

Introduction to Civil Engineering

Civil engineering is the oldest branch of engineering which is growing right from the stone age civilization. American Society of Civil Engineering defines *Civil Engineering* as the profession in which a knowledge of the mathematical and physical sciences gained by study, experience and practice is applied with judgement to develop ways to utilize economically the materials and forces of nature for the progressive well-being of man.

In this chapter, scopes of different fields of civil engineering are discussed and the importance of developing infrastructure in the country is presented.

1.1 SCOPE OF DIFFERENT FIELDS OF CIVIL ENGINEERING

Civil Engineering may be divided into the following fields:

- (i) Surveying
- (ii) Building Materials
- (iii) Construction Technology
- (iv) Structural Engineering
- (v) Geotechnical Engineering
- (vi) Hydraulics
- (vii) Water Resources and Irrigation Engineering
- (viii) Transportation Engineering
- (ix) Environmental Engineering and
- (x) Architecture and Town planning

Scope of each one of these is discussed below.

(i) Surveying

Surveying is the science of map making. To start any development activity in an area the relative positions of various objects in the horizontal and vertical directions are required. This is approved

by surveying the area. Earlier, the conventional instruments like chain, tape and levelling instruments were used. In this electronic era, modern equipments like distance meters and total stations are used to get more accurate results easily. The modern technologies like photogrammetry and remote sensing have made surveying easier.

(ii) Building Materials

Shelter is the basic need of civilization. To get good shelter continuous efforts are going on right from the beginning of civilization. Stones, bricks, timber, lime, cement, sand, jellies and tiles are the traditional building materials. Use of steel, aluminium, glass, glazed tiles, plaster of paris, paints and varnishes have improved the quality of buildings. The appropriate mixture of binding materials like lime and cement with sand is known as mortar. The mixture of cement, sand and jelly (crushed stones) with water is known as concrete. The use of concrete with steel bars placed in appropriate position has helped in building strong and durable tall structures. The composite material of concrete and steel is called reinforced cement concrete which is popularly known as R. C. C. A civil engineer must know the properties of all the building materials so that they can be used appropriately. Improved versions of many building materials appear in the market. A good civil engineer will make use of them at the earliest.

(iii) Construction Technology

Construction is the major activity of civil engineering which is continuously improving. As land cost is going up there is demand for tall structures in urban areas while in rural areas need is for low cost constructions. One has to develop technology using locally available materials. In India, contribution of Central Building Research Institute (CBRI) - Roorkee and Gaziabad, several educational institutions throughout the country and Nirmithi Kendras in the technology development are noteworthy.

(iv) Structural Engineering

Load acting on a structure is ultimately transferred to ground. In doing so, various components of the structure are subjected to internal stresses. For example, in a building, load acting on a slab is transferred by slab to ground through beams, columns and footings. Assessing the internal stresses in the components of a structure is known as Structural Analysis and finding the suitable size of the structural component is known as design of structure. The structure to be analysed and designed may be of masonry, R. C. C. or steel. Upto midsixties considerable improvements were seen in classical analysis. With the advent of computers numerical methods emerged and analysis and design packages are becoming popular. Matrix Method of analysis and Finite Elements Analysis have helped in the analysis of complex structures. A civil engineer has not only to give a safe structure but he has to give economical sections. To get economical section mathematical optimization techniques are used. Frequent earthquakes in the recent years have brought, importance of analysis of the structure for earthquake forces. Designing earthquake resistant structures is attracting lot of researches. All these aspects fall under structural engineering field.

(v) Geotechnical Engineering

Soil property changes from place to place. Even in the same place it may not be uniform at various depths. The soil property may vary from season to season due to variation in moisture

content. The load from the structure is to be safely transferred to soil. For this, safe bearing capacity of the soil is to be properly assessed. This branch of study in Civil Engineering is called 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 dams, canals and earth retaining structures. It involves study of ground improvement techniques also.

(vi) Hydraulics

Water is an important need for all living beings. Study of mechanics of water and its flow characteristics is another important field in Civil Engineering and it is known as hydraulics.

(vii) Water Resources and Irrigation Engineering

Water is to be supplied to agriculture field and for drinking purposes. Hence suitable water resources are to be identified and water is to be stored. Identifying, planning and building water retaining structures like tanks and dams and carrying stored water to fields is known as water resources and irrigation engineering.

(viii) Transportation Engineering

Transportation facility is another important need. Providing good and economical roads is an important duty of civil engineers. It involves design of base courses, suitable surface finishes, cross drainage works, road intersections, culverts, bridges, tunnels etc. Railway is another important long-way transport facility. Design, construction and maintenance of railway lines, signal system are part of transportation engineering. There is need for airports and harbours. For proper planning of these transportation facility, traffic survey is to be carried out. Carrying out traffic survey, design, construction and maintenance of roads, bridges, railway, harbour and airports is known as transportation engineering.

(ix) Environmental Engineering

Proper distribution of water to rural areas, towns and cities and disposal of waste water and solid waste are another field of civil engineering. Industrialisation and increase in vehicular traffic are creating air pollution problems. Environmental engineering while tackling all these problems provides healthy environment to public.

(x) Architecture and Town Planning

Aesthetically good structures are required. Towns and cities are to be planned properly. This field of engineering has grown considerably and has become a course separate from Civil Engineering.

1.2 TYPES OF INFRASTRUCTURE

Infrastructure facilities involve various civil engineering amenities, electricity, telephone, internet facility, educational and healthcare facilities. Civil engineering amenities in the infrastructure developments are listed below:

- (i) A good town planning and developing sites
- (ii) Providing suitable roads and network of roads
- (iii) Railway connection to important places
- (iv) Airports of national and international standards

- (v) Assured water supply to towns, cities and rural areas
- (vi) A good drainage and waste disposal system
- (vii) Pollution free environment.

1.3 EFFECT OF INFRASTRUCTURE FACILITIES

Connecting producing centre to marketing places minimises exploitation from middlemen. Both producer and consumers are benefitted. Imports and exports become easy as a result of which whole world becomes a village. The infrastructure development generates scope for lots of industries. Manpower is utilized for the benefit of mankind. Antisocial activities come under control. Improved education and healthcare give rise to skilled and healthy work force. Quality of life of the people is improved. In case of natural calamities assistance can be extended easily and misery of affected people is reduced. Infrastructure facility improves defence system and peace exists in the country. Improved economical power of the country brings a respectable status in the world.

The world has realized that a government should not involve itself in production and distribution but should develop infrastructure to create an atmosphere for economical development.

1.4 ROLE OF CIVIL ENGINEERS IN THE INFRASTRUCTURE DEVELOPMENT

A civil engineer has to conceive, plan, estimate, get approval, create and maintain all civil engineering infrastructure activities. He has to carry out research and training programmes to improve the technology. Civil engineer has a very important role in the development of the following infrastructures:

- (i) Town and city planning
- (ii) Build suitable structures for the rural and urban areas for various utilities.
- (iii) Build tanks, dams to exploit water resources.
- (iv) Purify the water and supply water to needy areas like houses, schools, offices, and agriculture field.
- (v) Provide good drainage system and purification plants.
- (vi) Provide and maintain communication systems like roads, railways, harbours and airports.
- (vii) Monitor land, water and air pollution and take measures to control them.

Questions

1. Briefly give the scope of different fields in Civil Engineering.
2. List various civil engineering amenities covered under infrastructure developments.
3. Discuss briefly impact of Civil Engineering infrastructure developments on the economy and environment.
4. Briefly explain the role of Civil Engineers in the infrastructure development.