

**Internal Assessment Test 1 – November 2021**

Sub: Urban Transport Planning				Code: 17CV751/18CV745		
Date: 13/11/2021	Duration: 90 mins	Max Marks: 50	Sem: VII	Branch (sections): CIVIL (A and B)		
<b><u>Answer any Five Questions</u></b>						
				Marks	OBE	
					CO	RBT
1.	Explain the urban transportation system approach with a neat flow chart.			[10]	CO2	L2
2.	Define urbanization and discuss its positive and adverse effects in detail.			[10]	CO1	L2
3.	Explain the inventory of land-use and economic activities in urban transportation planning.			[10]	CO2	L2
4.	Define: Trip generation, trip distribution, trip assignment and modal split			[10]	CO2	L1
5.	Discuss how roadside interviews and registration number plate surveys are carried out			[10]	CO1	L2
6.	What is sampling and explain how is expansion factor applied in home-interview survey?			[10]	CO1	L2

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Dept. Of Civil Engineering

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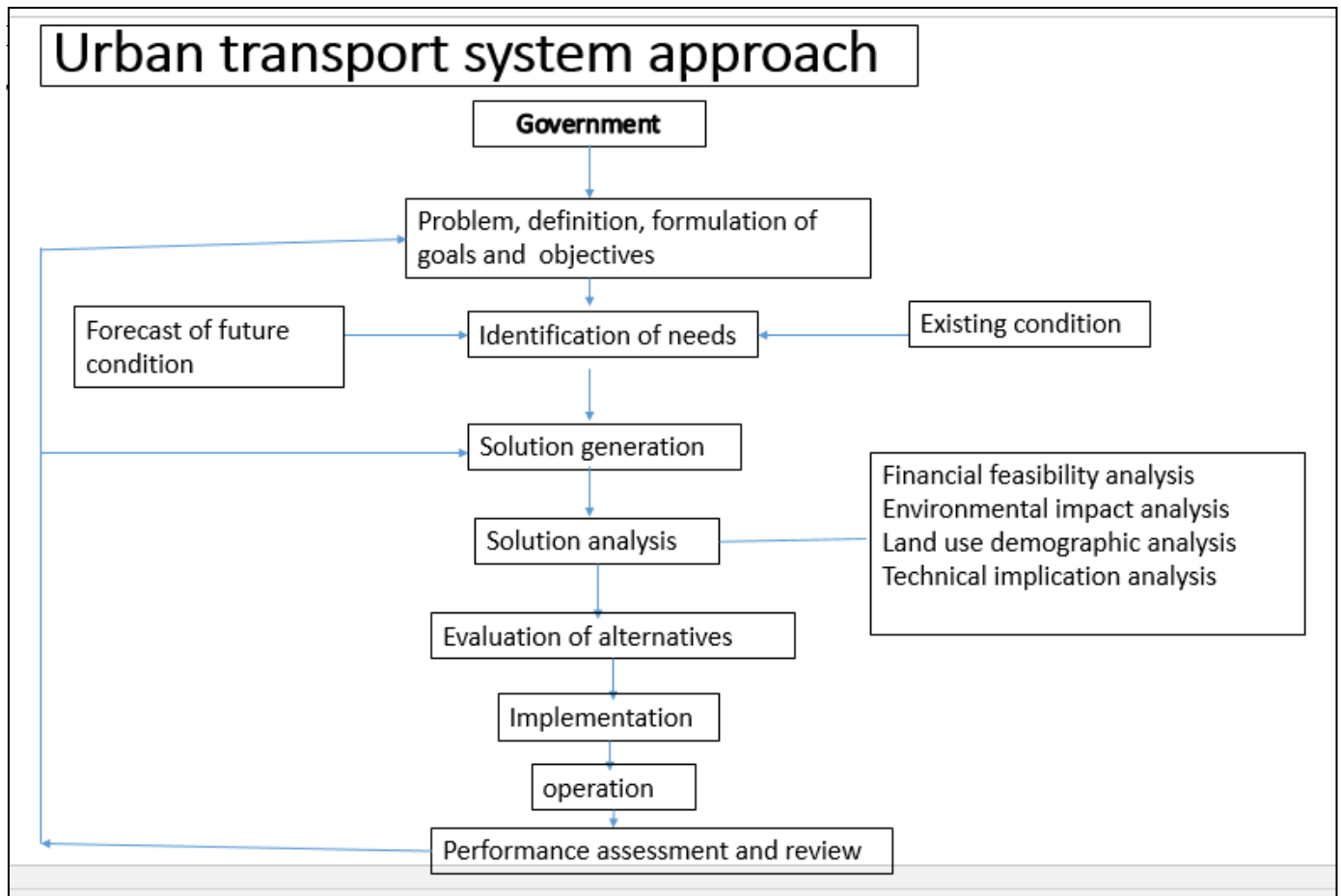
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## UTP IAT 1 Solutions

1. Explain, with a neat flow diagram, system approach to transportation planning



## **Solution Generation and Analysis**

Based on problem definition, transportation planners have to identify various alternatives and make choice about various modes like roadway ,railway, waterways or airways.

The technological aspect - such as high speed train, raised monorails underground transit system, driver information system.

Traffic engineering aspect - such as changing or improving flow pattern by making certain road one way, reducing delay on arterial street by improving signalization or grade separated intersection, disallowing certain movement at intersection

Regulatory aspect - such as reserving land for only high occupancy vehicles, disallowing high polluting vehicles, imposing speed limit.

For example, to travel from Kanpur to Delhi following alternatives can be worked out.

- Facilitate train leaving Kanpur at 6:30 am and reaching Delhi at 10:30 am and again leaving Delhi at 5:30pm and reaching Kanpur at 10:30pm.
- Developing existing airport at Kanpur
- Improve the existing road facilities providing operating speed 120 kmph.

## **Evaluation of possible alternatives**

Compare the various alternatives and select the best plan based on estimated cost and benefits.

## **Implementation and assessment**

Once the best plan is selected and becomes operational, the performance is assessed and monitored regularly for further improvement. Based on the performance assessment it may be necessary to go back to certain stages of planning and repeat the process (see flowchart).

### **2. What is Urbanization and explain its causes and the positive and ill effects of it.**

Urbanization is the process of movement of people from villages to towns and cities in search of employment. Growth of industries contribute to growth of cities. As a result of industrialization, people started moving towards cities in search of employment.

The causes of urbanization are

Industrialization - for better employment opportunities.

Social factors: attraction of cities, better standard of living, better educational facilities, need for status also induce people to migrate to cities.

Employment opportunities: In rural sector people have to depend mainly on agriculture for their livelihood. But as Indian agriculture is depending on monsoon, in drought situations or natural calamities, rural people have to migrate to cities.

Modernization: Urban areas are characterized by sophisticated technology better infra-structure, communication, medical facilities, etc. People feel that they can lead a comfortable life in cities and migrate to cities.

### **Positive effects:**

Efficiency: Cities are extremely efficient. Less effort is needed to supply basic amenities like

electricity and water. Research and recycling programs are possible only in cities.

Employment opportunities: Plenty of job opportunities in all sectors- banking, retailing, industries, IT, export companies, educational institutes, medical, Pharmaceutical, research and development.

Transport and communication facilities: easy connectivity to all locations. Good infrastructure and transportation facilities to reach any destination faster.

Educational facilities : schools, colleges, universities are established in cities to develop human resources.

Increase in the standard of living : Better health care facilities, advanced communication , high concentration of resources, access to social and cultural activities make city life sophisticated and comfortable.

Improvement in economy: High Tech industries earn big part of their money in dollars thus boosting country's economy

### Adverse effects

Problem of over population – this result in accommodation problem resulting in growth of slums.

Disintegration of joint families-Joint family can't be maintained in cities on account of high cost of living: People prefer to live in the nuclear type of families.

High Cost of living: it is very difficult for lower income groups to maintain a decent standard of living.

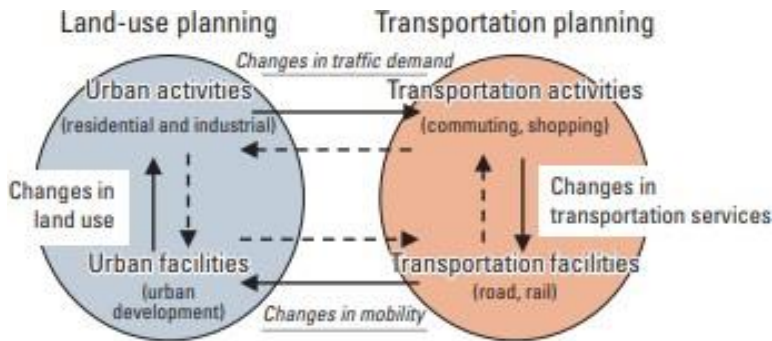
Increase in Crime rates: Urban areas are known for high rate of crimes. Theft, Dacoity, Murder, Cheating, Pick pocketing, rape etc. are common in urban localities.

Environmental impacts of urbanization

- Problem of Pollution: caused by industries or by excessive movement of vehicles.
- Rise in temperature: Due to construction of high rise buildings and apartments, industries lead to loss of vegetation, thus increasing temperature drastically.
- Water related issues: Ground water depletion due to high water consumption and water pollution due to industry effluents and improper dumping of waste generated from industries.
- Destruction of habitats: Urbanization causes deforestation. Areas that would have been the habitat for many animals and birds are destroyed for construction of buildings.

Stress: In cities employment of women is almost inevitable to meet the increasing cost of living. Changing role of women in the family creates stress in the family which may result in divorce or strained relations.

### 3. Explain the interaction between land use and transportation system.



**Figure 1. Relation between land use and traffic planning**

Land use means spatial distribution or geographic pattern of a place. Land use pattern of a city shall be residential, commercial, industrial, institutional, retail purpose, recreational. Transport is function of land use and vice versa. For a long run solution to traffic problems It is important to planning, guiding and controlling the pattern of land use. The pattern traced by traffic is closely related to the manner in which buildings with buildings are arranged.

Commuters' flows are dependent on location and size of workplace and home. School traffic is governed by schools and home areas. As the new systems of transport are built, the land-use patterns that follow has a close relation to the accessibility made possible.

Different pattern of land development result in different transport demand and in turn requires different transport system. The type of transport system provided also influence the pattern of land development.

Land use potential is a measure of scale of socio-economic activities that take place in an area. Land use has the ability to generate traffic. So, it is appropriate to relate the potential of land use to generate certain amount of traffic per day. The following table is a typical example for land-use potential.

Type of land/activity	Measure
Residential	Population, Dwelling units
Factories	Area, number of workers
Offices	Area, number of employees
Theaters	Seating capacity
Hotels	Floor area, number of rooms
Shopping center	Retail area, employees

#### 4. Define: Trip generation, trip distribution, trip assignment and modal split

##### Trip generation

Trip generation is the first stage in travel demand modelling. The trip generation aims at predicting the total number of trips generated and attracted to each zone of the study area. This stage answers the questions like how many trips originate at each zone, from the data on household and socioeconomic attributes.

##### Trip distribution

This is the 2nd stage in travel demand modelling

Trip distribution is a model of the number of trips that occur between each origin zone and each destination zone. It uses the predicted number of trips originating in each origin zone (trip production model) and the predicted number of trips ending in each destination zone (trip attraction model).

##### Modal split

This is the third stage in travel demand modelling. The modal split model determines the mode of travel chosen by the traveler. Modal split can be considered at any stage between trip generation and trip assignment.

##### Trip assignment

A trip assignment model aims to estimate how traffic flows through a road system and the associated effects of traffic on the system. These effects can be measured by a number of criteria including distance travelled, travel time, delay, fuel consumption and environmental pollution.

Trip assignment models can also be used to investigate the responses of traffic to changes in the system (for example, changes in travel demand, travelers' information, road capacities, signal timings, and road tolls).

Trip assignment is the procedure by which the route chosen by the trip maker is determined.

#### 5. Discuss how roadside interviews and registration number plate surveys are carried out

Roadside interview survey is one of the methods of carrying out a screen line or cordon line survey.

It can be directly done either by directly interviewing drivers of the vehicles at selected survey points or by issuing prepaid post cards containing questionnaire.

The survey points are selected along the junction of the cordon-line or screen line with roads. Cordons may be in the form of circular rings, rectangular grids or radial lines.

For small town with less population say less than 5000 single circular cordon at the periphery of the town should be enough.

The internal travel would be minimal for such a small area, external cordon survey in that case will Origin –destination data.

In case of medium sized cities, two cordon lines are necessary- one at the edge of study area and other around Central business district.

For large cities, the cordon lines and screen lines may be more complicated and home-interview technique cannot be dispensed with.

In such cases cordon line and screen line surveys by roadside interview technique serve to check the accuracy of home-interview survey data.

For roads with traffic in two directions, traffic in two directions will be interviewed at different times.

If the survey covers most of the day, it is sufficient to interview traffic in one direction only and assume that journey in opposite direction is same as that of direction interviewed.

As it is impractical to stop all the vehicles pass by, sampling is necessary. The number of samples depends on volume of traffic and number of interviewers.

To eliminate any bias in sampling, it is advisable to sample one in a fixed number of vehicles, viz one in every tenth or fifteenth vehicles etc.

Another simple method is to select the next vehicle as soon as each interview is completed.

Traffic flow should not be affected during survey

The interviewers don't have any power to stop vehicles. So they can take police's help.

One interviewer and an observer is posted at every survey station.

Observer will record the classified traffic flow concurrently at the time of interview.

Duration of interview is important. Survey is restricted to 16 hrs (0600-2200) or 12 hrs (0700-1900). Remainder of the day vehicular counts are made.

In order to eliminate any bias due to unusual conditions data are obtained during week days from Monday- Friday.

It is necessary to frame and design questions with care to get a reliable data from survey. Pre-printed forms are used to record the answers. Computer analysis will be faster.

Since the interviews are done by sampling basis, expansion factors are needed to calculate total number of trips.

Expansion factors are calculated separately for each class of vehicle for different time period.

If  $x_c$  = number of cars interviewed in a time.

$X_c$  = total number of cars counted in this time.





This survey also enables to estimate the number of local vehicles plying, which becomes the input for analyzing a financial Model and to arrive at feasibility of the road project.

The results of this analysis will form inputs for forecasting tollable traffic and toll revenue, deciding tolling strategy, developing capacity augmentation proposals.

The advantage of this survey is it does not interfere with traffic in anyway. But large number of observers are needed, and analysis of the result can be complicated.

Survey method:

Area to be surveyed is defined. Two observers are stationed. one will read out the number and the other one will record it. Actual time of entry and exit will also be noted to calculate the journey time. The type of vehicle (car, bus etc.) and full registration numbers are noted. If sampling is done due to heavy traffic, only numbers with pre-selected digits are recorded. A sample form of survey is shown below.

Sample Registration Number Plate Survey Form			
			Sheet No.
Site : Okhla		Weather : Overcast	
Observation point : Mathura Road .		Observer : BNG	
Movement Observed : Delhi-bound		Recorder : OPB	
Sheet starting time : 8-00 A.M.		Date : 24-1-76	
Sample :			
Registration Numbers ending with : all even numbers, including zero.			
Vehicle class : All			
Column Start Time			
8-00	8-05	8-10	8-15
DLQ 2660	DLX 742	JKN 528	UPS 584
DLM 2832	DLN 3856		PUN 4974
DLP 8486	HRP 9486		DLQ 948

The analysis consists of tallying the number of vehicles at entry and exit points. The movement of all sampled vehicles are determined, and traffic flow movement is determined by applying appropriate expansion factor. Expansion factor to be applied is based on the method of sampling adopted.

Registration number plate survey is cumbersome if done manually, hence use of computer is sought.

6. What is sampling and explain how is expansion factor applied in home-interview survey?  
Data collection is the first step in transportation planning. It involves collection of data on all factors that will influence travel pattern, existing transport facilities and inventory various

landuse and economic activities. It is practically impossible to collect full data pertaining to study area. Hence sampling is done. Sampling is a technique which is used to get information about a population by studying the characteristics of samples drawn from the population. For example, in home interview survey, population is the set of all dwelling units in a study area and sample is the set of dwelling units where interviews are conducted. The accuracy of the information obtained from sampling increases as the size of the sample increases.

There are different types of samples such as random samples, sequential sample, systematic samples, stratified samples.

Commonly used is random samples. In this method, sampling is done in such a way that each member of population has the same chance of being chosen.

Expansion factor is used in order to derive the travel characteristics of entire population from the data derived from sampling.

For home interview surveys, the expansion factor is calculated as follows

$$\text{Expansion factor} = \frac{A - \frac{A}{B} \left( C + \left( \frac{C}{B} \right) D \right)}{B - C - D}$$

Where

A= Total number of addresses in the original list

B= Total number of addresses selected as original sample C= Number of sample addresses that are ineligible

D= number of sample addresses where no response is obtained.

### **Home interview surveys:**

Most Reliable type of survey for collection of origin and destination data.

Done to know the travel pattern of household and the general characteristics of house hold influencing trip making.

The information on travel pattern includes number of trip made, purpose of trip, origin and destination.

The information on Household characteristics include age, sex, vehicle ownership, number of drivers, family income, and type of dwelling unit.

Based on this information it is possible to relate the amount of travel to household and zonal characteristics and develop equation for trip generation rates.

Since wide variety of data has to be collected, it involves high cost. It is necessary to

standardize the survey procedure. Such procedure is done by Bureau of public road manual which set guidelines for how interviews to be conducted and information to be collected.

It is impractical to interview all the residents of the study area. Since travel pattern tend to be uniform in a particular zone, it is sufficient to employ the sampling procedure.

Sample size is based on study area and the following table gives the minimum sample size for home interview survey.

Population of study area	Min. sample size
Under 50000	1 in 10 households
50,000-1,50,000	1 in 20 hh
1,50,000-3,00,000	1 in 35 hh
3,00,000-5,00,000	1 in 50 hh
5,00,000- 10,00,000	1 in 70 hh
Over 10,00,000	1 in 100 hh

The sample is selected from the register of voters list.

Techniques for home interview

2. Full interview technique- interviewing as many members of household as possible and directly recording all the information. Yields accurate data. Expensive.
3. Home questionnaire- interviewer collects only the detail of HH characteristics, leaving forms with residents to complete travel information and the completed forms may be collected by the interviewer after one or two days. Not very accurate as that of full interview.

Prior notice should be given to residents about the interview. Also wide publicity is given about the survey in local press, newspapers, radio and television.

4. Telephonic interview – this method is successful only when there is high telephone ownership.
5. Postal survey – response may not be good inspite of publicity.

The information to be collected form home-interview

**a. Household information**

- Address
- Age and sex
- Occupation
- Place of work
- Number of motor vehicles owned
- Income

**b. Journey information**

- Info about journey made in past 24 hours including origin and destination of journey
- Purpose of trip

➤ Mode of travel

