

02.03.2016

Dr. Moazzem Hossain

• Topics -

- Transportation Engg
- " Functions
- " Systems
- Functional components
- Factors in transportation development
- Transportation modes
- Public transportation
- Emerging modes

~~Imp~~ ■ Definition of Transportation Engineering:

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.

Figure : Transportation as a system
 ↓
 compound arrangement
 of a number of elements

	Policy making	Admin-management	Planning	Analysis, synthesis and design	Construction	Operations	Maintenance	Testing and evaluation
Airways								
Conveyors								
Highways								
Pipelines								
Railways								
Waterways								
Multimodal								
Exotic								
Quasi-transport								

आने के लिए वाहनों का उपयोग
 use of vehicles
 ↓
 also used for loading and unloading

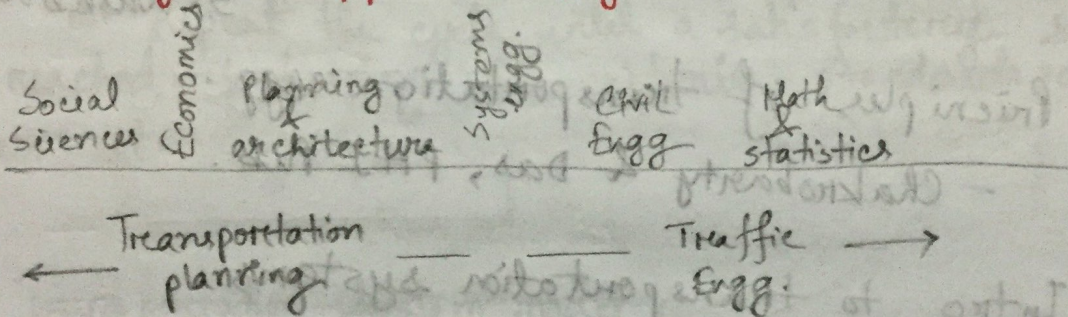
unique type of transport

इस प्रकार के परिवहन में इंटरनेट और कंप्यूटर का उपयोग किया जाता है।
 This is • Economical Scale — suppose 30 pieces, But industrialist 3000 piece. This is the difference of economic scale betⁿ the two
 very imp. mode of development

Imp. for planning \Rightarrow we should take professionals ce
it is a serious issue.

• Policy making \Rightarrow e.g. software

• The system approach figure:



• Steps in system analysis:

1. Recognise community problems & values
2. Establish goals
3. Define objectives
4. Establish criteria
5. Design alternative actions to achieve steps 2 & 3
6. Evaluate the alternative actions in terms of effectiveness & costs.

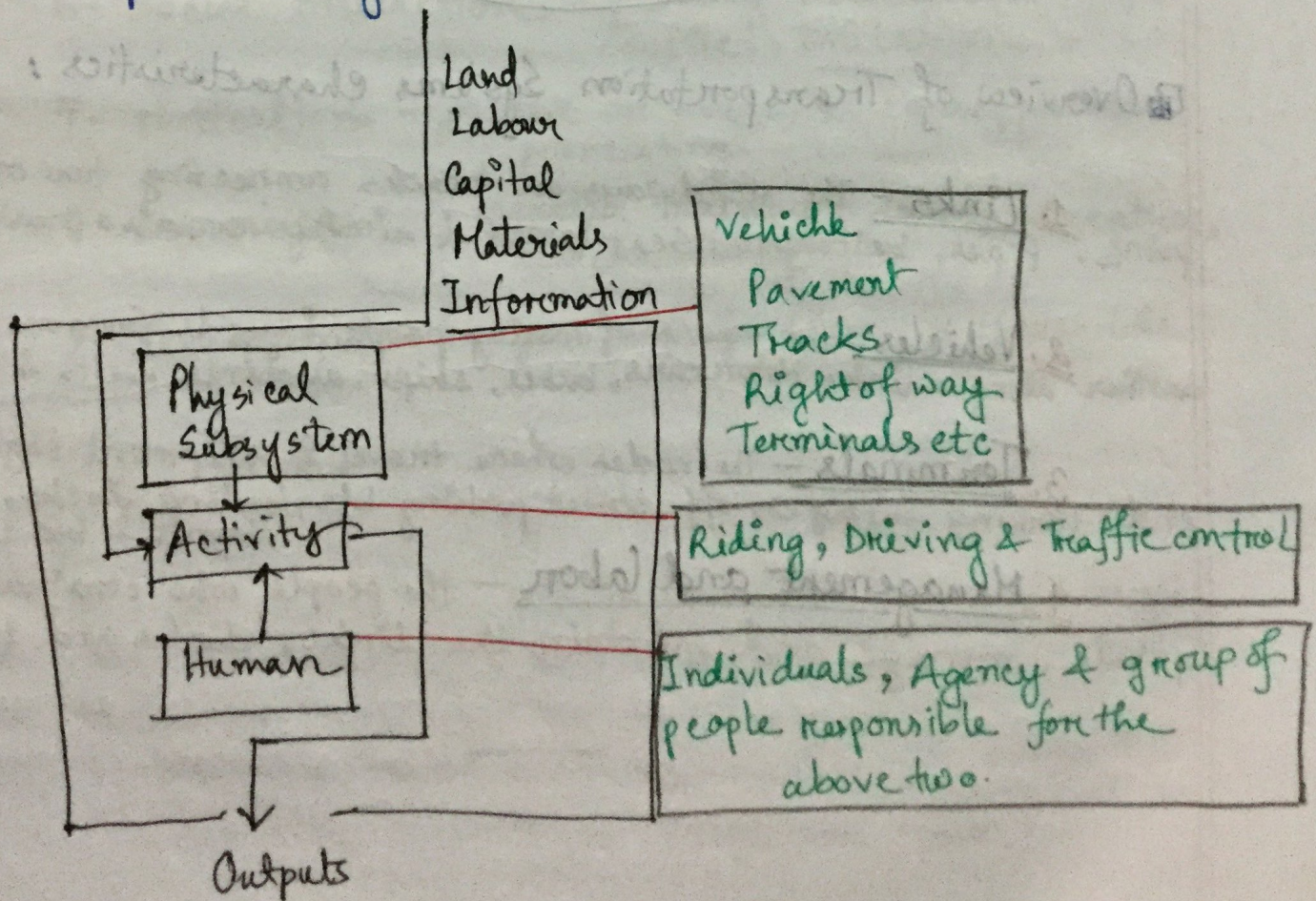
• Textbooks \Rightarrow what books we \leftarrow primarily for planning
it is a review of

- Transportation Engg
 - Khisty & Lally = primer book
- Principles of Highway Engg & traffic analysis
 - Fred L. Mannering, Walter P. Kilareski, Scott S. Washburn
- Principles of transportation engg.
 - Chakraborty & Das, PHI Pub.
- Intro to transportation systems
 - By Joseph Sussman, MIT Press

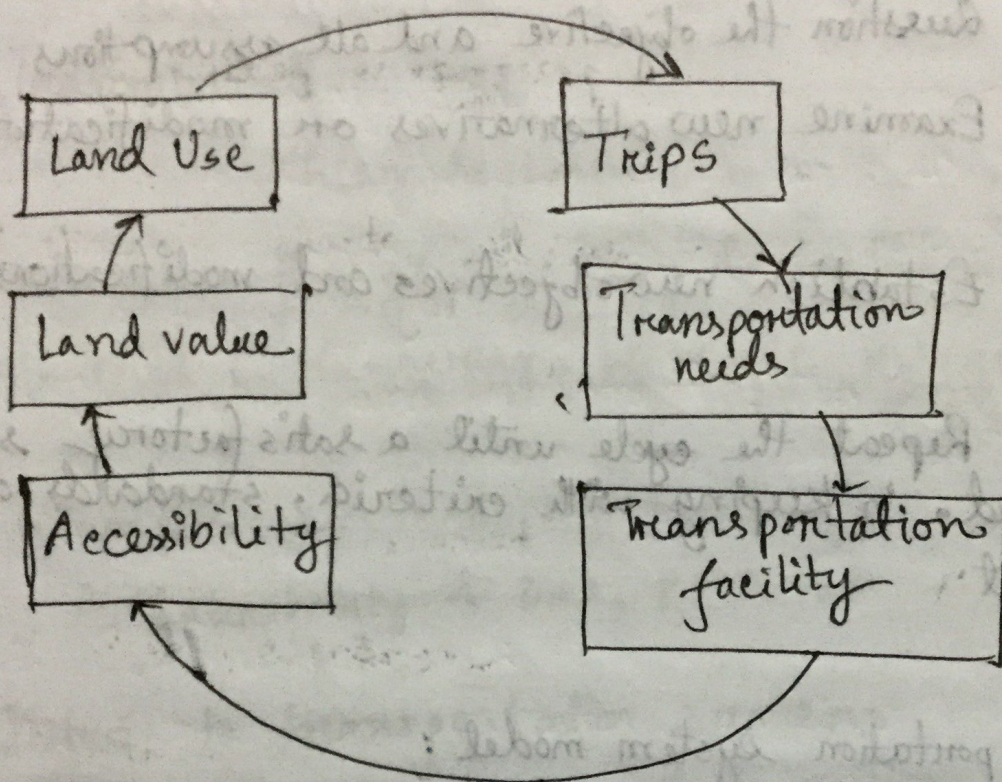
Steps in System Analysis (Continued).....:

7. Question the objective and all assumptions
8. Examine new alternatives or modifications of step 5
9. Establish new objectives and modifications of step 3
10. Repeat the cycle until a satisfactory solution is reached, in keeping with criteria, standards and values set.

Transportation System model :



Land Use / Transportation Cycle :



Overview of Transportation Systems Characteristics :

1. Links - the roadways or tracks connecting two or more points. Pipes, beltways, sea-lanes & airways can also be considered as links.

2. Vehicles - The means of moving people & goods from one node to another along a link. Motor cars, buses, ships, airplanes, belts & cables.

3. Terminals - The nodes where travel & shipment begin or end. Parking garages, off-street parking lots, loading docks, bus stops, airports, & bus terminals.

4. Management and labor - the people who construct, operate, manage and maintain the links, vehicles and terminals.

• Nine categories of human behaviour that are affected by transportation -

1. Locomotion - passengers, pedestrians
2. Activities - vehicle control, maintenance, community life
3. Feelings - motivation
4. Manipulation - choice, route selection
5. Health & Safety - accidents, disabilities, fatigue
6. Social interaction - privacy, territoriality, conflict, imitation
7. Motivation - positive or aversive consequences, potentiating
8. Learning - operator training, driver education, merchandising
9. Perception - images, mapping, sensory thresholds

23.03.2016

Contd. \Rightarrow 11 properties of physical environment that have a direct impact on human behaviour -

1. Spatial Organization: this dimension often includes the shape, scale, definition, bounding surfaces, internal organization of objects and society and connection to other spaces & settings.

2. Circulation and movement: This property includes people, goods & objects used for their movement - car, trains,

3. Communication: Both explicit & implicit signals, signs or symbols communication, required behaviour, responses, and meanings are covered by this dimension.

4. Ambience: includes such items as microclimate, light, sound & odour.

5. Visual properties: includes colour, shape & other visual modalities.

6. Resource: the physical components & amenities of a transportation-system paths, terminals and vehicles could be included.

7. Symbolic Properties: the social values, attitudes and cultural norms that are represented or expressed by the environment fall into this category.

8. **Architectonic Properties:** refers to the sensory or aesthetic properties of the environment

9. **Consequation:** Measures of consequence includes such items as costs, risks and congestion.

10. **Protection:** Safety factors are in general implied in this category.

11. **Timing:** All the items mentioned before are scheduled in time and some of them fluctuate with various cyclical rhythms such as - daily, weekly or hourly timing.

❑ **Transportation system can be evaluated by 3 basic criteria -**

1. **Ubiquity** - the amount of accessibility to the system, directness of routing between access points and the system's flexibility to handle a variety of traffic conditions. Highways are very ubiquitous compared to railroads.

2. **Mobility** - (opposite to ubiquity)

Then quantity of travel that can be handled. The capacity of a system to handle traffic & speed are two variables connected with mobility. Here again, a freeway has high mobility, a local road has low mobility.

3. Efficiency —

The relationship between the cost of transportation and the productivity of the system. Direct cost of the system

• 4 types of costs —

1. fuel cost

2. Travel-time cost

3. Emission cost

4. Safety cost

* Table 1.1: Overview of Major Transportation System.

- Road \Rightarrow highest energy consumption
 - Rail
 - Water \Rightarrow lowest fuel/energy consumption
 - Air \Rightarrow efficiency low but used for long distance travel.
- Rail line is an inaccessible place.

• Transportation systems, Hierarchies & Classification:

- A series of distinct travel movements are recognizable in most trips.
- On a highway system —
 - main movement along a free-way, a transition to an arterial via freeway off-ramp

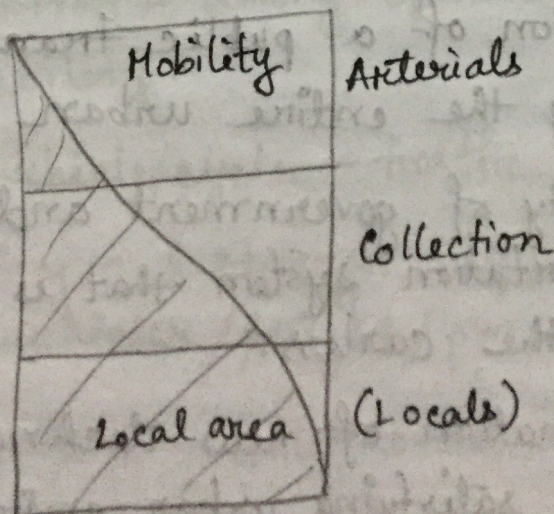
- then further movement along an arterial where traffic is distributed and

- later collected via a collector, finally accessing a terminal (a garage or on-street parking lot)

- Further movement of the passenger may be as a pedestrian on a sidewalk of a local street and finally to his or her destination.

• The urban principal arterials serve the major activity centers, such as universities, shopping centers and stadiums and also the highest-traffic-volume corridors.

Fig: Relationship of functionally classified systems in Service Traffic Mobility and Land Access.



30.03.2016

Figure: Vehicle-Miles of Travel by Street Class.

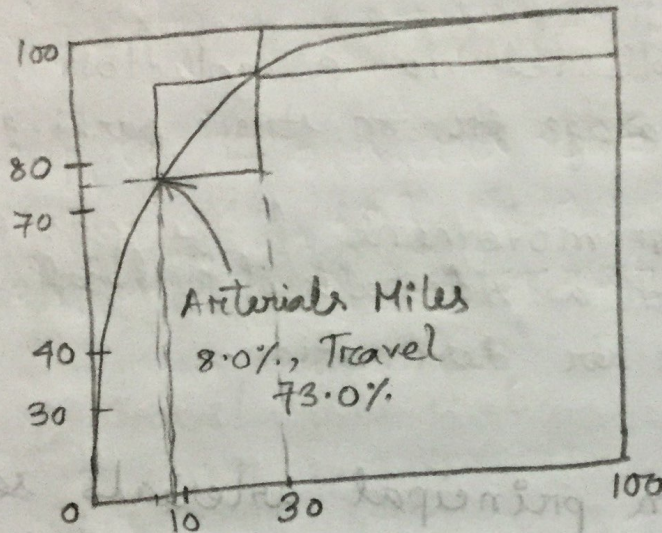


Figure: Transportation gaps.

Transportation and Transportation related Problems:

- The tremendous dependence on the automobiles and relation of this dependency to urban form and the location of people and their jobs.
- The evolution of a public transportation system capable of serving the entire urban area effectively.
- The capability of government and its policies to provide a transportation system that is equitable to both car owners and the carless.
- The combination of new technologies and effort to design a more satisfying urban environment in the

long run.

- Complexities of new problems due to the uncertainty of energy supplies.

- Solving urban transportation problems through the public and private sectors; and the cost implication of alternative federal policies.

▣ Transportation System :

• Keypoints -

1. Behaviour - people and organization alter behaviour based on transport service

2. Transportation is a part of a broader system - economic, social & political.

3. Competition - among operators for better service availability.

4. The vehicle cycle - traffic flow & network analysis

5. Queuing and storage - queuing for service and storage for vehicles / freight / passengers.

6. Transfers - Intermodal and intramodal transfer number and ease

- 7. Operating policy — affects LOS
- 8. Capacity — a complex system characteristics
- 9. Supply — ensures LOS
- 10. Availability of Information.

1. Behaviour — people and organization other
 behaviour based on transport service

2. Transportation is a part of a broader system —
 economic, social & political.

3. Competition — among operators for better
 service availability.

4. The vehicle cycle — the flow & network analysis
 queuing and storage — queuing for service and
 storage for vehicles (weight / passenger).

5. Transfer — intermodal and intramodal
 transfer for various modes.

• Keypoints (Continued):

11. Infrastructure shape - affects geo-economic shape
12. Cost-Prices-LOS - they may not be consistent
[travel time কমিয়ে cost বাড়ালেও বেশি safe হতে পারে।]
13. Cost of service estimation - modelling করতে হবে cost cost modelling থাকলে tax (বড় হবে / অন্য ৩য় সম্পদের দ্বারা পাৰ।)
14. Costs/LOS trade-offs
15. Demand Consolidation - may reduce costs for like demands
16. Peaking - design capacity trade-off
17. Different time scales - long, short, medium and infrastructure plan.
18. Equilibrium - between demand and supply.
19. Transport, development and land-use - relation among transportation, economic development and location of activities.
20. Performance measures

Urban Transport System

• Factors influencing urban transport pattern —

— Infrastructure / Investment choices :

expressway / LRT / Metro / Busway .

— Income changes and economic development
(Income and car ownership)

— Interaction of transport and urban form
and the influence of urban planning policy

— Prices & economic instruments (car/fuel
price / tax ; KL vs. Singapore)

— Technology choice (NMT / MC / Car / rail vs.
expressway)

— Transport patterns and infrastructure
influence the urban form that evolves in any
particular city and conversely, the urban form
of a city influences its transport patterns and
further infrastructure investments.

City & Transport

• 3 conditions may be there -

1. Walking City -

- High density

- mixed use

- short distance origin and destination patterns highly dispersed throughout the city.

2. Transit City -

- High density city centre with mixed use

- short distance origin and destination patterns within city centre.

- long distance and radial origin destination pattern with satellite/suburb township.

3. Automobile City - (worst city type)

- High density commercial use core

- Commercial, retail and industrial land use separated and dispersed throughout the city.

- long distance origin destination pattern highly dispersed throughout the city.

Engineering Transportation Technology

1. Smart traffic Signal Control System sense heavy traffic flows at road.

2. Freeway management system meters vehicles entering freeways with signals on on-ramps.

3. Transit management system helps managers to control and monitor the movements of transit vehicles & adjust schedules accordingly.

20.21

4: Incident Management system (IMS) detect & manage non-recurring traffic congestion caused by random unpredictable incidents such as traffic accidents, lane blockages, hazardous material spills resulting in major traffic congestion for considerable time periods. IMS has been in practice for quite some time.

5: Electronic toll collection on bridges & roads has been in operation on over a dozen sites.

6: Electronic fare payment systems have also been in practice for a long time but have to be refined further.

7: Emergency response allows emergency vehicles to control traffic lights at intersections. The emergency vehicle driver can hold the green phase until the intersection is cleared.

8: Travel information systems provide traffic information to users so that they can adjust their travel plans based on what they learn.

9: Route guidance systems are based on Global Positioning System (Satellite) technology & assist motorists with distance & direction information to select destination.

Light rail:

- Key decisions ←

Heavy rail/Metro:

- Key decisions -

Bangladesh Transport Review

- Historical development —
 - Before British Colonial Period
 - During Colonial Period
 - During Pakistan Era
 - After liberation in 1971
 - Flow of aid fund after 1975
 - Sporadic, Peacemeal,
- Transport Sector problem —
- Bangladesh Railway —

Table
