

## Module - 1

# INTRODUCTION TO TRANSPORTATION ENGINEERING

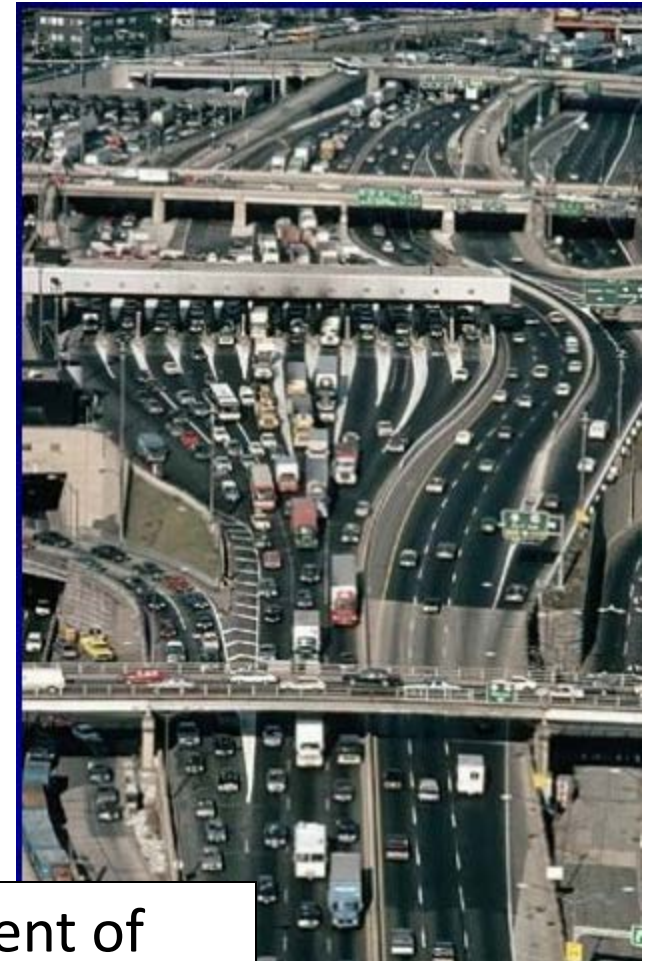
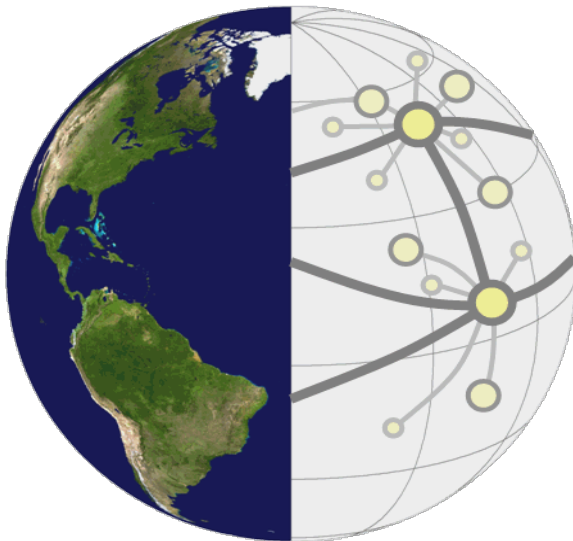
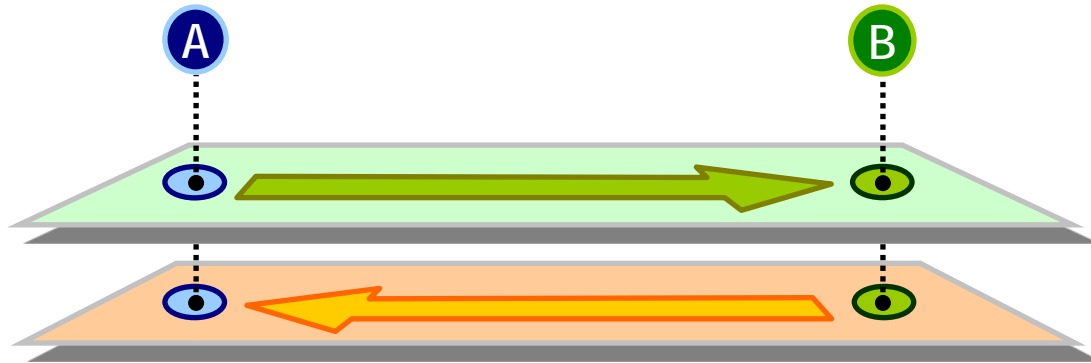


IN THE NAME OF  
**ALLAH**  
THE MERCIFUL THE MAGNIFICENT





# What is Transportation?



Movement of  
persons and goods  
over space

# Why do we need Transportation...?

- Economic Wealth
- Political Reasons
- Military Power



# Transportation Engineering

- **Historical Background**

- **Move of people and goods**
- **Invention of wheel in 5000 BC**
- **Early manufactured roads were**
  - **Stone paved streets of Ur in middle east 4000 BC**
  - **Corduroy –log path of Glastonbury, England 3300 BC**
  - **Brick pavings in India 3000 BC**
- **Oldest wooden track of 2 km long Sweet Track in England**
- **Oldest stone road built in Crete, Europe in 2000 BC**
- **Pioneers in road network (Via Appia) – Romans**
  - **78000 km in Length & 4.25 m wide**
- **Term roads & streets were introduced in 16<sup>th</sup> century**

# Transportation Engineering

- **Historical Background**

- **The 1<sup>st</sup> Pipeline was laid in 1825**
- **First Rail road opened in 1825**
- **Internal combustion engine invented in 1866**
- **First automobile was produced in 1886 by Daimler and Benz**
- **Wright brothers flew 1<sup>st</sup> heavier than air machine in 1903**
- **First Diesel electric locomotive was introduced in 1921**
- **Lindbergh flew over Atlantic ocean to Europe in 1927**
- **First diesel engine bus were used in 1938**
- **First limited access highway in US (the Pennsylvania Turnpike) opened in 1940**
- **Interstate highway system was introduced in 1950**
- **First commercial Jet appeared in 1958**

# Transportation Engineering

- Historical Background

- Definition

- *The application of technological 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, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods*

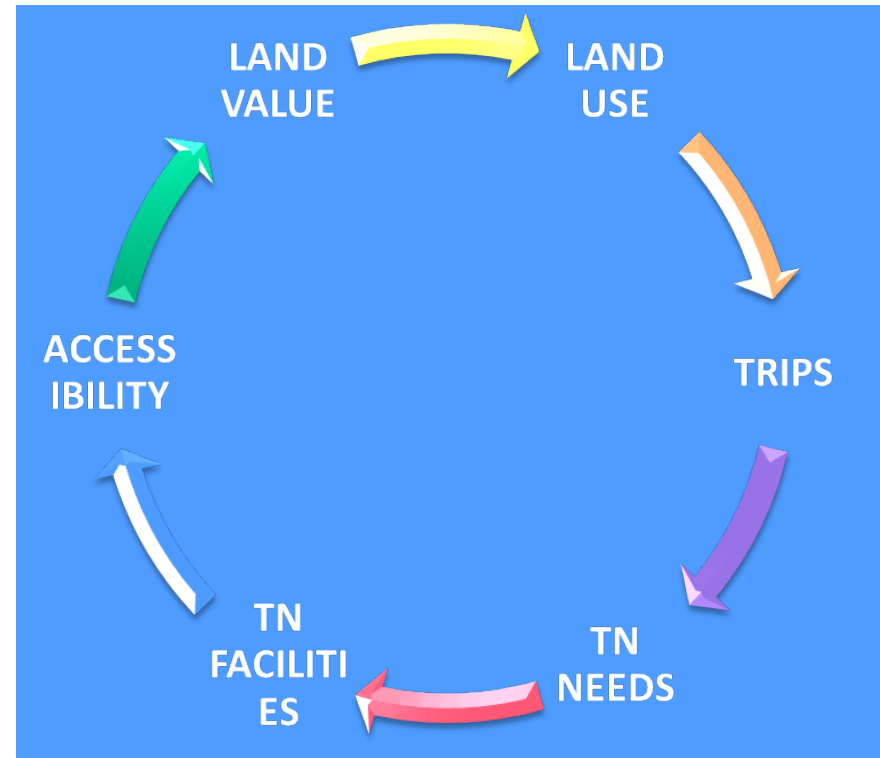
Institute of Transportation Engineers



# Transportation Engineering

- **A Cyclic Process**

- Land Use
- Trips
- Transportation Needs
- Transportation Facilities
- Accessibility
- Land Value
- Land Use .....



# Transportation Engineering

- **Modes of Transportation:** Specific way to travel usually defined by either the Physical System being used, Technology being used or the organizational characteristics



Road



Rail



Air



Water



Pipeline



Ropeway

# MODES OF TRANSPORTATION

## A. Land Transportation

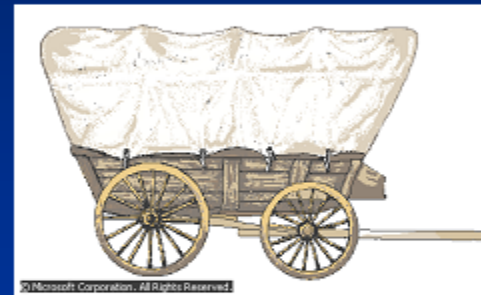
### 1. Human Power



### 2. Domestic Animals



### 3. Wheeled vehicles



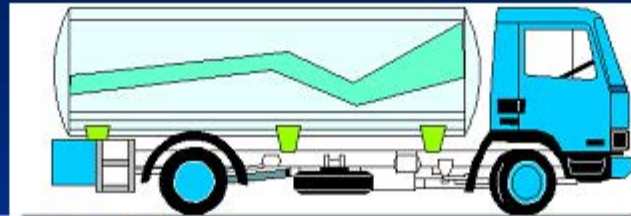
# Land Transportation

## 4. Railroads



## 5. Motor Vehicles

- Heavy truck



- Motorcycle



- Snowmobile



- Bus



- Car





## B. Air Transportation

### 1. Airplanes



### 2. Helicopters



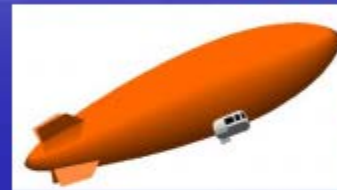
### 3. Lighter-than-air vehicle (Airships)

#### a. Balloons



### 4. Lighter-than-air vehicle: (Airship)

- blimps
- dirigibles



### 5. Outer-Space Vehicles





## B. Air Transportation

### 6. Recreational Air Vehicles

- glider



### Ultralights

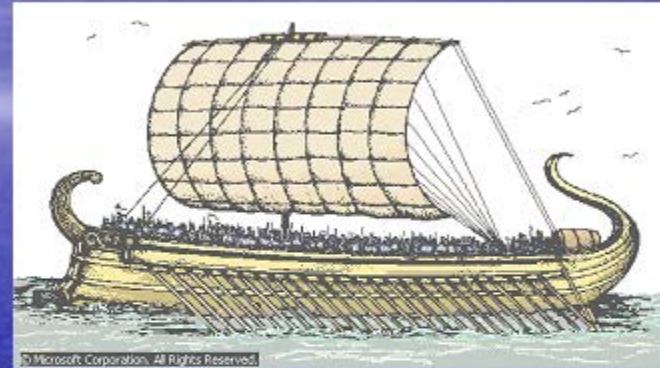


## C. Water Transportation

### 1. Raft, canoe, kayak



### 2. Oar-Driven Boats



### 3. Sailboat



### 4. Sailing ship





## C. Water Transportation

5. boat



7. Crane barge



8. Hydrofoil missile ship



9. hydrofoil



6. barge



10. hovercraft



## C. Water Transportation

### 11. Steamships



### 12. Cruise ship



### 14. Freight vessel



### 13. Container vessel





## C. Water Transportation

15. Roll on-Roll off Vessel



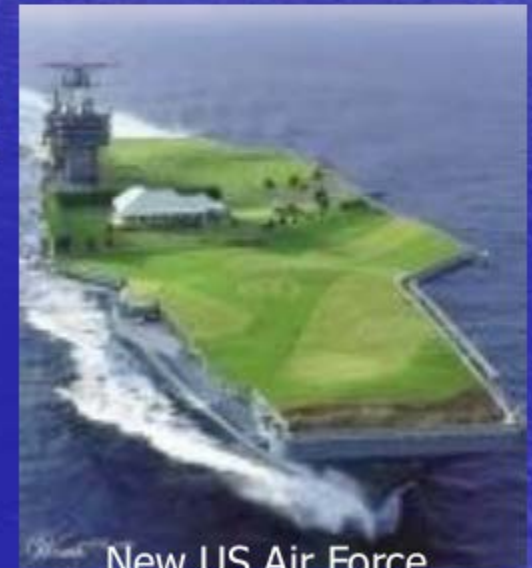
16. Lighter-Aboard Ship



17. Tanker



18. Aircraft Carrier



New US Air Force Aircraft Carrier



## D. Pipelines



MAIN OIL AND GAS PIPELINES IN EUROPE



# E. Cable and Belt Systems

Conveyor belt



Ski Lift



# Evolution of Tn

**1500-1840**

**Average speed**

**Wagon/sail ships: 16 km/hr**

**1850-1930**

**Average speed**

•trains: 100 km/hr.

•steamships: 25 km/hr

**1950**

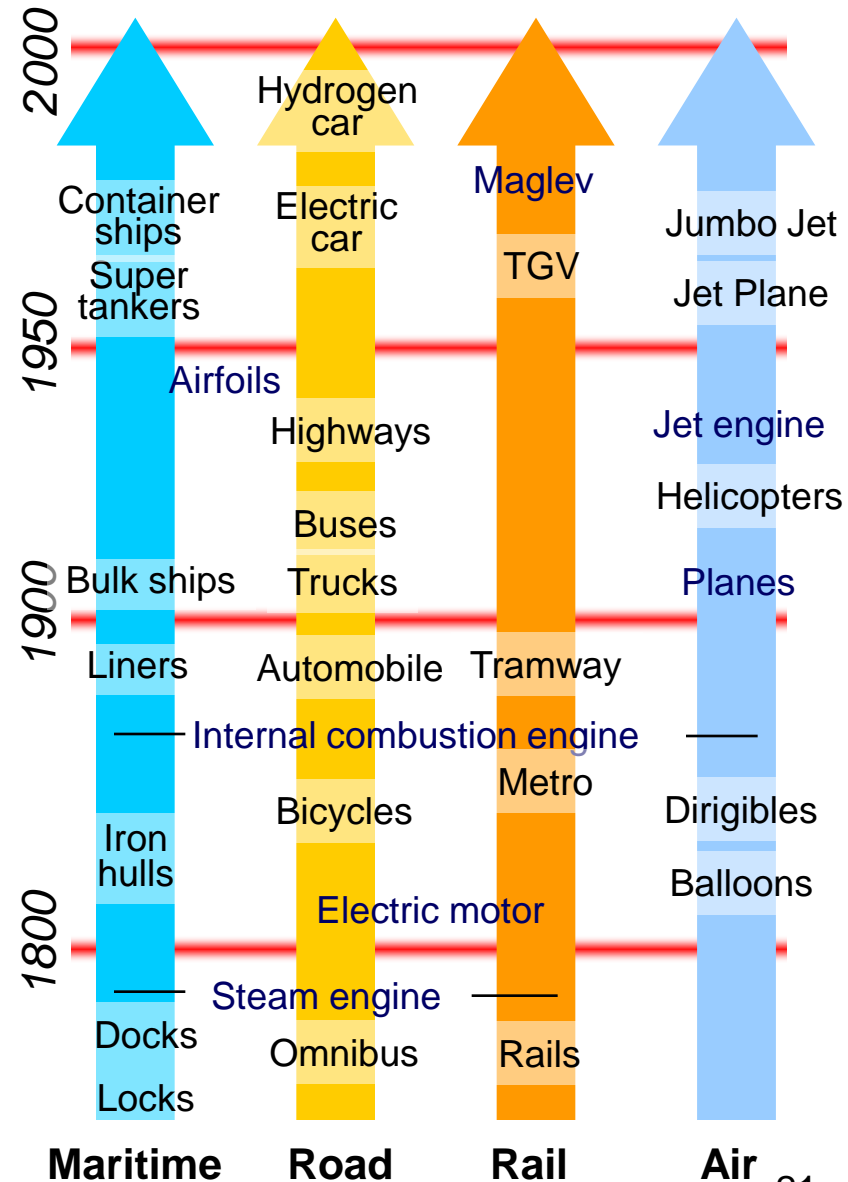
**Average speed**

**airplanes: 480-640 km/hr**

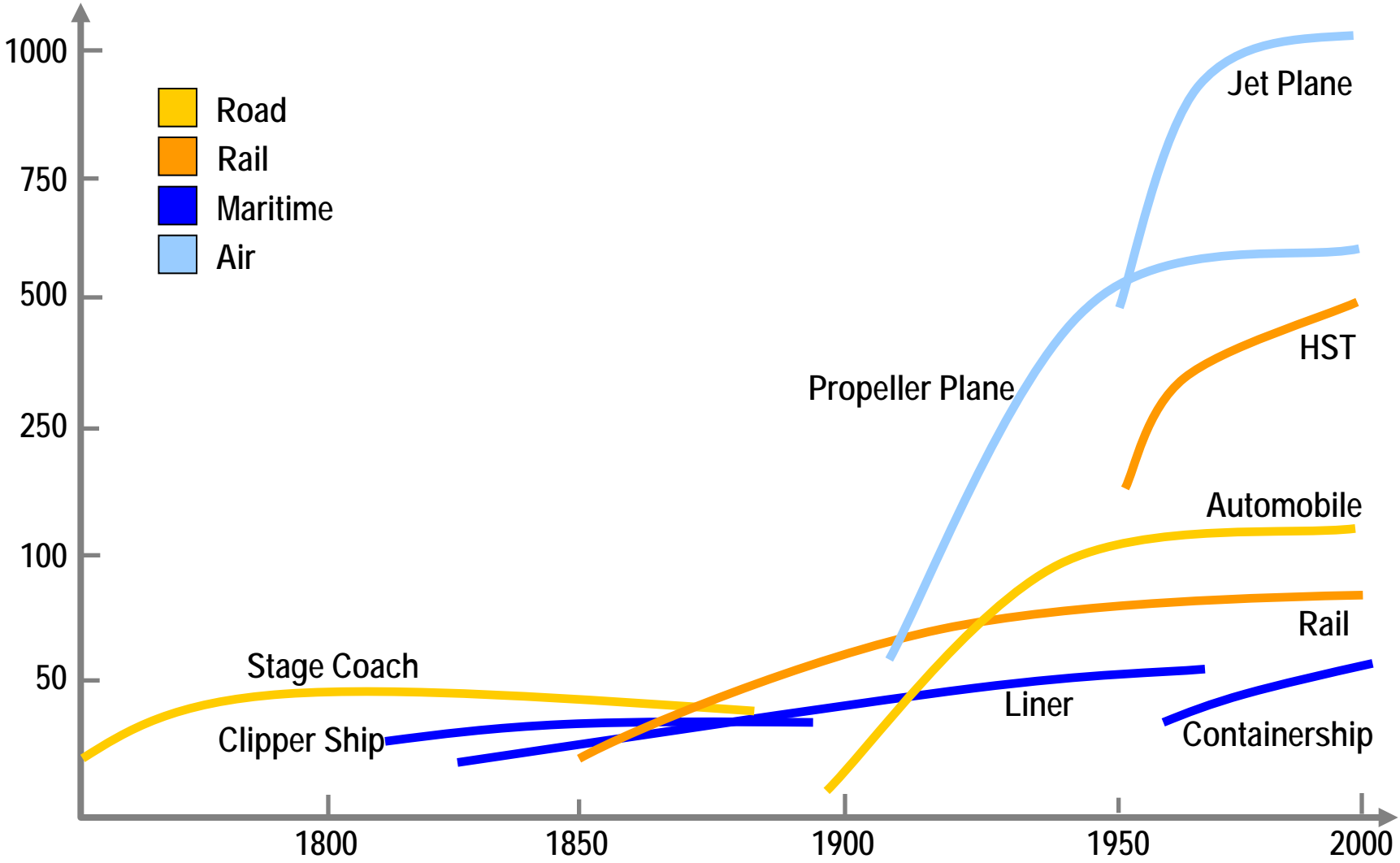
**1970**

**Average speed**

**jet planes: 800-1120 km/hr**



# Evolution of Tn

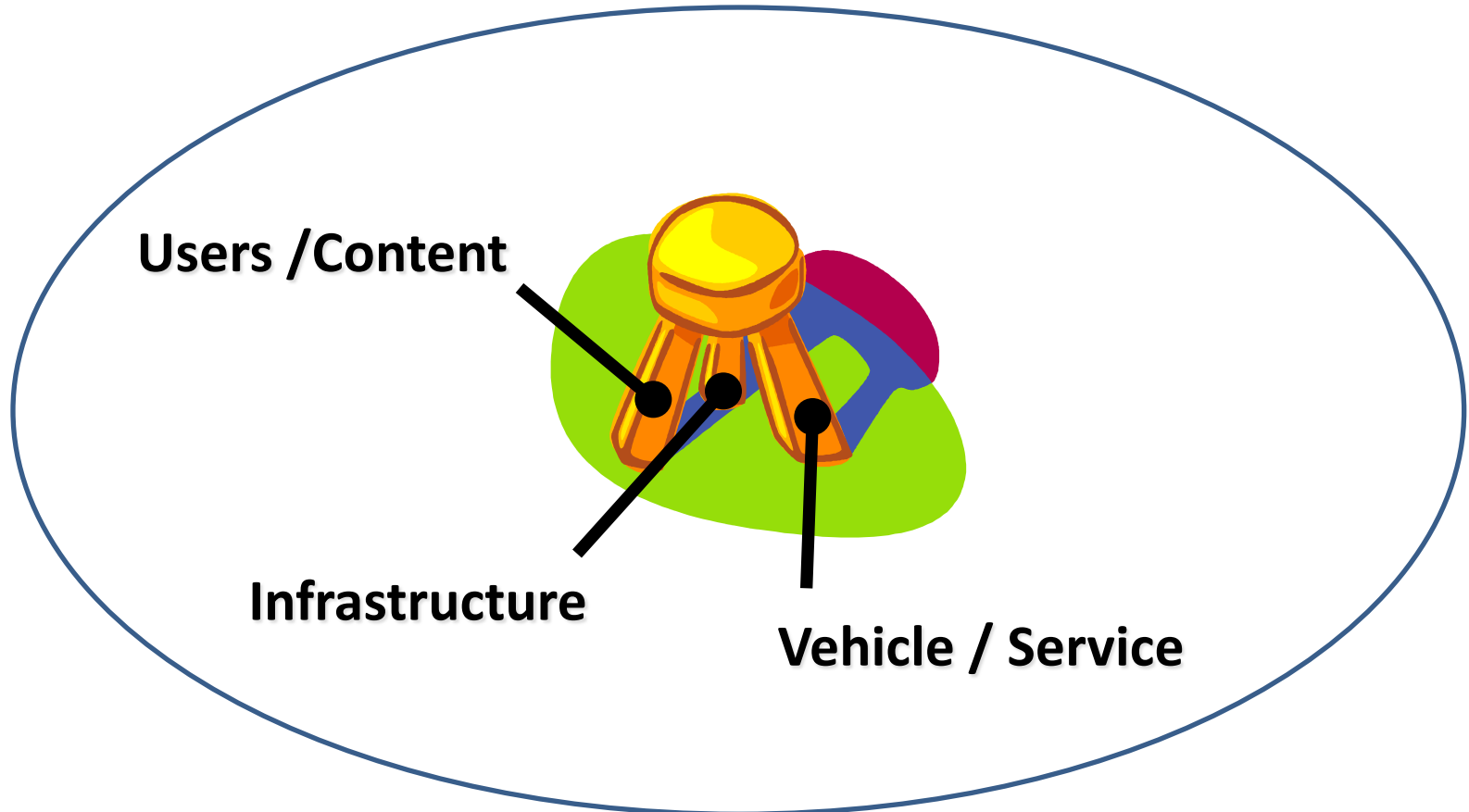


# Transportation System

- **A transportation system may be defined as a planned network of elements or physical components that play different roles in the transportation of goods and persons from one place to another.**
- **The elements or physical components of a transport system are referred to as the facilities.**
- **A transport system can therefore be considered as consisting of fixed facilities, the flow entities, and control system that permit people and goods to overcome the friction of geographical space efficiently in order to participate in a timely manner in some desired activity.**



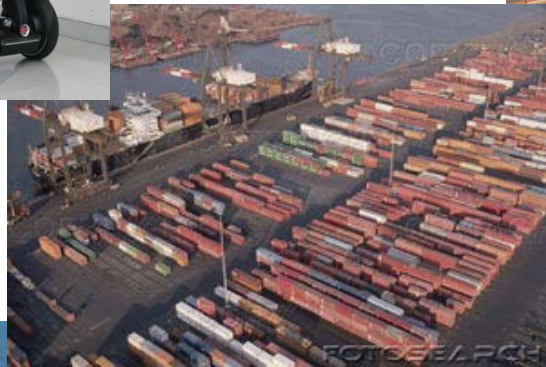
# Transportation System → Elements



# Fixed Facilities (Infrastructure)

- **The fixed facilities are the physical components of the system that are fixed in space and constitutes network of links and nodes of transportation system.**
- **For example, the links could be roadway segment and railway track and the nodes could be intersections, interchanges, transit terminals, harbours, and airports**
- **The design of these fixed facilities has traditionally been within the realm of civil engineering.**
- **The design includes soil and foundation engineering design, structural engineering design, the design of drainage systems, and geometric design, which is concerned with the physical proportioning of the elements of fixed facilities.**

# Infrastructure



# Flow Entities (Vehicles / Services)

- **Flow entities are the units that traverse the fixed facilities. These include people, vehicles, container units, railroad cars, and so on.**
- **In the case of a road system, the fixed facilities are expected to accommodate a wide variety of vehicle types, ranging from bicycles to large tractor-trailer combinations.**



# Vehicles / Services

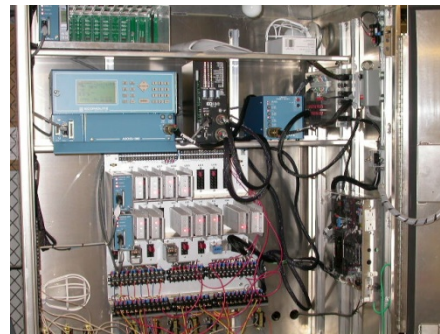




# Control System

- **The control system consists of vehicular control and flow control. Vehicular control refers to the technological way in which individual vehicles are guided on fixed facilities. Such controls can be manual or automated.**
- **In the case of highway facilities, where the vehicles are manually controlled, these include driver's characteristics, such as time a driver takes to perceive and react to various stimuli. In the case of automated systems, similar, but more precisely definable response times exist as well.**
- **The flow control system consists of the means that permit the efficient and smooth operation of streams of vehicles and the reduction of conflicts between vehicles. This system includes various types of signing, marking, and signal systems and the underlying rules of operation.**

# Control System



# Transportation System

- **Essentials of a Transportation System**

- Economy
- Safety
- Comfort
- Efficiency
- Impact upon environment

- **Input/Outputs of a Transportation System**

