Course Code: ESC106A

Course Title: Construction Materials and Engineering Mechanics

Lecture No. 1:

Introduction to Civil Engineering

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Lecture Intended Learning Outcomes

At the end of this lecture, student will be able to:

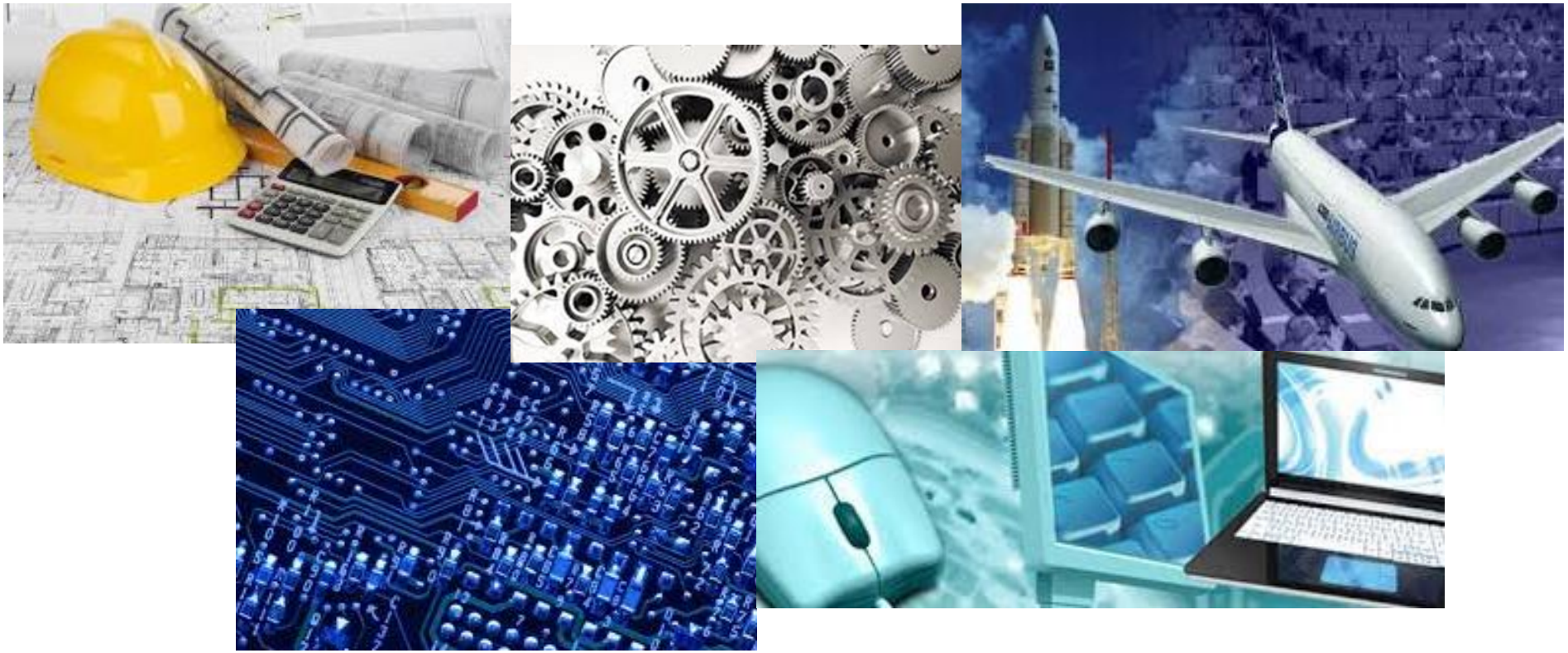
- Describe Engineering and Civil Engineering in particular
- Explain the different disciplines of civil Engineering and their applications
- Interpret the role of Civil Engineering in infrastructure development

Contents

- **Introduction to Civil Engineering:**

  Scope of different fields of Civil Engineering - Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources and Irrigation Engineering, Transportation Engineering, Environmental Engineering, role of civil engineer in infrastructure development.

Engineering



Engineering is a profession in which scientific knowledge is used to develop practical applications

Its role is to direct the resources of nature to the use and convenience of mankind

Civil Engineering

The Cybertecture Egg: New Jewel in Mumbai

Civil Engineering is a professional Engineering discipline that deals with the design and construction of the physical and natural built environment, including works such as bridges, canals, dams and buildings

Building Big!!!!

Buildings & Structures: Cities

Infrastructure: Transportation

Culture: Art: Architecture

The Future: Without Limit!

Civil Engineering

Civil Engineering gives vast scope for irrigation by constructing barrages, dams, canals and distributaries

Vast areas of dry land have been successfully irrigated and green revolution has become a reality in India

Cont..

The construction of the dams and power stations that provide the electricity we use every day requires Civil Engineers

Cont..

The water and sewage treatment plants that provide us with safe water supplies require the expertise of civil engineers

Cont..

The paths and roads we travel are civil engineering projects

Cont..

In fact most structures, large and small, require the help of a civil engineer whether in the designing, planning, managing and execution of the project

Civil Engineering is the oldest Engineering after Military Engineering

It is traditionally broken into several sub-disciplines including

1. Surveying
2. Building Materials
3. Construction Technology
4. Structural Engineering
5. Geotechnical Engineering
6. Water resources and Irrigation Engineering (Hydraulics)
7. Transportation Engineering
8. Environment Engineering
9. Architecture and Town Planning

Surveying

Surveying is the science of map and plan making

Cont..

Survey maps provide the relative positions of various objects of the area in the horizontal as well as vertical directions

Surveying

- Survey maps provide the relative positions of various objects of the area in the horizontal as well as vertical directions.
- Earlier conventional instruments like chain, tape, compasses, theodolites and levels were used for various measurements in surveying.
- In this electronic era the modern equipment's like electronic distance meters and total stations are used for measurements.
- Modern technology like remote sensing has made surveying vast area in a short period possible.

Building Materials

Shelter is the basic need of civilized society

Building Materials

- Stones, bricks, timber and lime concrete are the traditional materials used for the construction of houses and other buildings.

- The invention of cement and concrete has provided durable buildings.

Building Materials

- Reinforced concrete which is composite construction of steel and concrete has helped in building large structure.
- Steel, aluminium, glass, plastics, glazed tiles, plaster of Paris, linoleum, paints and varnishes have improved the quality of buildings.
- Improved versions of many building materials keep on appearing in the market regularly.
- A civil engineer has to make use of all these materials judiciously

Construction Technology

Construction Technology deals with different types of construction of structures with required economy, efficiency and factor of safety

Cont..

Construction Technology involves planning and execution of the designs from Transportation, Hydraulic, Environmental, Structural and Geotechnical Engineering

Structural Engineering

Structural Engineering deals with the Planning, Analysis and Design of structural systems

Cont..

Structural engineers design steel, concrete, or timber framed structures such as:

- Tall buildings,
- Towers,
- Bridges,
- Dams,
- Retaining walls,
- Foundations,
- Stadiums

Structural Engineering

- Before building a structure, it should be analysed and designed to decide about its size to resist the possible forces coming on it.

- The structure should be safe and at the same time its components should be as small as possible.

- Disasters due to earthquakes have made civil engineers to study earthquake forces and build earthquake resistant structures.

Structural Engineering Cont..

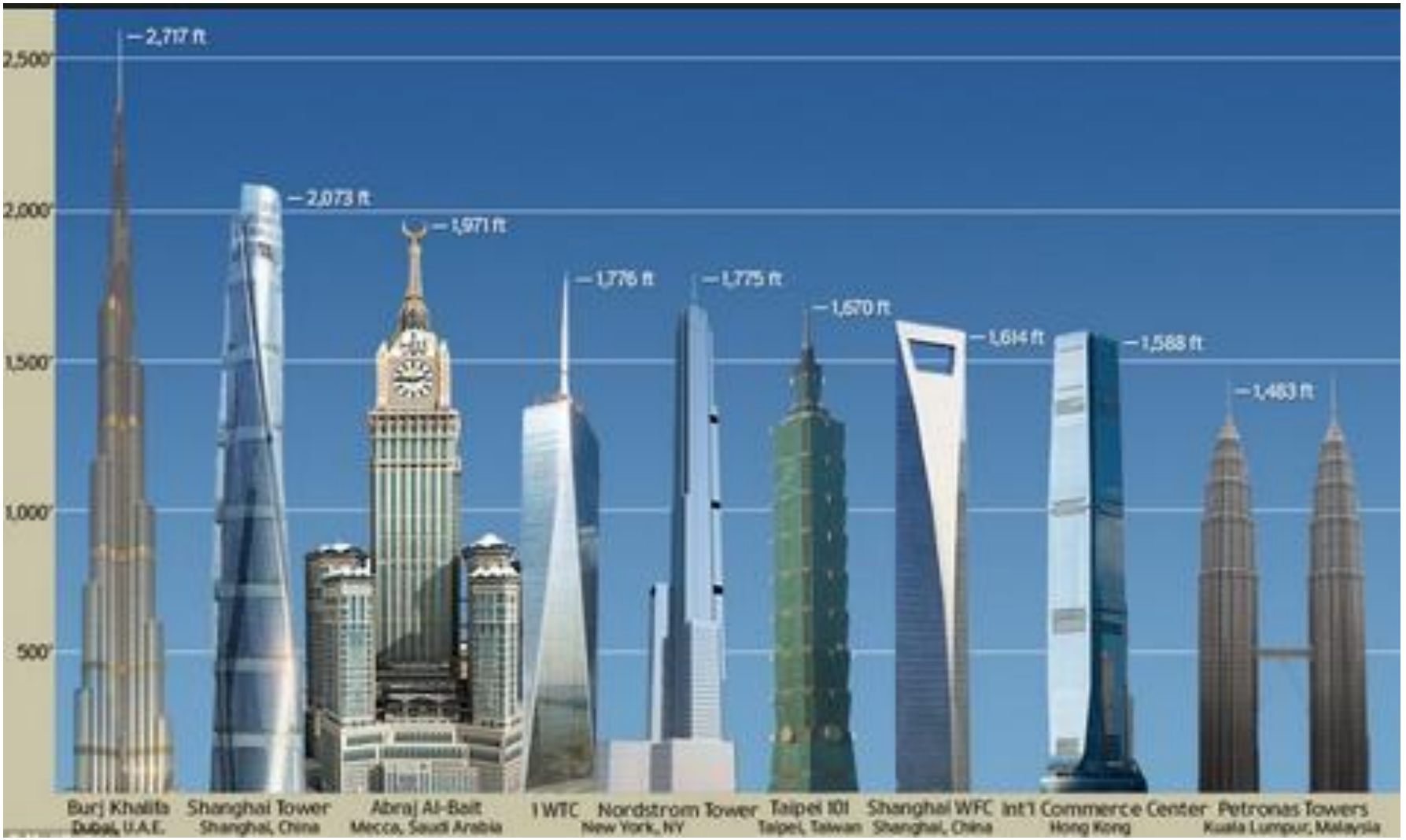
- It needs the knowledge of structural dynamics.
- A civil engineer has to not only give a safe structure but he has to give an economical structure also.
- Hence, there is need for studying mathematical optimization techniques.
- All these aspects of analysis and design fall under structural engineering field.

Know it.....!!!

World's Longest Bridge

Danyang–Kunshan Grand Bridge, Nanjing, Shanghai

Know it.....!!!



Worlds Tallest Buildings

Know it…..!!!

1.Burj Khalifa
(828m)

2.Shanghai Tower
(632m)

3.Abraj Al-Bait
Clock Tower
(601m)

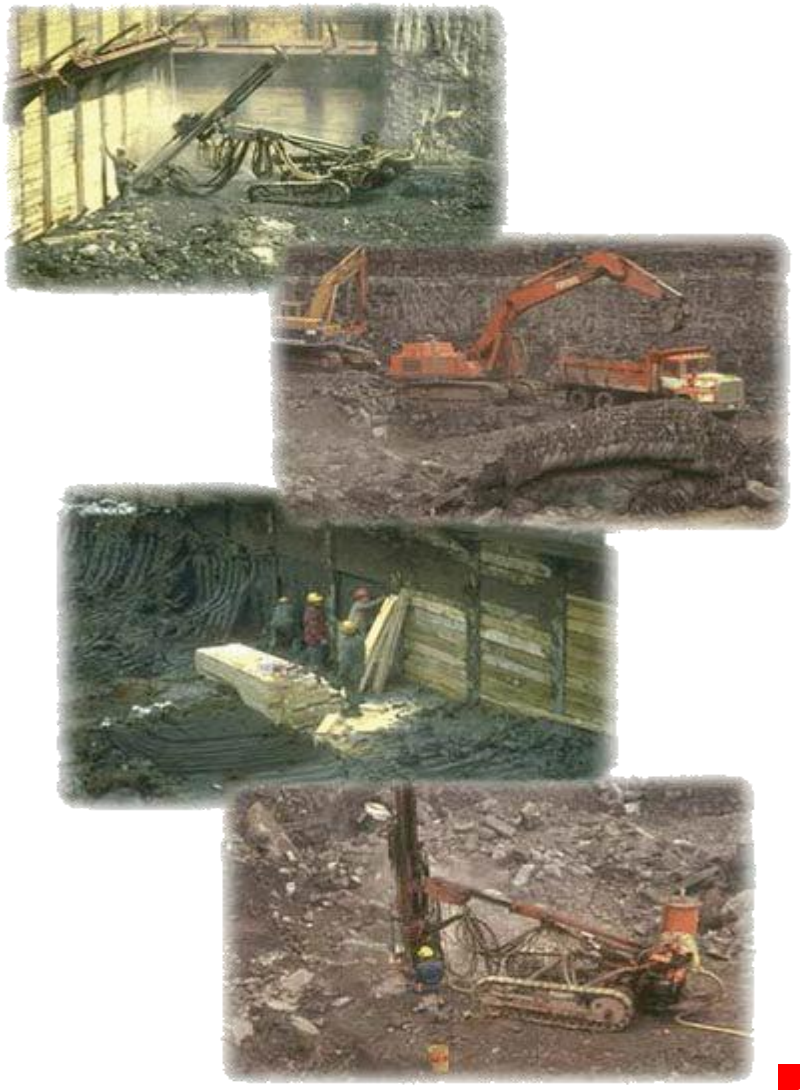
4.One World Trade Center
(541.3m)

Worlds Tallest Buildings

Geotechnical Engineering

- Geotechnical Engineers analyze the subterranean rock and soil to determine its suitability to support extreme loads.

- Geotechnical Engineering is essential for a safe and secure structure.



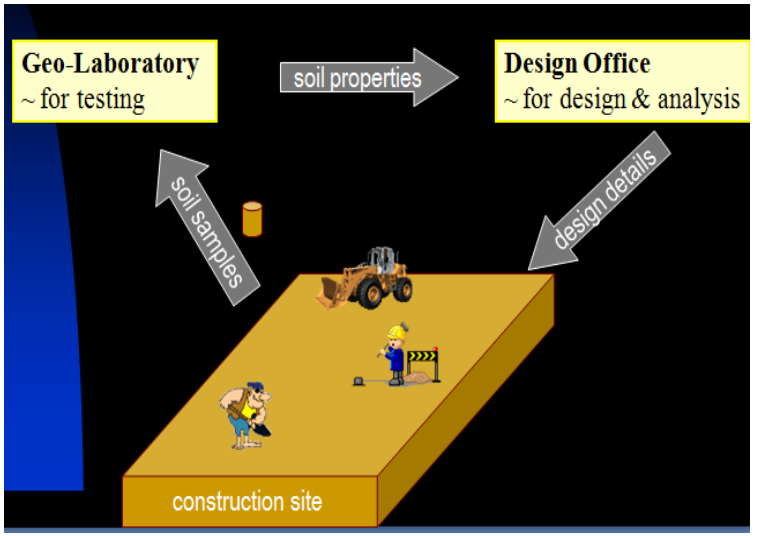
Geotechnical Engineering

- All structures have to finally transfer the load acting on them to soil safely
- Soil property changes from place to place
- Even in the same place it may not be uniform at different depth and in different seasons
- Hence, a Civil Engineer has to properly investigate soil and decide about the safe load that can be spread on the soil

Geotechnical Engineering

- This branch of study in civil engineering is known as geotechnical engineering

- Apart from finding safe bearing capacity for foundation of buildings, geotechnical engineering involves various studies required for the design of pavements, tunnels, earthen dam, canals and earth retaining structures



Water Resources and Irrigation Engineering (Hydraulics)

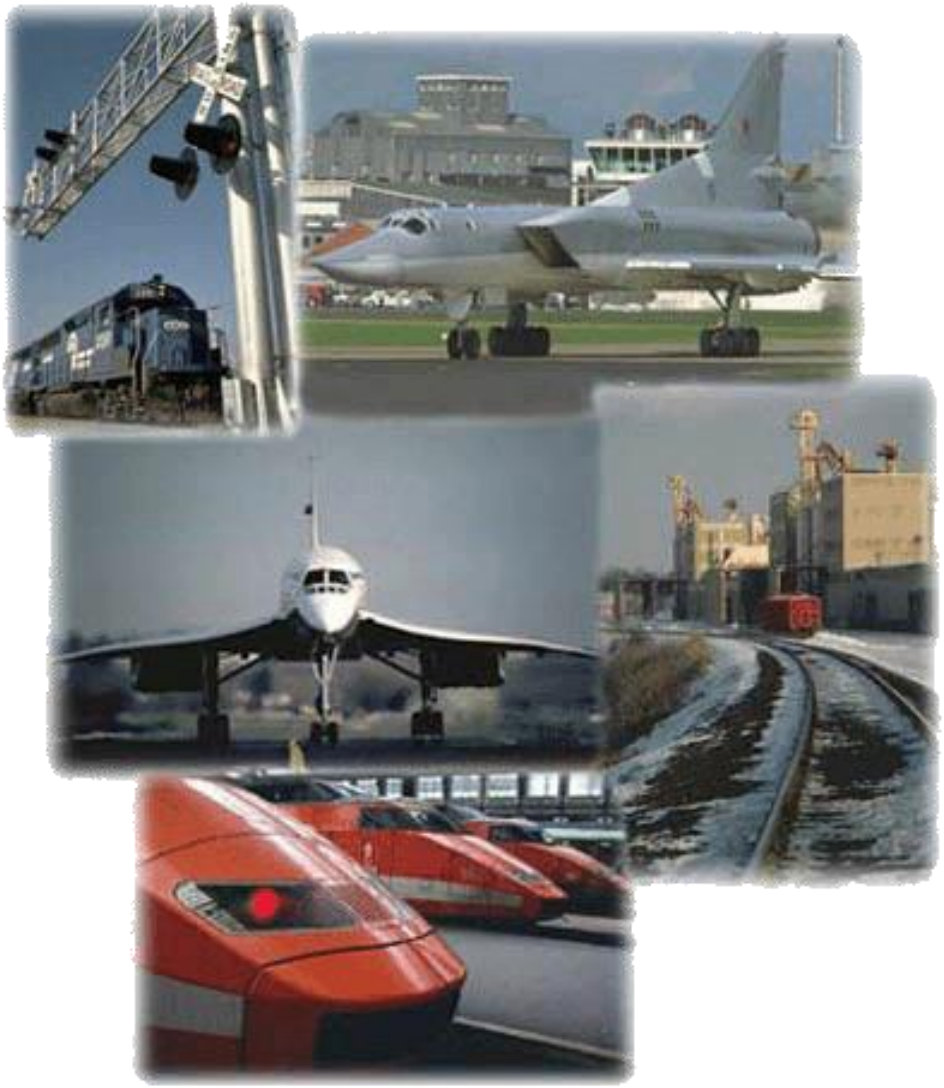
- Hydraulic engineering is a sub-discipline of civil engineering concerned with the flow and conveyance of fluids, principally water

Transportation Engineering

- Transport Engineering involves construction and maintenance of transportation infrastructure which includes canals, roadways, rail systems, airports, ports, and mass transit systems

Transportation Engineering

- Transportation Engineers design and analyze
  - Highways,
  - Railways,
  - Airports,
  - Urban and Suburban Road Networks,
  - Parking Lots, and
  - Traffic Control Signal Systems.



Environmental Engineering

Environmental Engineering deals with
- Supply of pure water
- Treatment and disposal of waste water
- Solid waste
- Air pollution problems

Environmental Engineering

- Wastewater treatment Engineers are Civil or Environmental Engineers trained to design or analyze water treatment plants.

- Water treatment plants are categorized as follows:
  - Sanitary waste treatment facilities,
  - Industrial waste treatment facilities,
  - Potable (drinking) water treatment facility.

Architecture and Town Planning

It deals with planning of Towns ,cities and aesthetically designed structures

Architecture and Town Planning

- With the growth of population and industries new towns are coming up and existing ones are growing.
- Proper town planning is to be made by Civil Engineers.
- Structures should be aesthetically good also.
- Architecture covers this area.
- This field of Civil Engineering has grown up so much that it has become a separate branch of Engineering

Role of Civil Engineer

A Civil Engineer will involve in various Engineering activities such as

Surveying and preparation of estimates

Role of Civil Engineer

Planning , designing and construction of,
-Houses
-Apartments
-Office Buildings
-Commercial establishments and factory building

Planning and design of transportation facilities such as highways and Railways

Construction of ports and harbours, Railway stations, bus and truck terminals, airports and helipads

Construction of dams and canals for irrigation

Planning, design and construction of pollution control facilities such as sewage

Role of Civil Engineer

- Measure and map the earth's surface
- Plan new townships and extension of existing towns
- Build the suitable structures for the rural and urban areas for various utilities
- Build tanks and dams to exploit water resources
- Build river navigation and flood control projects
- Build canals and distributaries to take water to agricultural fields
- Purify and supply water to the needy areas like houses, schools, offices etc.

Role of Civil Engineer

- Provide and maintain communication systems like roads, railways, harbours and airports
- Devise systems for control and efficient flow of traffic
- Provide and maintain solid and waste water disposal system
- Monitor land, water and air pollution and take measures to control them

Impact of infrastructural development in the economy of the country

Civil engineering activities in the infrastructural development are,

- Assured water supply
- A good drainage system
- Pollution free environmental conditions
- A well planned and built network of roads and road crossings
- Railways connections to all important cities and towns
- Airports and harbours of national and international standards

Impact of infrastructural development in the economy of the country

Effect of infrastructure facilities are:

- Connecting producing centers to marketing places minimize exploitation of producers by middlemen. Imports and exports became easy and as a result of which whole world becomes a village.
- Improved irrigation facility enhances agricultural products and hence producers as well as consumers are benefitted.
- Infrastructural facility develops scope for a number of industries and it creates job opportunities.
- Improved education and health care give rise to skilled and healthy work force. Quality of life of the people is improved.

Impact of infrastructural development in the economy of the country

- Utilization of manpower for the benefit of mankind brings down antisocial activities.
- In case of natural calamities assistance can be easily extended to the affected areas and misery of affected people minimized.
- Infrastructural facility improves defense system and peace exists in the country.
- Improved economical power of the country brings a respectable status in the world.

Summary

- Civil Engineering deals with the design and construction of the physical and natural built environment

- Civil Engineering is broken into several sub-disciplines of
  - Surveying,
  - Building Materials,
  - Construction Technology,
  - Structural Engineering,
  - Geotechnical Engineering,
  - Water resources and Irrigation Engineering (Hydraulics),
  - Transportation Engineering,
  - Environment Engineering
  - Architecture and Town Planning

Summary

- Role of a Civil Engineer
  - Devise systems for control and efficient flow of traffic
  - Provide and maintain solid and waste water disposal system
  - Monitor land, water and air pollution and take measures to control them