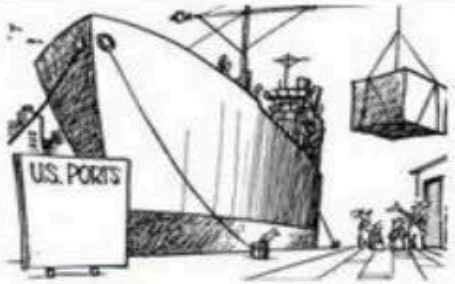
Summary of Discussion on Infrastructure Demand Demand Curve and Elasticity

Types of Infrastructure and Demand Sectors

Roads

Airports



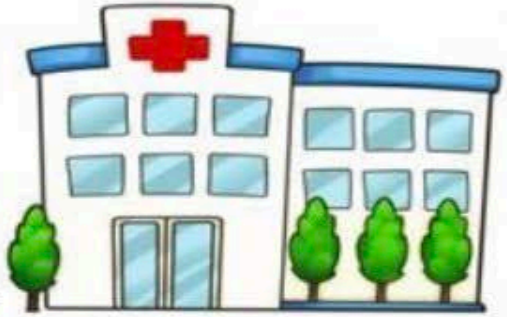
Ports

Railways

Energy

Utilities

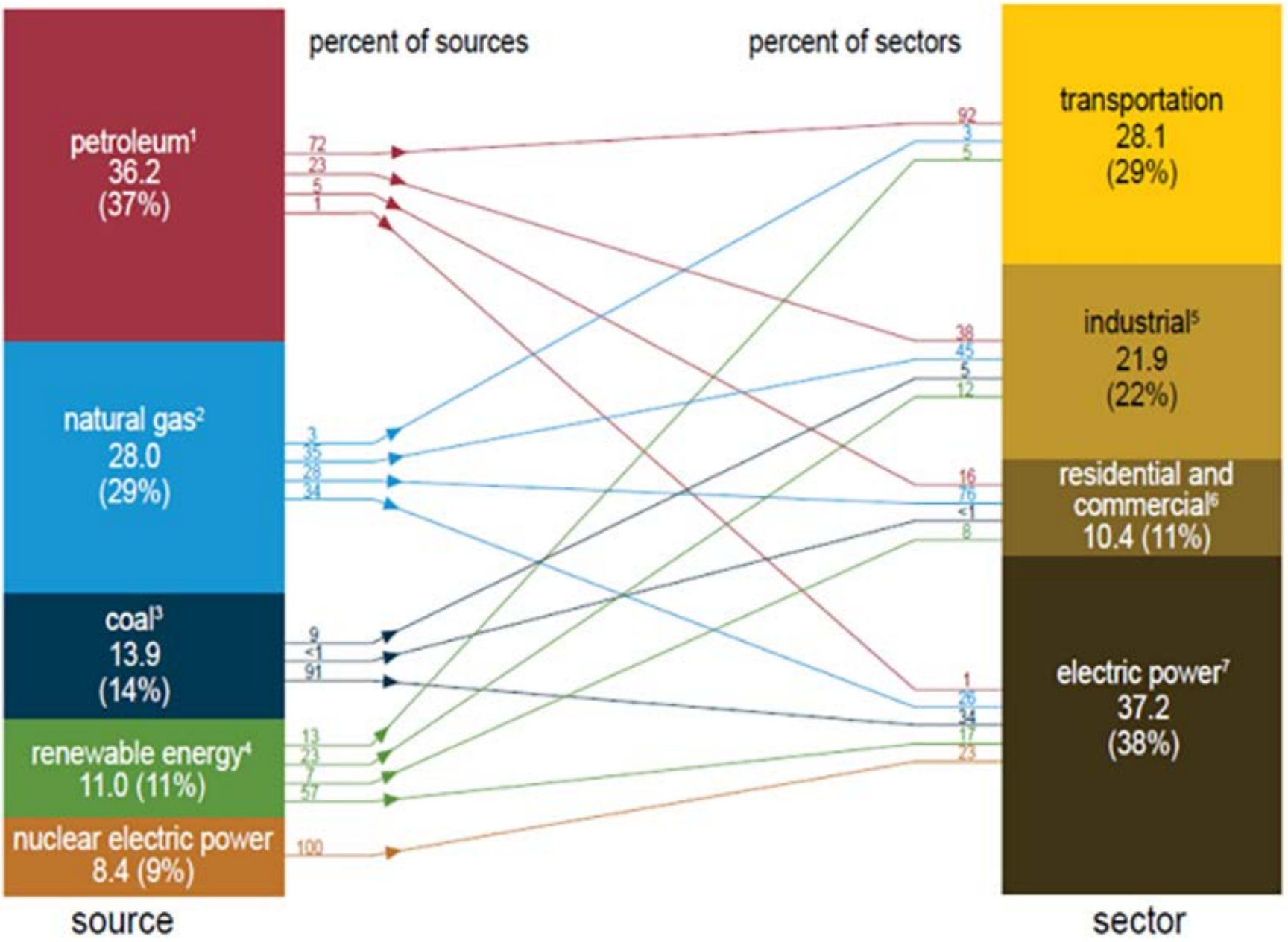
Education



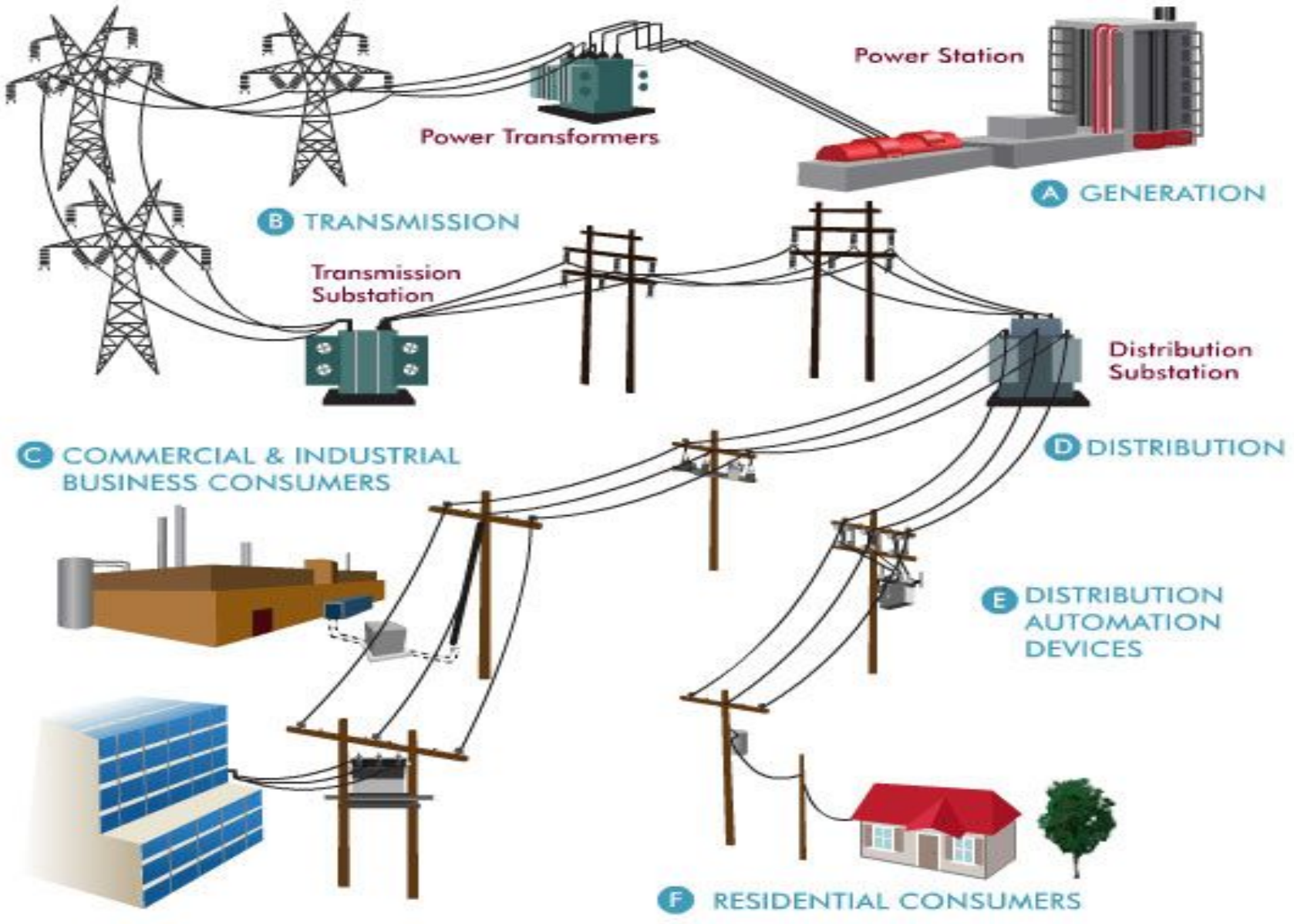
Healthcare

Social

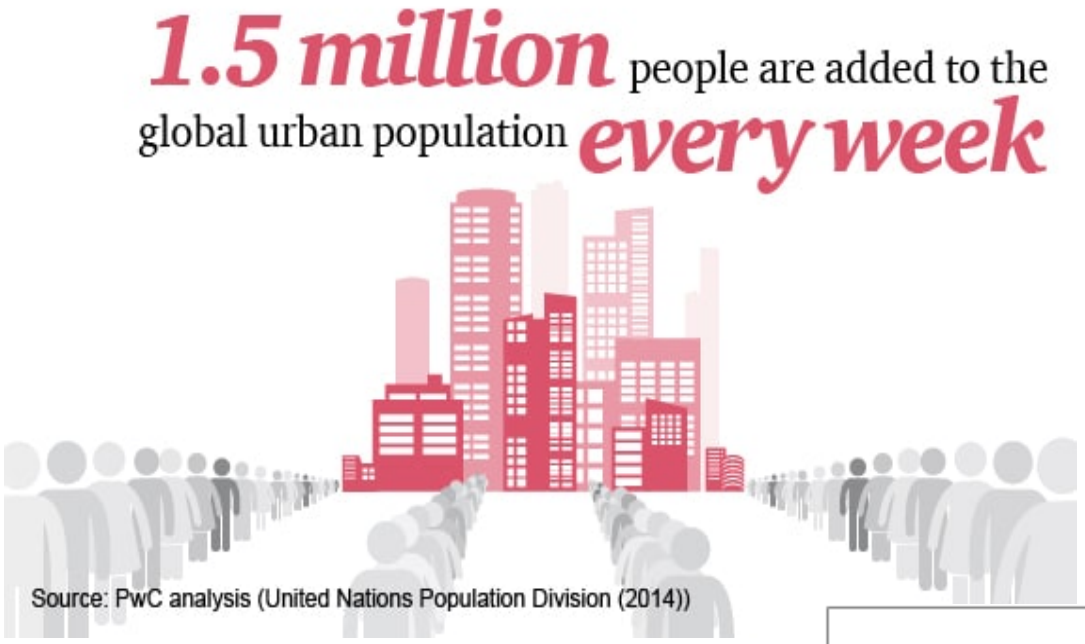
Energy Demand

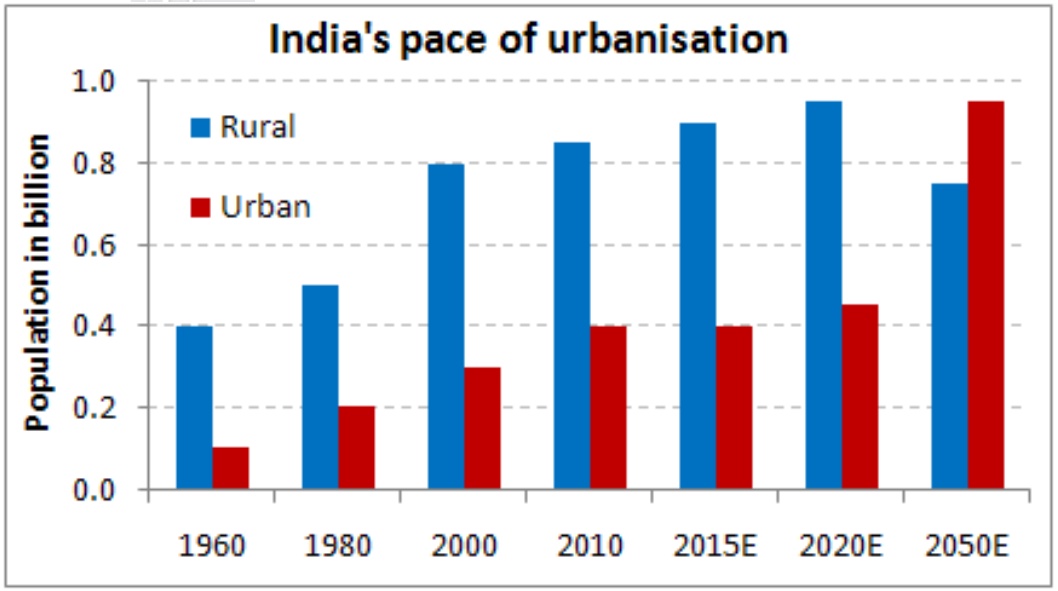


Supply of Infrastructure for Energy Sector

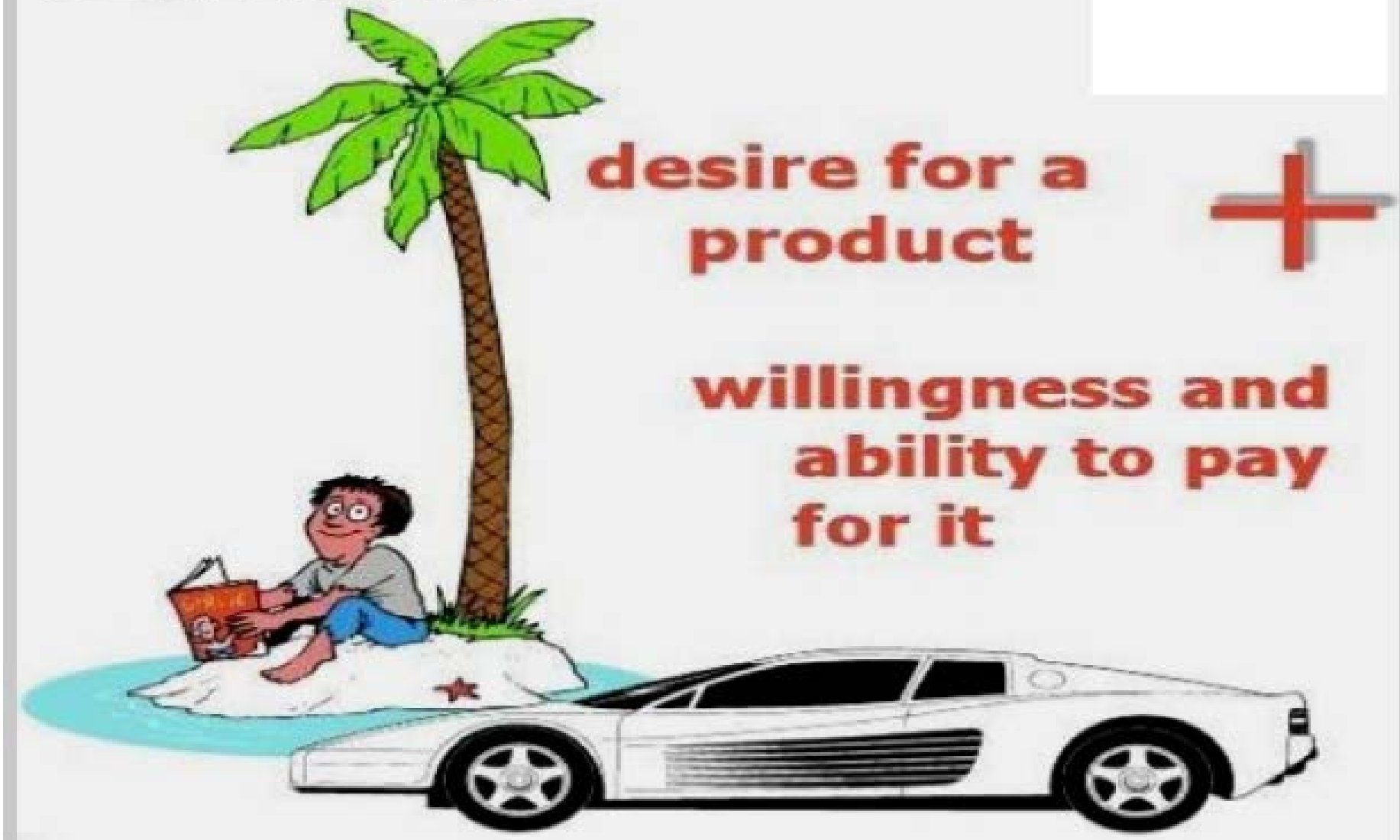


Rapid Urbanization: Demand for Real Estate



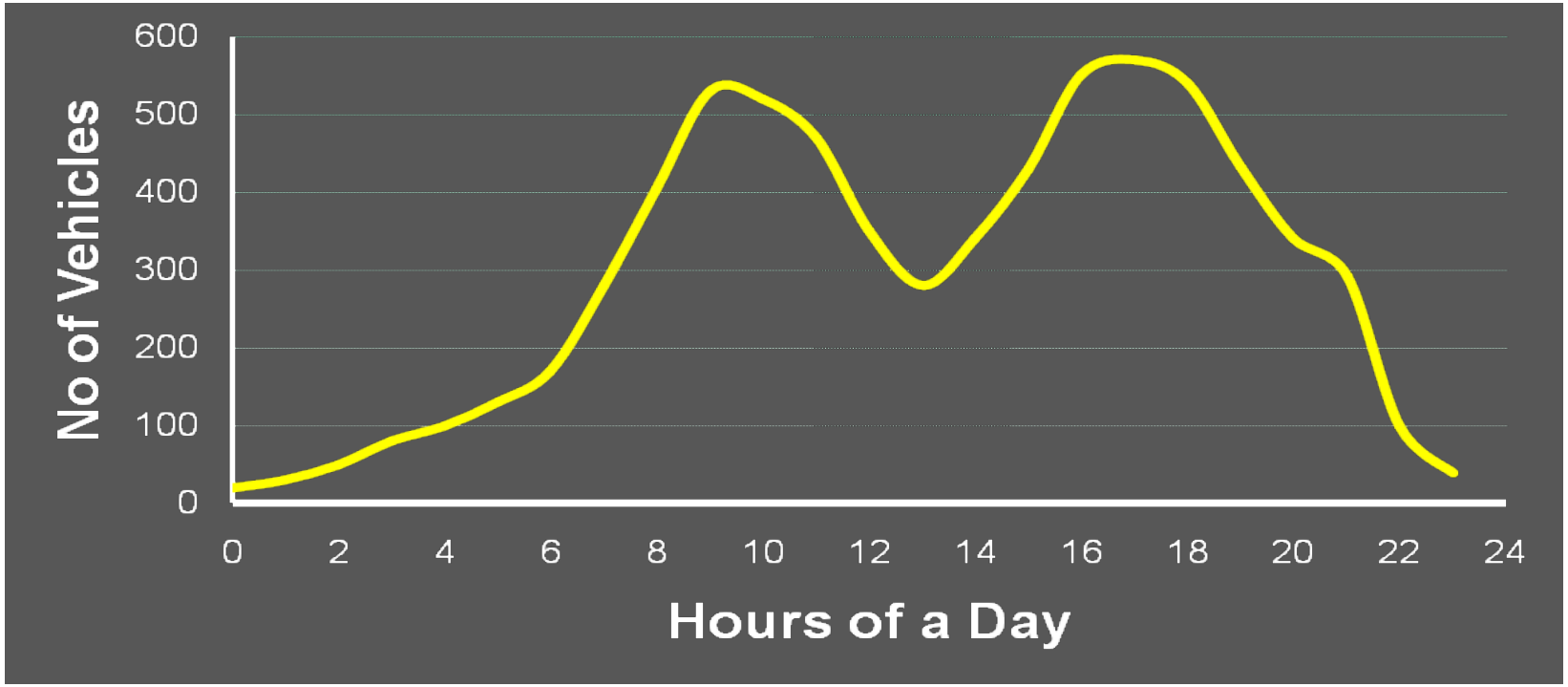


Demand =



Example: Travel Demand Variation in Bhubaneswar City

- Systematic and distinct variation of demand over time – A special characteristics of transport demand
- Transport demand in urban areas: Typically, two peaks- one in the morning and the other in the evening which are attributed to work and business trips (in weekdays)



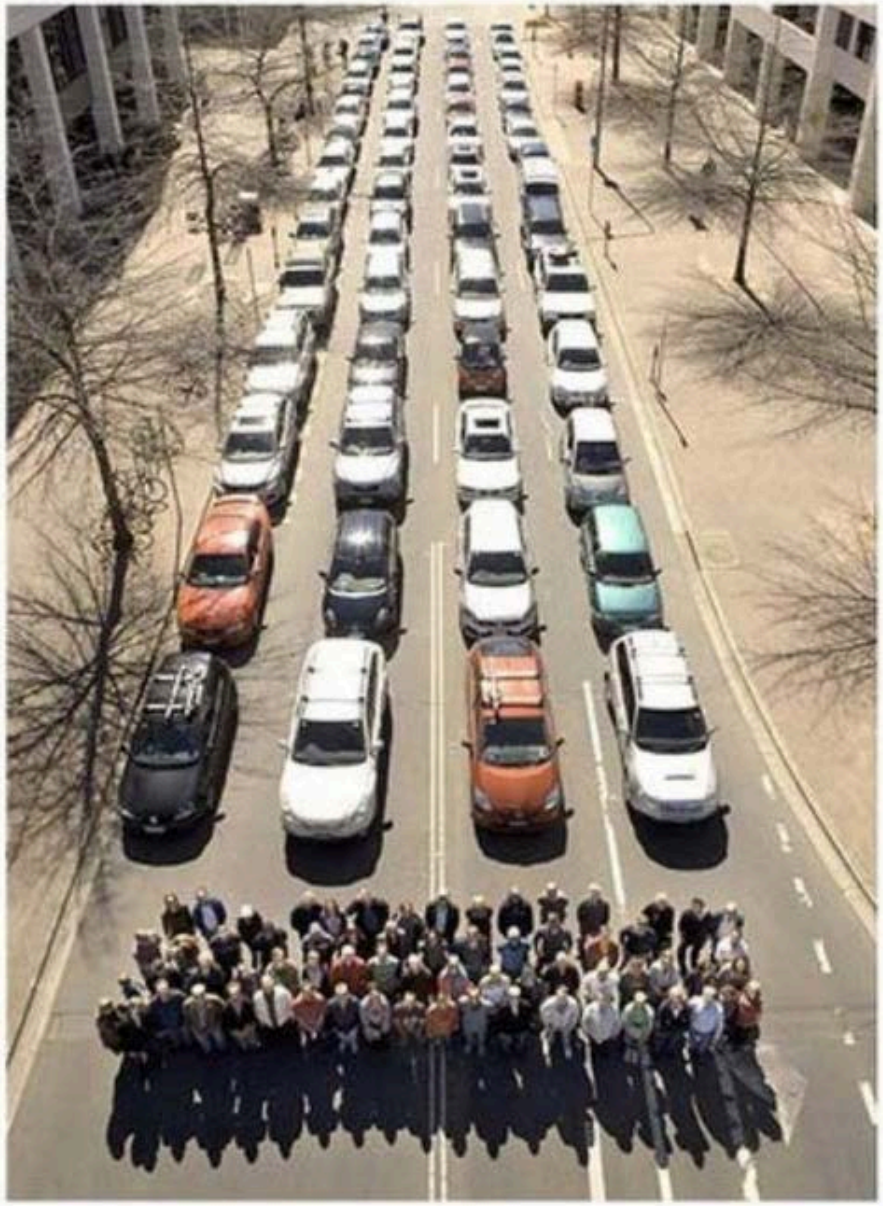
Implications of Peak Transport Demand

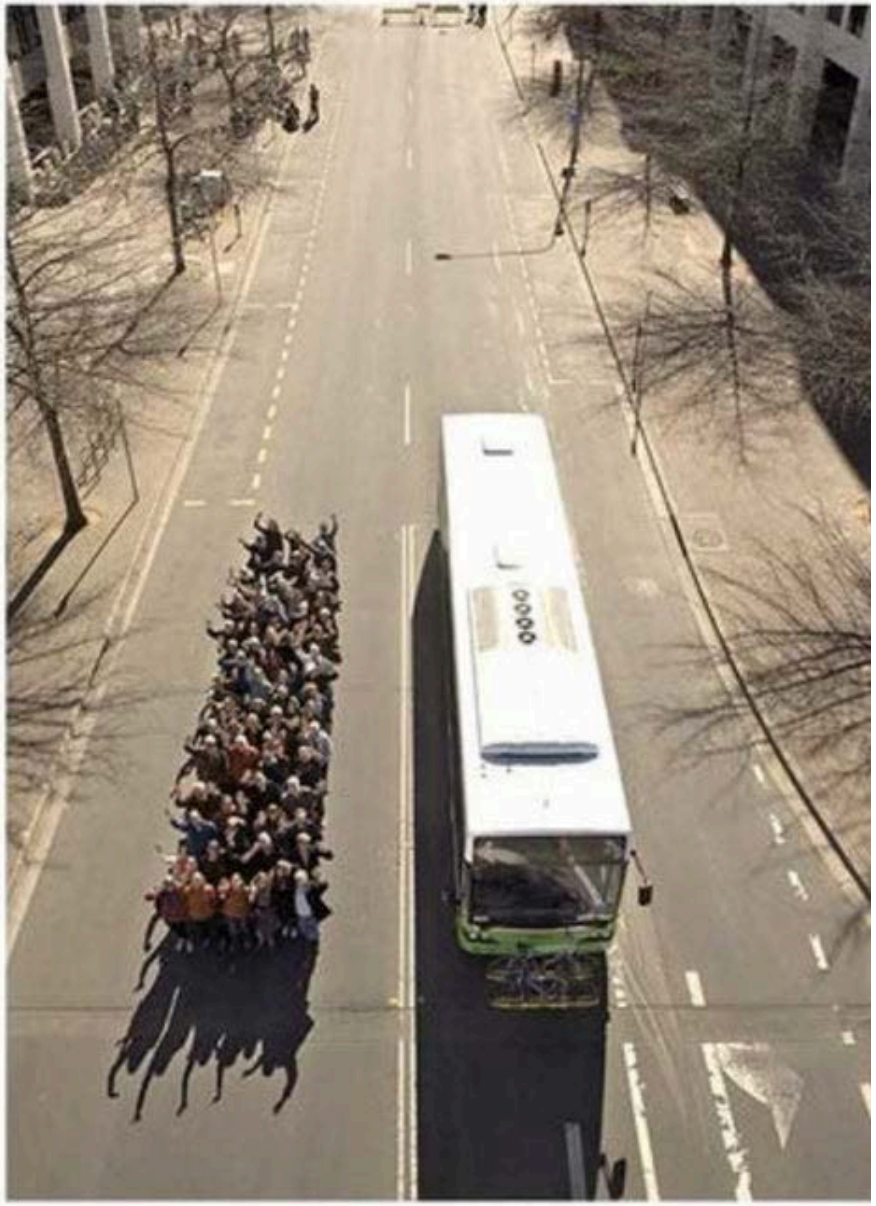
- The capacity of infrastructure remains constant but the transport demand varies during different hours

- The peak demands often create demand-supply imbalance (Demand/Capacity nears 1.0) and significant impacts: congestion, delay, emission, and economic loss

- Traffic congestion in urban areas during the peak hours is a major concern not only in India but also in other countries

Delay due to Traffic Congestion

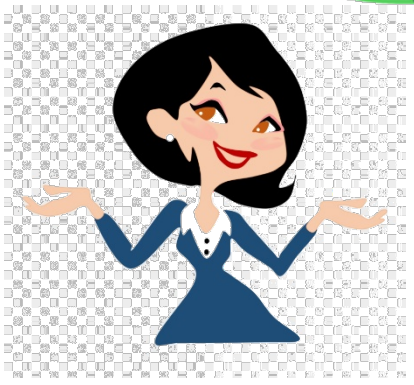




Demand Management by augmentation of more Urban Public Transport [City Bus, Tram, Light-Rail Transit] Services

Improvement in Travel Time: Supply

Supply: Road Widening [addition of No. of lanes or Capacity; fly-over]



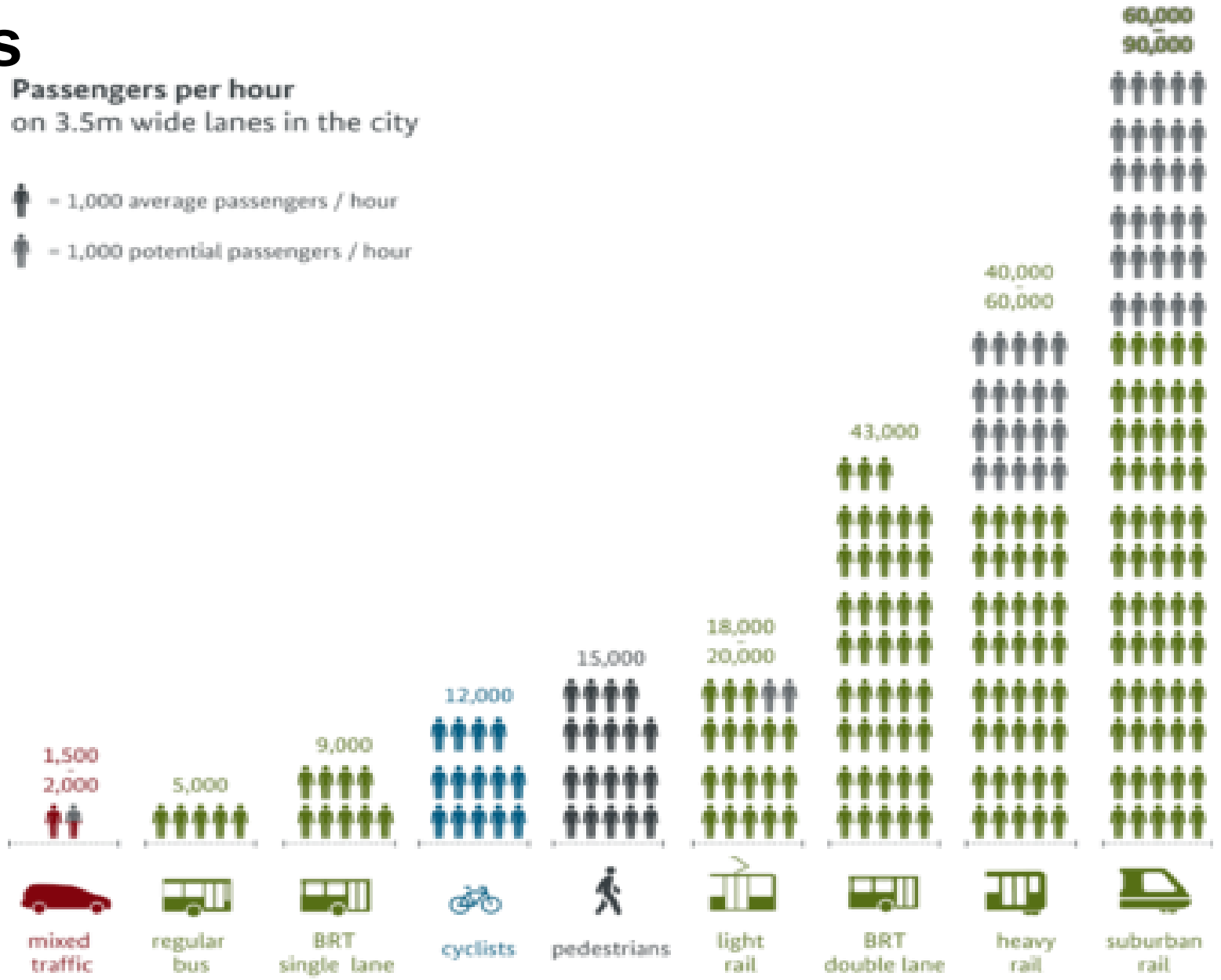
Example: Urban Travel Demand Management

- Introduction of Intelligent Transport System [ITS]
- Advanced Traveler Information System [Mobile-based; Road Information System]
- Flexi-Time for Worker in Work-Place

Example for Supply Management for Urban Traffic

- Introduction of more fly-overs
- Grade-separated intersection
- Addition of number of lanes on urban roads
- Enhancement of road-capacity
- Augmentation of more public transport Services

Example: Supply of Various Transport Modes



Introduction

What is Demand??

Demand in Economics means the willingness as well as the ability to purchase a commodity at alternative prices.

A person may be willing to get a commodity/use of a service, but he is not able to pay the due price/charges (say fare). It is not demand in the economic sense.

Demand depends largely upon consumers/users Income and the Price/charges of a particular good/services

In economics, to demand something means to be willing, able and ready to purchase a good or service

Willing to Purchase/Pay for Services

- Being willing to purchase/pay for any service means that one likes an item enough to want to buy it – this is what people usually think of when they encounter the concept of demand

- While it is good to want things, desire to purchase/Pay for Services is not the only requirement for economic demand

Demand Function / Curve

- Demand function: Represents the Willingness of Consumers/users to purchase the Transportation goods or Services at alternative Prices
- Demand curve: A graph depicting the relationship between the price of a certain commodity and the amount of it that consumers/users are willing to pay and able to purchase at that given price
- All other determinants such as price of other commodity, income, population etc. remaining constant

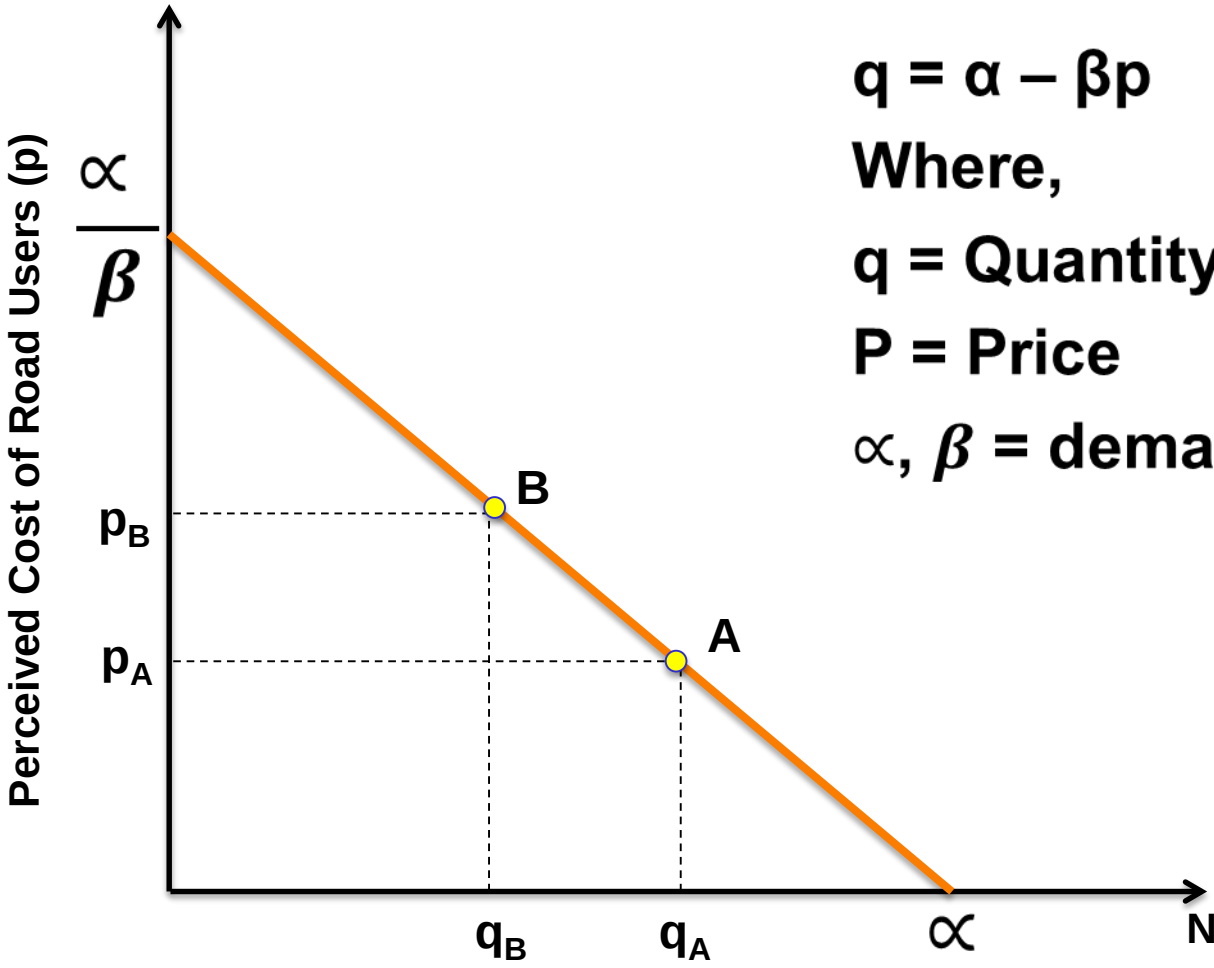
Able to Purchase

- Wanting to purchase an item doesn't mean “a whole lot”, if one doesn't have the means to make the transaction happen
- Ability to purchase is another important factor of demand
- How an individual pays for an item is not a concern

Ready to Purchase

- Demand is, by its nature, a current quantity
- An individual is only said to demand something if she/he is willing-to and also able-to purchase it now as opposed to some point in the future

Linear Travel Demand Function/ Curve



$q = \alpha - \beta p$

Where,

q = Quantity of demand

P = Price

$\propto, \beta$ = demand parameters

Demand (say Number of Vehicles using a road Infra. q)

- **A Demand Curve**
  - ✓ Assumes a particular level and distribution of income, population, and socioeconomic characteristics
  - ✓ Represents the aggregate volume of products/services demanded at different prices by a consumers
  - ✓ Represents short-run change in demand due to price change only

- Generally, at higher prices, a lower quantity will be demanded, (i.e. 'all other things being equal‘) and at lower prices, a higher quantity will be demanded.
- Goods of conspicuous consumption are exception

  These goods are demanded because they are expensive, and relates to social status of the consumer

  A reduction in price of such goods could actually serve to reduce its overall demand

Shift of Demand Curve

- When there is a change in any non-price determinant of demand, a shift of a demand curve takes place, resulting in a new demand curve
- All the determinants of demand are likely to change quantity demanded, even if price of the product remains unchanged
- Shifted demand curves represent changes in demand due to variables other than the price (i.e. long-run change)

Elasticity of Demand

- **Elasticity is used to forecast changes in travel volume caused by specific changes in price in the short run**
- **Elasticity is the ratio of relative changes in demand to relative changes in price**

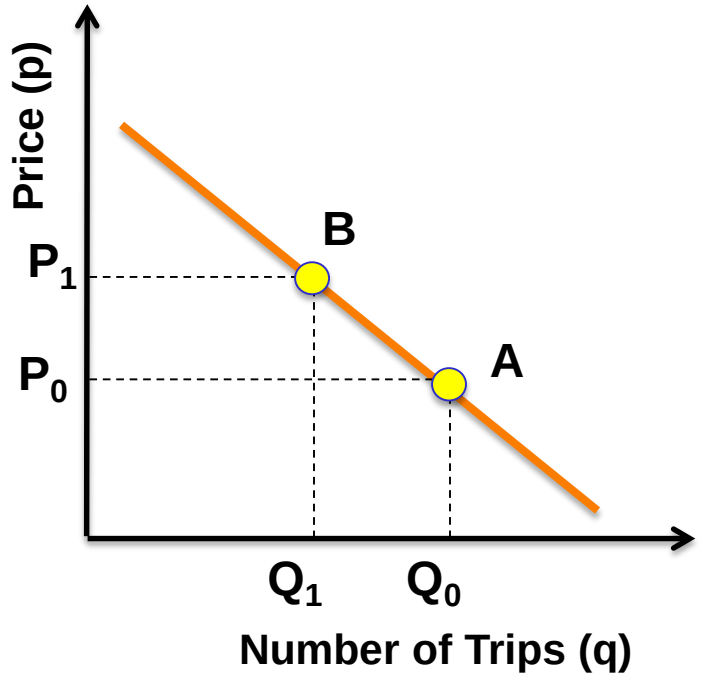
$$e_p = \frac{\delta q/q}{\delta p/p} = \frac{\delta q}{\delta p} * \frac{p}{q}$$

Where δq is the change in demand that accompanies δp change in price

- **Elasticity is defined as percentage change in demand caused by each one-percent change in its price**
- **Elasticity is always negative except for conspicuous goods. Therefore, the absolute values (without the negative sign) are considered for comparison**

Midpoint (or Linear) Arc-Elasticity

$$e_{arc} = \frac{(Q_1 - Q_0)(P_1 + P_0)/2}{(P_1 - P_0)(Q_1 + Q_0)/2}$$



Where, Q_0 and Q_1 represent the quantity of trips demanded corresponding to prices P_0 and P_1

<u>Example Problem:</u> When the price changes from INR 9 to INR 10, the demand changes from 160 to 120. Calculate the elasticity using Mid-point Elasticity

P_0= 10, P_1= 9, Q_0= 120 and Q_1= 160

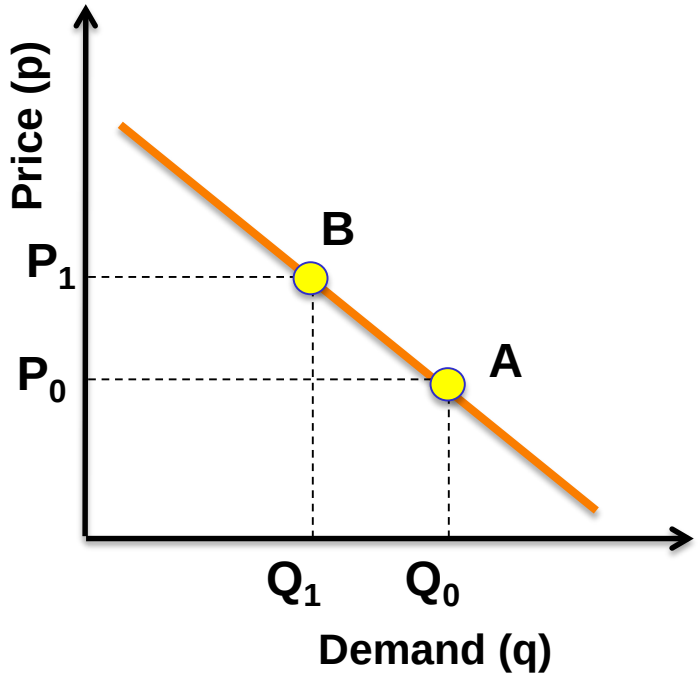
$(Q_1 - Q_0) = (160-120) = 40$

$(P_1 - P_0) = (9-10) = (-)1.0$

$(Q_1 + Q_0)/2 = 140$

$(P_1 + P_0)/2 = 9.5$

$E_{arc} = (-)\ (40 \times 9.5)/(140) = (-)2.7$



Price/Fare/User-Charges Elasticity for a Linear Demand Function

Linear Demand Function

$$q = \alpha - \beta p$$

Elasticity of Demand

$$e_p = \frac{\delta q/q}{\delta p/p} = \frac{\delta q}{\delta p} * \frac{p}{q}$$

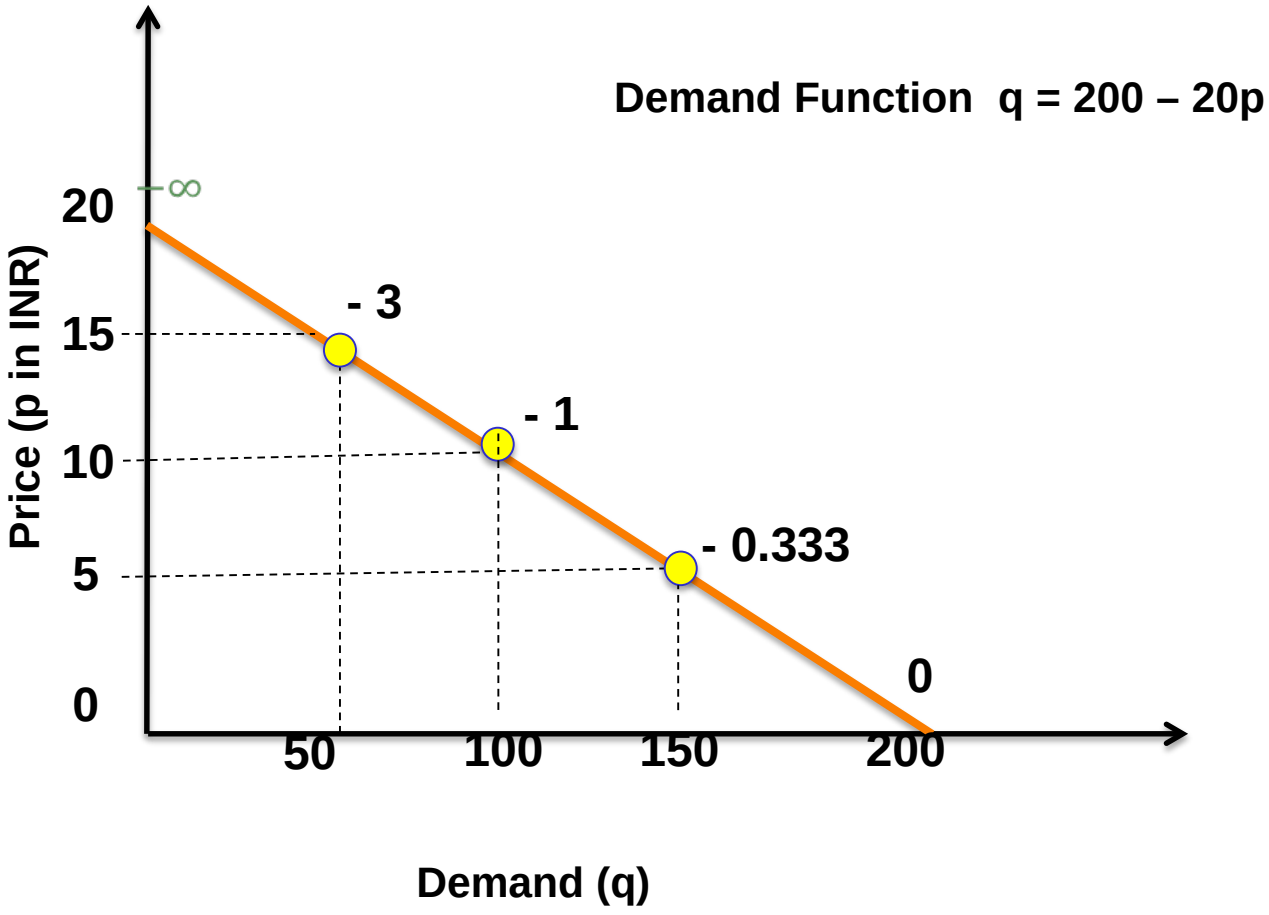
From demand function

$$e_p = \frac{\delta q/q}{\delta p/p} = \frac{\delta q}{\delta p} * \frac{p}{q}$$

After Substitution for p, from demand function

$$e_p = 1 - \frac{\propto}{q}$$

Elasticity Values at Different Points



Liner Demand Function and Elastic Zone