ELEMENTS OF ENGINEERING
ME144

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A. Objective of the Course:

This course covers the basics of mechanical and civil engineering. The principles and application of the two core branches of engineering is covered along with the fundamentals of engineering drawing. The objectives of the course are to:

1. **Introduce the universal language and tool of communication for engineers and understand the concepts, elements & grammar of engineering drawing.**
2. **Introduce the important aspects and applications of mechanical engineering and explain the working of different mechanical systems.**
3. **Understand the scope and basic elements of civil engineering.**

Part: C		
10.	Scope of Civil Engineering	02
11.	Introduction to Surveying	06
12.	Elements of building Construction	07

Detail Syllabus

10.	**Scope of Civil Engineering**
10.1	Scope of Civil Engineering,
10.2	Branches of civil engineering,
10.3	Role of civil engineer
11.	**Introduction to Surveying**
11.1	Definition of surveying,
11.2	Objects of surveying, Uses of surveying,
11.3	Primary divisions of surveying, Principles of surveying,
11.4	List of classification of surveying, Definition: Plan and Map, Scales : Plain scale and Diagonal scale, Conventional Symbols
11.5	Introduction to linear and angular measurements, Concepts of land profiling
12.	**Elements of building Construction**
12.1	Types of building, Design loads,
12.2	Building components (super structure and substructure),
12.3	Principles of Planning,
12.4	Basics Requirements of a building Planning,
12.5	Types of Residential Building,

Books

- Khasia R.B. and Shukla R.N., “Elements of Civil Engineering”, Mahajan Publication.
- Punamia B.C., “Surveying”, Vol. I & II.

Branches of Engineering

1. Civil Engineering: discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings
2. Mechanical Engineering: Design, test, build and operate all type of machines
3. Electrical engineering: Largest and most diverts; development and design, application and manufacture of systems and devices that use electrical power.
4. Electronic Engineering: Research, design, integration and application of circuits and applications
5. Computer Engineering:
6. Chemical Engineering:
7. Environmental Engineering
8. Agricultural Engineering
9. Safety Engineering
10. Nuclear Engineering
11. Marine Engineering
12. Industrial Engineering
13. Aeronautical Engineering
14. Geological and Mining Engineering
15. Textile Engineering

Surveying

- Surveying and leveling includes the measurement in horizontal and vertical planes with the help of surveying instruments.

- Surveying fixes the relative positions of different points on the surface of the earth.

- It also includes the area and volume measurements.

- Basic aim of surveying is to prepare a map of the area to some scale.

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Instruments

Survey Compass

bearings

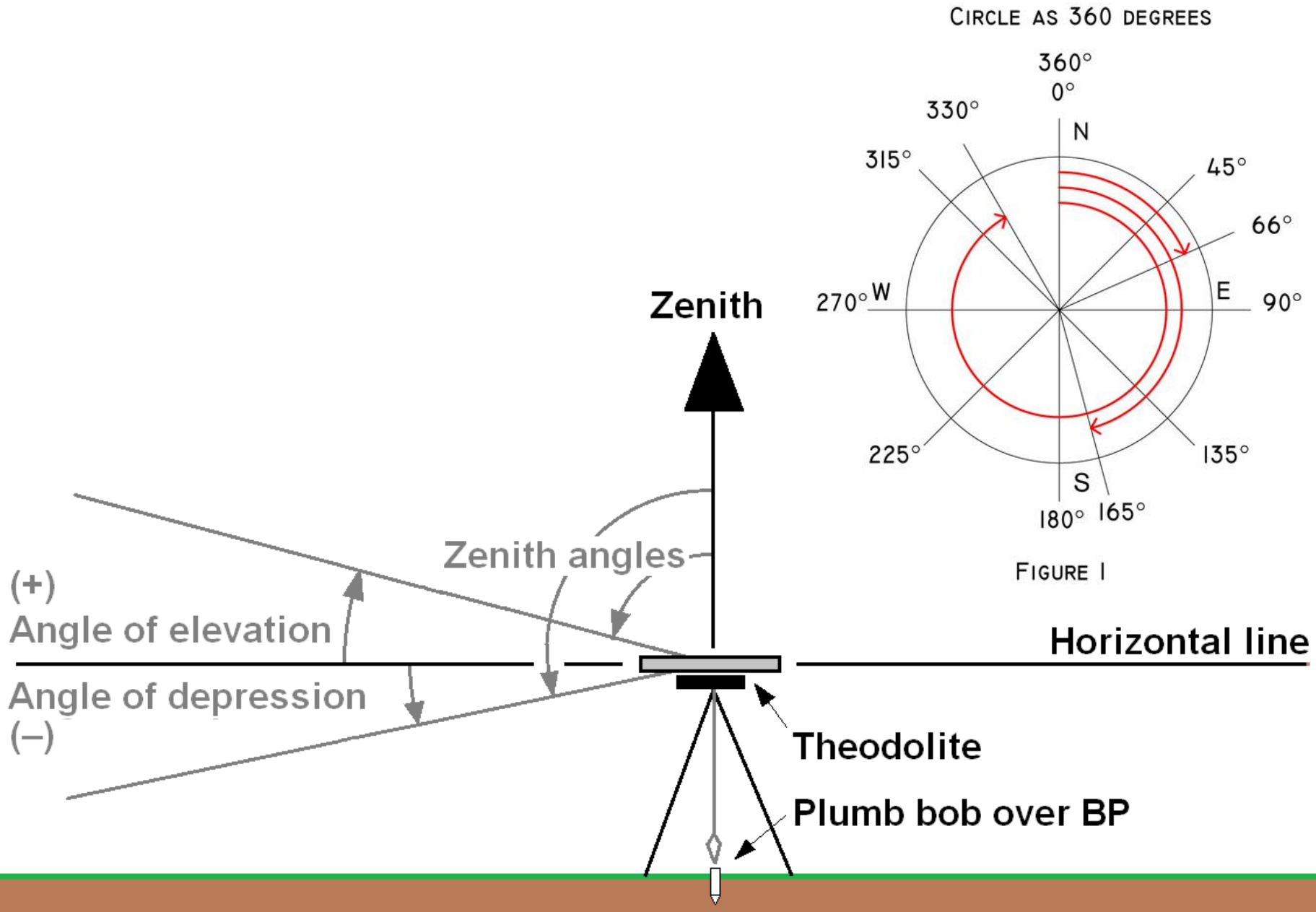
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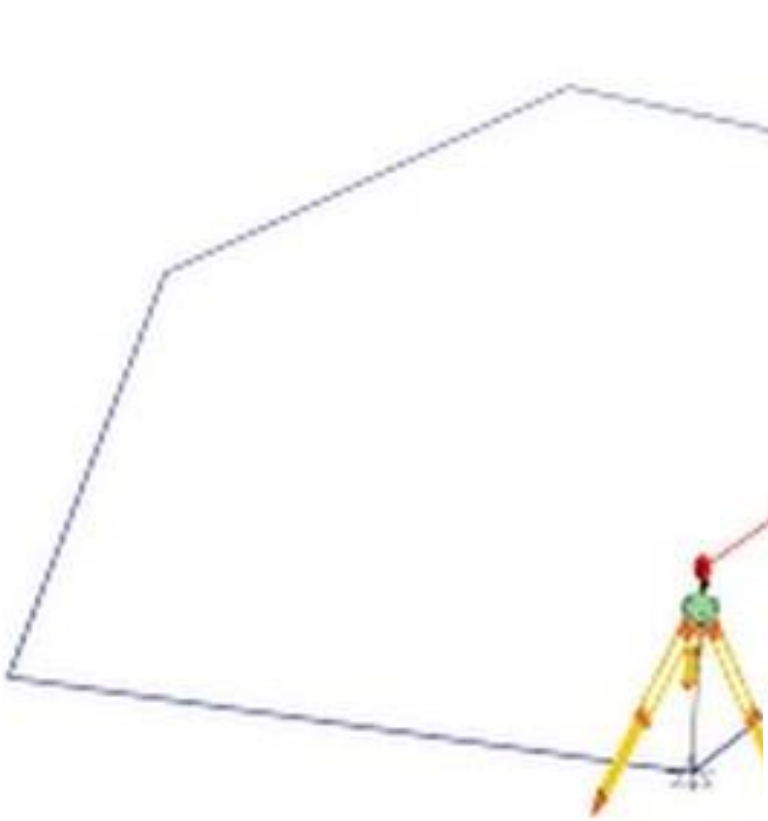
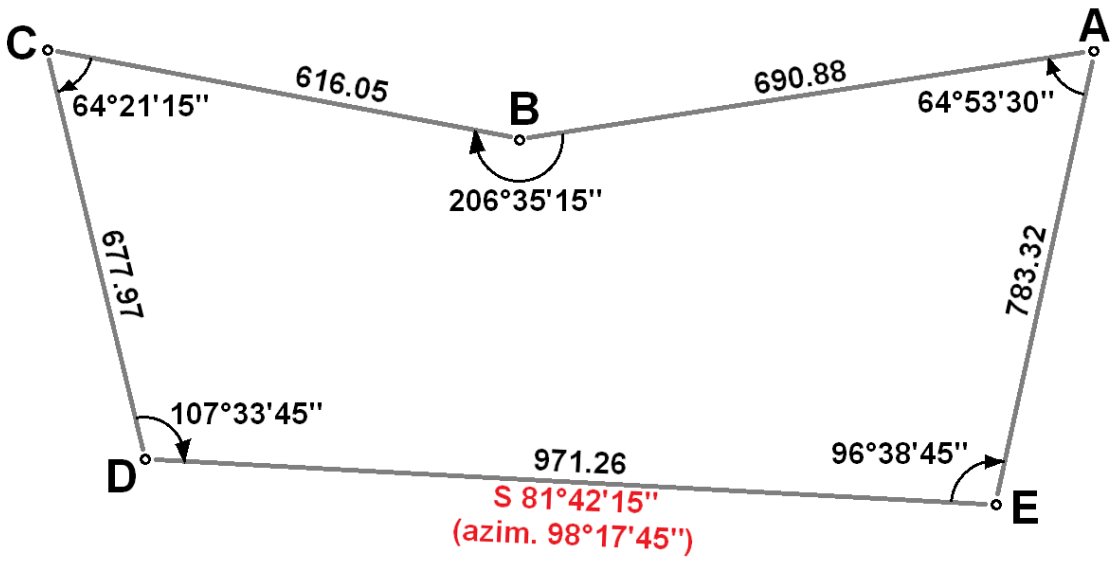
FIGURE 1
Zenith
Zenith angles
(+)
Angle of elevation
Horizontal line
Angle of depression
(–)
Theodolite
Plumb bob over BP

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Geotechnical engineering

- Geotechnical engineering is the field which deals with soil investigation and design of the foundations.

- Soil investigation includes collection and testing of soil samples, soil bearing capacity, settlement.

- It also includes the construction and design of well foundations, construction and foundation of dams, construction of tunnels, sub base of the roads, pile foundations.

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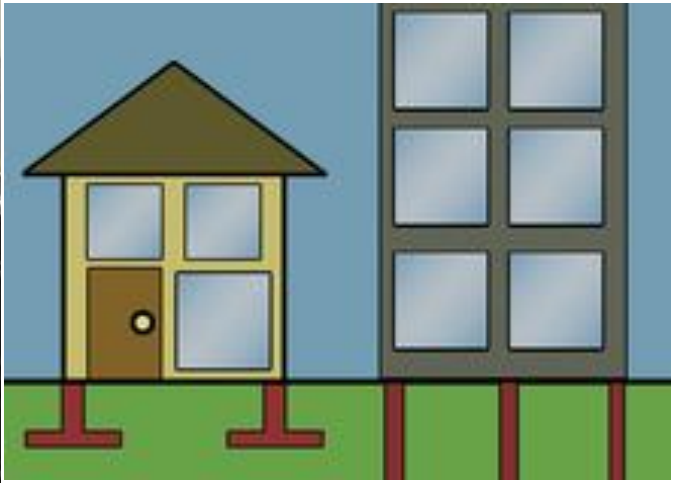


DRILLING TIEBACKS, PINCAOPLES

Structural analysis and design

- This branch of civil engineering deals with the structural analysis and design.
- Structural analysis is done to calculate stresses in the structural component, on the bases of loads acting on the structure.
- According to strength of the materials the various components of the building beams, columns, slabs, foundations are to be designed.
- Design and analysis of the multistory building, towers, retaining walls, water tanks, bridges, dams, industrial buildings is included in this branch.
- Structures should be safe, durable and economic.
- It also should be designed according to the earthquake resistant.

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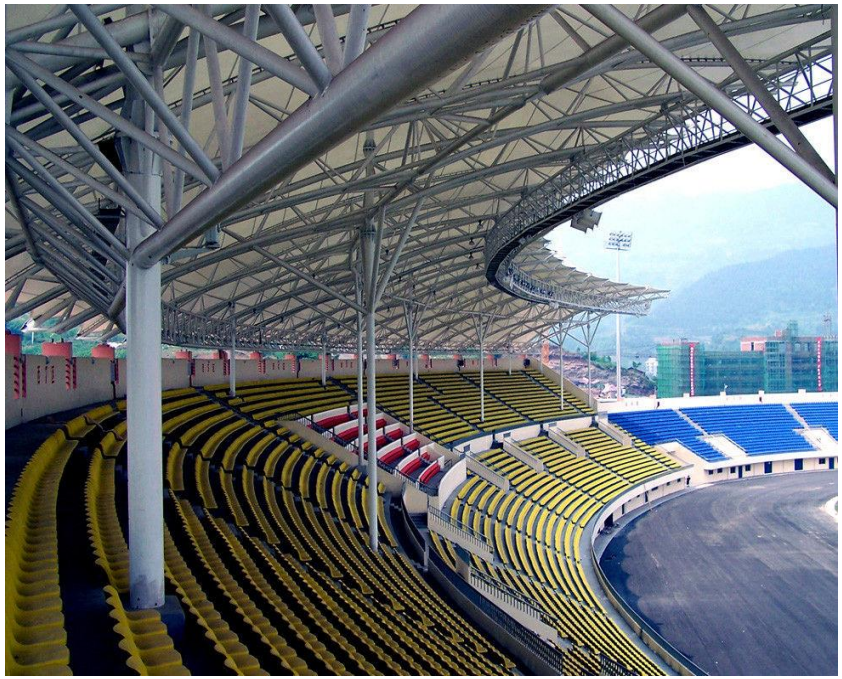

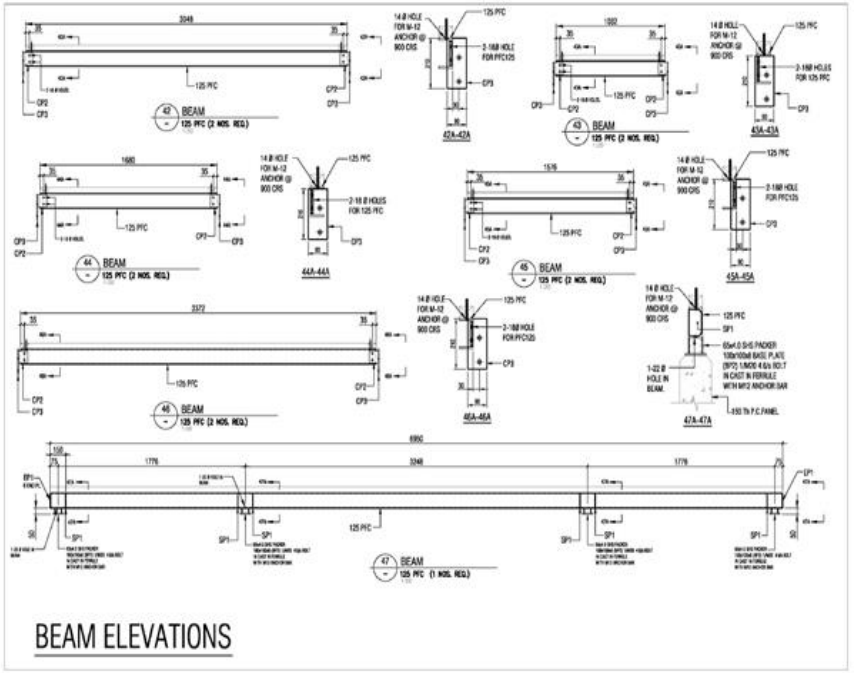
BEAM ELEVATIONS

Building planning and construction

- Civil engineers are concerned with many types of the structures of which buildings are of prime importance.

- Building are planned according to the fundamental principles of planning and bye laws of local municipal bodies.

- Main components of the buildings are foundations, masonry walls, beams, columns, stairs, doors, windows.
- Main building materials are cement, bricks, sand, grit, wood, tiles. Steel, lime, glass, plastic.

- Various types of the buildings are residential, public utility buildings, industrial buildings.

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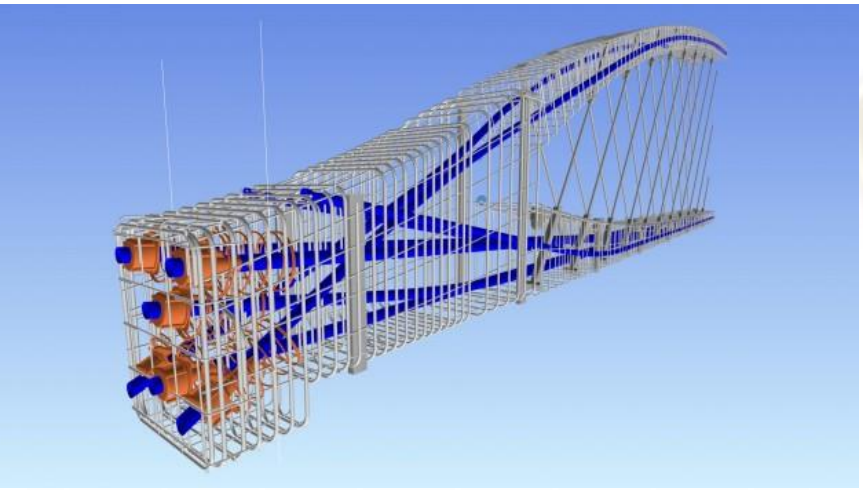
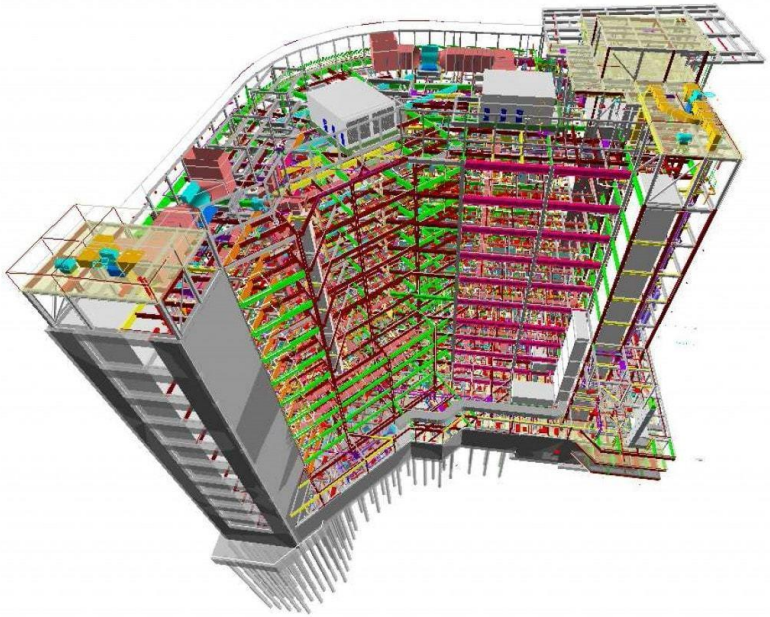
Details

Plan Code	: DHG 005
Type	: 3BHK
Plot Area	: 1600 Sq. ft.
Plot Size	: 40' x 40'
Plinth Area	: 1139 Sq. ft.





Town planning

- Town planning means planned and controlled growth of town by dividing land of the town in to the different land use zones.
- To regulate building construction to provide better environment for the people of the town.
- In town planning, areas of town are divided in to residential, commercial, industrial zones, which is known as zoning.
- Services like road network, water supply and drainage network are planned.
- Gardens and green belts are planned for to create better environment.
- Floor space index are to be fixed to regulate the construction of the buildings.
- For towns and cities master plan are to be prepared.

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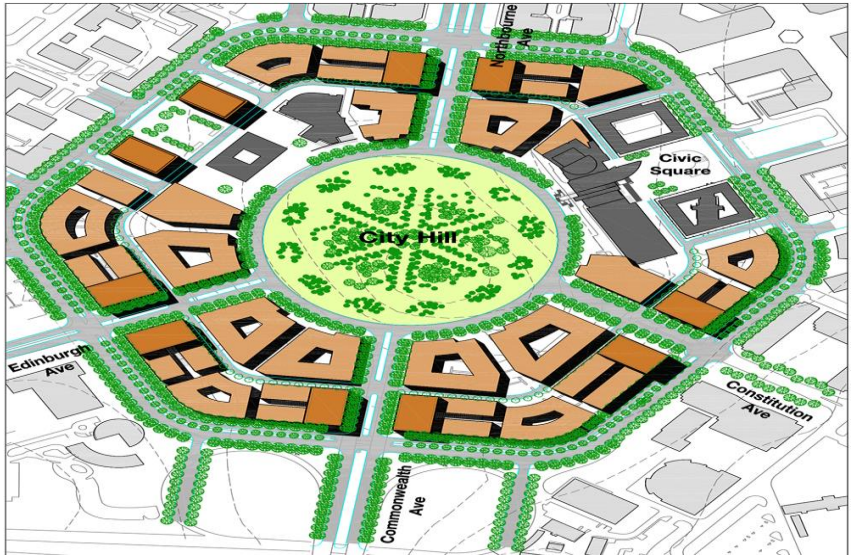
SUBJECT TO
CENTRE PLAN &
EXISTING STRUCTURE


Northbourne Ave
Civic Square
City Hill
Edinburgh Ave
Constitution Ave
Commonwealth Ave


KASARVADAVALI
कासारवडवली
Sanjay Gandhi
National Park
संजय
गांधी
राष्ट्रीय
उद्यान
BORIVALI
बोरिवली
GORAI
गोराई
KANDIVALI
WEST
कांदिवली
पश्चिम
Thane
ठाणे
MULUND WEST
मुलुंड
वेस्ट
GOREGAON EAST
गोरेगाव
ANDHERI EAST
अंधेरी
ईस्ट
JUHU
जुहू
Mumbai
मुंबई
CHEMBUR EAST
चेंबूर
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Jawaharlal
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Trust Twp
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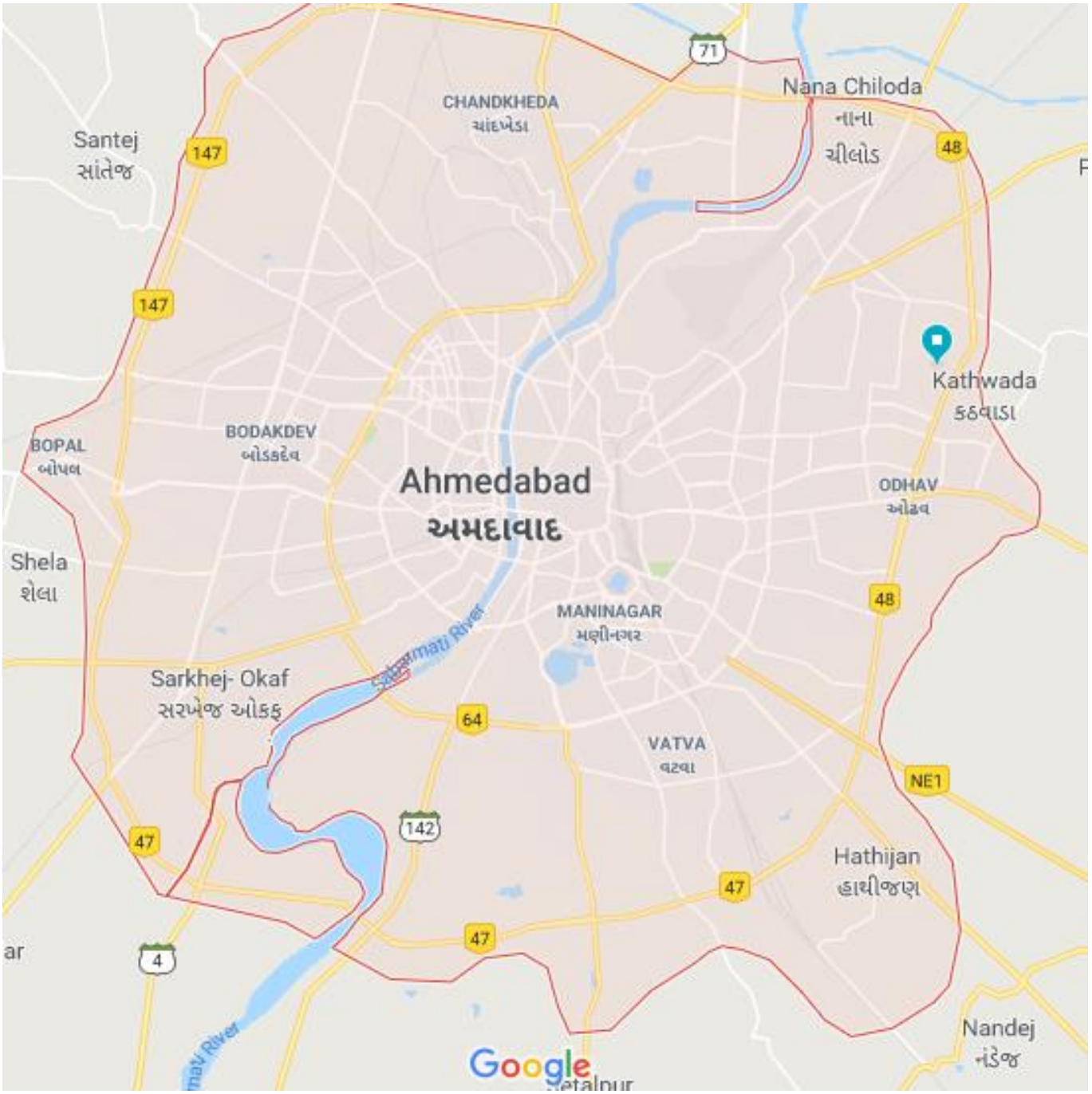
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ચાંદખેડા
Nana Chiloda
નાના
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Kathwada
કઠવાડા
BOPAL
બોપલ
BODAKDEV
બોડકદેવ
Ahmedabad
અમદાવાદ
ODHAV
ઓઢવ
Shela
શેલા
MANINAGAR
મણીનગર
Sarkhej- Okaf
સરખેજ ઓકફ
VATVA
વટવા
Hathijan
હાથીજણ
Nandej
નંડેજ
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Park
ઇલેક્ટ્રોનિક
પાર્ક
71
Kolavada
કોલવડા
Sector 28
Garden
સેક્ટર 28
ગાર્ડન
Thermal Power Stat
થર્મલ પાવર
પ્લાન્ટ
K Rd
BAPS Akshardham
Temple | Gandhinagar
સ્વામિનારાયણ
અક્ષરધામ મંદિર
133
Vidhan Sabha
વિધાન સભા
Sabarmati River
Gandhinagar
ગાંધીનગર
Sarita Udhyan
સરીતા ઉદ્યાન
INFOCITY
ઈન્ફોસિટિ
Kudasan
કુડાસણ
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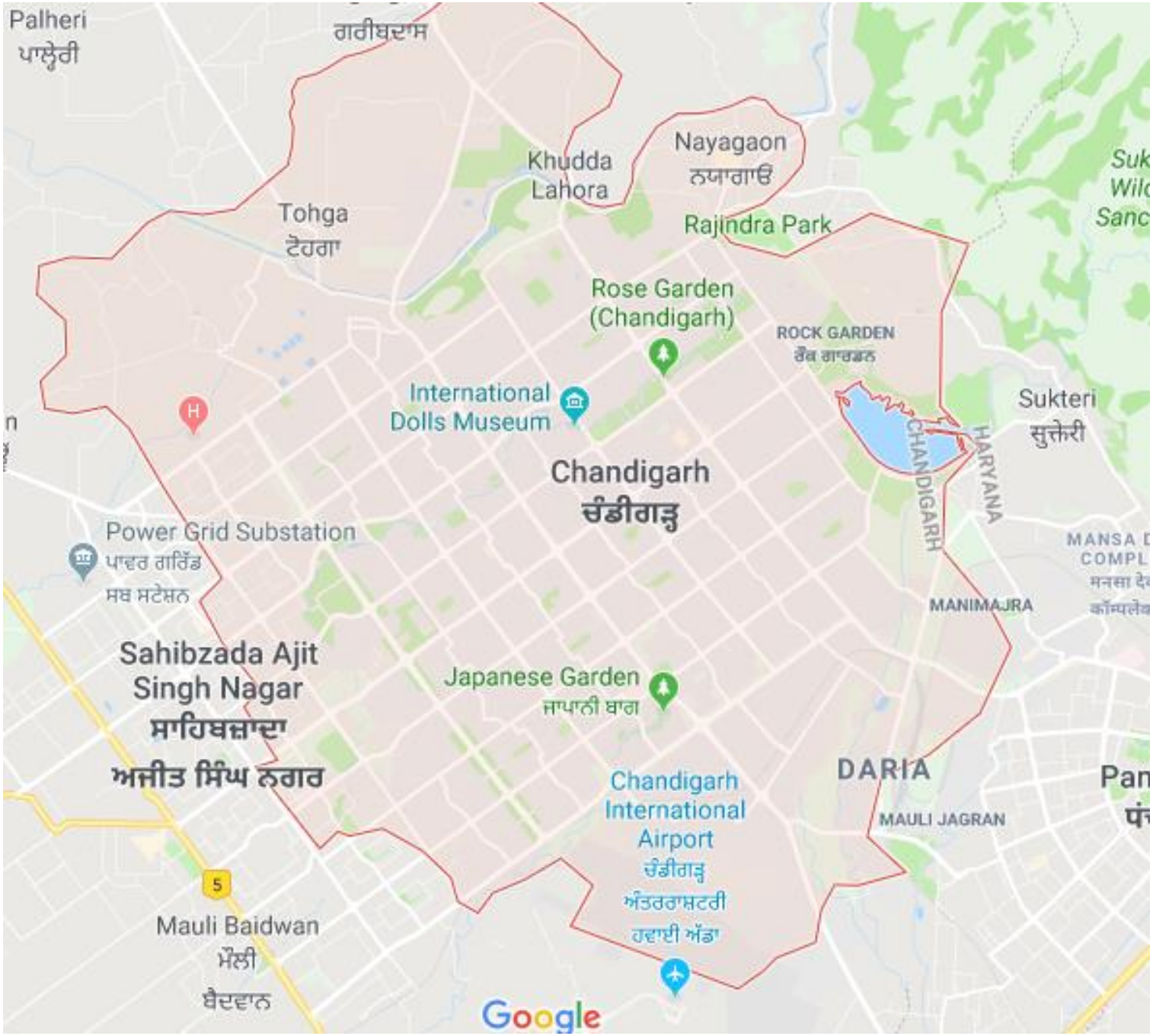
Palheri
ਪਾਲ੍ਹੇਰੀ
ਗਰੀਬਦਾਸ
Khudda
Lahora
Nayagaon
ਨਯਾਗਾਓ
Tohga
ਟੋਹਗਾ
Rajindra Park
Rose Garden
(Chandigarh)
ROCK GARDEN
ਰੌਕ ਗਾਰਡਨ
International
Dolls Museum
Sukteri
ਸੁਕ੍ਤੇਰੀ
Chandigarh
ਚੰਡੀਗੜ੍ਹ
CHANDIGARH
HARYANA
Power Grid Substation
ਪਾਵਰ ਗਰਿੱਡ
ਸਬ ਸਟੇਸ਼ਨ
MANIMAJRA
Sahibzada Ajit
Singh Nagar
ਸਾਹਿਬਜ਼ਾਦਾ
ਅਜੀਤ ਸਿੰਘ ਨਗਰ
Japanese Garden
ਜਾਪਾਨੀ ਬਾਗ
DARIA
MAULI JAGRAN
Chandigarh
International
Airport
ਚੰਡੀਗੜ੍ਹ
ਅੰਤਰਰਾਸ਼ਟਰੀ
ਹਵਾਈ ਅੱਡਾ
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Mauli Baidwan
ਮੌਲੀ
ਬੈਦਵਾਨ
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Water resources engineering

• Water resources engineering means measurements, utilization and development of water resources for agriculture, municipal and power generation purpose.

• It includes irrigation engineering, design of hydraulic structures like dams, canals.

• It deals with planning, constructing and designing of the hydraulic structures.

• Hydrology is the main part of the water resources engineering.

• Hydrology includes the study of the sources of water in the surface , below the surface and in the atmosphere, measurement of rainfall, flood control.

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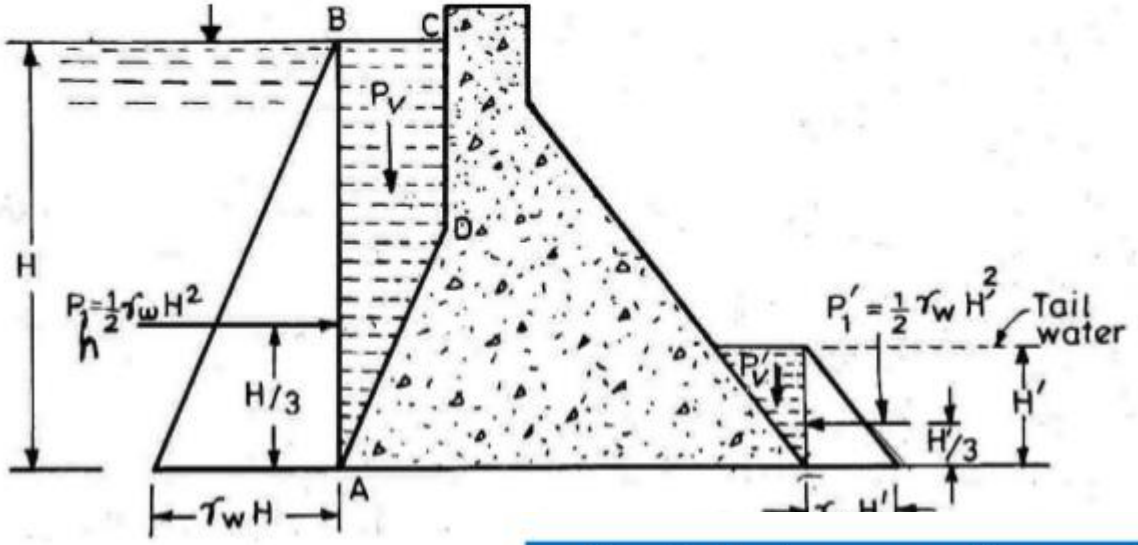
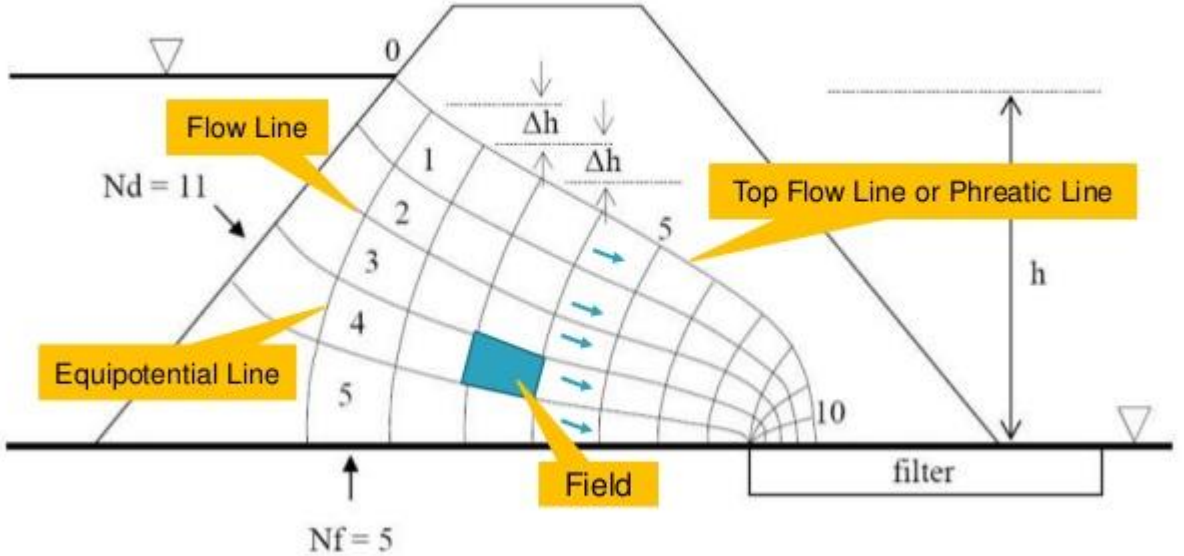
WATER PRESSURE



Phreatic Line is a seepage line separating saturated and unsaturated zones



Flow Net for an Earth Dam

Transportation engineering

- Transportation means movement of passengers and goods by vehicles on land, ships on water and aircraft in air.
- Transportation is that branch of civil engineering which deals with planning, designing and constructing of roads, bridges, railways, tunnels, harbors, ports, airports, docks.
- For a development of a nation having good transportation facility is a basic need.
- It also includes the traffic engineering.
- It also includes the study of the materials used for construction of roads like metal, bitumen, asphalt, tar, concrete.

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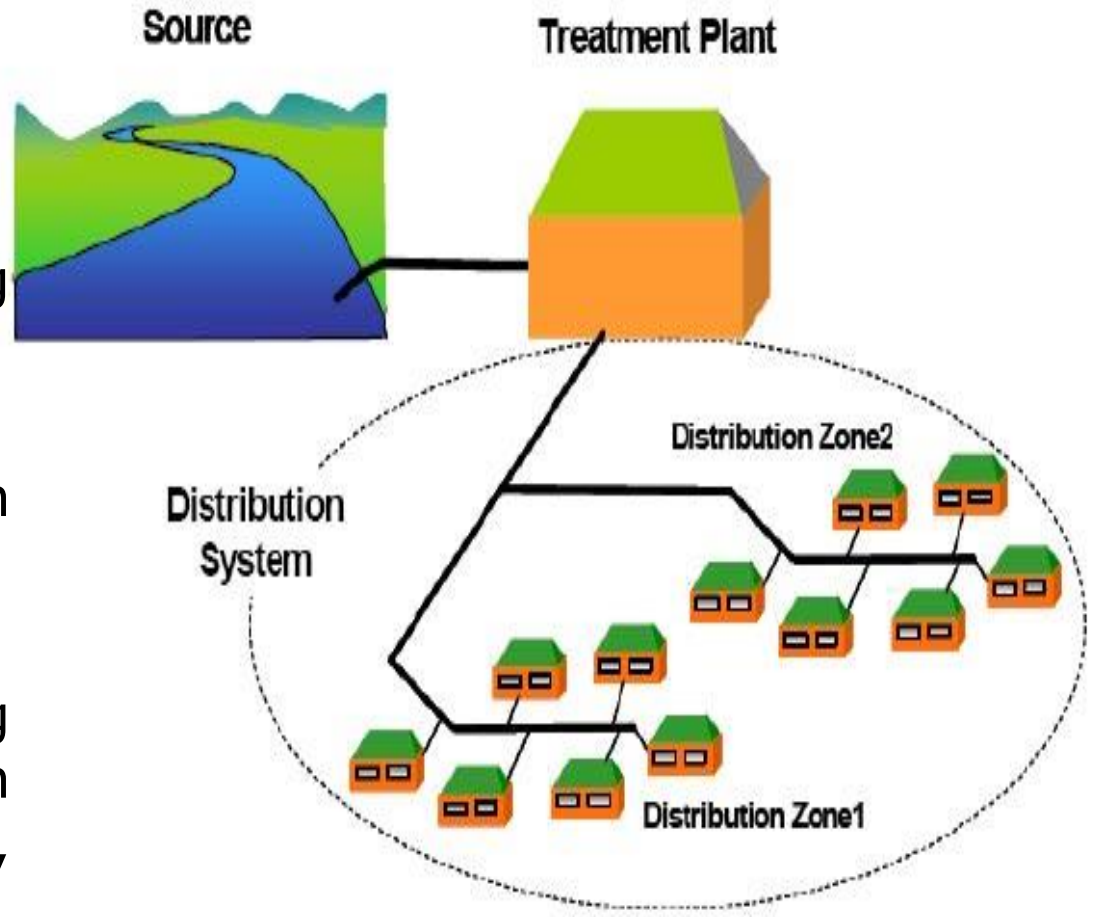
Environmental engineering



• Environmental engineering deals with pollution control.

• It also includes public health engineering.

• In public health engineering includes water distribution system, drainage system, water treatment plant.

•The planning, construction and design of public health department is included in this branch of civil engineering.

• It also includes the study of solid waste management.

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Construction Engineering & Management

- Deals with planning, scheduling and execution of construction activity related to a project.
- Comprises of men, material, machinery, time and money management.
- Importance on new construction practice, use of appropriate and local technology, safety of men and material, utilization of marginal materials etc.
- Basic work involved are review contracts, provide quality control and ensure project completion status with optimum cost(budgeted cost).

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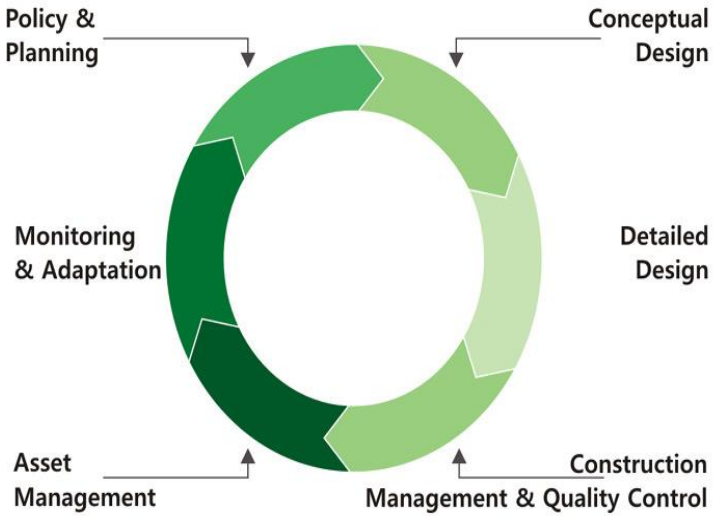
Construction Management



Branches of Civil Engineering

1. Transportation Engineering:

Deals with the transport of men and materials through different communication routs. Planning, Designing, execution and Maintaining,

- Highway engineering: Road
- Railway Engineering: Rail
- Waterway Engineering: Sea routes
- Airport engineering: Airways

2. Surveying and Leveling:

Various type of survey techniques, preparation of plans, contour maps etc. ..

3. Geotechnical and foundation engineering:

Geotechnical Engg.: Various parameters of Soil, its behavior on application of load and application as engineering material is studied.

Foundation: Analysis of soil as a foundation

4. Construction technology and management:

Deals with the properties and suitability of different type of material like, timber, cement, bricks etc.

5. Structural and Design engineering:

Analysis of various type of forces in a building and based on that the reinforcement detailing is done and design is prepared.

6. Estimating and Costing:

Deals with the financial aspect of the construction

7. Environmental Engineering:

Deals with the various means and measures to minimize environmental disintegration

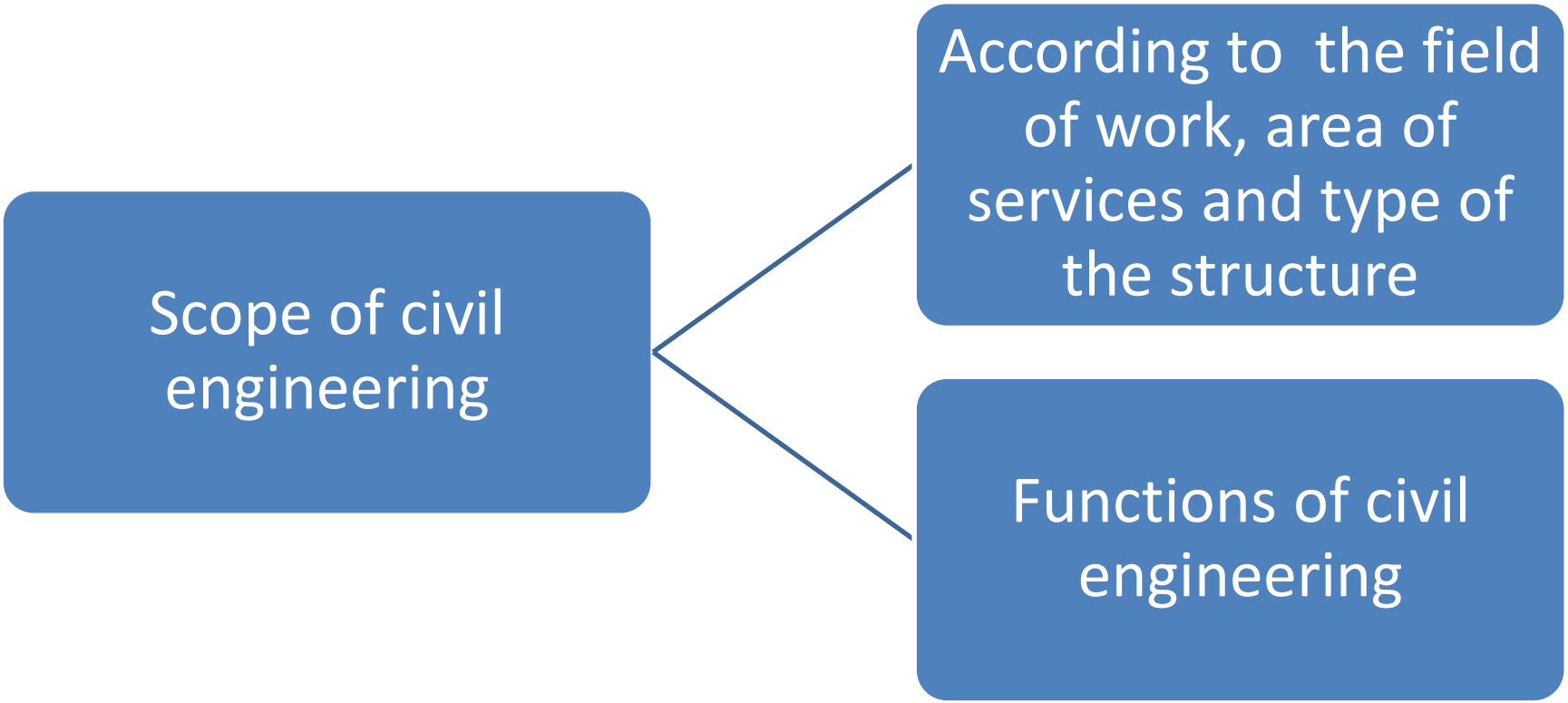
8. Water Resource and Irrigation engineering:

Deals with, how efficiently and optimally use the water resource

9. Town planning:

Planning of town road, water supply and other civil works

Scope of Civil Engineering



1.) According to field of work, area of services and type of the structure

- **Building construction:-**

✓ It includes constructing residential, public buildings and industrial buildings.

✓ It also includes study of building materials, construction techniques of building components like foundation, masonry, doors, windows etc.

- **Construction of heavy structures:-**

✓ It includes the construction of bridges, dams, ports, airports, harbors, well foundations & its various techniques, modern equipments and materials.

- **Geotechnical engineering:-**

✓ It includes the designing methods of various types of foundations, underground structures, earthen dams, earth work for highways & railways.

✓ It also includes soil investigation and its testing.

- **Transportation engineering:-**

✓ Constructing & designing the roadways, railways, bridges, harbors, airports.

✓ It also includes the traffic engineering & study of the highway materials.

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- **Water resources engineering:-**

✓ Constructing structures relating to water resources engineering like dams, canal structures, hydro power structures.

✓ It also irrigation methods, flow management, rain water harvesting, flood control and water power engineering.

- **Environmental engineering:-**

✓ Constructing structures related to water treatment plant, water distribution network, drainage system and pumping system.

✓ It also includes solid waste management and pollution control from the town.

- **Town planning:-**

✓ Planning of town by zoning of the land, planning road network, planning other services like drainage, water distribution system.

✓ Preparing master plan of the town planning schemes and regulating construction by building bylaws.

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2.) According to the functions of civil engineering

- **Surveying:-**

✓ To carry out surveying for setting out of works & preparing map of land.

✓ Measurements of distances and angles are taken by surveying instruments.

✓ With the help of leveling, levels are taken and prepare a contour map.

- **Planning:-**

✓ To carry out planning of a building is for the purpose to satisfy basic needs of the occupants.

- **Structural analysis and design:-**

✓ To carry out that the structure is safe from the various loads acting on it.

✓ To carry out the design of the structure with the help of various constructing materials e.g. steel or concrete.

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2.) According to the functions of civil engineering

- **Professional practice**

❖ **Estimating:-**

✓ To prepare estimate of work from the data of drawing, specifications and rates.

❖ **Costing and accounts:-**

✓ To carry out the costing to know the actual expenditure in the payment of bills to the contractor, and many other expenditure, during construction of the work.

❖ **Valuation:-**

✓ To carry out valuation of the property like land or land with building.

✓ Valuation is carried out for the purpose of knowing the fair & just price or market value of the property for the purpose of sales, purchases, insurance, taking loans & other purposes.

❖ **Contracts:-**

✓ To carry out the construction of work through contractor according to the conditions of the contract. On the bases of the contractor's qualification, past performance and rates filled in the tender papers, work is allocated to the contractor.

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- **Construction management:-**

❖ **Planning and scheduling:-**

✓ To carry out the project planning and according to prepare different schedules.

✓ Scheduling is the process to fix the execution of the project activity after planning.

✓ Scheduling can be done using bar chart or critical path methods.

❖ **Construction execution & supervision:-**

✓ To carry out the actual execution and supervision of the construction activity of the project as per the plan, specification & condition of the contract.

✓ To manage material storing, handling equipments, safety of the labor & to observe the labor laws.

- **Quality control and research:-**

✓ To have a quality check of the material, equipment.

✓ During the actual construction, the quality of the material can be checked with the help the testing equipments.

✓ Materials should be used as per the specifications.

- **Maintenance of structure:-**

✓ To carry out the maintenance of the structure after the construction is over.

✓ Structure needs maintenance & proper care. Due to continuous utilization of the structure, wear and tear occur therefore the maintenance of the structure is required.

✓ Different types of the repair works are to be done for the maintenance of the structure. Current repairs, special repairs & major repairs are the different types of the repairs.

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Role of the civil engineer in society

- The main role of civil engineer is **surveying, planning, designing, constructing, maintaining** of the various types of the structures.
- To **solve different engineering problems** with the help of enough experience of field, numerical methods, laboratory techniques.
- To carry out **soil investigations** for the design of the foundations.
- To carry out the **leveling and surveying and prepare map** to fix the boundaries of the plots and to calculate the area and the volume.
- To **fix the alignment** of the various paths for making the roadways, railways.
- To carry out the **planning & supervise proper the execution** of the actual construction activity.
- To **prepare the proper drawing, analyzing and designing** the various types of the structures.
- To **invite the tenders & to select contractor** for the work.
- To carry out **valuation of land or building** for the purpose of finding its scale or purchase price or taxation.
- To **fulfill the basic needs of the occupants** by using fundamentals of the building planning & by the help of the various building materials.

Thank You