

Lecture 1: Introduction to Transportation Engineering
Assistant Lecturer Tameem M. Hashim

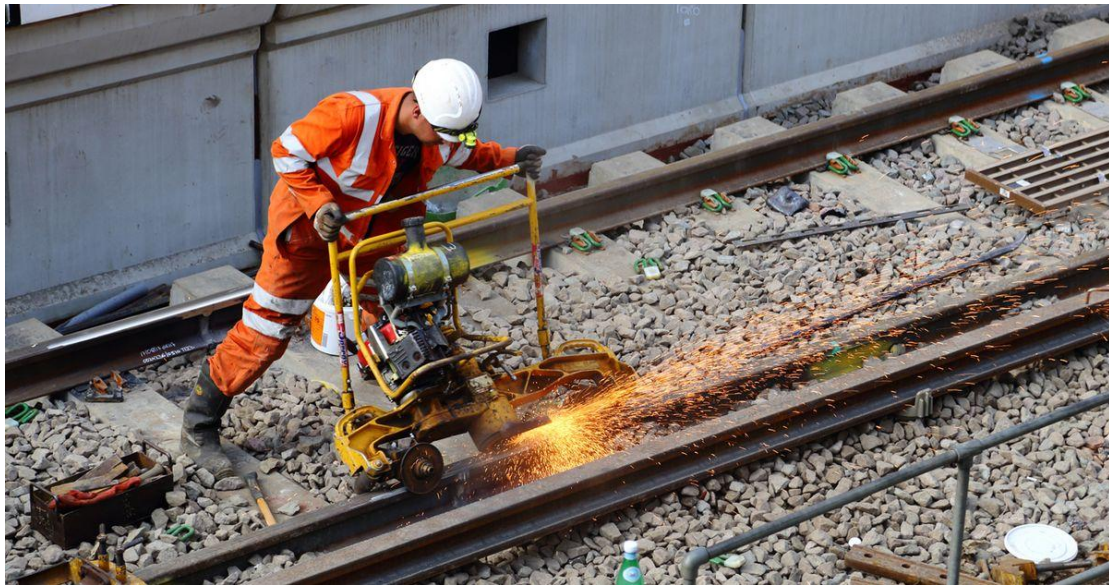


**Ministry of Higher Education and
Scientific Research
Al-Mustaqbal University College
Building and Construction Technical
Engineering Department**



Lecture # 1

Introduction to Transportation Engineering



By

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Lecture 1

Introduction to Transportation Engineering

1. Transportation Engineering

1.1 Introduction

Transportation engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods (transport). It is a sub-discipline of civil engineering and of industrial engineering. Transportation engineering is a major component of the civil engineering and mechanical engineering disciplines.

Transportation is essential for a nation's development and growth. In both the public and private sector, opportunities for engineering careers in transportation are exciting and rewarding. Elements are constantly being added to the world's highway, rail, airport, and mass transit systems, and new techniques are being applied for operating and maintaining the systems safely and economically. Many organizations and agencies exist to plan, design, build, operate, and maintain the nation's transportation system.

For as long as the human race has existed, transportation has played a significant role by facilitating trade, commerce, conquest, and social interaction, while consuming a considerable portion of time and resources. The primary need for transportation has been economic, involving personal travel in search of food or work, travel for the exchange of goods and commodities, exploration, personal fulfillment, and the improvement of a society or a nation. Figure 1 shows the transportation input and output.

Lecture 1: Introduction to Transportation Engineering
Assistant Lecturer Tameem M. Hashim

1.2 Importance of Transportation

Transportation moves people and goods from one place to another using a variety of vehicles across different infrastructure systems. It does this using not only technology (namely vehicles, energy, and infrastructure), but also people's time and effort; producing not only the desired outputs of passenger trips and freight shipments, but also adverse outcomes such as air pollution, noise, congestion, crashes, injuries, and dead.

The speed, cost, and capacity of available transportation have a significant impact on the economic vitality of an area and the ability to make maximum use of its natural resources. Examination of most developed and industrialized societies indicates that they have been noted for high-quality transportation systems and services. Nations with well-developed maritime systems (such as the British Empire in the 1900s) once ruled vast colonies located around the globe.

1.3 Modes of Transportation

Basically transport is possible through **land, air or water**, which are called the different modes of transport. On land we use trucks, tractors, etc., to carry goods; train, bus, cars etc. to carry passengers. In air, we find aero planes, helicopters to carry passengers as well as goods. Similarly in water we find ships, steamers, etc., to carry goods and passengers. All these are known as various means of transport. **The modes of transport can be broadly divided into three categories: Land transport, Water transport and Air transport.**

Lecture 1: Introduction to Transportation Engineering
Assistant Lecturer Tameem M. Hashim

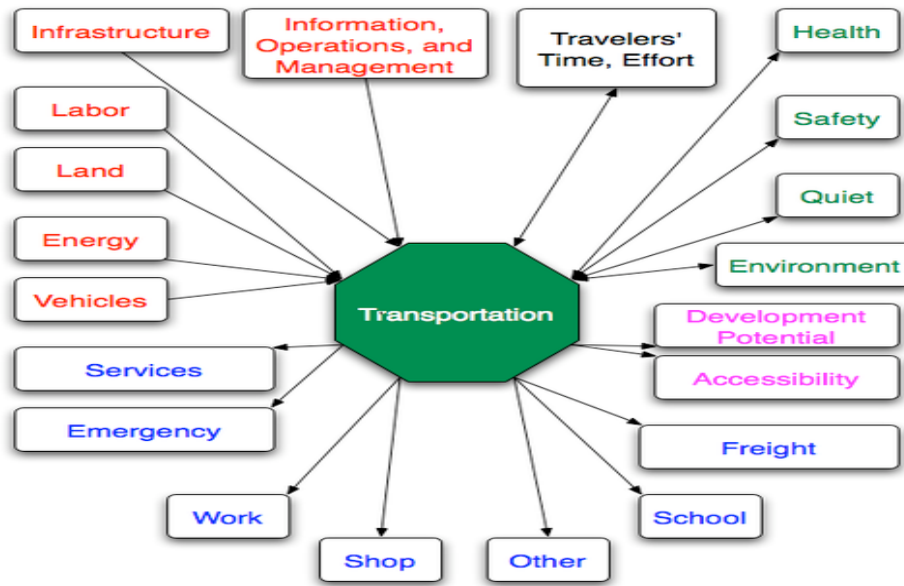


Figure 1 The transportation input and output

1.3.1. Land Transport

Land transport refers to activities of physical movement of goods and passengers on land. This movement takes place on road, rail, rope or pipe. So land transport may further be divided into Road transport, Rail transport, Ropeway transport, pipeline transport.

1. Road Transport

Roads are the means that connect one place to another on the surface of the land. You must have seen roads in your village, in towns and cities. Not all of them look alike. Some of them are made of sand and some may be of chips and cement or co-altar. You find different vehicles plying on roads like bullock carts, cycles, motorcycles, cars, truck, buses, etc. All of these constitute different means of road transport. **Road transport has some advantages. These advantages are:**

- a. It is a relatively cheaper mode of transport as compared to other modes.
- b. Perishable goods can be transported at a faster speed by road carriers over a short distance.
- c. It is a flexible mode of transport as loading and unloading is possible at any Destination. It provides door-to-door service.

Lecture 1: Introduction to Transportation Engineering
Assistant Lecturer Tameem M. Hashim

- d. It helps people to travel and carry goods from one place to another, in places

Which are not connected by other means of transport like hilly areas.

The limitations of road transport are:

- a. Due to limited carrying capacity road transport is not economical for long distance transportation of goods.
- b. Transportation of heavy goods by road involves high cost.
- c. It is affected by adverse weather conditions. Floods, rain, landslide, etc., sometimes create obstructions to road transport.

2. Rail Transport

Transportation of goods and passengers on rail lines through trains is called rail transport. It occupies an important place in land transport system of our country and is the most dependable mode of transport to carry goods and passengers over a long distance. Besides long distance, local transport of passengers is also provided by local trains or metro-rail in some metropolitan cities. Rail transport is available throughout the country except some hilly or mountainous regions. In India two types of trains are found. One is passenger train and other is goods train. While passenger trains carry both human beings and a limited quantity of goods, the goods trains are exclusively used for carrying goods from one place to another. These trains are driven by rail engines and they use steam, diesel or electric power to move.

The advantages of rail transport include:

- a. It is a convenient mode of transport for travelling long distances.
- b. It is relatively faster than road transport.
- c. It is suitable for carrying heavy goods in large quantities over long distances.
- d. Its operation is less affected by adverse weathers conditions like rain, floods, fog, etc.

The limitations of railway transport include:

- a. It is relatively expensive for carrying goods and passengers over short distances.
- b. It is not available in remote parts of the country.

Lecture 1: Introduction to Transportation Engineering
Assistant Lecturer Tameem M. Hashim

- c. **It provides service according to fixed time schedule and is not flexible for loading or unloading of goods at any place.**
- d. **It involves heavy losses of life as well as goods in case of accident.**

3. Pipelines Transport

In modern times, pipelines are used for various purposes. Water supply to residential and commercial areas is carried on with the help of pipeline. Petroleum and natural gas are also transported from one place to another through pipelines.

This is the most convenient as well as economical mode of transport for petroleum as well as natural gas in comparison to road and rail transport, provided the volume to be transported is large. But the cost of installation and maintenance requires large capital investment.

4. Ropeway Transport

Ropeway refers to a mode of transport, which connects two places on the hills, or across a valley or river. In the hilly areas, trolleys move on wheels connected to a rope and are used for carrying passengers or goods, especially building materials, food, etc.

1.3.2. Water Transport

Water transport refers to movement of goods and passengers on waterways by using various means like boats, steamers, launches, ships, etc. With the help of these means goods and passengers are carried to different places, both within as well as outside the country. Within the country, rivers and canals facilitate the movement of boats, launches, etc. Since the goods and passengers move inside the country, this type of transport is called inland water transport. When the different means of transport are used to carry goods and passengers on the sea route it is termed as ocean transport.

1. Inland Water Transport

Inland water transport use boats, launches, barges, streamers, etc., to carry goods and passengers on river and canal routes. These routes are called inland waterways and are used in domestic or home trade to carry bulky goods. Passenger transport through waterways is not so popular in our country.

2. Ocean Transport

Ocean transport refers to movement of goods and passengers with the help of ships through sea or ocean waterways. It plays an important role in the development of international trade. It is also used for transporting goods and passengers in the coastal areas. Ocean transport has its fixed route, which links almost all the countries of the world. Sea transport may be of the following two types:

a. Coastal Shipping

In this transport, **ships ply between the main ports of a country.** This helps in home trade, and also in carrying passengers within the country.

b. Overseas shipping

In this transport, **ships ply between different countries separated by sea or ocean.** It is mainly used for promotion and development of international trade. It is economical means of transport to carry heavy machines and goods in bulk. Overseas transport is carried out on fixed routes, which connect almost all the countries.

The advantages of water transport are:

- a. It is a relatively economical mode of transport for heavy goods.**
- b. It is a safe mode of transport with respect to occurrence of accidents.**
- c. The cost of maintaining and constructing routes is very low as most of them are naturally made.**
- d. It promotes international trade.**

The limitations of water transport are:

- a. The depth and navigability of rivers and canals vary affect operations of different transport vessels.**
- b. It is a slow moving mode of transport and therefore not suitable for transport of perishable goods.**
- c. It is adversely affected by weather conditions.**
- d. Sea transport requires large investment on ships and their maintenance.**

Lecture 1: Introduction to Transportation Engineering
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1.3.3. Air Transport

This is the fastest mode of transport. It carries goods and passengers through airways by using different aircrafts like passenger aircraft, cargo aircraft, helicopters, etc. Besides

passengers it generally carries goods that are less bulky or of high value. In hilly and mountainous areas where other mode of transport is not accessible, air transport is an important as well as convenient mode. It is mostly used for transporting goods and passengers during natural calamities like earthquake and floods, etc.

During war, air transport plays an important role in carrying soldiers as well as supplies to the required areas. Air transport may be classified as domestic and international air transport. While domestic air transport mainly facilitates movement within the country, international air transport is used for carrying goods and passengers between different countries. Air transport is carried out in fixed air routes, which connect almost all the countries.

Air transport has the following advantages:

- a. It is the fastest mode of transport.**
- b. It is very useful in transporting goods and passengers to the area, which are not accessible by any other means.**
- c. It is the most convenient mode of transport during natural calamities.**
- d. It provides vital support to the national security and defense.**

Air transport has the following limitations.

- a. It is relatively more expensive mode of transport.**
- b. It is not suitable for transporting heavy goods.**
- c. It is affected by adverse weather conditions.**
- d. It is not suitable for short distance travel.**
- e. In case of accidents, it results in heavy losses of goods, property and life.**

According to above information, the types of transportation engineering can be classified to highway engineering, railway engineering, airport engineering, and Port and harbor engineering

Figure 2 shows the modes types of transport

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(a) Trucks Transport



(b) Railway Transport



(c) Water Transport

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Assistant Lecturer Tameem M. Hashim



(d) Air Transport