



TRANSPORTATION ENGINEERING -I



Introduction to transportation engineering

- Mobility is a basic human need. From the times immemorial, everyone travels either for food or leisure.
- A closely associated need is the transport of raw materials to a manufacturing unit or finished goods for consumption.
- Transportation fulfills these basic needs of humanity.
- Transportation plays a major role in the development of the human civilization. For instance, one could easily observe the strong correlation between the evolution of human settlement and the proximity of transport facilities.
- Also, there is a strong correlation between the quality of transport facilities and standard of living, because of which society places a great expectation from transportation facilities.
- In other words, the solution to transportation problems must be analytically based, economically sound, socially credible, environmentally sensitive, practically acceptable and sustainable.
- Alternatively, the transportation solution should be safe, rapid, comfortable, convenient, economical, and ecofriendly for both men and material



Transportation system

- In the last couple of decades transportation systems analysis has emerged as a recognized profession.
- More and more government organizations, universities, researchers, consultants, and private industrial groups around the world are becoming truly multi-modal in their orientation and are opting a systematic approach to transportation problems.

Diverse characteristics

1. Multi-modal: Covering all modes of transport; air, land, and sea for both passenger and freight.
2. Multi-sector: Encompassing the problems and viewpoints of government, private industry, and public.
3. Multi-problem: Ranging across a spectrum of issues that includes national and international policy, planning of regional system, the location and design of specific facilities, carrier management issues, regulatory, institutional and non official policies.
4. Multi-objective: Aiming at national and regional economic development, urban development, environment quality, and social quality, as well as service to users and non official and economic feasibility.
5. Multi-disciplinary: Drawing on the theories and methods of engineering, economics, operations research, political science, psychology, other natural, and social sciences, management and law.



Study context

1. Planning range: Urban transportation planning, producing long range plans for 5-25 years for multimodal transportation systems in urban areas as well as short range programs of action for less than five years.
2. Passenger transport: Regional passenger transportation, dealing with inter-city passenger transport by air, rail, and highway and possible with new modes.
3. Freight transport: Routing and management, choice of different modes of rail and truck.
4. International transport: Issues such as containerization, inter-modal co-ordination.

Background: A changing world

1. Change in the demand: When the population, income, and land-use pattern changes, the pattern of demand changes; both in the amount and spatial distribution of that demand.
2. Changes in the technology: As an example, earlier, only two alternatives (bus transit and rail transit) were considered for urban transportation. But, now new systems like LRT, MRTS, etc offer a variety of alternatives.
3. Change in operational policy: Variety of policy options designed to improve the efficiency, such as incentive for car-pooling, bus fare, road tolls etc.
4. Change in values of the public: Earlier all beneficiaries of a system was monolithically considered as users. Now, not one system can be beneficial to all, instead one must identify the target groups like rich, poor, young, work trip, leisure etc.

Role of transportation engineer

- In spite of the diversity of problem types, institutional contexts and technical perspectives there is an underlying unity: a body of theory and set of basic principles to be utilized in every analysis of transportation systems.
- The core of this is the transportation system analysis approach. The focus of this is the interaction between the transportation and activity systems of region.
- This approach is to intervene, delicately and deliberately in the complex fabric of society to use transport effectively in coordination with other public and private actions to achieve the goals of that society. For this the analyst must have substantial understanding of the transportation systems and their interaction with activity systems; which requires understanding of the basic theoretical concepts and available empirical knowledge.

Major disciplines of transportation

1. **Transportation Planning**:-Transportation planning essentially involves the development of a transport model which will accurately represent both the current as well as future transportation system
2. **Geometric Design**:-Geometric design deals with physical proportioning of other transportation facilities, in contrast with the structural design of the facilities. The topics include the cross-sectional features, horizontal alignment, vertical alignment and intersections.
3. **Pavement Design**:-Pavement design deals with the structural design of roads, both (bituminous and concrete), commonly known as (flexible pavements and rigid pavements) respectively. It deals with the design of paving materials, determination of the layer thickness, and construction and maintenance procedures
4. **Traffic Engineering**:-Traffic engineering covers a broad range of engineering applications with a focus on the safety of the public, the efficient use of transportation resources, and the mobility of people and goods. Traffic engineering involves a variety of engineering and management skills, including design, operation, and system optimization

Other important disciplines

- ***Public transportation***: Public transportation or mass transportation deals with study of the transportation system that meets the travel need of several people by sharing a vehicle. Generally this focuses on the urban travel by bus and rail transit. The major topics include characteristics of various modes; planning, management and operations; and policies for promoting public transportation.
- ***Financial and economic analysis*** :-Transportation facilities require large capital investments. Therefore it is imperative that who ever invests money should get the returns. When government invests in transportation, its objective is not often monetary returns; but social benefits.
- ***Environmental impact assessment*** :-The depletion of fossil fuels and the degradation of the environment has been a severe concern of the planners in the past few decades. Transportation; in spite of its benefits to the society is a major contributor to the above concern.



Other important disciplines

- ***Accident analysis and reduction:-*** One of the silent killers of humanity is transportation. Several statistics evaluates that more people are killed due to transportation than great wars and natural disasters. This discipline of transportation looks at the causes of accidents, from the perspective of human, road, and vehicle and formulate plans for the reduction.
- ***Intelligent transport system:-***With advent to computers, communication, and vehicle technology, it is possible in these days to operate transportation system much effectively with significant reduction in the adverse impacts of transportation. Intelligent transportation system offers better mobility, efficiency, and safety with the help of the state-of-the-art-technology.
- ***In addition disciplines specific to various modes are also common. This includes railway engineering, port and harbor engineering, and airport engineering.***



Summary

- Transportation engineering is a very diverse and multidisciplinary field, which deals with the planning, design, operation and maintenance of transportation systems. Good transportation is that which provides safe, rapid, comfortable, convenient, economical, and environmentally compatible movement of both goods and people.
- This profession carries a distinct societal responsibility.
- Transportation planners and engineers recognize the fact that transportation systems constitute a potent force in shaping the course of regional development.
- Planning and development of transportation facilities generally raises living standards and enhances the aggregate of community values.