



RAMAIAH
Institute of Technology

BASICS OF CIVIL ENGINEERING & MECHANICS

Course code:CV14/CV24

Credits:3:0:0

Topics Covered

Introduction to Civil Engineering



Introduction to Civil Engineering:

One of the oldest branch of engineering next to military engineering.

A Professional engineering discipline that deals with the analysis, design, construction and maintenance of infrastructural facilities such as building bridges, dams, roads etc..

Application of physical, mathematical and scientific principles for the convenience of civilization.

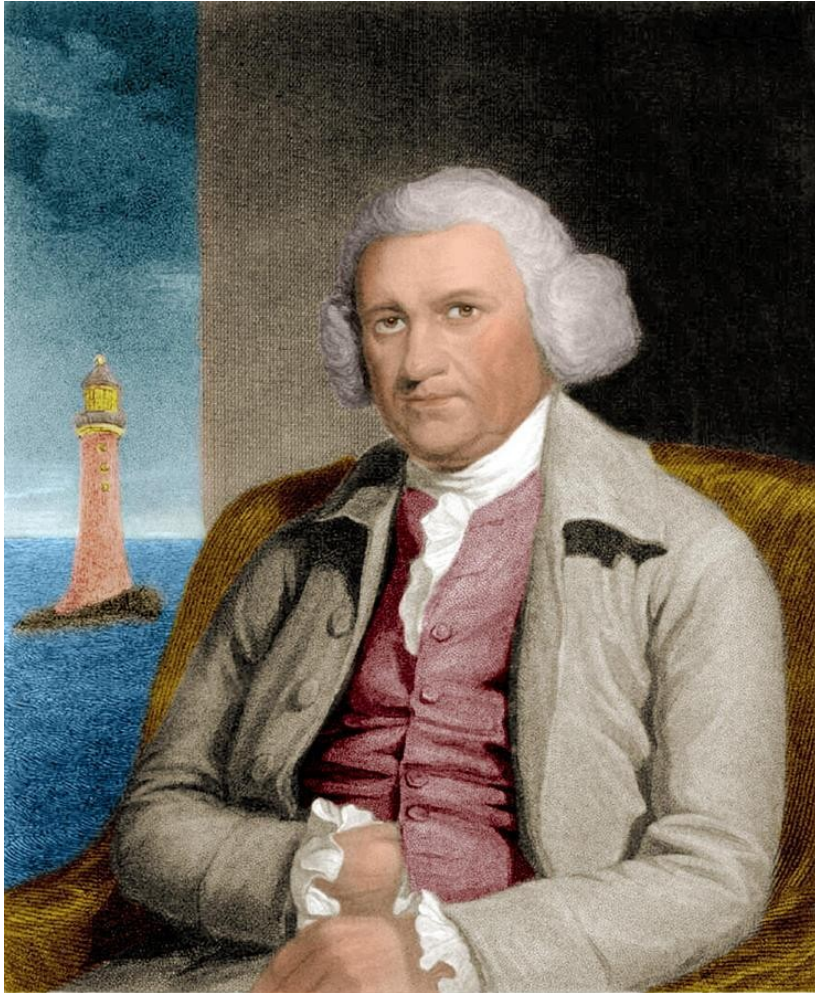
John Smeaton was the first self proclaimed Civil Engineer who built Eddystone Light House in 1771.



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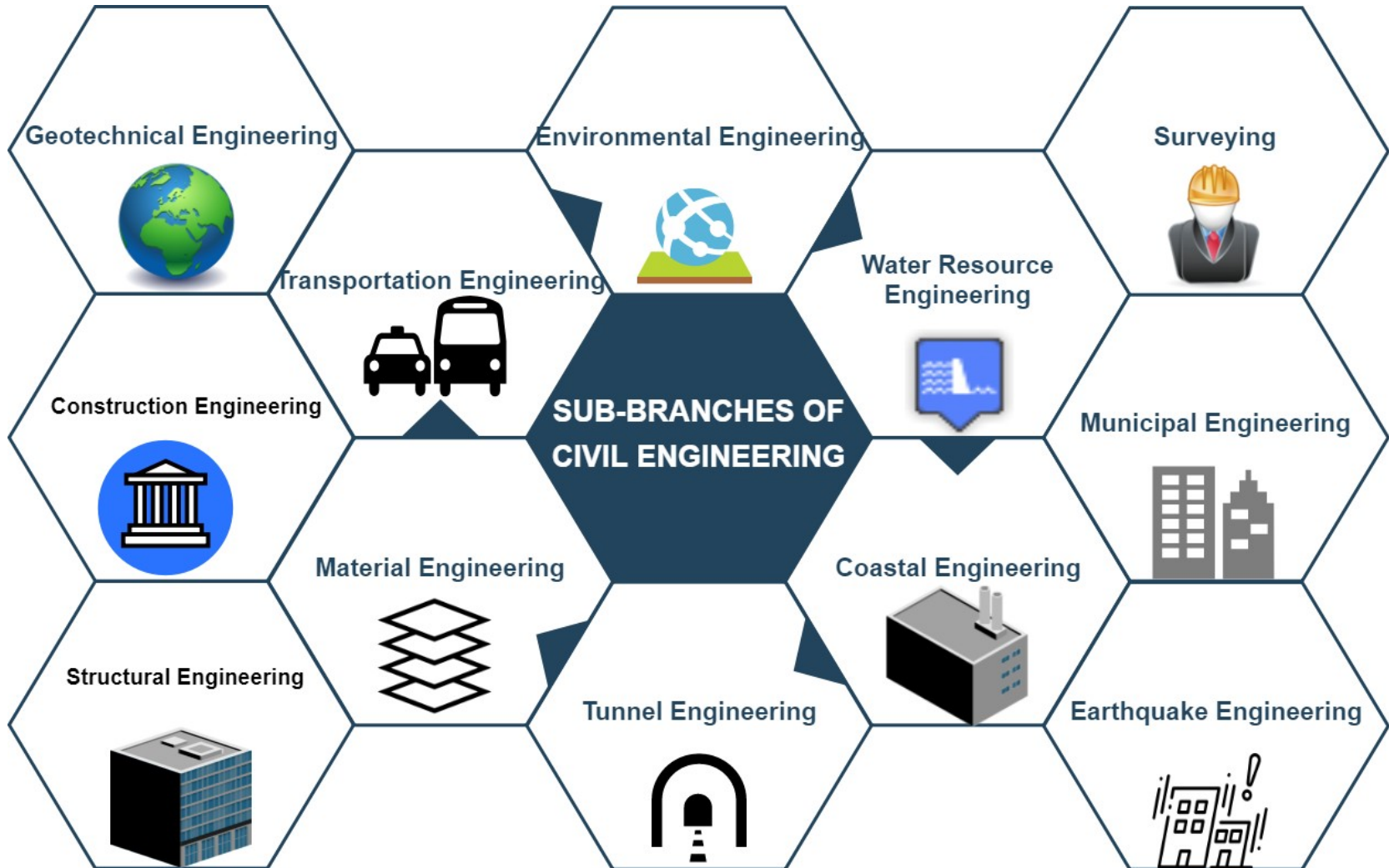
John Smeaton



John Smeaton Eddystone Lighthouse

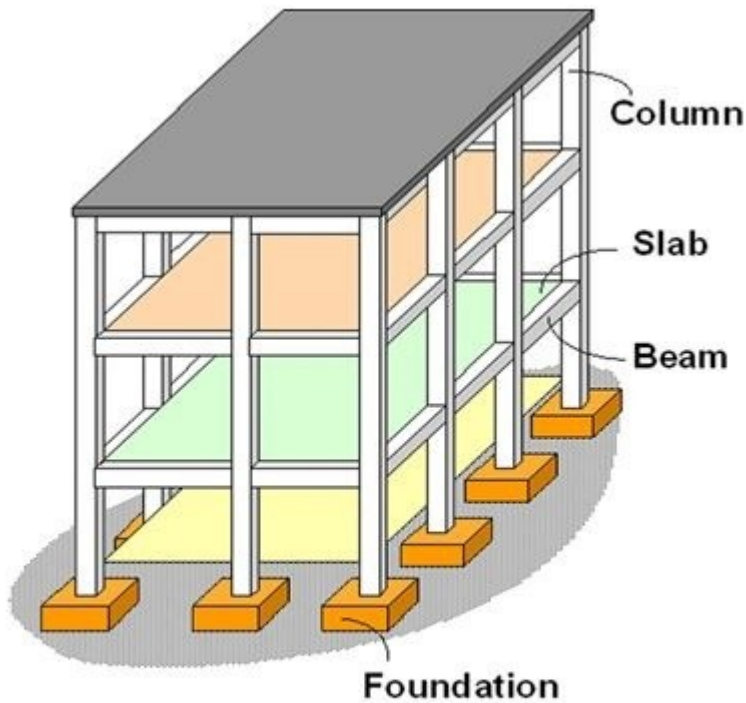


Broad Disciplines of Civil Engineering:

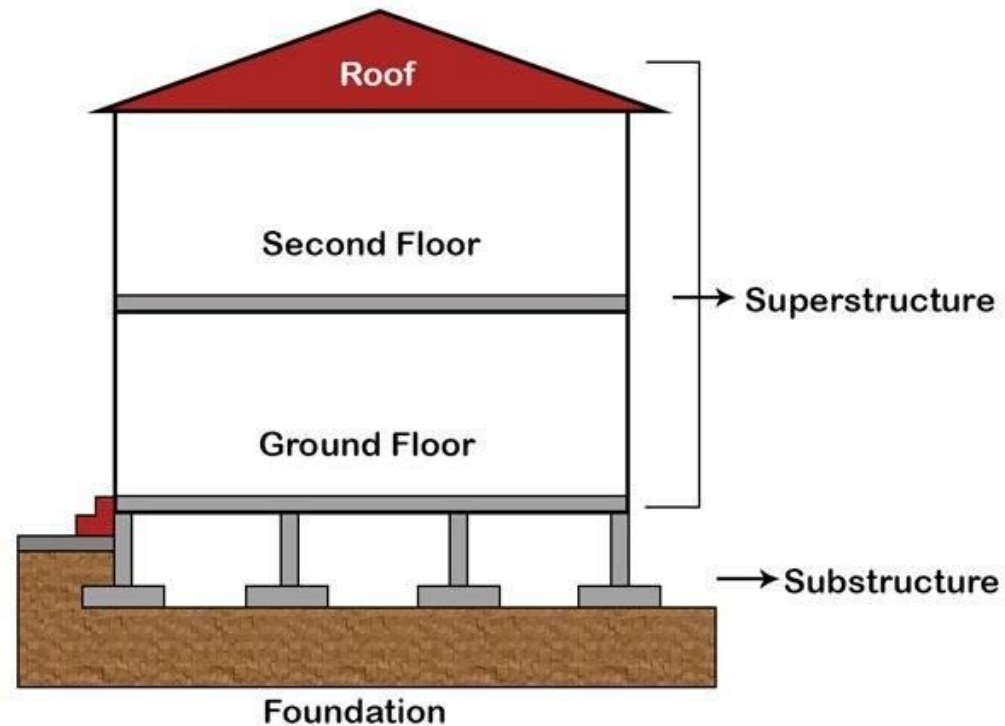




Components of Building:



Typical RC Frame Building



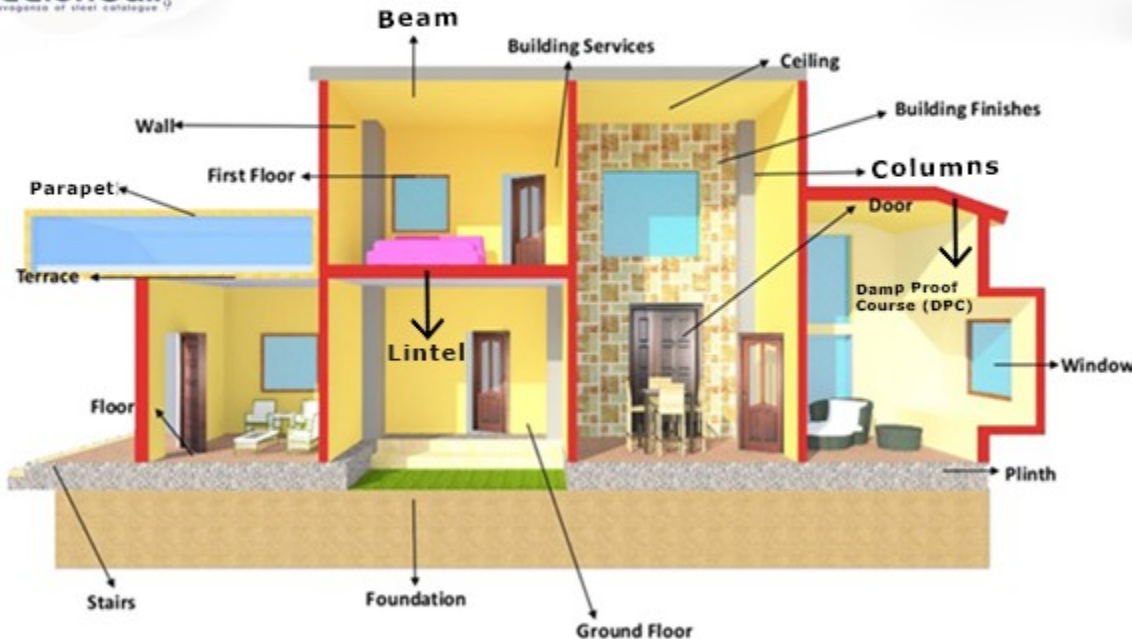
Typical Building Elevation



Components of Building:



WHAT ARE THE STRUCTURAL COMPONENTS OF A BUILDING ??



- 1.ROOF**
- 2.PARAPET**
- 3.LINTEL**
- 4.BEAM**
- 5.COLUMNS**
- 6.DAMP PROOF COURSE (DPC)**
- 7.WALLS**
- 8.FLOORS**
- 9.STAIRS**
- 10.FOUNDATION**
- 11.PLINTH**
- 12.SURFACE FINISH**

Structural Engineering:

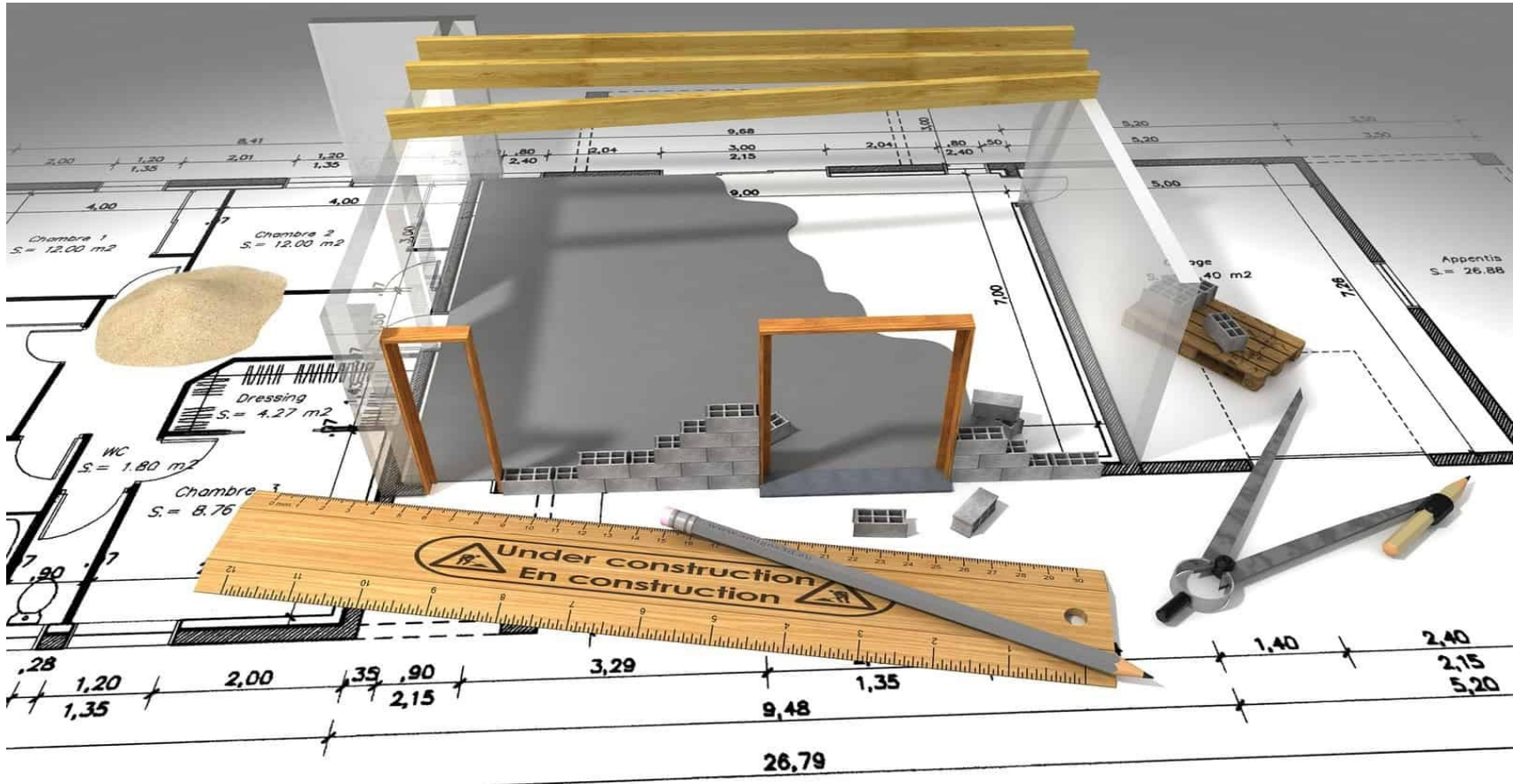
- Structural engineering is the science and art of designing and making, with economy and elegance, buildings, bridges, frameworks and other structures so that they can safely resist the forces to which they may be subjected.
- Structural Engineers play a vital role in the planning, design, supervision, and implementation of a construction project for the structures to be materialized.





Responsibilities

- Design structures, such as buildings or bridges.
- Create structural models by using computer-aided design software.
- Measure loads and pressures caused by environmental or human influence.
- Follow construction safety guidelines.
- Choose appropriate materials based on structural specifications.
- Monitor on-site construction processes and supervise construction workers.



- Prepare and allocate budgets.
- Track and report on project progress
- Collaborate with contractors and project managers



GEOTECHNICAL ENGINEERING

- Geotechnical Engineering is the study of rock and soil supporting Civil Engineering systems.
- Identification of soil properties presents challenges to geotechnical engineers as the soil properties vary from place to place and with depth.
- The material properties and behavior of soil are difficult to predict due to its variability and limitation on investigation.
- It involves in the design of foundations, tunnels, embankments, dams, retaining walls, stability of natural slopes, mining, petroleum exploration, offshore structures, landfills etc.



APPLICATIONS OF GEOTECHNICAL ENGINEERING



SITE INVESTIGATION AND FIELD TESTS TO ASSESS SOIL PROPERTIES



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DESIGN OF FOUNDATIONS



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TUNNELS, EARTHEN EMBANKMENTS AND DAMS



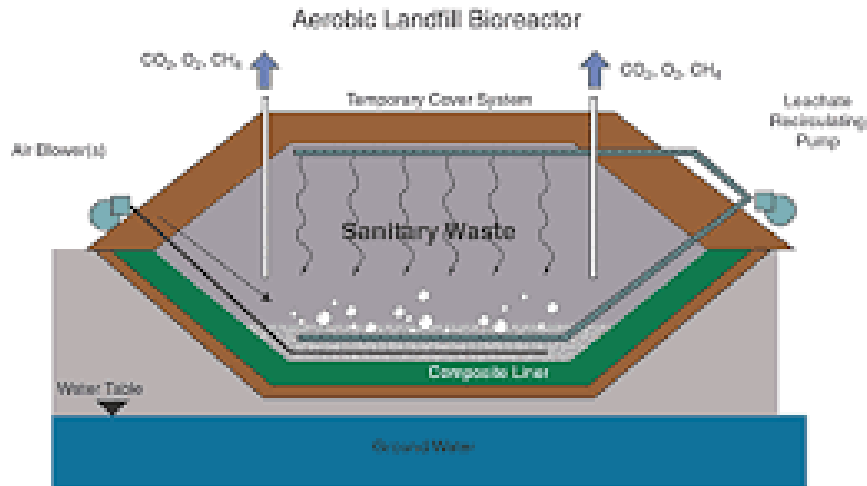
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**DESIGN OF RETAINING WALLS, SOIL SLOPES, MINING &
FOUNDATIONS OF OFFSHORE STRUCTURES**



DESIGN OF LANDFILLS & GROUND IMPROVEMENT



HYDRAULICS ENGINEERING

- ❖ Hydraulic engineering is the application of the principles of fluid mechanics to problems dealing with the collection, storage, control, transport, regulation, measurement, and use of water.
- ❖ The widespread applications of hydraulics in civil engineering include transportation of fluids in pipes and in open channels, as well as flow measurement for both pipes and open channels.
- ❖ A Hydraulic engineer design the hydraulic structures such as dams, levees, water distribution networks including both domestic and fire water supply, storm water management, water collection networks etc..



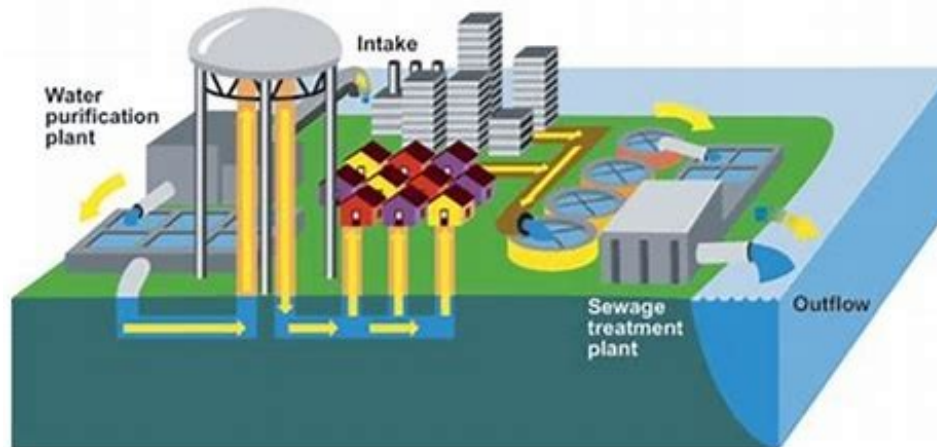
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Municipal water supply and sewage treatment



WATER RESOURCES ENGINEERING

- Water Resources Engineering is the quantitative study of the hydrologic cycle. It is concerned with the collection and management of water (as a natural resource).
- As a discipline it therefore combines elements of hydrology, environmental science, meteorology, conservation and resource management.
- This area of Civil Engineering relates to the prediction and management of both the quality and quantity of water in both ground and surface water resources.
- Applications include the management of the urban water supply, the design of urban storm – sewer systems, flood forecasting, design of hydraulic structures, irrigation systems etc.

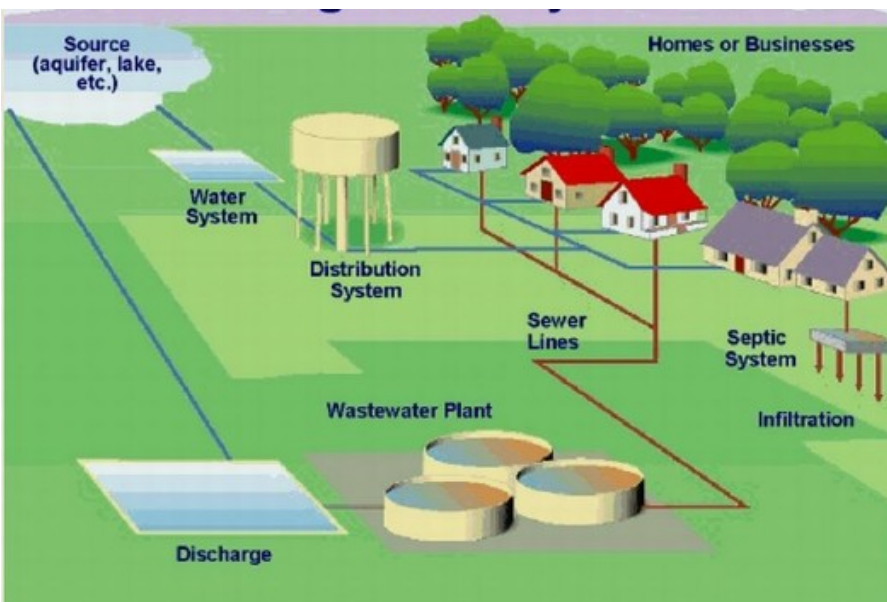


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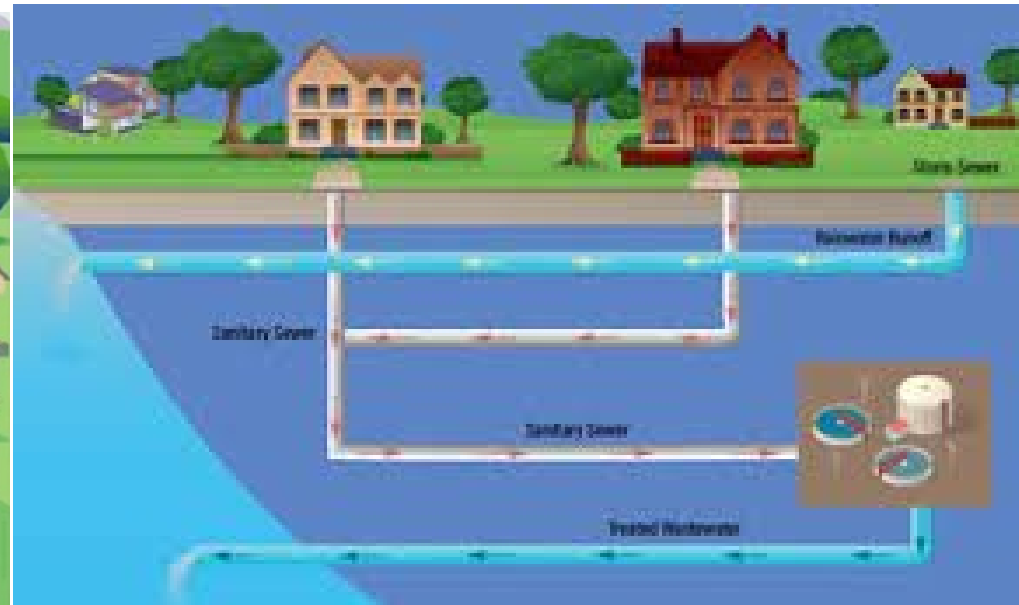
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APPLICATIONS OF WATER RESOURCES ENGINEERING



WATER SUPPLY SYSTEM

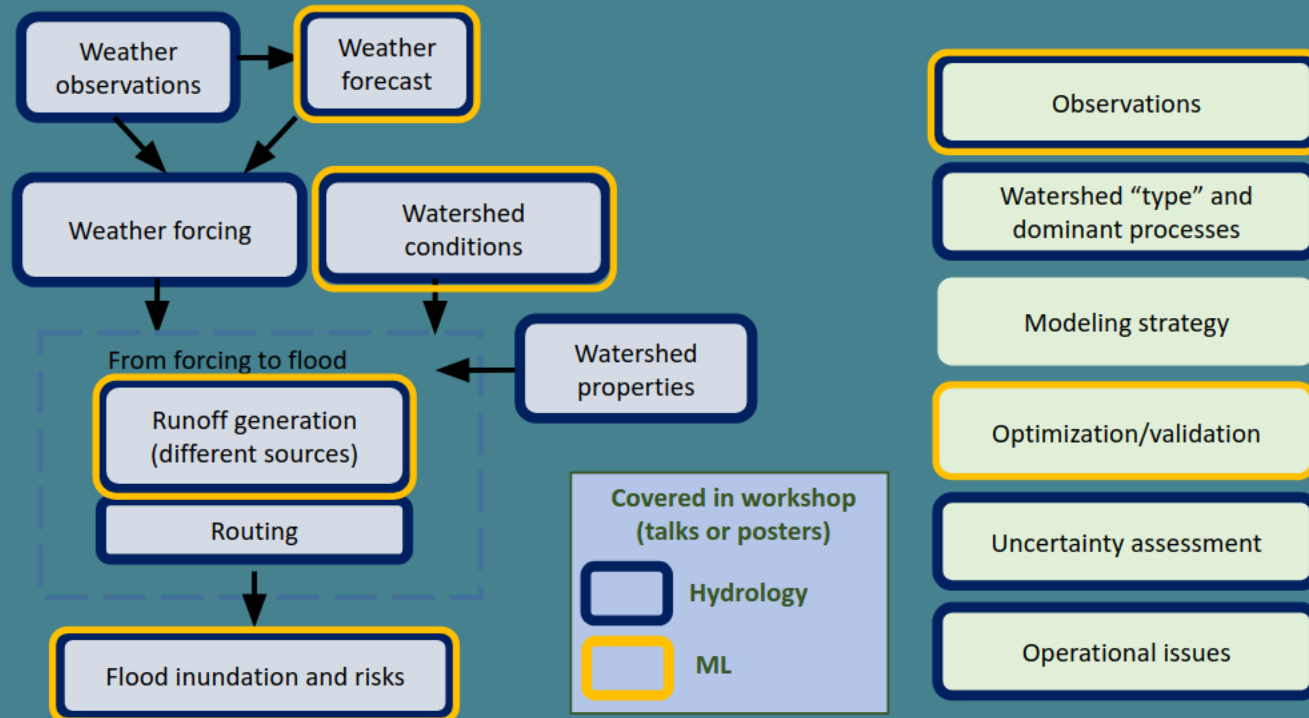


SEWER SYSTEM

DESIGN OF WATER SUPPLY AND SEWER SYSTEMS



Flood Forecasting Landscape



FLOOD FORECASTING



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DESIGN OF HYDRAULIC STRUCTURES



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DESIGN OF IRRIGATION SYSTEMS



Transportation Engineering

- Transportation engineering is a sub discipline of Civil engineering and is essentially defined as applying technology and science principles in order to plan, create functional designs, operate and manage facilities which pertain to any mode of transportation. The goals include safe, efficient, rapid, convenient, comfortable, economical and environmentally acceptable movement of goods and people.



Branches of Transportation Engineering

1. Highway engineering
2. Railroad engineering
3. Port and harbour engineering
4. Airport engineering

Role of Transportation Engineer:

1. To develop the various Transportation strategies for the efficient movement of Traffic.
2. To plan, design, and develop the transportation systems, which include traffic signal systems.
3. To develop and maintain traffic systems and processes.



4. To prepare the administrative-technical and statistical reports on the traffic operations.
5. To integrate safety procedures and Standards in transport operations.
6. To evaluate the traffic control devices and determine the need of its modification and expansion.

Importance of the Transportation Engineering:

7. Transportation helps in the economic, social, and commercial development of the nation.
8. Transportation also helps in the cultural as well as political development of the country.



4. Transportation improves the import and export of the country and helps in the industrial development throughout the nation.
5. Transportation has to connect two countries or areas with each other and improve the employment opportunities



Classification of Roads:

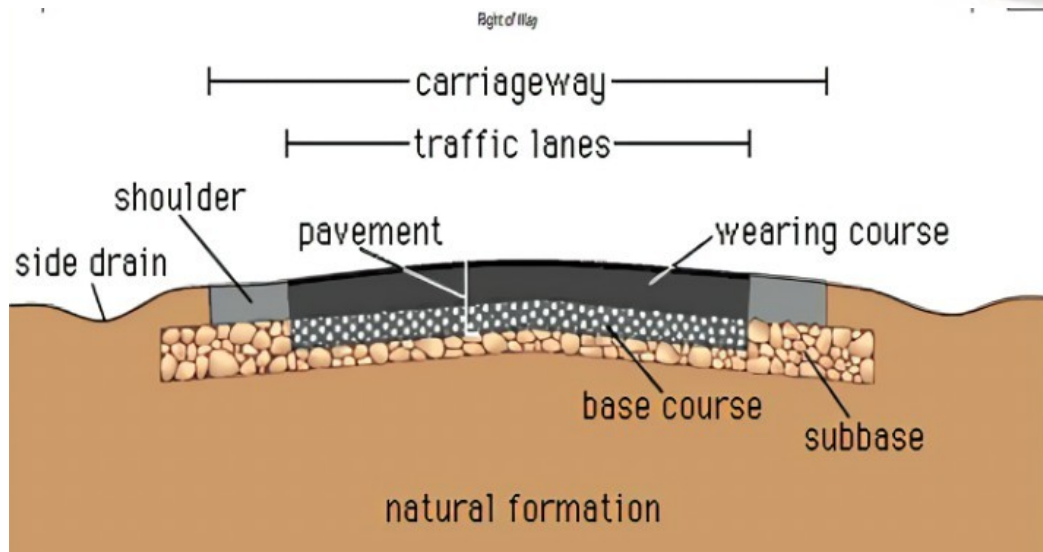
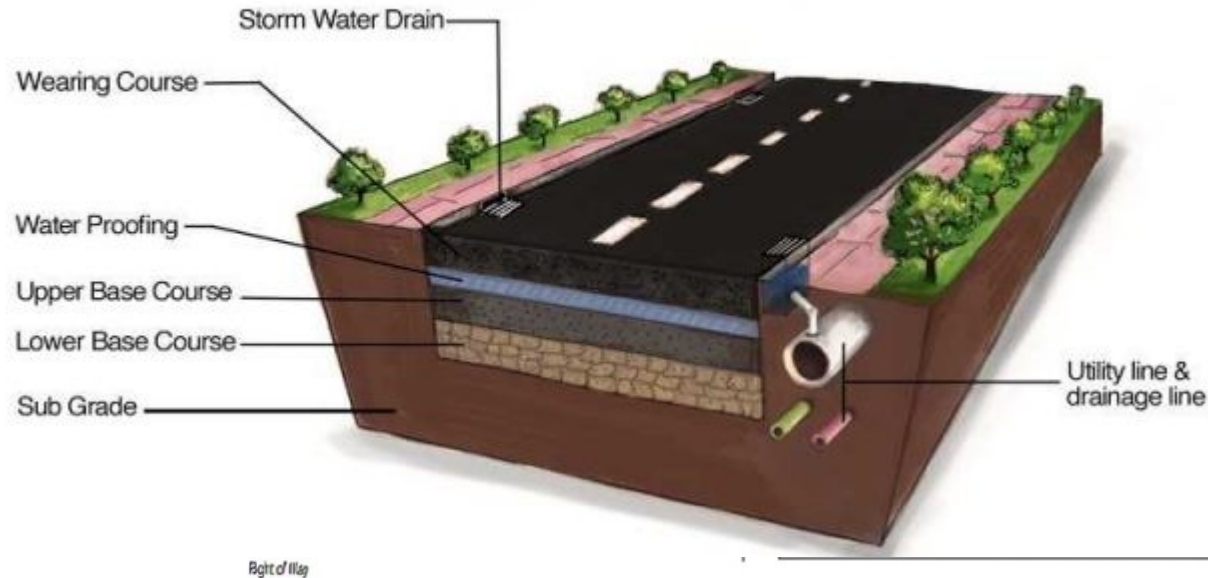
Based on location and function as

1. National Highway(NH)-Yellow and White
2. State Highway(SH)-Green and white
3. Major District Roads(MDR)-Black and white
4. Other District Roads(ODR)
5. Village Roads (VR)





CROSS-SECTION OF A ROAD





ENVIRONMENTAL ENGINEERING

- It involves waste management, waste disposal systems, pollution control, environmental sustainability, public health, water supply and treatment, waste water treatment, water resources management, air pollution management, pollutant transport, hazardous waste management etc.
- Applications include quantification of different types of pollutants, fixing standards for effluents, monitoring / prevention of different types of pollution, environmental impact assessment for factories and industries, conservation and preservation of natural resources and environment, design and construction of pipe lines etc.



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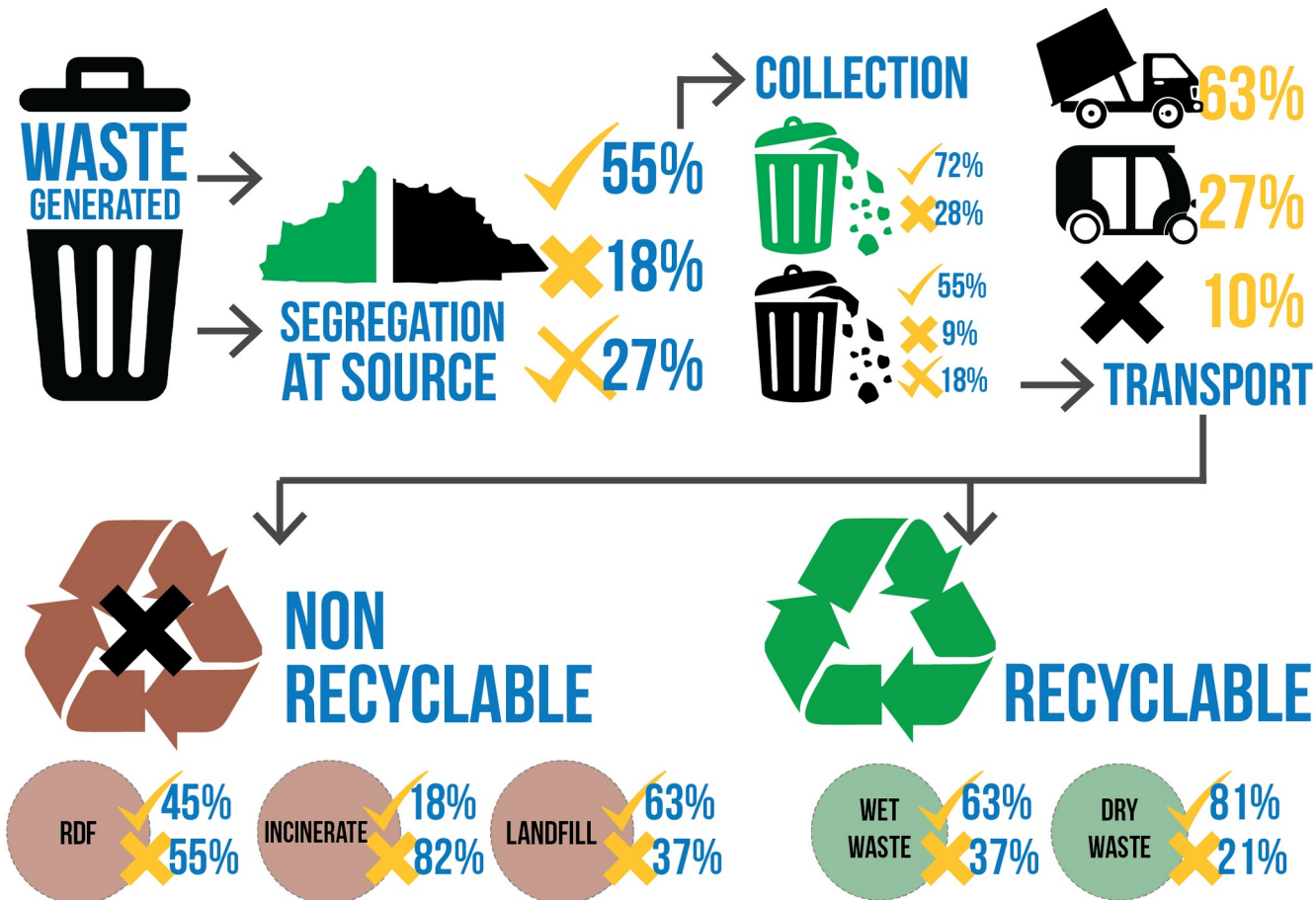
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ENVIRONMENTAL ENGINEERING

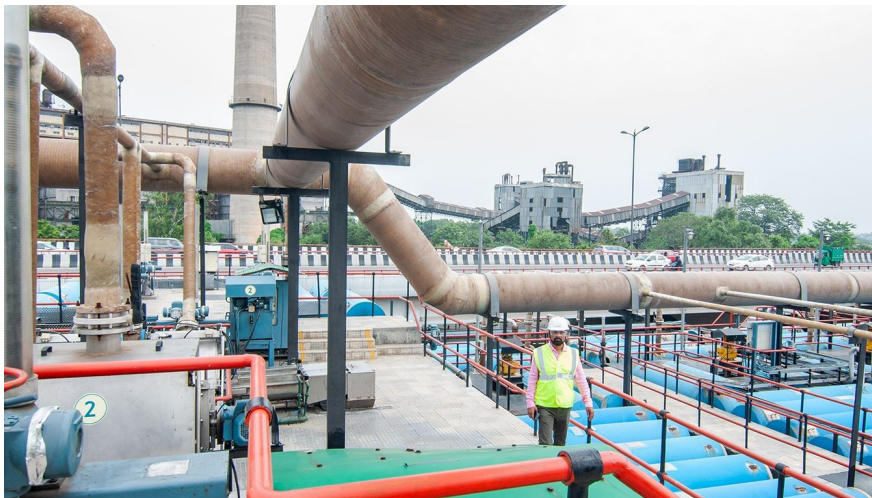
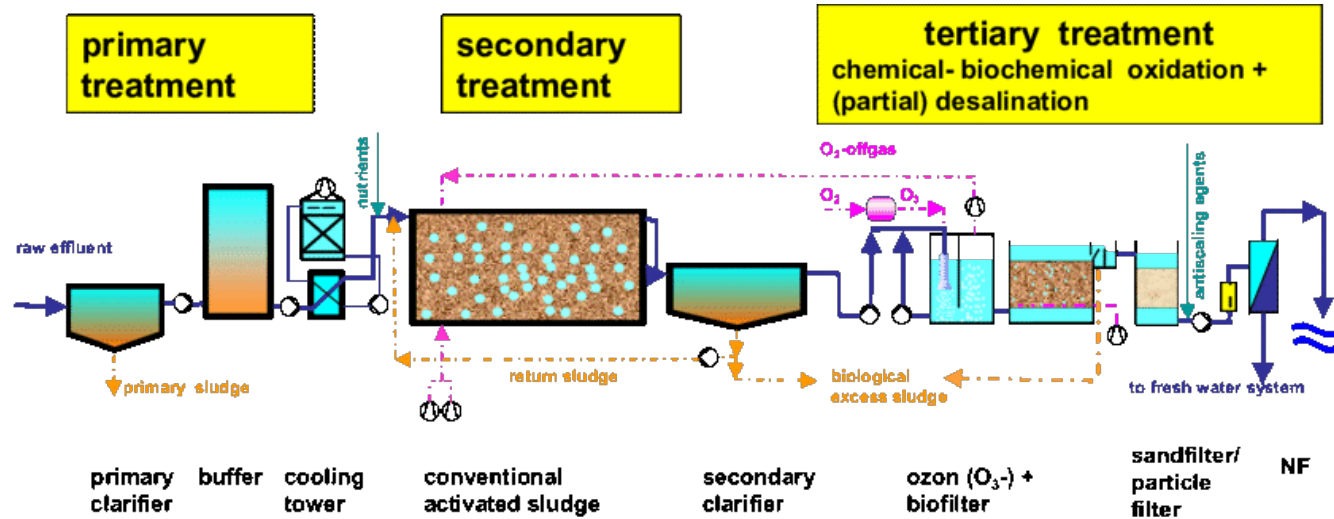
- Environmental engineering also deals with the remediation of contaminated sites after waste disposal or accidental contamination.
- Environmental engineers administer pollution reduction, green engineering, industrial ecology and compile information on environmental consequences of proposed actions.



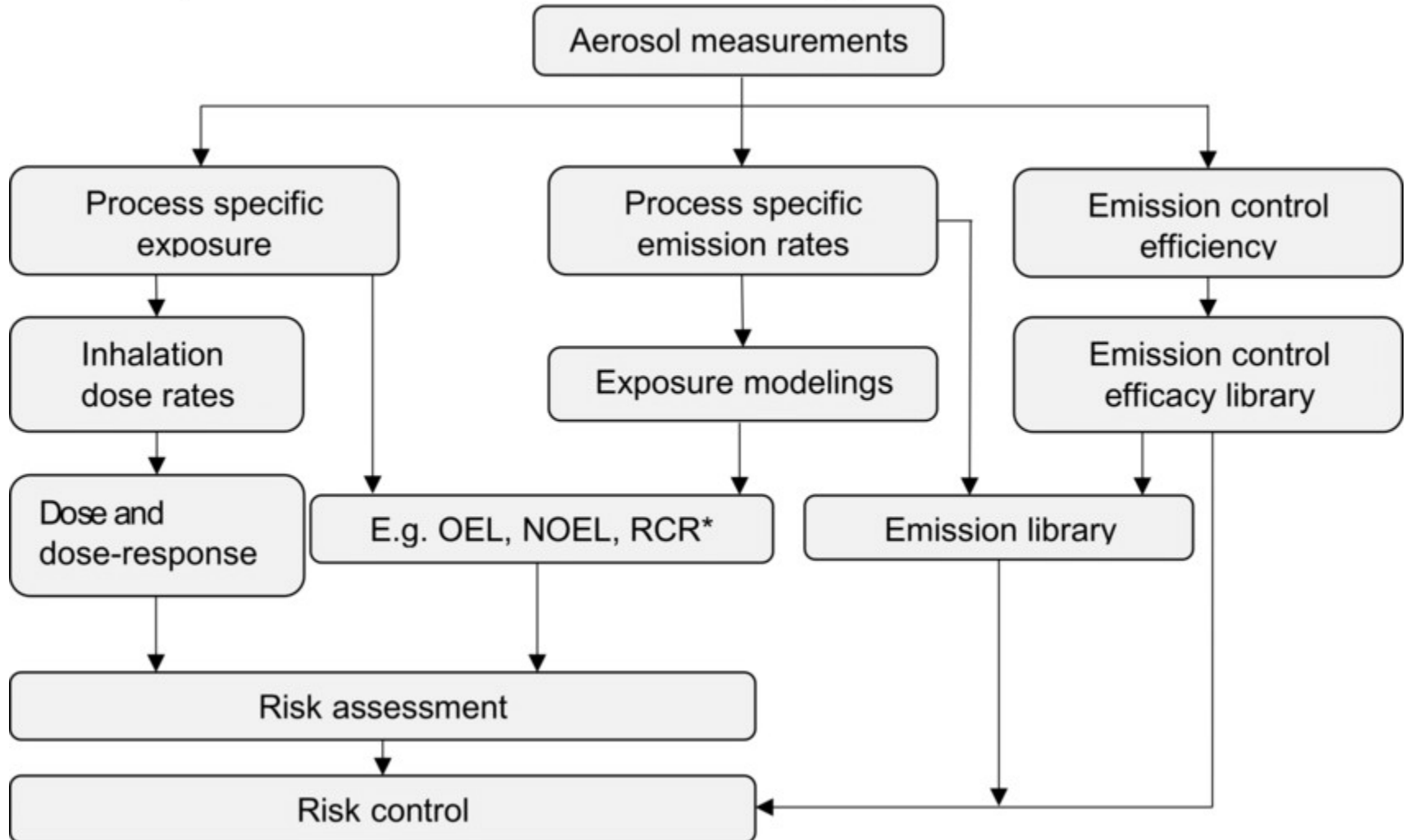
APPLICATIONS OF ENVIRONMENTAL ENGINEERING



WASTE MANAGEMENT



WASTE WATER TREATMENT



*OEL: Occupational Exposure Limit; DNEL: Derived No Effect Level; RCR: Risk Characterization Ratio

AIR POLLUTION MANAGEMENT



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HAZARDOUS WASTE MANAGEMENT



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REMEDIATION OF CONTAMINATED SITES



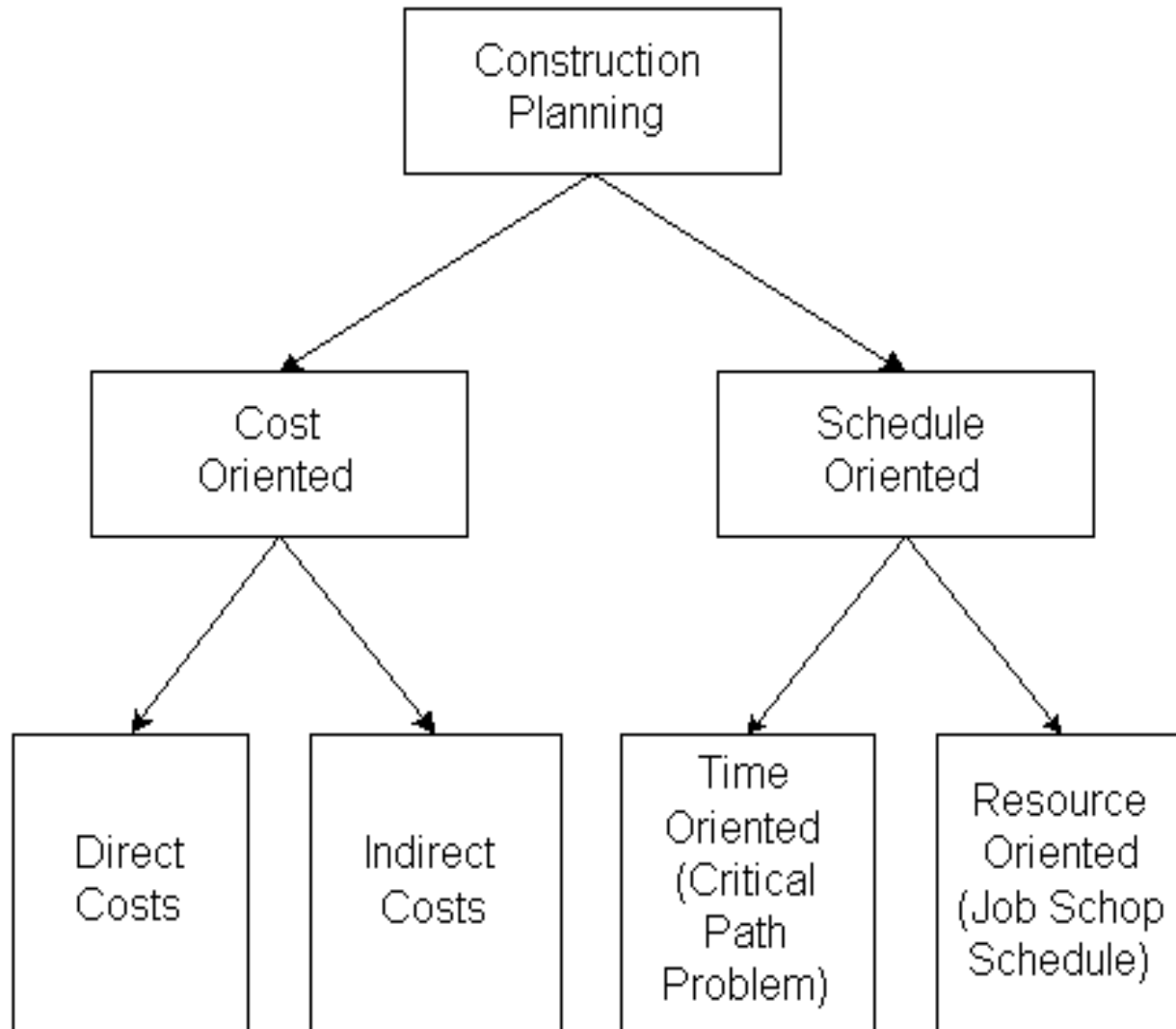
GREEN BUILDING TECHNIQUES



Construction Planning and Management

- Planning, scheduling is an important part of the construction management. Planning and scheduling of construction activities helps engineers to complete the project in time and within the budget.
- The term 'Construction' does not only denotes physical activities involving men, materials and machinery but also covers the entire gamut of activities from conception to realization of a construction project. Thus, management of resources such as men, materials, machinery requires effective planning and scheduling of each activity.

Construction Planning and Management





■ What is Construction Management?

Management is the science and art of planning, organizing, leading and controlling the work of organization members and of using all available organization resources to reach stated organizational goals. Construction management deals with economical consumption of the resources available in the least possible time for successful completion of construction project. 'Men', 'materials', 'machinery' and 'money' are termed as resources in construction Management.



Objectives of Construction Management:

- Prepare and negotiate cost estimates, budgets, and work timetables
- Select appropriate construction methods and strategies
- Interpret and explain contracts and technical information to workers and other professionals
- Report on work progress and budget matters to clients



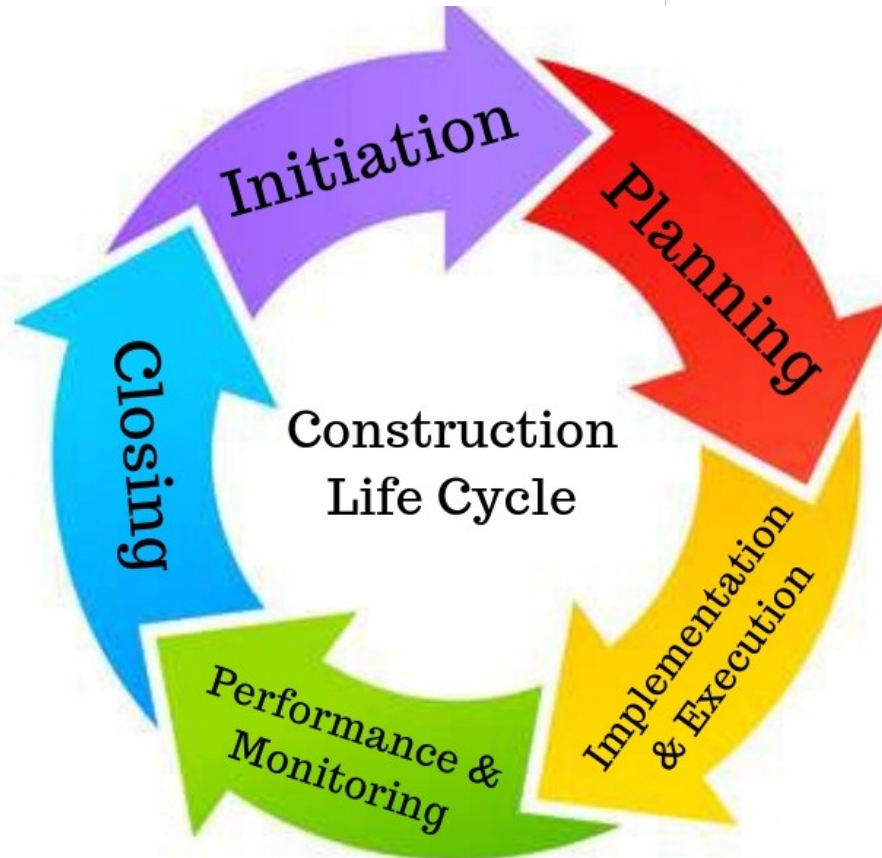
Objectives of Construction Management:

- Collaborate with architects, engineers, and other construction and building specialists
- Instruct and supervise construction personnel and activities onsite
- Respond to work delays and other problems and emergencies
- Select, hire, and instruct laborers and subcontractors
- Comply with legal requirements, building and safety codes, and other regulations



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Functions of Construction Management:

The functions of construction Management are

- (a) Planning
- (b) Scheduling
- (c) Organizing
- (d) Staffing
- (e) Directing
- (f) Controlling
- (g) Coordinating



(a) Planning in Construction Management:

It is the process of selecting a particular method and the order of work to be adopted for a project from all the possible ways and sequences in which it could be done. It essentially covers the aspects of 'What to do' and 'How to do it'.





- Planning helps to minimize the cost by optimum utilization of available resources, reduces irrational approaches, duplication of works and inter departmental conflicts. It encourages innovation and creativity among the construction managers.

b) Scheduling in Construction Management:

Scheduling is the fitting of the final work plan to a time scale. It shows the duration and order of various construction activities. It deals with the aspect of 'when to do it'.



c) Organizing:

Organizing is concerned with decision of the total construction work into manageable departments/sections and systematically managing various operations by delegating specific tasks to individuals.

d) Staffing:

Staffing is the provision of right people to each section department created for successful completion of a construction project.



e) Directing: It is concerned with training subordinates to carry out assigned tasks, supervising their work and guiding their efforts. It also involves motivating staff to achieve desired results.

f) Controlling: It involves a constant review of the work plan to check on actual achievements and to discover and rectify deviation through appropriate corrective measures.





g) Coordinating:

It involves bringing together and coordinating the work of various departments and sections so as to have good communication. It is necessary for each section to be aware of its role and the assistance to be expected from others.

