Internal Assessment Test –II Oct 2018
Solution

Sub: Urban Transport Planning **Code:** 15CV751

Sem: VII **Branch:** CIVIL

1. Write in detail the procedure for conducting home interview surveys.

Home-interview survey

Home-interview survey is one of the most reliable type of surveys for collection of origin and destination data. The survey is essentially intended to yield data on the travel pattern of the residents of the household and the general characteristics of the household influencing tripmaking.

The information on the 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 type of dwelling unit, number of residents, age, sex, race, vehicle ownership, number of drivers, family income and so on. Based on these data it is possible to relate the amount of travel to household and zonal characteristics and develop equations for trip generation rates.

It is impractical and unnecessary to interview all the residents of the study area. Since travel patterns tend to be uniform in a particular zone. The size of the sample is usually determined on the basis of the population of the study area. And the standards given by the Bureau of Public Roads as shown in below table.

Standards for Sampling Size for Home-interview survey

Population of Study Area	Sample Size
Under 50,000	1 in 5 households
50,000 – 150, 000	1 in 8 households
150,000 – 300,000	1 in 10 households
300,000 – 500,000	1 in 15 households
500,000 – 1,000,000	1 in 20 households
Over 1,000,000	1 in 25 households

The usual procedure is for an interviewer to call on a household on a scheduled data and to leave a copy of the home interview questionnaire. This questionnaire is broadly divided into :

a) General household characteristics – number of residents, vehicles owned, income, dwelling type.

b) Characteristics about family members – occupation, sex, age.

c) Individual travel information – trip origin and destination, purpose, land – use, travel time and transport mode.

Once the questionnaire is ready, the next step is to conduct the actual survey with the help of enumerators. Enumerators has to be trained first by briefing them about the details of the survey and how to conduct the survey. They will be given random household addresses and the questionnaire set. They have to first get permission to be surveyed from the household.

They may select a typical working day for the survey and ask the members of the household about the details required in the questionnaire. They may take care that each member of the household should answer about their own travel details, except for children below 12 years. Trip details of children below 5 years are normally ignored. Since the actual survey may take place any time during the day, the respondents are required to answer the question about the travel details of the previous day. There are many methods of the administration of the survey and some of them are discussed below:

1. Telephonic: The enumerator may use telephone to an appointment and then conduct detailed telephonic interview. This is very popular in western countries where phone penetration is very high.

2. Mail back: The enumerator drops the questionnaire to the respondent and asks them to fill the details and mail them back with required information. Care should be taken to design the questionnaire so that it is self explanatory.

3. Face-to-face: In this method, the enumerator visits the home of the respondent and asks the questions and fills up the questionnaire by himself. This is not a very socially acceptable method in the developed countries, as these are treated as intrusion to privacy. However, in many developed countries, especially with less educated people, this is the most effective method.

2.   Give a brief description of UTPS approach.

Sequential models view the travel as an interlinked chain of decisions having a definite sequence. This can be described as how much travel, from where to where, through which mode and through which route.

The analysis and the model building phase starts with the step commonly known as *trip generation*. This is the term used in the transportation planning process to include the estimated number of trips that end in a given area (i.e., how much travel; for example, either from homes or workplaces). The objective of the trip generation stage is to understand the reasons behind the trip-making behaviour and produce mathematical relationships to synthesise the trip-making behaviour and analyse the trip-making pattern on the basis of observed trips, land use data and the household characteristics.

Second stage is *trip distribution* or *interchange*. In this stage, the spatial interchange of trips is modelled (from where to where). Trip distribution modelling is done based on the observed interchange pattern, with land use and accessibility as independent inputs.

Third stage is related to *modal split* (which modes are used). This depends upon the observed relationship between modes used in relation to personal characteristics, trip characteristics and mode characteristics. The modal split analysis may also be taken up at the second stage, i.e., after trip generation stage.

The last stage in sequential demand modelling is *traffic assignment* (i.e., the route chosen). In this stage, the movement pattern of the trips is generated on the basis of certain network criteria and then the trips are assigned according to these criteria. This results in loading of trips into an identified network, showing the usage of links with respect to their practical capacities.

Thus, at the end of the process which is also known as the *urban transport planning system (UTPS)*, the output is in terms of the usage of transport network and system, which can be analysed against the supply and policy measures needed for planning

3.   Write in detail about inventories of existing conditions.

The conduct of urban transport planning study finally results into a set of recommendations for the development of present and future transport infrastructure to meet the present and future travel demand. The recommendations for the expenditures of public funds must

obviously be based upon the detailed economic and financial analysis. To obtain a measured understanding of the subject, inventories and data collection are undertaken. The required data on road network, travel and traffic, economics, finance and engineering may be available through the concerned departments and agencies. Specially designed studies and surveys are often undertaken to collect the following basic data required for urban transport planning. Road inventory data can be collected as a part of primary survey.

Traffic data

Studies are undertaken to obtain knowledge of the type and volume of the base year traffic to project future travel demands. The following information is collected:

1. Traffic census counting number of vehicles and volume yearly, monthly, weekly or hourly
2. Type of traffic such as trucks, buses, cars, tongas, etc.
3. Nature of traffic (heavy at certain times of the day)
4. Purpose of trip (business, official, recreational, educational, etc.)
5. Origin and destination-where a trip starts and where it ends
6. Speed of traffic
7. Conditions of vehicles
8. Accident records
9. Miscellaneous information such as axle load, type of tires, etc.
10. Parking supply and demands
11. Special surveys and data on bus passenger service, taxi users and passenger fare.
12. Commercial vehicles and their utilisation

Economic data

Economic data determine the economic status and development of the locality. These include information on
1. Dispersal and location of the population
2. Towns and villages classified on population basis
3. Location of existing industries and sources of material
4. Anticipated future development of industries
5. Classification of area as agricultural, semi-agricultural and non-agricultural
6. Location of marketing centres, size and goods sold
7. Number of people going to market and industry, etc. and their mode of transportation
8. Per capita income of people living in the area

This information helps in planning road system based on its population, development, mobility and economic life of the people.

Financial planning data

This data [4] concerns itself with the financial aspects such as allotment of funds, compilation of statistics for income from different roads, study of the sources of revenue and expenditures incurred under different heads of transportation improvement. Any organisation must review its ability for transportation development programme as a part of comprehensive transportation planning. Accordingly, any transportation improvement plan developed should be seen against the available fund allocated and costing may be done as per the fund allocation. It remains for the transportation authority to review or examine the past expenditures and financial situation to assess the ability in order to attain the desirable level of service. To help local authority in assessing the present situation, certain financial data

should be collected and analysed as a part of transportation study. These data may be classified as:

1. Fund allocation statistics: It covers the following:

(i) Allocation of funds to different roads/other transport projects and regions

(ii) Priority establishment keeping in view the political and financial obligations, traffic demands, etc.

2. Expenditures incurred: This involves

(i) Total expenditures on transportation facilities by the type of facility

(ii) Capital expenditure on transportation facilities by the type of facility

(iii) Total expenditures on other municipal sectors

3. **Cost of capital programmes:** This involves cost of capital programmes in municipal sectors.

Engineering data

The engineering data includes

1. Topography of the area under study
2. Types of soil
3. Available materials of construction
4. Methods of construction and maintenance of transport facilities
5. Drainage problems
6. Availability of labour
7. Road life cycle studies, etc.
8. After collecting the basic data, relationship among the land use, transport system and the resulting travel pattern is analysed and quantified by using statistical as well as mathematical modelling techniques.

4. (a) Write short notes on Commercial Vehicle survey. (5 marks)

A survey of non-residential land uses could be designed to collect information on goods movements, but transport resources are rarely allocated to such an ambitious project. Instead, urban freight flows are usually measured indirectly from commercial vehicle survey.

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

Typical Form for Commercial Vehicle Survey

Firm/Owner	Visit 1	Time	Date	Interviewer's Name	Sheet of
Address	2 3	Comments:			Ser. No.
Person Interviewed	4 5				Zone No.
Telephone No.					

Part I. Business Information

A. Nature of Business   Male/female

B. Total Number of employees

C. Number of vehicles operating from address

Cars   Parked on premises   Parked elsewhere

Light Goods   Parked on premises   Parked elsewhere

Heavy Goods   Parked on premises   Parked elsewhere

D. Day of travel

E. Total number of trips made on day of travel

F. Type and number of vehicles interviewed

      Vehicle No.

      Vehicle Reg. No.

Part II. Vehicle Trip Information

G	H	I	J	K	L	
					Time of Trip	
Vehicle Type	Vehicle Number	Trip Number	Origin Address	Destination Address	Start AM PM	Finish AM PM
		Nature of Business:		Nature of Business:		
					AM PM	AM PM
		Nature of Business:		Nature of Business:		

4. (b) Write short notes on various techniques adopted for sampling.

Cluster method It refers to the collection of samples by grouping different areas/zones into homogenous groups like slums, tenements, independent houses or areas with low level of development, normal development and well developed.

Time cluster sampling: This method of sampling allows the interviewers to conduct interviews with the means that within one time interval, vehicles coming from either of one direction of the road will be considered for surveys alternatively. The same number of interviewers conducts O-D survey in one direction. At the same time, no O-D survey is conducted in the other direction of the traffic flow.

Volume cluster sampling: In this procedure, the number of vehicles to be interviewed is predetermined on the basis of sample sizes already selected. Therefore, the remaining vehicles can be allowed to pass through the area without being interviewed.

Variable rate sampling: Transport Research Laboratory, UK developed this sampling technique which is generally used at the cordon point survey. In this procedure, the sample

size varies according to the magnitude of traffic. In order to ensure the adherence to sample size, the interviewers have to be employed at constant rate.

Quota sampling

It is used when it is proposed to restrict the number of samples. The number of households to be surveyed in each zone is fixed and same adopted for all zones. Within this number, the investigator should choose households to represent different socio-economic levels and vehicle owners.

5. (a) Write short notes on **Growth Factor model:**

Growth factor modes tries to predict the number of trips produced or attracted by a house hold or zone as a linear function of explanatory variables. The models have the following basic equation:

$$T_i = f_i t_i \tag{7.1}$$

where T_i is the number of future trips in the zone and t_i is the number of current trips in that zone and f_i is a growth factor. The growth factor f_i depends on the explanatory variable such as population (P) of the zone , average house hold income (I) , average vehicle ownership (V). The simplest form of f_i is represented as follows

$$f_i = \frac{P_i^d \times I_i^d \times V_i^d}{P_i^c \times I_i^c \times V_i^c} \tag{7.2}$$

where the subscript " d" denotes the design year and the subscript "c" denotes the current year.

(b) Write short notes on "Zonal Regression Model".

Zonal regression Model :

In this case an attempt is made to find a linear relationship between the number of trips produced or attracted by zone and average socioeconomic characteristics of the households in each zone. The following are some interesting considerations:

1. Zonal models can only explain the variation in trip making behaviour between zones. For this reason they can only be successful if the inter-zonal variations adequately reflect the real reasons behind trip variability. For this to happen it would be necessary that zones not only had a homogeneous socioeconomic composition, but represented as wide as possible a range of conditions. A major problem is that the main variations in person trip data occur at the intra-zonal level.

2. Role of the intercept. One would expect the estimated regression line to pass through the origin; however, large intercept values (i.e. in comparison to the product of the average value of any variable and its coefficient) have often been obtained. If this happens the equation may be rejected; if on the contrary, the intercept is not significantly different from zero, it might be informative to re-estimate the line, forcing it to pass through the origin.

3. Null zones. It is possible that certain zones do not offer information about certain dependent variables (e.g. there can be no HB trips generated in non-residential zones). Null zones must be excluded from analysis; although their inclusion should not greatly affect the coefficient estimates (because the equations should pass through the origin), an arbitrary increment in the number of zones which do not provide useful data will tend to produce statistics which overestimate the accuracy of the estimated regression.

4. Zonal totals versus zonal means. When formulating the model the analyst appears to have a choice between using aggregate or total variables, such as trips per zone and cars per zone, or rates such as trips per household per zone and cars per household per zone. It is important to remark that even when rates are used, zonal based regression is conditioned by the nature and size of zones (i.e. the spatial aggregation problem). This is clearly exemplified by the fact that inter-zonal variability diminishes with zone size.

6. Write in detail about the procedure for road side interview survey.

Road-side interview survey is one of the methods of carrying out a screen-line or cordon survey. The road side 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, radial lines of rectangular grids. For small towns, say with a population less than 5000, single circular cordon at the periphery of the town should suffice. The internal travel being light, the external cordon survey in that case will give the origin-destination data. In the case of medium sized cities, say with a population in the range 5,000 to 75,000 two cordon lines a necessary, the external cordon at the edge of the urban developme and the internal cordon at the limits of the central business distri Road side interviews at the intersection of roads with these t cordon lines should be able to fairly assess the patterns of trave such cities. For large cities, the cordon-lines and screen lines ma more complicated, and the home-interview technique cannot dispensed with. Cordon line and screen line surveys by the road interview technique serve to check the accuracy of the h interview survey data.

For dual carriageways or roads with very little traffic the tr in both the directions is dealt with simultaneously. In other cases traffic in two directions will be interviewed at different times. I in one direction only and to assume that the journeys in the opposite direction are the same as in the direction interviewed.

It is impractical to stop and interview all the vehicles. Sampling is, therefore, necessary. The number of samples depends on the number of interviewers and the traffic using the road. It may become necessary to vary the sampling rate at the traffic flow changes during
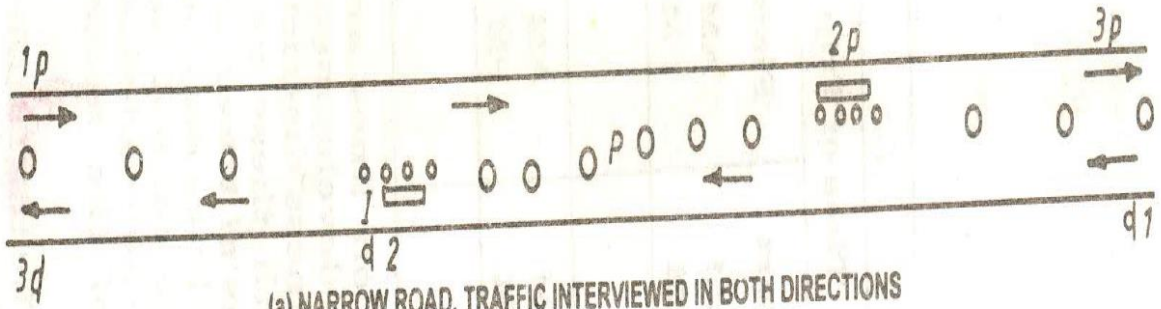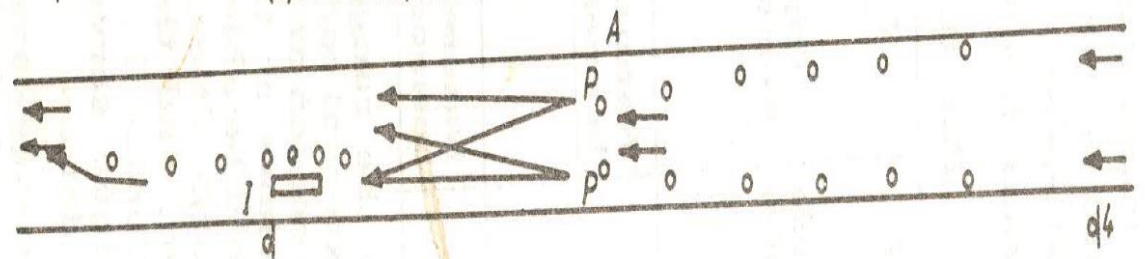
(a) NARROW ROAD, TRAFFIC INTERVIEWED IN BOTH DIRECTIONS

SIGN TYPE	MESSAGE
1.	TRAFFIC SURVEY - PLEASE STOP AHEAD
2.	STOP HERE FOR INTERVIEW
3.	THANK YOU FOR TROUBLE
4.	TRAFFIC SURVEY - PLEASE STOP IF REQUIRED
5.	TRAFFIC SURVEY - DRIVE WITH EXTRA CARE
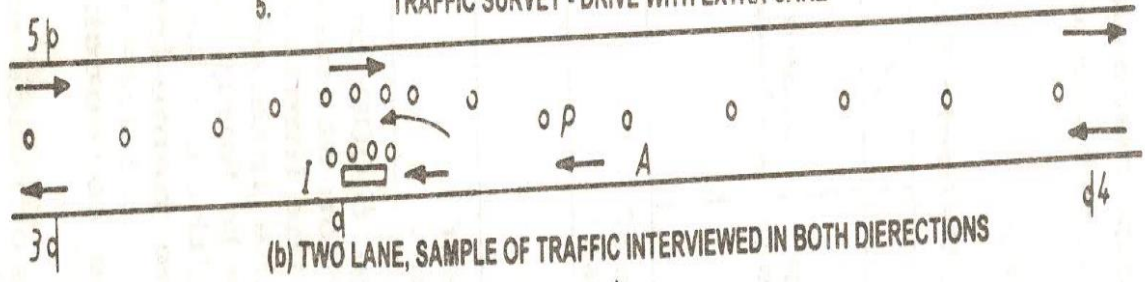
(b) TWO LANE, SAMPLE OF TRAFFIC INTERVIEWED IN BOTH DIERECTIONS

LEGEND
I INTERVIEWER
P POLICEMAN
o TRAFFIC CONES
d TEMPORARY ROAD SIGNS
▭ VEHICLE IN INTERVIEW BAY
A LINE AT WHICH TRAFFIC IS SAMPLED

2 or MORE LANES IN ONE DIRECTION,
SAMPLE OF TRAFFIC INTERVIEWED

the different parts of the day. Sampling methods should eliminate any element of bias. A convenient method is to sample one in a fixed number of vehicles. *viz.* every tenth, fifteenth or twentieth vehicle etc. Another simple method is to select the next vehicle as soon as each interview is completed.

Since interviews may last for several minutes, vehicles must be stopped in a interview bay so that traffic flow is not obstructed. Suitable advance warning signs should be erected. Some typical layouts for road side interview surveys are illustrated in Fig. 30·2.

The interviewers have no statutory powers to stop the vehicles and question the drivers. This makes it necessary to seek the help of the police to control and direct the traffic for being interviewed.

In addition to at least one interviewer at each survey station, an observer is posted to record the classified traffic flow concurrently with the period of interviewing.

The period and duration of the survey are important matters that need careful prior thought. A 24 hours count will not normally be needed, and the survey is often restricted to 16 hour (0600–2200 hours) or 12 hours (0700–1900 hours) in a day. For the remainder of the day, vehicular counts are, however, made. In order to eliminate bias due to unusual conditions on any particular day, it is the practice to obtain data for each week day (Monday-Friday).

For complete and reliable data to be obtained by the survey, it is necessary to frame and design the questions with care. The enumerators must also be given adequate training and instructions to avoid ambiguity in the answers and to ensure uniform pattern of data from different enumerators. Pre-printed forms are used to record the answers. A sample form used for the purpose is given in Table 30·6.

It will be seen from the sample form in Table 30·6 that coding of data will be an advantage.

The analysis of the data by computers will be easy. Since the interviews are done by sampling basis, expansion factors are needed to calculate the total number of trips. These expansion factors will be calculated separately for each class of vehicle and for different time periods (half-hour etc.) Thus if x_c represents the number of cars interviewed in a particular time period, and if X_c is the total number of cars counted during this time period, then the expansion factor is X_c / x_c.

Road side interview is an economic method of survey and yields accurate and reliable data. The disadvantage with the method is that vehicles are delayed when being interviewed.

Sample Roadside Interview Form

| Day | Wet | Separate Yes... | | | Sheet |
| Date | Dry | Count ? No... | | | No. |

Site				Private	Sample	Total
Direction				Bus		
Half-hour starting at				Goods		

Veh. Type	No. of occupants	Last Stop	Next stop	Last land use	Next land use	Trip purpose

Vehicle Type	Land use	Trip purpose
0. Motor cycle	0. Residential	0. To work
1. Car	1. Hotel, guest house, Restaurant	1. Work to home
2. Taxi	2. School, College, University	2. Others to home
3. City Bus	3. Offices	3. Shopping
4. Light Commercial	4. Shops, markets	4. Business (own or employed)
5. Heavy Commercial (truck)	5. Industrial, docks, utilities	5. Personal affairs
6. Passenger Vehicle (truck)	6. Hospitals, doctors	6. School
7. Country Bus	7. Cultural recreational and other	7. Eat meal
	8. Police, military, fire stations	8. School/recreational
	9. Transport terminals, bus stops	9. Serve passenger