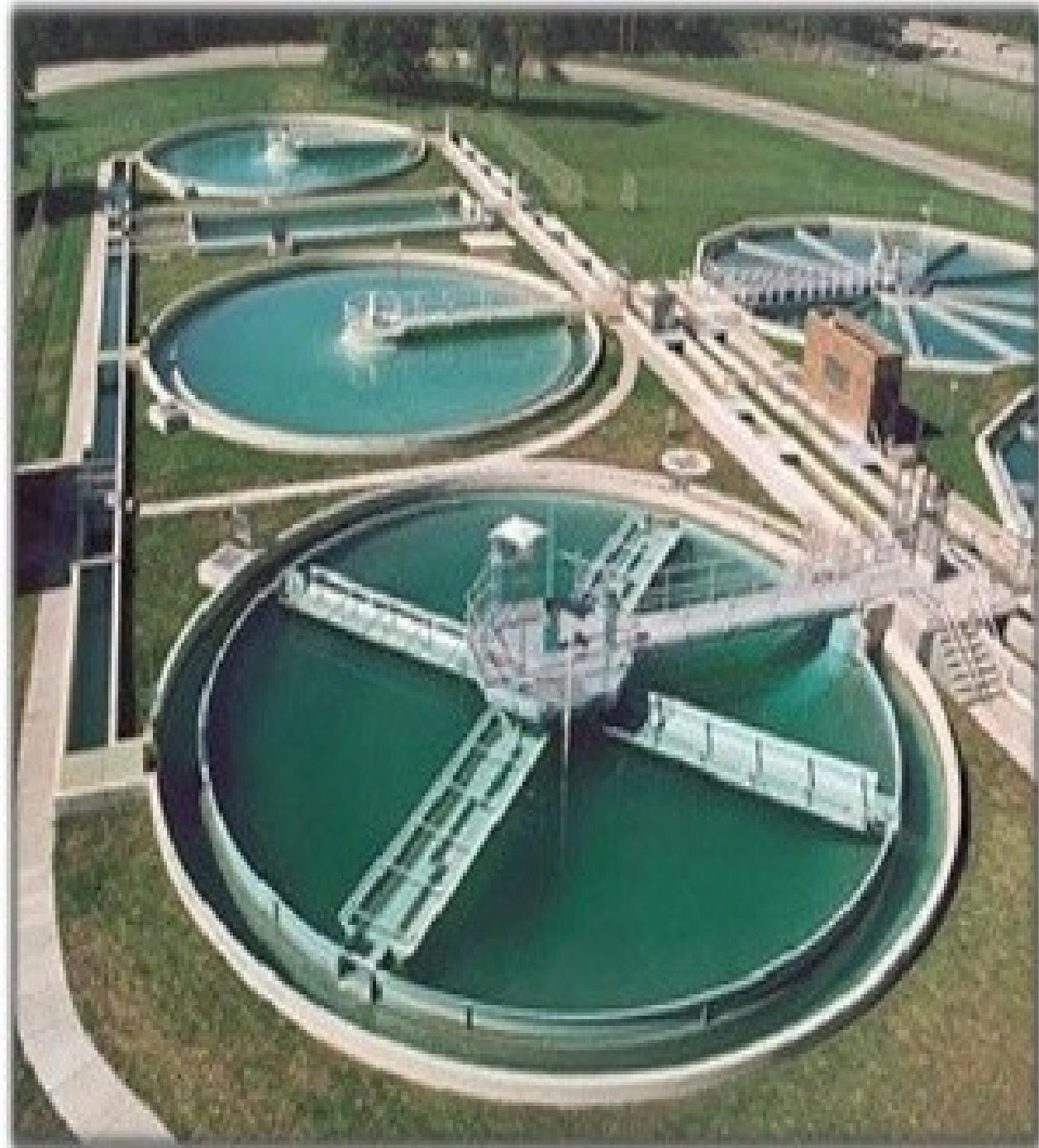
TRANSPORTATION ENGINEERING

- 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.

ENVIRONMENTAL ENGINEERING



ENVIRONMENTAL ENGINEERING



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.

WATER RESOURCES & HYDRAULICS ENGINEERING



WATER RESOURCES ENGINEERING



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.

TOWN PLANNING



TOWN PLANNING

- Town planning means planned & controlled growth of town by dividing town in to different land use zones and regulating building construction to provide better environment for the people of the town.
- In the town planning areas of town are divided into residential, commercial, recreational and industrial zones, which is called zoning.
- Floor space index, and other byelaws are fixed to guide and regulate the building construction.

NATIONAL BUILDING CODE (NBC)

- Bureau of Indian Standards (**BIS**) : guidelines for regulating the building construction activities across the country
- Published on 1970
- First Revision – 1983
- Latest Edition – 2016
- Also known as SP 7
- Consists of 12 parts

BUILDING - DEFINITION

- Structure enclosing any land or space
 - ✓ for different *purposes*
 - ✓ constructed with different *materials*
 - ✓ Including : foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, verandah, balcony, cornice
- ❖ *Tents/ shamianahs / pandals, tarpaulin shelters, etc, erected for temporary and ceremonial occasions shall not be considered as building.*



CLASSIFICATION OF BUILDINGS

i) Occupancy Classification

A) Residential building

B) Educational building

C) Institutional building

D) Assembly building

E) Business building

F) Mercantile building

G) Industrial building

H) Storage building

J) Hazardous building

GROUP A: RESIDENTIAL

- The buildings in which *sleeping accommodation* is provided for normal residential purposes, *with or without cooking or dining or both facilities*



SUB DIVISIONS A -1: LODGING OR ROOMING HOUSES

Any building or group of buildings under the *same management*, in which *separate sleeping accommodation* for a total of *not more than 40 persons* is provided, *with or without dining facilities, without cooking facilities for individuals*



SUB DIVISION A - 2 :ONE OR TWO FAMILY PRIVATE DWELLINGS

Any *private dwelling* which is occupied by members of a *single family* and has a total *sleeping accommodation* for ***not more than 20 persons***



SUB DIVISION A - 3 : DORMITORIES

- building in which group *sleeping accommodation* is provided, *with or without dining facilities* for persons who are not members of the same family
- For example school, and college dormitories



SUB DIVISION A - 4 : APARTMENT HOUSES (FLATS)

- Buildings in which living quarters are provided for *three or more families* living *independently* of each other and with *independent cooking facilities*



SUB DIVISION A - 5 :

HOTELS

Group of buildings *under single management* in which *sleeping accommodation with or without dining facilities* is provided



Sub Division A - 6 :

STARRED HOTELS

5 star and above hotels includes

in this



GROUP B : EDUCATIONAL BUILDINGS

Any building used for *school, college or day care* purposes for *more than 8 hrs per week* involving assembly for instruction, education etc



GROUP B- subdivisions

- **B-1 Schools up to senior secondary level**
- **B-2 All others/training institutions**
- If *residential accommodation* is provided in the schools/institutions, that *portion of occupancy* shall be classified as a building in **sub-division A-3.**



Group C : Institutional building

Building for a *medical or other treatment or care* of all persons providing *sleeping accommodation* for the occupants

Subdivision C-1 Hospitals and sanatoria



Subdivision c2 :Custodial institutions

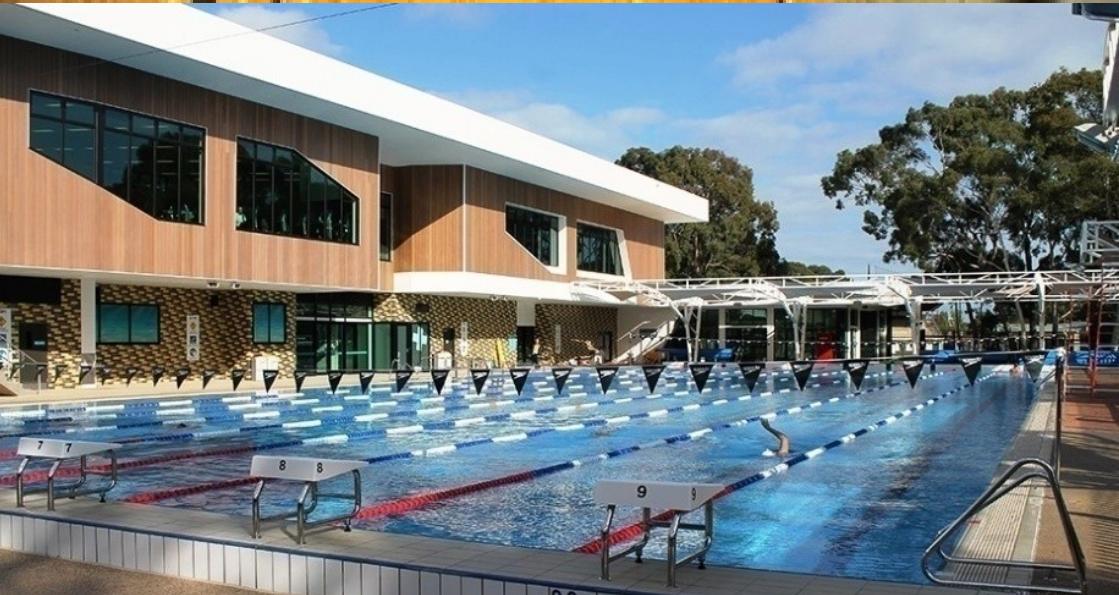


Subdivision C-3 :Penal and mental institutions



GROUP D: ASSEMBLY BUILDING

- Any building or part of building where *group of people* gather for *amusement, recreation, social, religious* and similar purposes.
- For example: theatres, exhibition hall, dance halls, club rooms etc

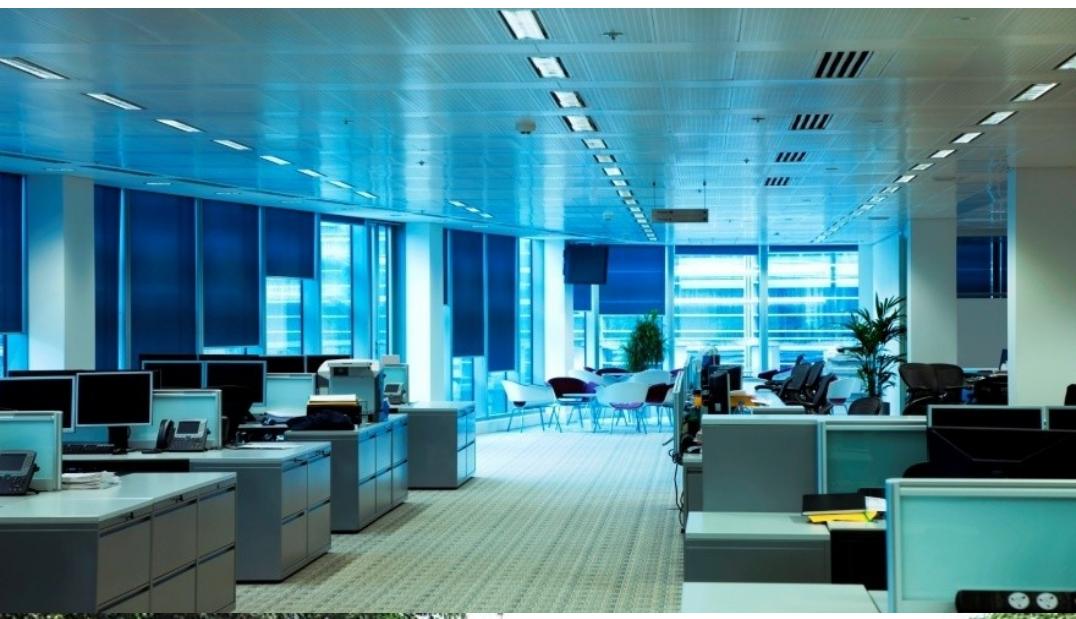


- **Sub-division-D1**:with fixed seats *over 1000 persons* like theatres
- **Sub-division-D2**:with fixed seats *less than 1000 persons*
- **Sub-division-D3**:without permanent seats for *over 300 persons*
- **Sub-division-D4**:without permanent seats for *less than 300 persons*
- **Sub-division-D5**:temporary structures at ground level *amusement park structures, circus tents* etc
- **Sub-division-D6**: *mixed occupancy* like *malls*
- **Sub-division-D7**: *permanent or temporary* structure built *underground or elevated* like underground or elevated railways



GROUP E : BUSINESS BUILDING

- building or part of building for the *transaction of business, for the keeping of accounts and records*
- For example: city halls, town hall, court houses and libraries
 - **sub-division E-1:** Offices, banks, professional establishments, like offices of architects, engineers, doctors, lawyers and police stations.



– *sub-division E-2:*

Laboratories, research establishments, libraries and test houses.

– *sub-division E-3 :*

Computer installations.

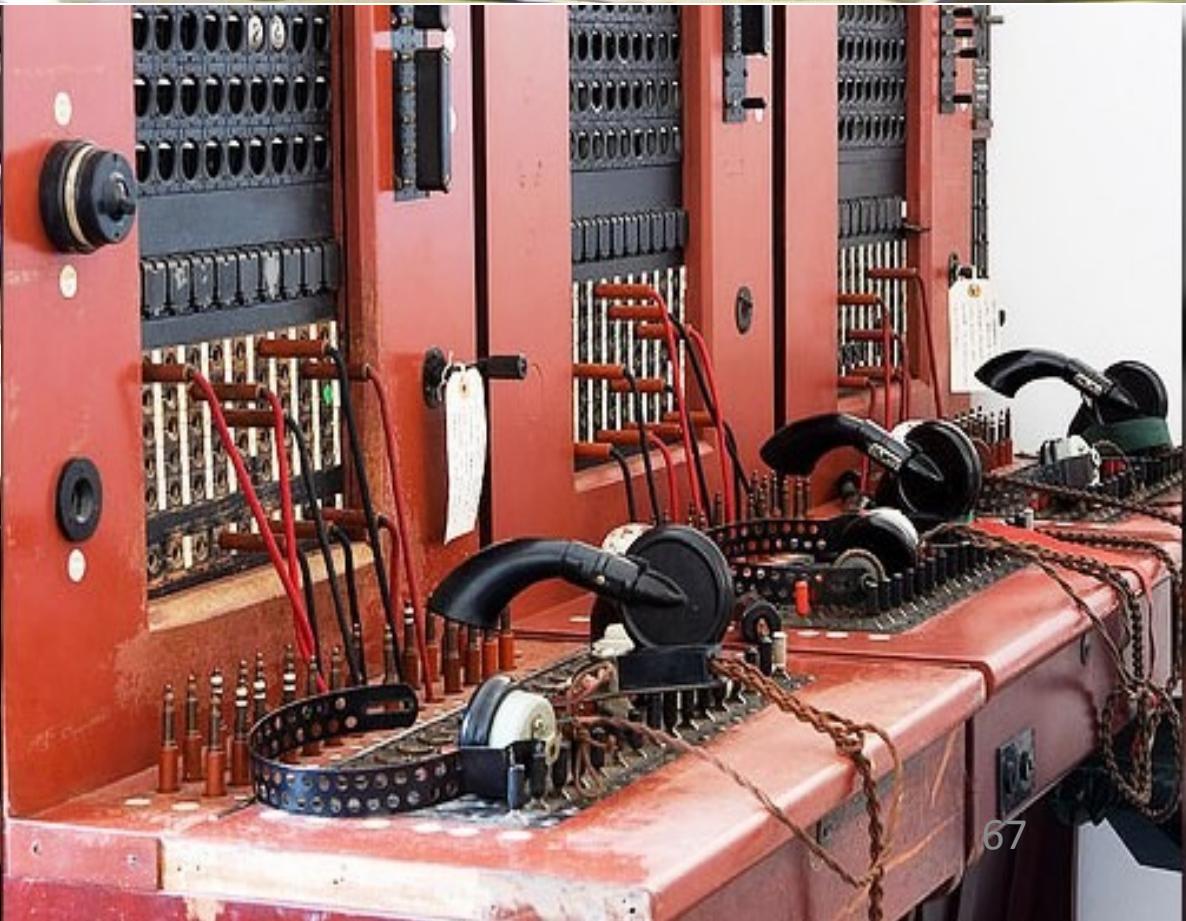


- *sub-division E-*

4 : Telephone exchanges.

- *sub-division E-5:*

Broadcasting stations and T.V. stations.



GROUP F: MERCANTILE BUILDING

- Building or part of building which is used as *shops, stores, markets* for display and sale of merchandise, *either wholesale or retail*

– *sub-division*

F-1

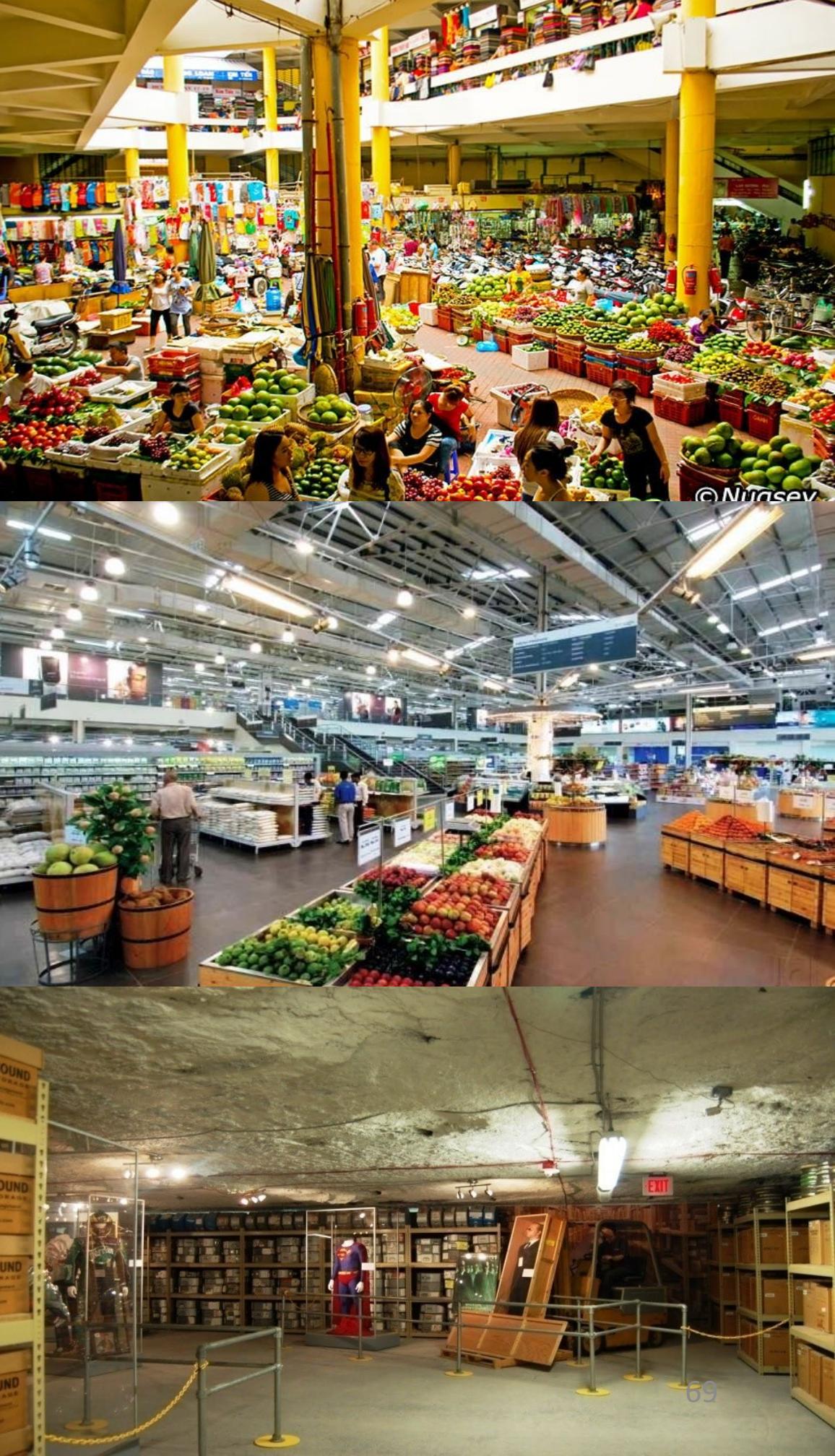
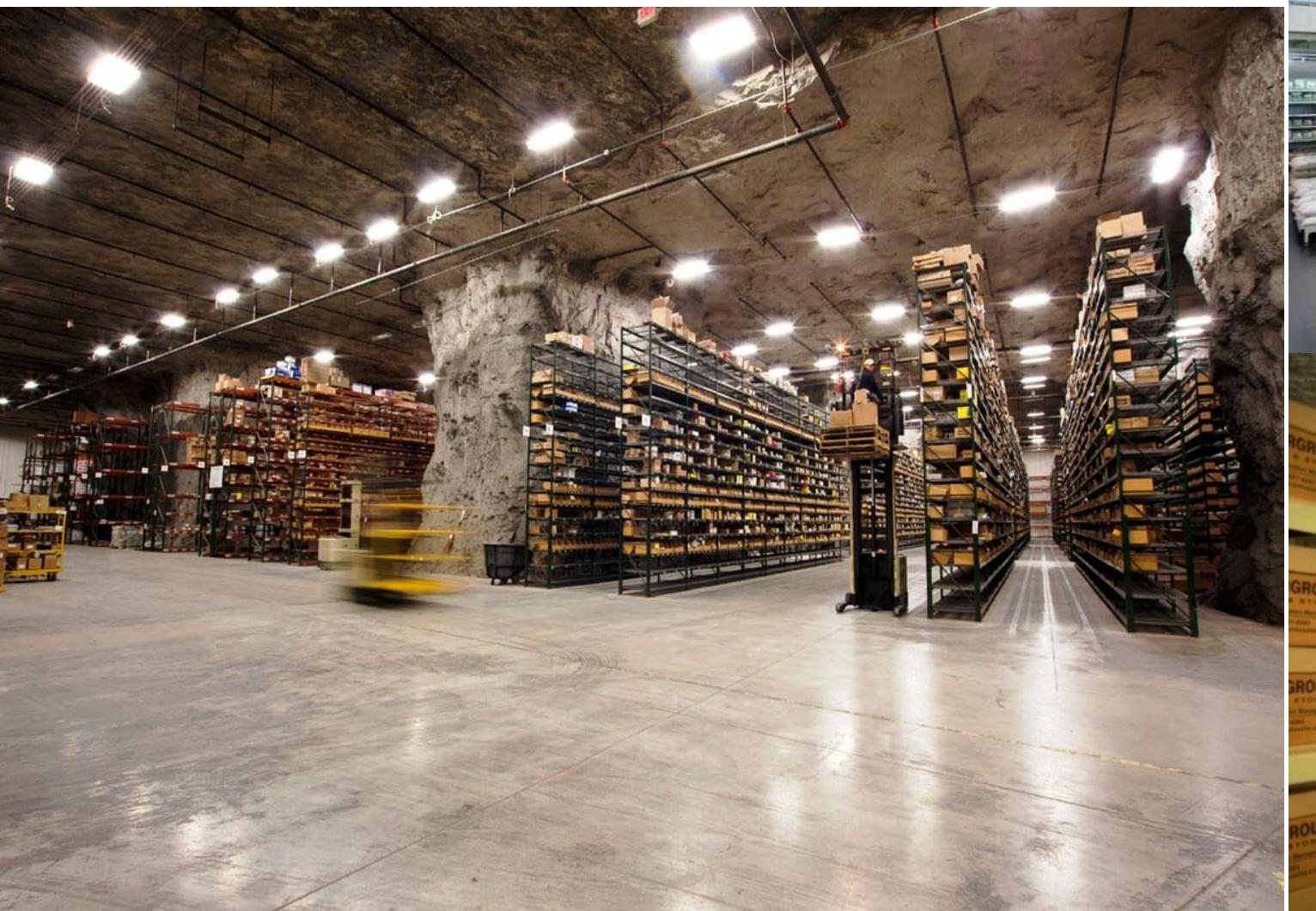
Shops, stores, departmental stores markets with area *up to 500 m²*.



- **sub-division F-2** Shops, stores, departmental stores markets with area *more than 500 m²*.

- **sub-division F-3**

Underground storage and service centres.



GROUP G: INDUSTRIAL BUILDING

- Any building or part of a building or structure in which *products or materials* of all kinds and properties are *fabricated assembled or processed*
- For example : laboratories, dry cleaning plants, power plants, pumping stations, gas plants, saw mills etc
 - **sub-division G-1:** Buildings used for *low hazard industries* like dry cleaning plants.



– *sub-division G-2:*

Buildings used for
moderate hazard industries like refineries,
saw mills



– *sub-division G-3:*

Buildings used for *high hazard industries*.



GROUP H: STORAGE BUILDING

- Building or part of building used primarily for the *storage of goods, vehicles or animals*
- warehouses, truck terminals, store houses, cold storages, hangers



GROUP J: HAZARDOUS BUILDINGS

- Building or part of a building which is used for the *storage, handling, manufacture or processing of highly combustible or explosive materials*
- Factories manufacturing, handling and storing explosives, fire works etc



ii) Material Classification

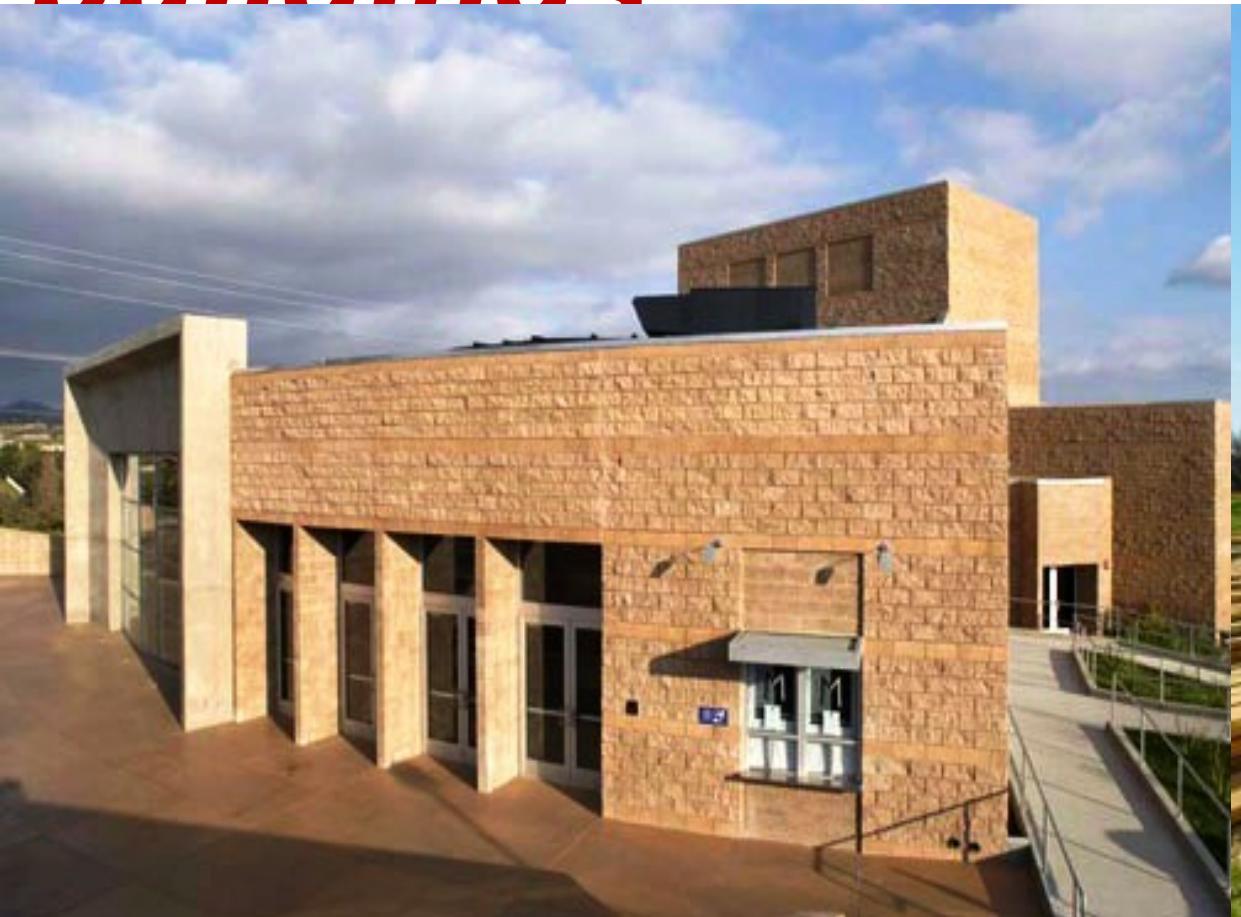
- A) Earthen buildings
- B) Thatched building
- C) Masonry building
- D) Wooden building
- E) Steel building
- F) Reinforced Cement Concrete building

Earthen buildings thatched

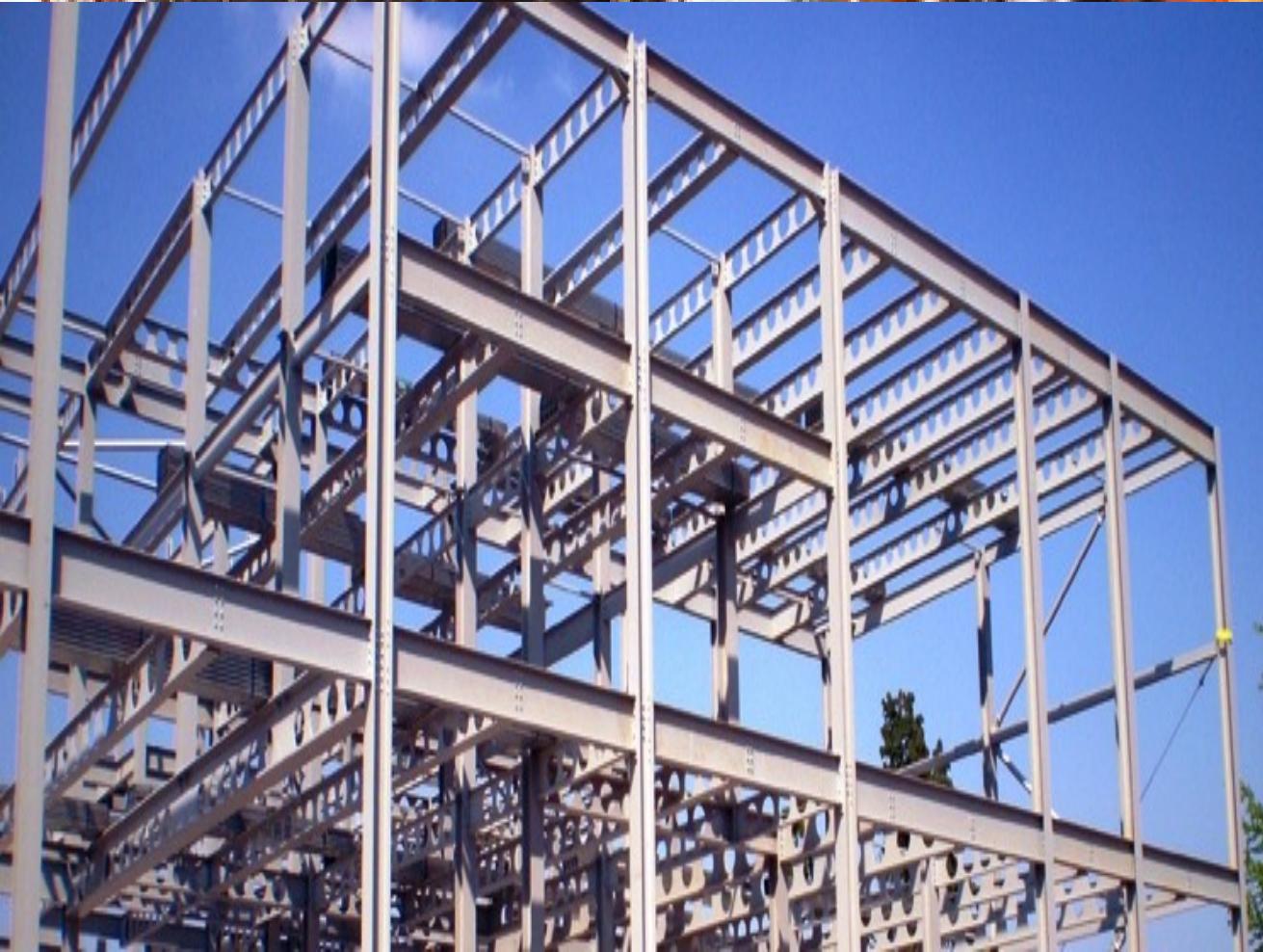


MASONRY buildings

buildings



STEEL buildings



Light gauge steel framing services
for the construction industry

RCC buildings



iii) Based on height of construction

1) ***High Rise Building:*** buildings with $height \geq 15m$



**2) Low
Building:** buildings
with *Rise*
height < 15m



iv) Based on mode of load transfer

1) *Load bearing masonry buildings:*

loads transferred *through masonry* to the foundation



2) *Framed buildings:* loads transferred through
frame work of columns and beams to the foundation



v) Based on mode of fire
resistant capacity

1) Type 1 construction :

- ✓ All *structural* components are *incombustible*, like stone masonry
- ✓ Fire resistant for *4 hours*



2) Type 2 construction :

- ✓ All *structural* components are *incombustible*, like steel structures coated with mortar
- ✓ Fire resistant for *3 hours*



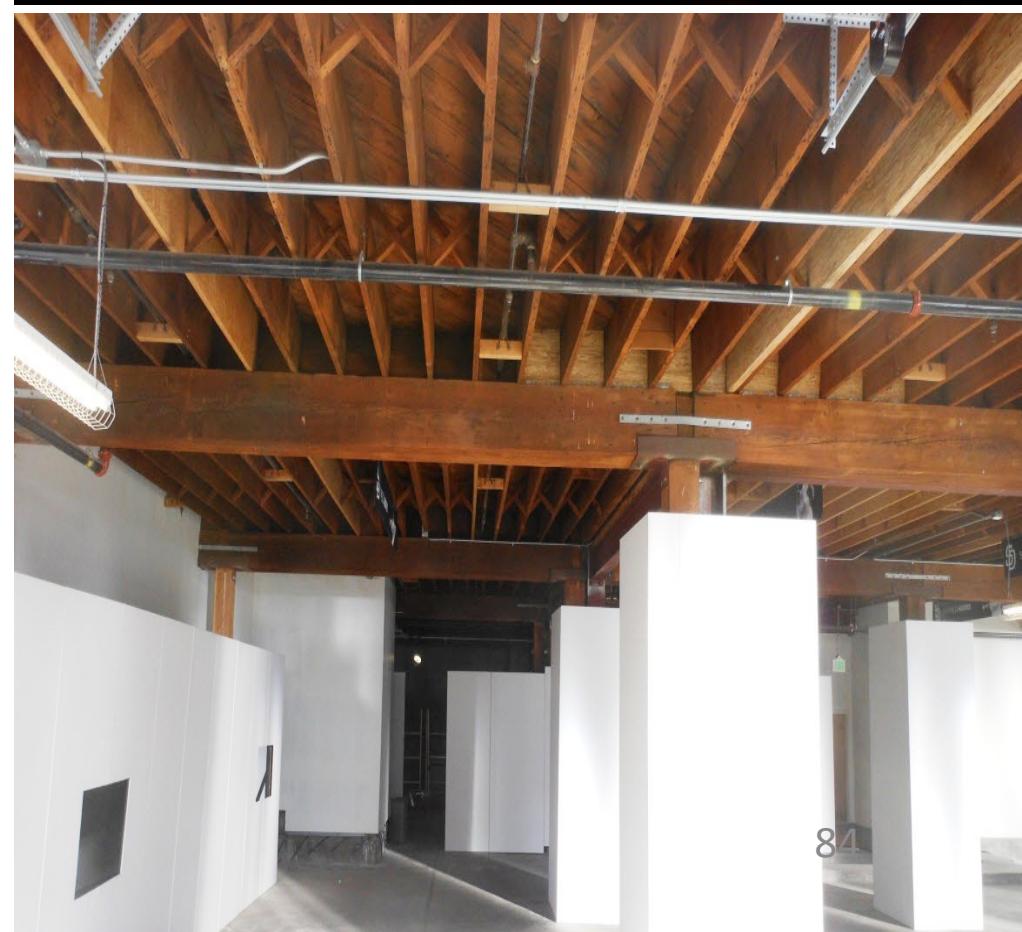
3) Type 3 construction :

- ✓ Exterior portions and inner walls are *incombustible*
- ✓ Other interior components are *combustible*
- ✓ Fire resistant for *2 hours*



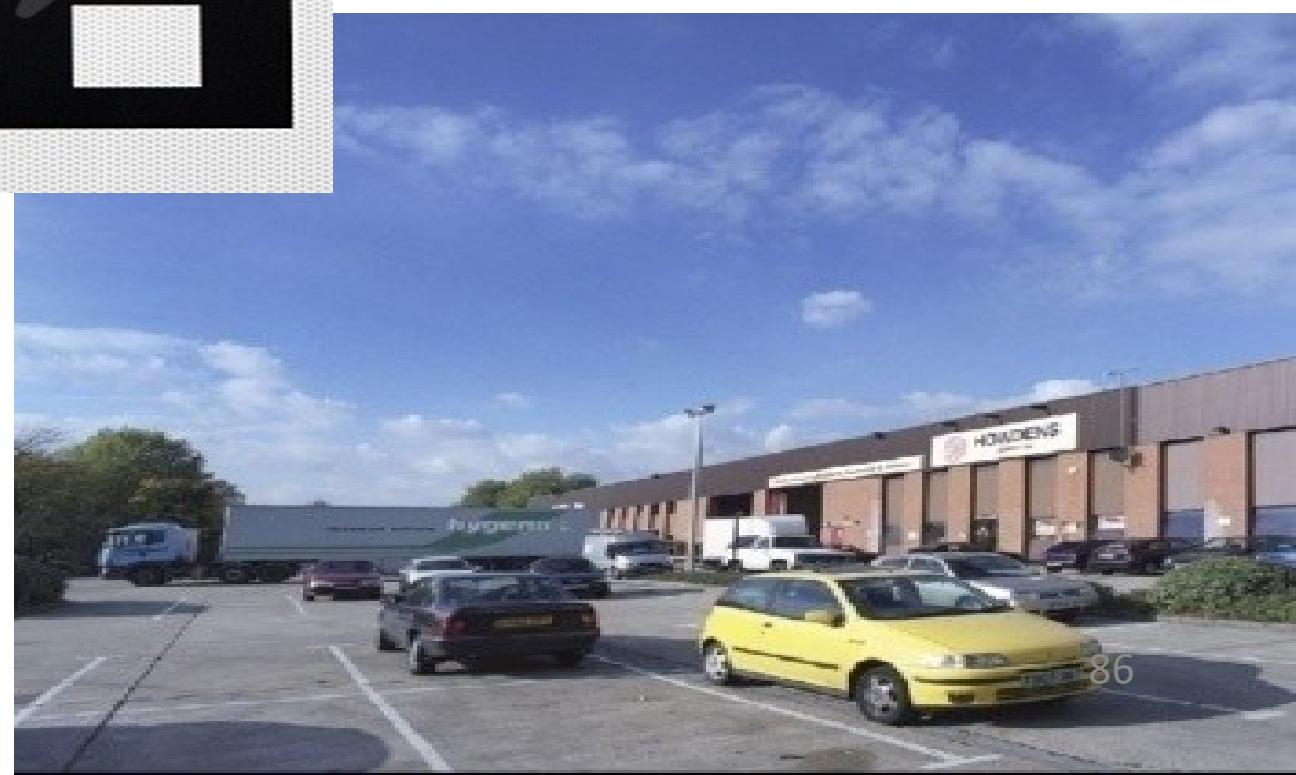
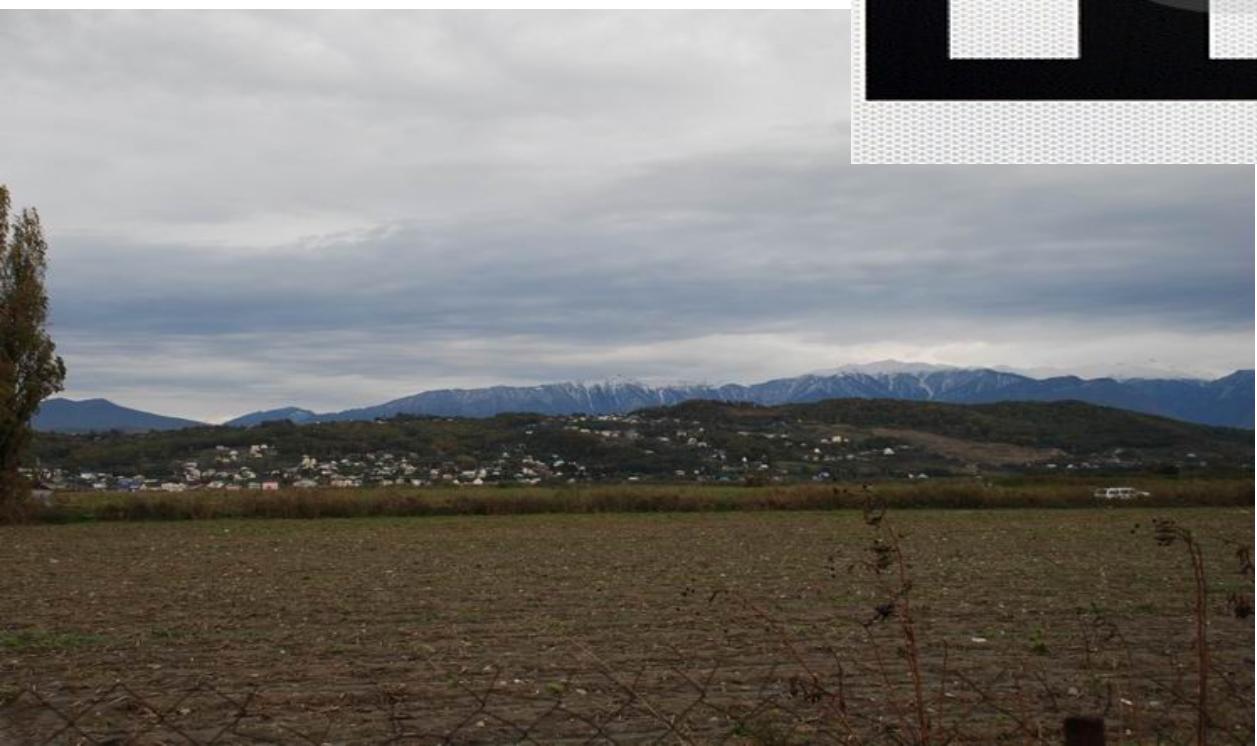
4) Type 4 construction :

- ✓ All *structural* and interior components are *combustible*, like wood, limestone, granite
- ✓ Fire resistant for *1 hour*



SELECTION OF SITE FOR BUILDINGS

How to choose???



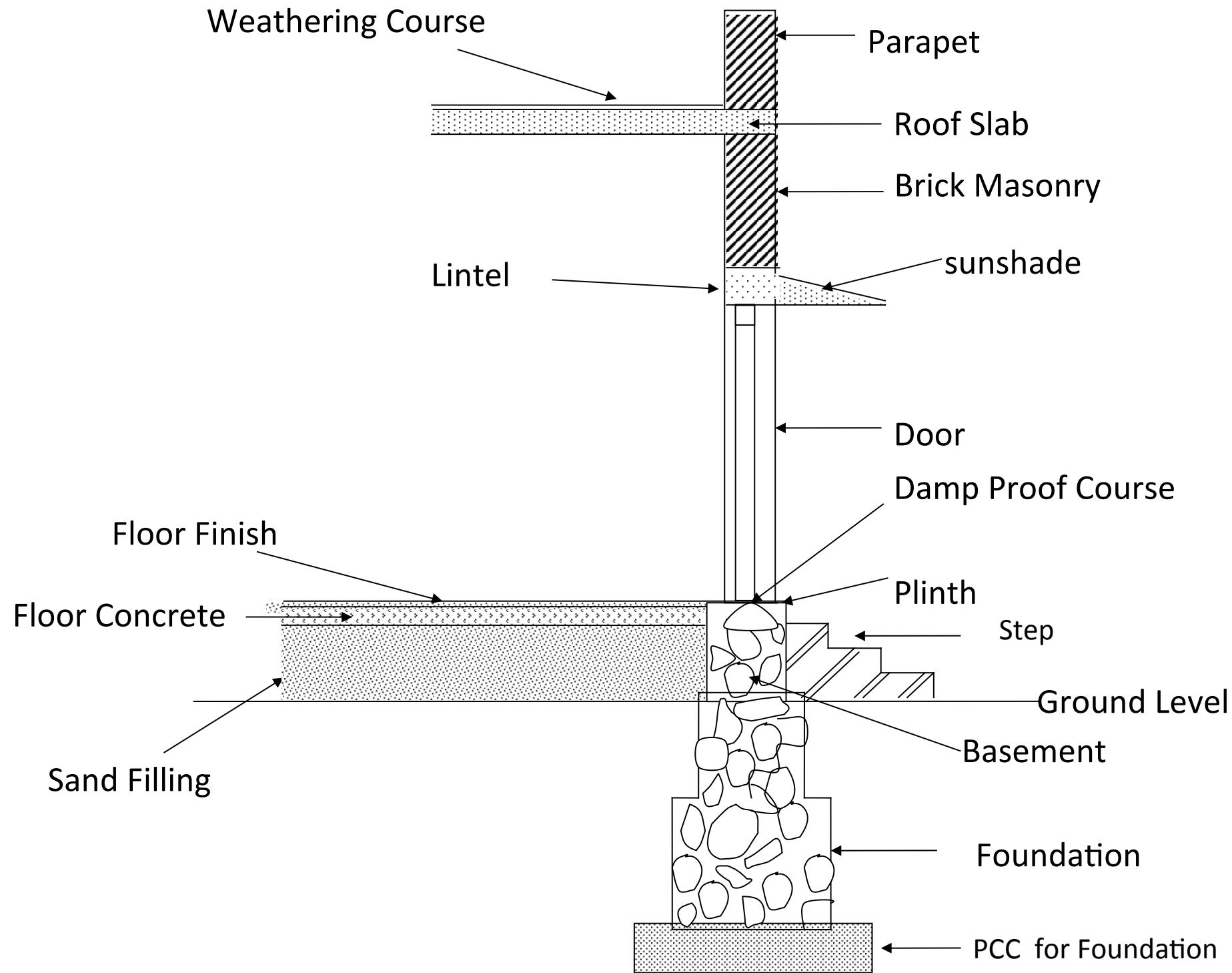
- The *selection of site* for a project depends upon the purpose of building ,mode of construction, available fund, future development if any required, accessibility from road, school, hospital etc
- *UQ:What are the factors to be considered while selecting the site for a residential building*

Requisites for site selection

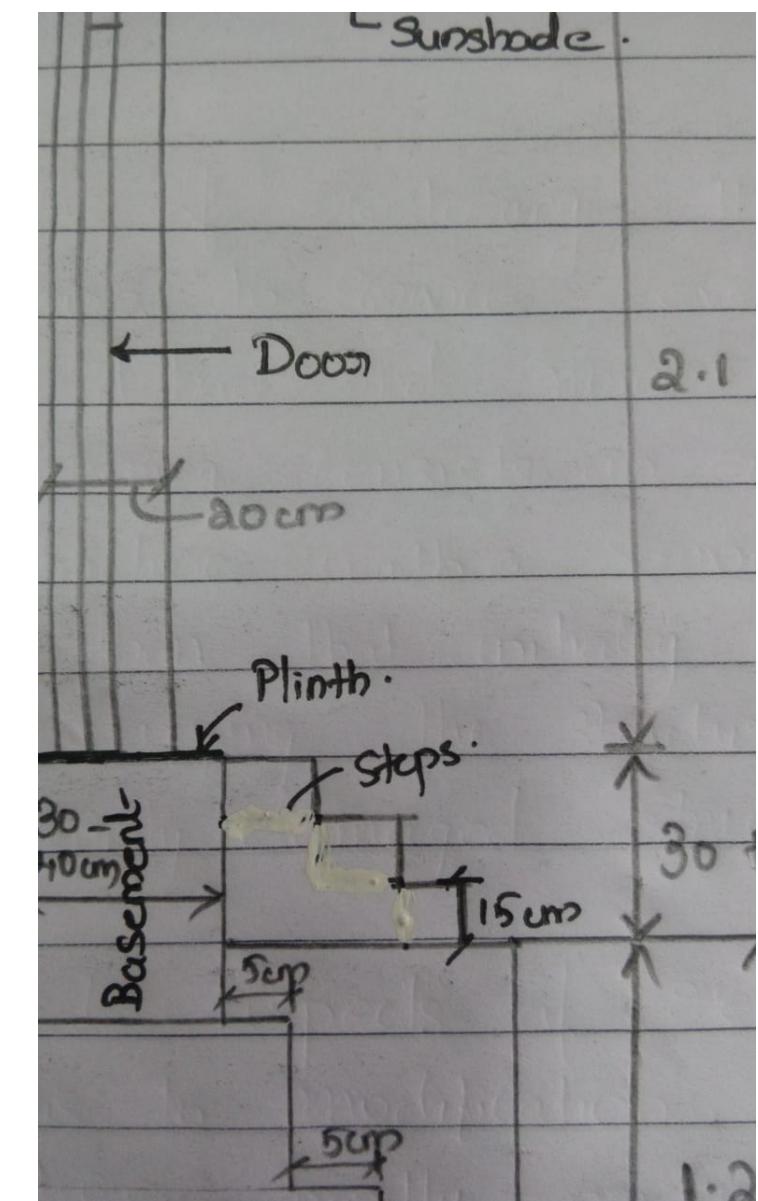
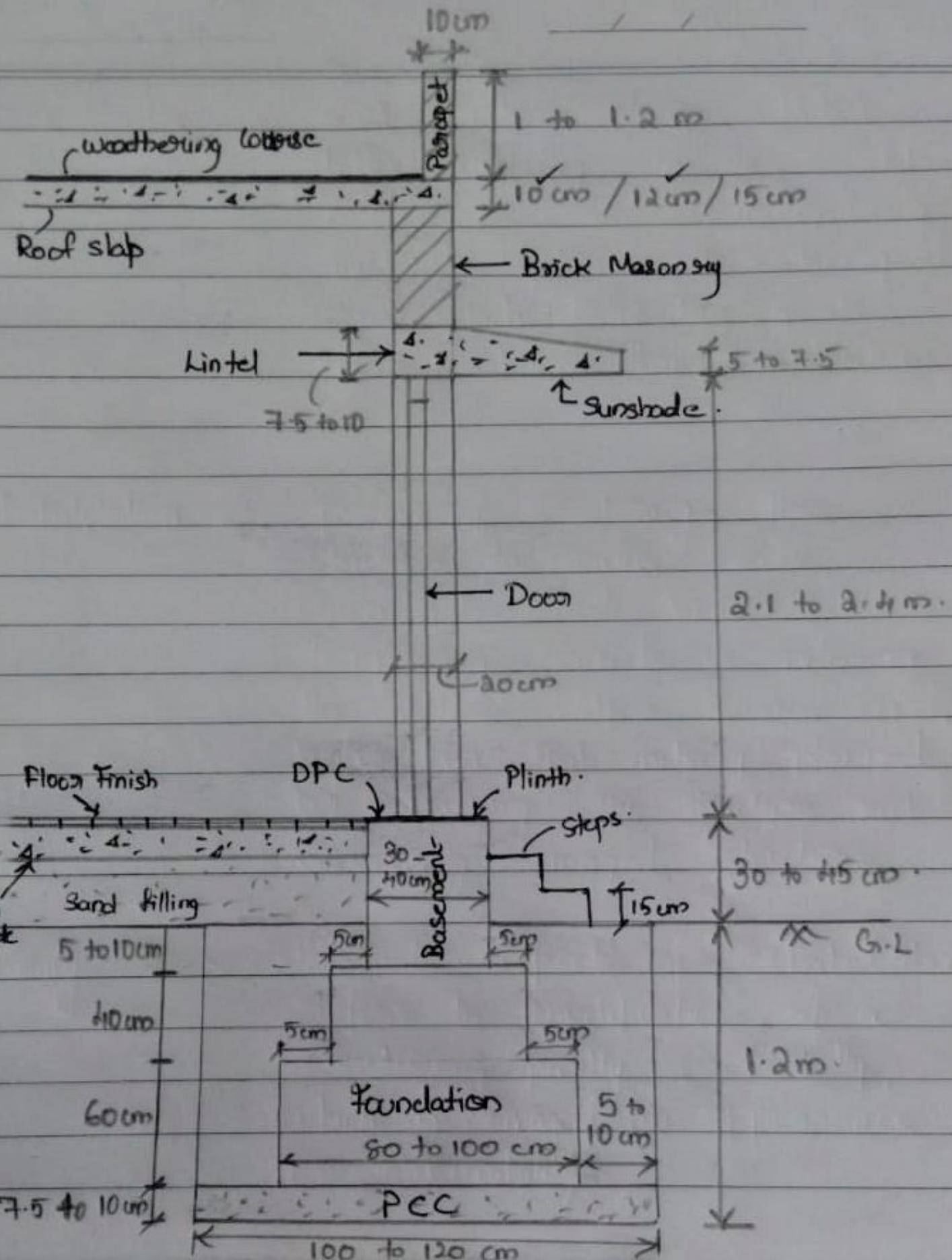
1. Site should be Fairly *level* with *good* quality of *soil*
2. It should be Connected by *roads and other modes of transport*
3. Should have Good *communication* facilities
4. Availability of *electricity, water* and *sewer lines*
5. *It should be Away* from *hazardous industries*
6. *Avoid* flood prone area, water logged area
7. *Amenities* like schools, hospitals, shopping centres should be *nearer*
8. Good *drainage* property

9. It may have *Regular* shape with sufficient *frontage*
10. Places prone to air and water *pollution* should be *avoided*
11. Proper *ownership* and other *legal matters* have to be checked before buying a site
12. Location should be calm but reasonably *developed*
13. Good *natural* ventilation and lighting
14. Area must be sufficient for *present* and *future development*
15. Type of land use recommended at proposed site should be complied as per *town planning/development* schemes

Building Components



UQ:Write short notes on various components of residential building and their functions with neat sketch

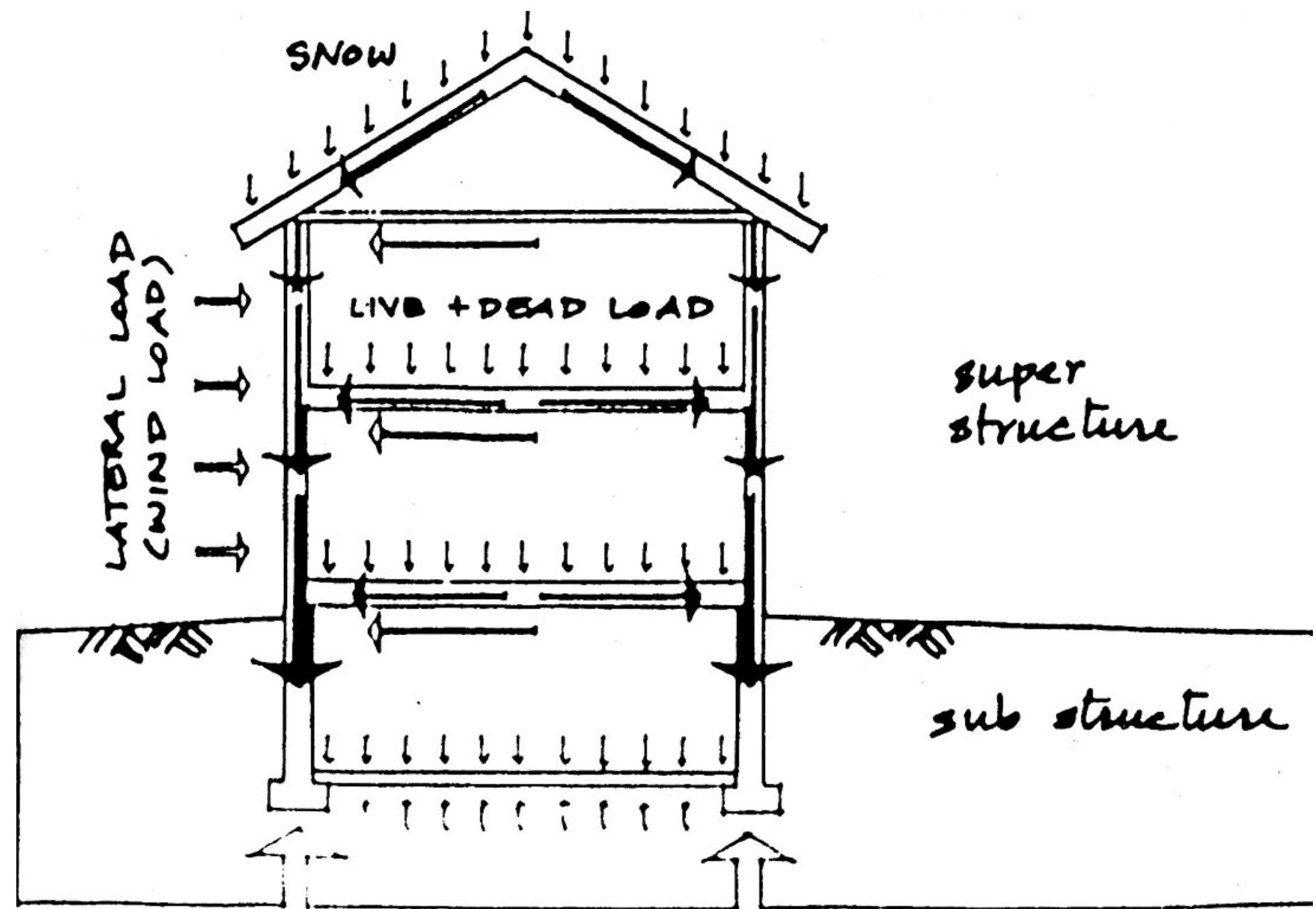


Introduction

A structure essentially consists of two parts,

- super structure which is above ground level
- substructure which is below ground level

UQ: distinguish between
substructure and
super structure(6)



Sub structure

- Portion of the building below ground level
- Which transmits the load of super structure to the soil
- It distributes the total load coming on building uniformly to a large area
- It provides a level surface for the construction of super structure
- It prevents unequal settlement
- It ensures the stability of the building

Super structure

- Component of building which is constructed above ground level
- Super structure includes
 - Walls, floors, doors, windows, lintels etc

foundation

- A **foundation** is the element of a structure which connects it to the ground, and transfers loads from the structure to the ground.
- Foundations are generally classified as
 - shallow ($D < \text{ or } = B$)
 - or deep ($D > B$)

BASEMENT

- The part of building lies between the ground level and plinth level
- **Plinth** : the top outer edge of the basement around the building

Wall and column

- Vertical members of superstructure used to transfer the loads to the foundation
- Function of wall is to divide the space into different rooms

floors

- Provided to divide the building into different stories
- Also give support to occupants, furniture and equipment of a building

Steps and stairs

- Provided for access to the building or to the other floors of the building

Doors and windows

- Provided to give *access* to outside of the building as well as *to connect* inner rooms of the building
- Windows are the *openings provided for ventilation and natural light*

Beams and lintels

- 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 wall





sunshade

- Projection provided outside of a building above the doors and windows *to prevent direct sunlight and rain to the room*

Parapet

- It is *a barrier which is an extension of the wall* at the edge of a roof, terrace, balcony, walkway etc



Roof

- Roof is a *cover* for the building
- it protect the building from rain, wind, snow, sunlight etc
- Roofs may be flat, sloping or curved type

Weathering course

- It is a layer provided over the roof slab to *protect the roof from weathering agencies* like sunlight, rain and wind

Damp proof course

- Provided at the plinth level to prevent moisture from rising to the wall of the building
- **Damp proof course (DPC)** is a barrier of impervious material built into a wall or pier to prevent moisture form moving to any part of the building.

- **Types of Materials for Damp Proof Course**
- Flexible Materials: Materials like bitumen felts (which may be hessian based or fiber/glass fiber based), plastic sheeting (polythene sheets) etc.
- Semi-rigid Materials: Materials like mastic, asphalt, or combination of materials or layers.
- Rigid Materials: Materials like first class bricks, stones, slate, **cement concrete** etc.
- Cement concrete is however commonly adopted material for DPC at plinth level, 38 to 50mm thick layer of cement concrete M15 (1:2:4 mix) serves the purpose under normal conditions.

Building rules and regulations

- National Building Code(**NBC**)
- Kerala Building Rules(**KBR**)
- Coastal Regulation Zone(**CRZ**)

National Building Code(NBC)

- A comprehensive building Code, is a national instrument providing *guidelines for regulating the building construction activities across the country.*
- It serves as ‘*Model Code*’ for adoption by all agencies involved in building construction works be they
 - ✓ Public Works Departments
 - ✓ other government construction departments
 - ✓ local bodies or
 - ✓ private construction agencies.

The Code mainly contains

- Administrative regulations
- Development control rules and general building requirements
- Fire safety requirements
- Stipulations regarding materials, structural design and construction (including safety)
- Building and plumbing services
- Approach to sustainability
- Asset and facility management.

- The Code was *first published in 1970* at the instance of Planning Commission and then first revised in 1983.
- Thereafter three major amendments were issued to the 1983 version, two in 1987 and the third in 1997.
- The *second revision of the Code was in 2005*, to which two amendments were issued in 2015.
- The National Building Code Sectional Committee, BIS and its 22 expert Panels; involving around 1 000 experts revised Code in 2016 as **National Building Code of India 2016** reflecting the state-of-the-art and contemporary applicable international practices.
- NBC 2016 contains *12 Parts* some of which are further divided into Sections totalling *33 chapters*

Kerala Building Rules(KBR)

- The *Kerala Municipality Act,1994* empowers the Government to make rules regarding various matters relating to *site, building and other structures*
- The Honourable High Court of Kerala has directed Government to incorporate *safety provisions* in the Building Rules,1984 for high rise buildings.
- In view of bulk of amendments, the Government decided to make new rules superseding the Kerala Building Rules,1984.

- The State Government framed the *Kerala Municipality Building Rules, 1999 (KMBR)* for planned development of the area concerned and also for the safety and well being of occupants of the buildings and the public.
- The rules came into force on *01 October 1999*.
- In *2011* KMBR was further divided into two ,adding Kerala Panchayat Building Rules(KPBR)

- According to KMBR, no person shall *construct/reconstruct* any building or make *addition/extension/alteration* to an *existing building* or *develop or re-develop* any *parcel of land in the area* concerned *without obtaining permit from the MC* in order to ensure planned development with due regard to *aesthetics, ecology and pollution constraints*.
- Operational constructions of Central and State Government such as *Railways, National Highways and Water ways, Aerodromes*, etc. are *exempted from KMBR*.
- Similarly, *permits are not necessary for minor works* such as providing and removing windows, doors and ventilators for partition, painting, petty repairs, etc. which do not otherwise violate provisions of KMBR.

- The Rules also prescribe specific and *separate norms for parking spaces, open area, fire escape, ventilators, sanitation facilities, front and rear yards*, etc. for each type of buildings based on their occupancy.
- The Act and Rules contain provisions for ensuring prompt delivery of services by the Corporations in issuing *building permits and occupancy certificates*.

Coastal Regulation Zone(CRZ)

- Under the *Environment Protection Act, 1986* of India, notification was issued in February 1991, for regulation of activities in the **coastal area** by the *Ministry of Environment and Forests (MoEF)*.
- As per the notification, the coastal land up to **500m** from the *High Tide Line (HTL)* and a stage of **100m** along *banks of creeks, estuaries, backwater and rivers* subject to *tidal fluctuations*, is called the **Coastal Regulation Zone(CRZ)**.

- *Areas immediately next to the sea are extremely delicate*, home to many *marine and aquatic life forms, both animals and plants*, and are also threatened by climate change, they *need to be protected against ‘unregulated development’*.
- CRZ Rules govern *human and industrial activity close to the coastline*, in order to *protect the fragile ecosystems near the sea*.
- They sought to restrict certain kinds of activities, like *large constructions, setting up of new industries, storage or disposal of hazardous material, mining, or reclamation and bunding, within a certain distance from the coastline*.

- Several kinds of restrictions apply, depending on criteria such as
 - ✓ the population of the area
 - ✓ the ecological sensitivity
 - ✓ the distance from the shore
 - ✓ whether the area had been designated as a natural park or wildlife zone.

Evolution of Rules

- Coastal Regulation Zones(CRZ) are *notified by the govt of India in 1991* for the first time.
- Under this coastal areas have been classified as CRZ-1, CRZ-2, CRZ-3, CRZ-4.
- ✓ **CRZ-1:** these are *ecologically sensitive areas* these are essential in maintaining the ecosystem of the coast. They lie between low and high tide line. *Exploration of natural gas and extraction of salt are permitted*
- ✓ **CRZ-2:** these areas are *urban areas located in the coastal areas.*

- **CRZ-3:** *rural and urban localities which fall outside the 1 and 2.* Only certain activities related to agriculture even some public facilities are allowed in this zone
- **CRZ-4:** this *lies in the aquatic area up to territorial limits.* *Fishing and allied activities* are permitted in this zone. *Solid waste should be let off* in this zone. This zone has been changed from 1991 notification, which covered coastal stretches in islands of Andaman & Nicobar and Lakshdweep

- The Centre notified fresh CRZ Rules in 2011, which addressed some concerns. An exemption was made for the construction of the *Navi Mumbai airport*, Projects of the *Department of Atomic Energy*, which plans to set up nuclear power plants near the coast, were exempted.
- The Environment Ministry issued fresh CRZ Rules in December 2018, which removed certain restrictions on building, streamlined the clearance process, and aimed to encourage tourism in coastal areas.
- In January 2019, the government notified new CRZ Rules with the stated objectives of promoting *sustainable development and conserving coastal environments*.



The judgment is very clear that at the time of construction, buildings were in CRZ II , But under the latest notification the area falls under CRZ III..

<https://english.manoramaonline.com/news/kerala/2019/09/12/explained-maradu-flats-supreme-court.html>

Responsibility of an engineer in ensuring the safety of built environment

- Built environment – human made space in which people live, work, recreate
- Civil engg context – single dwelling house, apartment complex, office building, industrial building, shopping mall, educational buildings etc.
- During construction phase – construction safety doc prepared and compiled by engineer and its added to on going basis throughout the life of the project
- Handed over to first occupier of the building and should contain details about maintenance and use of building
- Should highlight any potentially dangerous features of the building such as cleaning the windows on 12th floor and explain how the designer envisaged that this would be done safely
- Details of plant and machinery in the building and most effective use of these

Responsibility of an engineer in ensuring the safety of built environment

The responsibility of an engineer to ensure the safety in built environment include the following:

1. After project completion, ensure that all the installations including machineries, electrical appliances have met safety stds specified.
2. Identify any safety lapses in construction like un-guarded openings of ducts and ensure those are corrected.
3. Hand over all documentations of all installations in the building with specific safety remarks.
4. Ensure all warning instructions displayed in place and legible
5. Hand over the periodical maintenance schedule especially fire fighting equipments etc. to ensure the proper functioning of facilities

BUILDING AREA

Coverage

- The *covered area* of the building expressed as the *percentage* of the *plot area*. It shall not exceed :
 - 80%: residential, mercantile, commercial, small industries and storage places
 - 60% : assembly, office, large industries
 - 50 % : educational, institutional, hazardous buildings

Plinth Area

- *Built up* covered area of a building measured *at floor level at any storey.*
- Courtyards, open areas, area of open porch (not enclosed by wall),balconies ,cantilever projections, uncovered staircase and the like are *not included* in plinth area.

FloorArea

- The *sum of all built-up covered areas on all floors* of a building

CarpetArea

- In the absence of other data *20% of the floor area* can be *deducted* from total floor area in each floor to get the *carpet area*.

Carpet Area

“Net usable area within building”

To calculate carpet area deduct following areas from plinth area.

- Verandah,
- Passage
- Corridor,
- Porch
- Lift
- W/c bath
- Thickness of wall
- Vertical shaft for drainage

FloorArea Ratio (FAR)

It is the quotient obtained by dividing the total floor area on all floors by the area of the plot

$$\bullet \text{ FAR} = \frac{\text{Total Floor Area on all Floors}}{\text{Plot Area}}.$$

Carpet Area (20% of floor area)

Shall mean the plinth area less the area of following portions :

Verandah
Corridor & passage
Entrance hall & porch
Staircase & staircase cover
Lift shaft and machine room for lift
Bathroom & lavatory
Kitchen & pantry
Store
Canteen
Airconditioning duct and plant room
Shaft for sanitary piping

Coverage and Floor Area Ratio (F.A.R)

Sl. No.	Occupancy	Max. Permissible F.A.R		
		Max. Permissible coverage	Without additional fees	With additional fee at the rate of ₹ 5000 per square meters of additional floor area
(1)	(2)	(3)	(4)	(5)
1	Residential A1	65	3.0	4.0
2	Special Residential A2	65	2.5	4.0
3	Educational B	35	2.5	3.0
4	Medical/Hospital C	60	2.5	3.5
5	Assembly D	40	1.5	2.5
6	Office/Business E	70	3	4.0
7	Mercantile/ Commercial F	70	3	4.0
8	Industrial G1	65	2.5	