

# Urban Transportation Planning

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Unit - 1 Rib - Kadiyali Traffic Engineering & Transport Planning

Scope of subject :- Transport planning process

Transportation occupies a high place in modern life

Transportation planning is a science that deals with the study of problems that arise in providing transportation facilities in an urban and national areas and to prepare a systematic basis for planning such facilities.

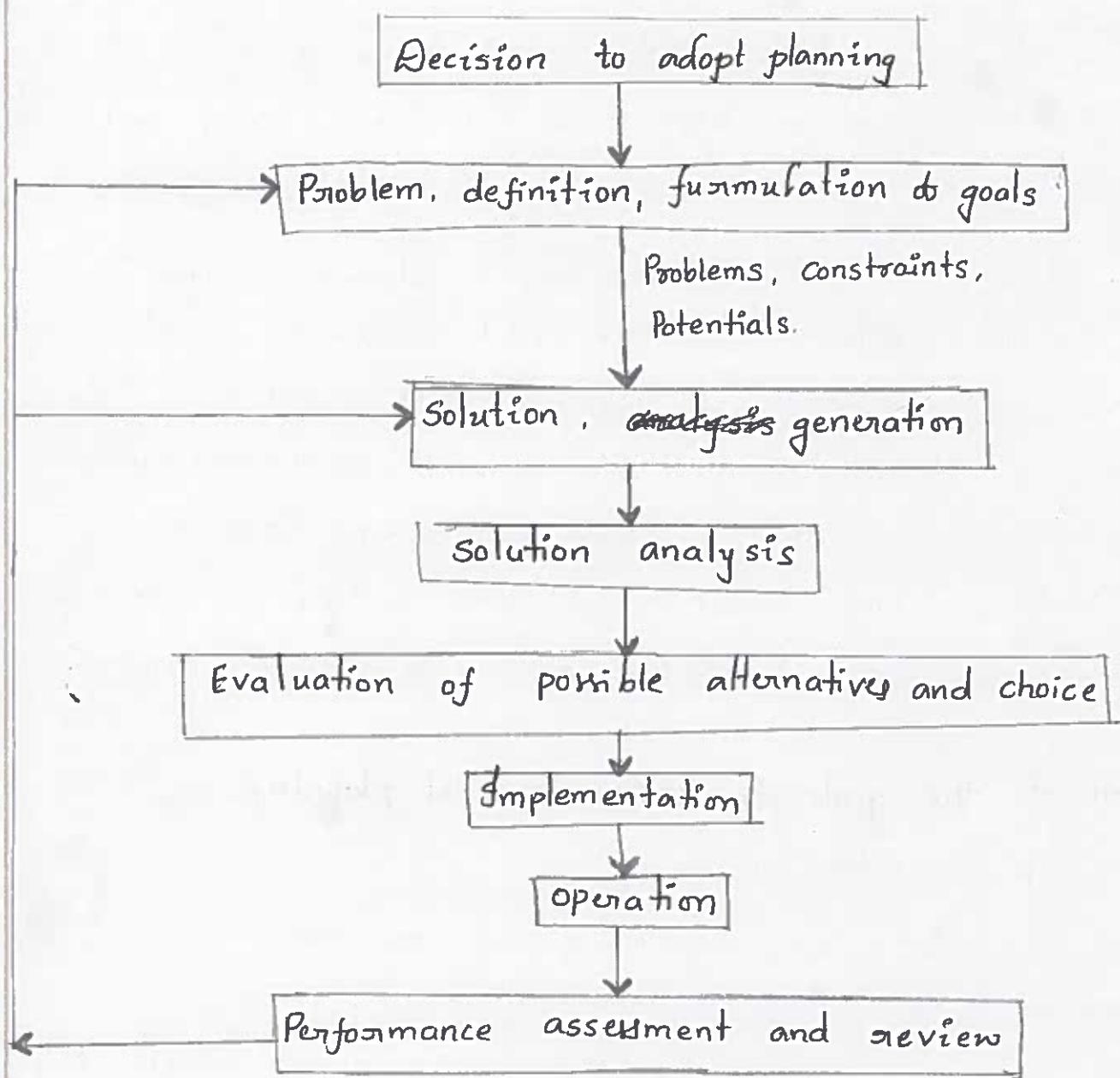
Though motor vehicles have revolutionised our life and brought comfort, pleasure and convenience, but they created problems of congestion, lack of safety and degeneration of environment. To understand the nature of these problems and formulate proposals for the safe and efficient movement of goods and peoples from one place to another is the subject of transport planning.

Some of the goals in urban transport planning :-

- To improve safety of travel
- Minimum disturbance to the general environment
- Minimum demolition of housing
- The removal of through traffic from urban centre and residential areas.
- A high benefit / cost ratio
- To enhance the levels of mobility of people while at the same time reduce dependence on the use of Personalized vehicle, conserve fuel and protect the environment
- To minimise the loss of human life and human suffering through injury from transportation related accidents.

## Systems approach to Transport Planning

The process involved in the system approach in transport planning can be represented by fig. 1



The transport planning process starts with the decision to adopt planning for certain desired goals and objectives. After goals and objectives are defined, solutions are generated taking problems, constraints, potentials. These solutions are evaluated after thorough analysis. The best among them is chosen for implementation.

After implementation the system is studied in operation and its performance assessed. Based on this assessment it may be necessary to go back to certain stages of planning and repeat the sequence.

### \* Stages in transport Planning

The broad sequence of operations in the systems approach to transport planning has already outlined. In this sec<sup>n</sup> it proposed to identify the greater detail the various stages in the transport planning process.

Five Important stages in transport planning process.

1. Survey and analysis of existing Conditions
2. Estimate, analysis of future conditions
3. Evaluation
4. Programme adoption and implementation
5. Continuing study.

#### I Survey and analysis of existing Conditions

The survey and analysis starts with the definition of the survey area and division of the area into smaller units called zones to study the pattern of movements.

(a) Inventory of existing travel pattern includes:

- (i) Collection of data on origins and destinations of journey by home-interview, road side interview registration number plate survey, Pre-paid post card survey, corridor surveys.
- (ii) Collection of data on traffic volume on the various existing network, including classification of vehicles, variation in traffic volumes during the days of the week and hours of the day.
- (iii) Collection of data on movement of goods vehicles.
- (iv) Collection of data on movement of public transport buses
- v] Collection of data on movement by rail transit
- vi] Parking characteristics [supply, usage, duration and method of charging]

(b) Inventory of existing transport facilities consists of

- (i) Inventory of streets forming the transport network, including dimensions, type and condition of surface, capacity, control devices, volume of traffic, pedestrian facilities.
- (ii) Studies on travel time by different modes
- (iii) Inventory of public transport buses, their operating speeds, headways, schedules, capacity, passengers carried etc.
- (iv) Inventory of rail transit facilities
- v) Parking inventory
- vi) Inventory of Airports.

C] The inventory of land-use and economic activity consists of:

- i) Information on land use - type (residential, industrial, commercial, recreational etc.)
- ii) Population data
- iii) House hold structure including family income, car-ownership, family size and gender
- iv) Employment pattern
- v) School attendance.

The above data describe the travel pattern, transport facility, and land use pattern.

Trip generation, trip distribution, trip assignment on the existing network. Trip generation models determine the number of trips produced in a zone and land use and socio-economic characteristics. Trip distribution models connect trip generation models between any two set of two zones. Trip assignment is produced by which the route route chosen by trip maker is determined.

## II Estimate, Analysis of Future Conditions

Transport plans are long-range in scope and involve planning for 20 to 25 years. Future transport demand is tied up with future economic activity & future land-use.

Population in future can be done by study of past trend. More detailed studies of birth, death data help in formulating population in future can be estimate.

Estimate of future employment pattern from economic activity. Future level of car ownership is an important parameter that influences future travel.

Estimate future growth in land-use pattern such as residential, industrial, commercial and open spaces can be determined by formulating suitable land use allocation models.

Future land-use activity arrangement and information concerning future income levels, family size, car ownership rates, employment, population and other economic factors formulated trip generation models.

### III Evaluation :-

In order to select the best from these, it is necessary to evaluate each of the alternatives as to how it fulfils the desired objectives.

Cost / Benefit techniques are used to evaluate the alternatives in economic terms.

### IV Programme Adoption and Implementation.

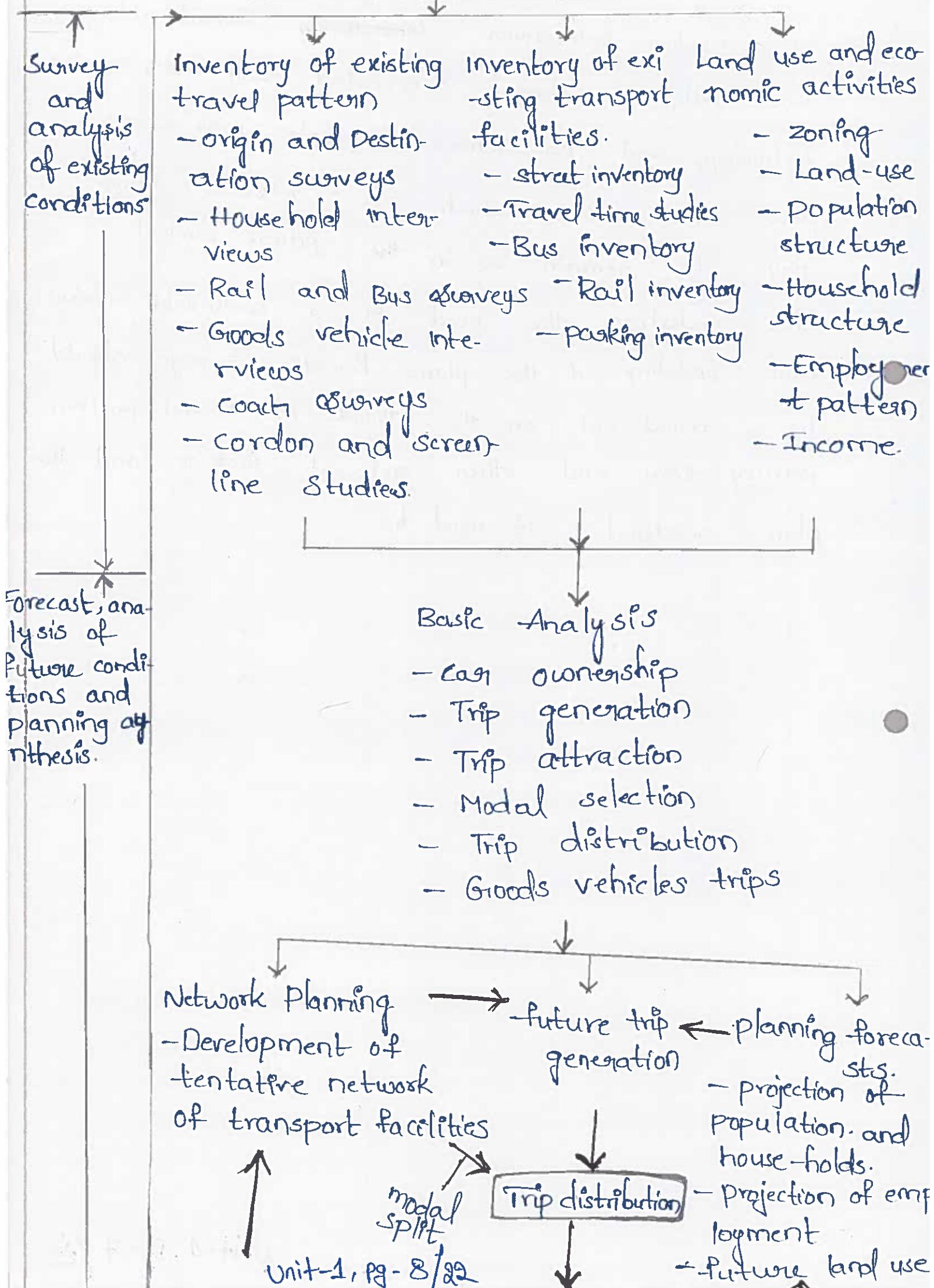
Best alternative from the evaluation study is selected for adoption and implementation. The stages in which the project is to be implemented are decided with the consideration for the financial resources.

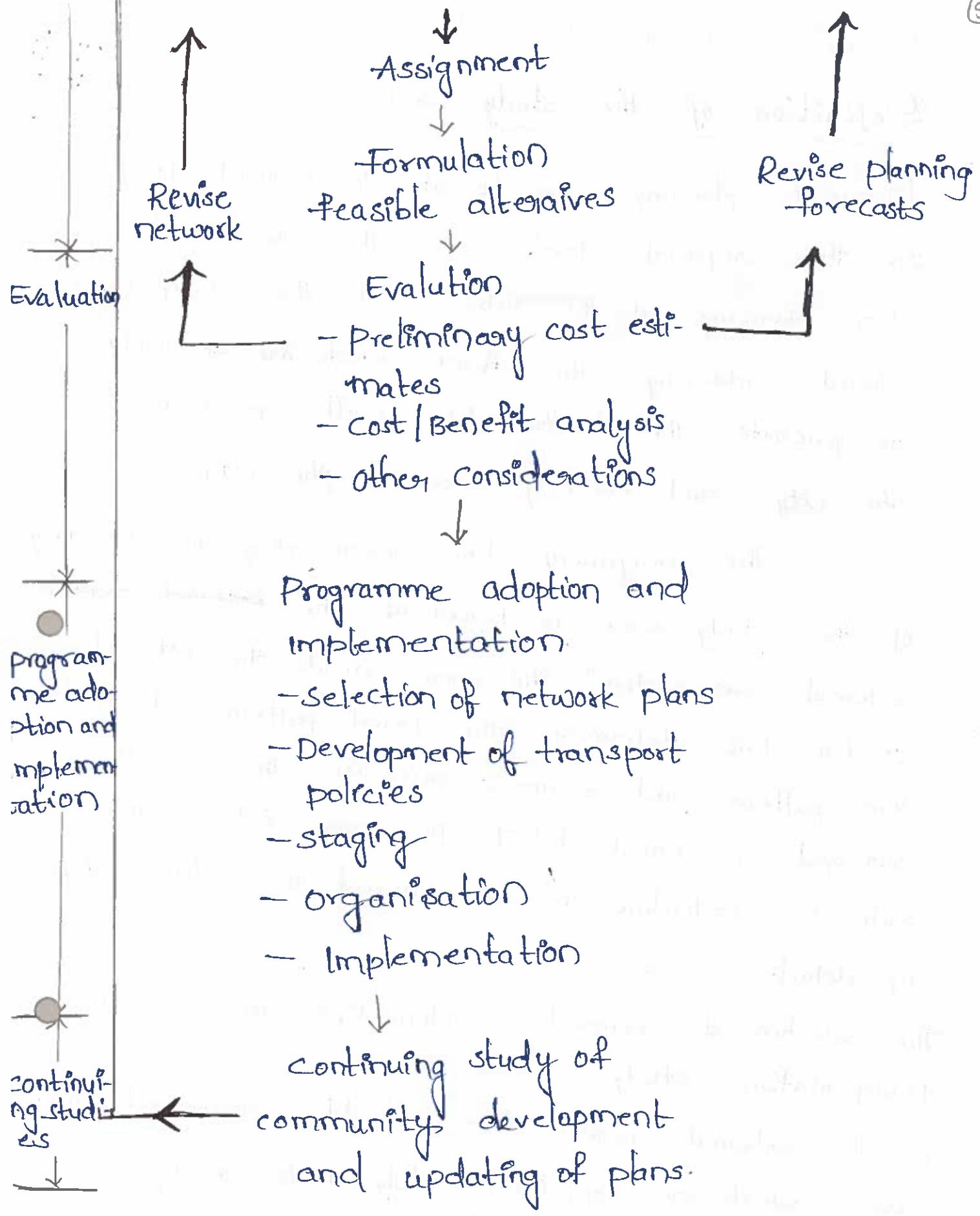
## IV Continuing Study

Continuing Study : The urban system and the people inhabiting it are not deterministic and are governed by random behaviour. ~~Considering~~ Considerable uncertainty is always associated with such systems. Technology and preferences of people may change. plans and policies which are relevant today may not remain so in the future context. This underlines the need for a continuous review and updating of the plan. Periodic surveys should be carried out on the trends in travel patterns, journey times and other relevant factors and the plan readjusted, if need be.

# Stages in the Transport Planning Process

Definition of the Survey Area, formulation of goals





Definition of the study Area :-

Definition of the study area :-

Transport planning can be at the national level, or the regional level or at the urban level.

For planning at the urban level the study area should contain the areas which are already to generate the traffic like built-up areas of the city and existing areas of the city.

The imaginary line representing the boundary of the study area is termed as the ~~external cordon~~ "external cordon". The area inside the external cordon line determines the travel pattern and land-use pattern and economic activity such as surveyed in great detail. The area outside the external cordon line is less studied to a lesser degree of detail.

The selection of external cordon line for an urban transportation study should be

i) The external cordon line should circumscribe all

areas which are considered likely to be developed during the period of study

ii) The external cordon line should contain all areas of systematic daily life of the people oriented towards the city centre and should ~~not~~ be in boundary line.

iii) The external cordon line should be continuous and uniform in its course so that movement crosses it only once. The line should intersect roads where it is safe and ~~Contra~~ - Unit-1, Pg-10/82

Convenient to carry out traffic surveys.

- iv) The external cordon line should be compatible with previous studies of the area of studies planned for the future.

### Zoning :-

The defined study area is sub-divided into smaller areas called zones.

The purpose of such a sub-division is to facilitate the spatial quantification of land use and economic factors which influence travel pattern. The data collected on individual household basis can not be conveniently considered and analysed unless they are aggregated into small zones which reflect the average characteristics of the individual households. Sub-division into zones further helps in associating the origins and destinations of travel.

The zones within the study area are called internal zones. In large study projects, it is more convenient to divide the study area into sectors, which are sub-divided into smaller zones. Zones can themselves be sub-divided into subzones depending upon land use.

A convenient system of coding of the zones will be useful for the study. One such system is to divide the study area into 9 sectors. The central sector is designated 0, and the remaining eight are designated 1 to 8 in clockwise manner. Each sector is sub-divided into 10 zones bearing numbers 0 to 9. Thus a system of

three digits denotes denotes a sub zone. A sub zone bearing the number 481 belongs to sector 4 and to zone 8 in that sector and is sub-zone 1 in that zone.

When dividing the area into zones the following points are taken :-

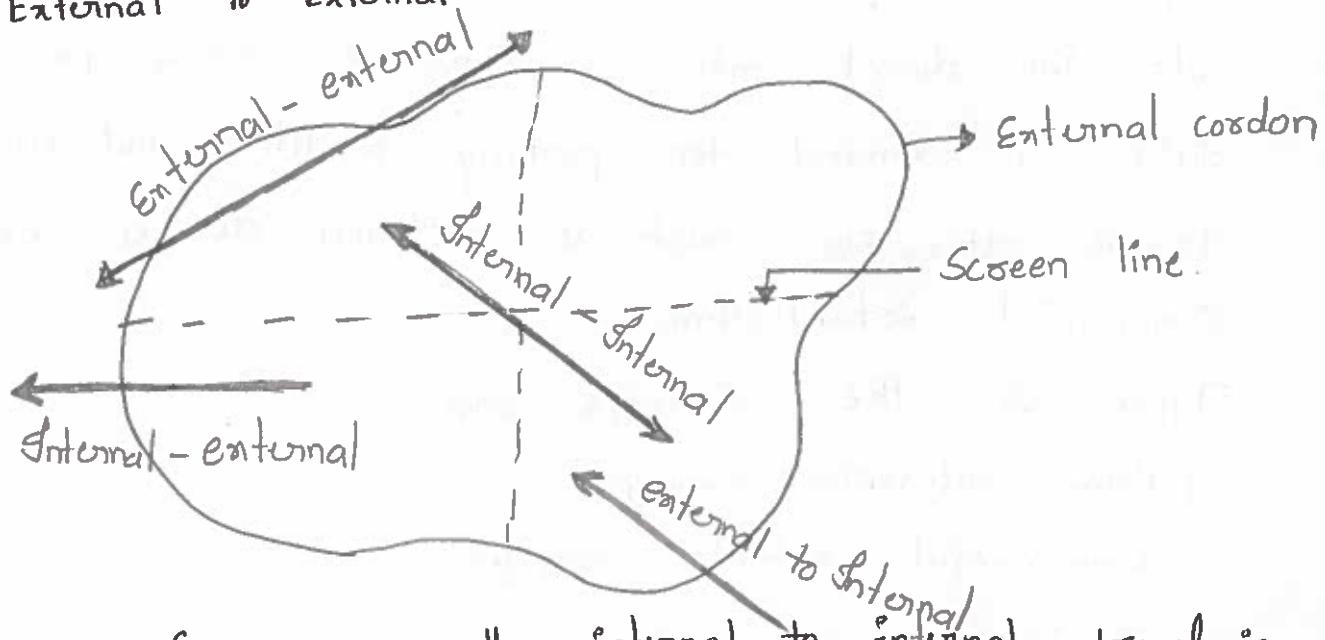
- 1] Land use is the most important factor in establishing zones for a transportation Survey. It is only when the origin and destination zones reflect properly the land use can traffic generated within the zones measured & quantified accurately.
  - 2] The zones should have a homogeneous land use so as to reflect accurately the associated trip-making behaviour.
  - 3] future changes in land use should be considered when sub-dividing the study area into zones.
  - 4] The zones should not be too large to cause considerable error in data. At the same time, they should not be too small either, to cause difficulty in handling and analysis the data.
- As a general guide, a population of 1000 - 3000 may be optimum for small areas and a population of 5000 - 10,000 may be optimum for a large area. In residential areas the zones should be accommodate roughly 1000 house hold.

- 5] The zones should preferably have regular geometric form for easily determining the centroid which represents the origin and generation of travel.
- 6] Zones must be compatible with cordon lines.
- 7] Natural or physical barriers such as canals, rivers, etc. can form convenient zone boundaries.

### Type of Movements

The basic movements for which survey data are required

- (i) Internal to Internal
- (ii) Internal to External
- (iii) External to Internal
- (iv) External to External



For large urban areas, the internal to internal travel is heavy whereas for small areas having a small population (say less than 5000) the internal to internal travel is insignificant

The internal to internal travel is best studied by the home interview technique with checks by screen line surveys. The internal-external, external to internal and external- external travels can be studied by Cordon Survey. The internal-external travel can also be surveyed by home interview technique.

### Types of Surveys :

The surveys can collect the data

i) at the home

ii) During the trip

iii) at the destination

When collected at the home, the data can be wide-ranging and can cover all the trips made during a given period. The data collected during the trip only on the particular trip intercepted. At the destination ends, the direct interview types of surveys provided data on demand for parking facilities and on major traffic attractors such as factories, offices and commercial establishments.

### Types of the Surveys are :

i] Home interview surveys

ii] Commercial Vehicle surveys

iii] Taxi Surveys

iv] Road - side interview surveys

v] Post card questionnaire Surveys

vi] Registration number & Surveys

vii] Tag Surveys

viii] Public transport surveys

(i) Household interview surveys :-

This type of survey used for collection of origin and destination data. The information on travel pattern includes number of trips made, their origin and destination, purpose of trip, travel mode, time of departure from origin and time of arrival at destination and so on.

The information on household characteristics includes number of residents, age, gender, vehicle-ownership, number of drivers, family income and so on.

Bureau of Public Roads (B.P.R.) are given

standards to size of the sample is usually determined on the basis of the population of the study area.

Population of study Area	Sample Size
Under 50,000	1 in 5 house holds
50,000 - 150,000	1 in 8 house holds
150,000 - 300,000	1 in 10 house holds
300,000 - 500,000	1 in 15 house holds
500,000 - 1,000,000	1 in 20 house holds
Over 1,000,000	1 in 25 house holds

The above standard are too costly to practice. In any case, the sample size should not be less than given table

Population of study Area	Sample size
under 50,000	1 in 10 house holds
50,000 - 150,000	1 in 20 house holds
150,000 - 300,000	1 in 35 house holds
300,000 - 500,000	1 in 50 house holds
500,000 - 1,000,000	1 in 70 house holds
over 1,000,000	1 in 100 house holds

A number of techniques are available for the home-interview survey. The full interview technique involves interviewing as many members of the household as possible and directly recording all information. This technique is more expensive, and it may be possible to collect the needed information only at the rate of eight interviews per eight hour day per interviewer. Full interview technique contains very accurate data.

In the home questionnaire technique, the interviewer collects only details of the households characteristics, leaving forms for household resident to complete the form regard travel information. The completed forms are collected by the interviewer after a day or two days. This technique is more speedy and cover about 20 households per day.

Variation of the above techniques sometimes used in the past are the telephone interview and the postal survey. In the telephone interview, questionnaire form is sent out by post before the survey date and the replies are collected by telephone. This method can be successful only in areas of high telephone ownership. In the postal survey method, the questionnaire form is mailed and the households are requested to send their replies by post in reply-paid envelopes.

The information to be collected from the home-interview survey can be broadly be classified under 2 group household information and journey data.

The household information contains information such as address, size of household, age, gender, structure of household, earning members, occupation, place of work, number of motor vehicles owned, household income. The journey data contains information on all journeys made during the 24 hour period, including the origin and destination of journeys, purpose of trip, mode of travel etc.

#### (ii) Commercial Vehicle surveys:-

Commercial vehicle surveys are conducted to obtain information on journeys made by all commercial vehicles based within the study area. The address of the vehicle operators are obtained and they are contacted. Forms are issued to drivers with a request that they record data of all the trips they would make. ~~As typified~~

#### (iii) Taxi Surveys:-

Large urban areas usually have sizeable amount of travel by Taxis. In such case a separate taxi survey is necessary. The survey consists of issuing questionnaires or form to the taxi drivers and requesting them to complete the same.

#### (iv) Road side Interview Survey:-

Road side interview survey is one of the methods of carrying out a screen line or cordon survey. The road interview survey can be done either by directly interviewing drivers of the vehicles at selected survey points or by issuing prepaid post cards containing the questionnaire to all or a sample of the drivers.

The survey points are selected along the junction of the cordon-line or screen line with the roads.

The cordons may be in the form of circular rings, rectangular grids. For small towns, say with population less than 5000, single sized circular cordon at the periphery of the town should be sufficient. the internal travel being light, the external cordon survey will give origin-destination data. In case of medium sized cities, population in the range 5,000 to 75,000 two cordon lines are necessary, the external cordon at the edge of the urban development and internal cordon at the limits of the central business district.

For dual carriageways or roads with very little traffic the traffic in both directions is collected Survey simultaneously. In other cases the traffic in two directions is heavy the Survey should covers in one direction only and to assume that the journey in the opposite direction are the same as in the direction interviewed.

#### Past - card Questionnaire

In this method, ~~steely~~ Questionnaires are handed over to each of the drivers of a sample of them at the Survey points and requesting them to complete the information & return by post. The method avoids delay caused to the drivers by the direct roadside interview method but suffer from the disadvantage that response may not be good. For this reason its use is not generally recommended for developing countries. The method is simpler and cheaper than many others.

#### Registration number Plate survey:-

Registration number plate survey consists of noting the Registration number of vehicles entering or leaving an area

an area at survey points located on the cordon line.

By matching the registration numbers to vehicles at the points of entry and exit from the area, one is enabled to identify two points on the paths of the vehicles.

The method neither gives the origin or the destination of the trip nor yields any other useful information such as trip purpose. The advantage of the method is that the work does not interfere with the traffic in any way. However, a large number of observers are needed and the analysis of the results can be complicated.

First of all, the area to be surveyed is defined and the roads intersecting the cordon line are identified. At each survey point, one or two observers are stationed to record the data in each direction of travel. If two observers are available at each point, one can call out the registration number of the vehicle and the other can record. Time should be recorded at regular intervals.

If the actual times at entry and exit are noted, an estimate of the journey speed of the vehicles can also be had. The type of vehicles (car, commercial vehicle, bus etc) as well as the full registration number are noted.

### Tags on Vehicles:-

In this method, at each point where the roads cross the cordon line, vehicles are stopped and a tag is affixed.

~~usually~~ The tags for different survey stations have different shapes and colours to identify the survey station. The vehicles are stopped again at the exit points where the tags are removed. The times of entering and leaving the area may be

marked on the tags in order to enable the journey times to be determined. The survey can be conveniently divided into ~~area~~ ~~as the traffic~~. Periods of say 15-30 minutes intervals. The analysis is simple and errors are not very large. The method can also be extended to cover vehicles that enter the area but are parked in the area during the rest of the study period. For this purpose, the parking areas are surveyed at the end of the study period and the tags on parked vehicles collected.

#### Public Transport Surveys:-

In order to assess the number of bus passengers passing through an external cordon, the survey can either be by direct interview with the passengers or by issuing post-card questionnaires. Direct interview is likely to result in large delays and requires a large number of interviews. In order to minimize the delays, the interviewer may enter the vehicle and carry out the interviews when the vehicle is in motion. Post card questionnaires eliminate delays.

#### Inventory of Transport Facilities.

The inventory of existing transport facilities should be undertaken to identify the deficiencies in the present system and the extent to which they need to be improved. The inventory consists of:

- (i) Inventory of streets forming the transport network
- (ii) Traffic volume, composition, peak and off-peak hours
- (iii) Studies on travel time by different modes
- (iv) Inventory of Public transport buses

v] Inventory of rail transport facilities

vi] Parking inventory

vii] Accident data.

### i] Inventory of streets

An understanding of the extent and quality of the road network is very important to formulate plans for future. The inventory should covers details such as classification of the street system, length, cross sectional dimensions, type and condition of the surface, capacity, intersections, control devices, structures etc

### ii] Traffic Volume:-

Data obtained to traffic volume and its composition will be needed to check on the survey data collected by the home - interview and cordon surveys. The variation of the traffic volume over different hours of the day, of different days of the week and different months of the year is also needed.

### iii] Travel Time studies:-

Estimate of travel time between different zones by various modes is necessary for transport planning. Travel times are usually measured for the peak hour conditions and non-peak hour conditions.

### iv] Inventory of Public Transport facilities:-

The inventory of public transport buses includes information on the total number of buses, their capacity, schedules, routes, operating speeds, number of passengers carried.

### v] Inventory of rail transport facilities:-

The inventory of rail transport facilities should include the length, capacity, schedules, operating speeds, stations, number of passengers carried etc.

### vi] Parking inventory :-

Parking inventory should collect information on the existing on-street and off-street parking facilities, the parking demand and the utilization of existing facilities.

### vii] Accident data :-

Accident data over the past years will help to understand the nature and extent of the hazard hazards inherent in the present system and the need to improve the situation.

## Inventory of Land Use and Economic Activities :-

Inventory of Land use: -  
Travel characteristics are closely related to the land use pattern so it is most important that an accurate inventory of land-use be prepared. The zones are classified into land use activity such as residential, industrial, commercial, recreational, open space and so on. For this purpose, the Town and Country Planning authorities need to be consulted. Aerial photography has also been used as a source of land use data.

### Inventory of economic Activities:

Data on economic activities should be collected in include the following

1. Population of the survey area and the various zones
2. Age, gender and composition of the family
3. Employment statistics
4. Housing statistics
5. Income
6. Vehicle ownership.

The population data helps in the estimation of the future trip making behaviour. Population maps indicating the density, school enrolment, institutional population and sociological factors will facilitate presentation of results and better understanding of the travel pattern/Unit-1, pg-22