QUESTION NO. 1

WHAT IS PLANNING?

It is an activity or process that examines the potential of future actions to track an event or system towards a desired intended direction which occurs in the present having objectives to obtain pre-defined future goals. In Transportation Engineering it is related to the operations of the highway system, its geometry and traffic movement in order to ensure better mobility of public and goods to achieve the sustainable economic goals.

SCOPE OF TRANSPORTATION PLANNING:

All projects should start with a comprehensive plan. The more significant the project, the more intensive and long term planning is desired to carry out for its successful implementation.

FUNDAMENTAL ASSUMPTIONS IN TRANSPORTATION PLANNING:

The following assumptions are made for achieving the product of better planning models while designing a highway project.

1. Travel patterns may be tangible, stable and predictable.
2. Movement demands are directly related to the distribution and intensity of land use which is capable of being accurately determined for future.
3. Decisive relationship exists between all modes of transport and that the future role of a particular mode cannot be determined without giving consideration to all other modes.
4. The transportation system influences the development of an area as well as serving that area.
5. Area of continuous urbanization requires a region-wide consideration of transport situation.
6. The transportation study is an integral part of the overall planning process and cannot be considered in isolation.
7. The planning process is continuous and requires continuous updating, validating and amendment.

STUDIES IN STRATEGIC TRANSPORTATION PLANNING:

Various studies are carried out in strategic transportation planning, few of them are explained as under:

(1) SHORT & MEDIUM TERM TRANSPORTATION PLANNING (S&M)

For efficient transportation planning short term and medium term models may be developed to enhance the capacity and efficiency of existing system. In order to ensure the same we must reduce vehicle use in congestion, to improve the transit service and internal management.

Planning with short range objectives based upon studies with limited scope and local orientation. Evaluation Criteria can be accidents, travel time etc.

(2) TRAFFIC VOLUME COUNTS:

In this method numbers of vehicles passing a point are counted and it is comprehensive in nature covering the entire main road system in an area. Counts on all roads are made which intersecting a cordon line that encircles a particular area. Specific points are selected for counts on different roads and the information to be collected are traffic volume with direction, volume of turning traffic at intersections, hourly, daily and seasonal variations of traffic and proportion of cars, trucks and busses.

(3) ORIGIN & DESTINATION SURVEYS:

A traffic count gives the amount of traffic passing a specified point on the road but it could not mention the origin and destination of that particular traffic. Therefore, O&D study is conducted. The O&D survey is primarily done for transportation planning and particularly for the design and programming of new or improved highway facility. An origin and destination survey may range from a relatively simple study to determine the amount of traffic that would by-pass a town to a comprehensive transportation survey for planning and design of the transportation system in a large metropolitan area. Survey is carried out by various methods such as recording registration numbers, handing postcards to drivers, roadside interviews tag-on-vehicle surveys and home interview surveys.

(4) SPEED STUDIES:

In speed studies we use a radar meter which gives us direct reading of speed of vehicle moving on a specified highway meant for future planning. Photographs of a section of road at a predetermined time interval are taken with cameras fitted and the distance is measured. The overall results is compiled and presented in tabular form, graphical animations and diagrams. Few useful models are Speed distribution and cumulative frequency distribution curves, mean speed (TMS & SMS) and 85^{th} percentile Speed.

(5) TRAVEL TIME AND DELAY STUDIES:

Travel time is a very useful tool that measures the average journey time and journey speed on various sections which are predefined for the purpose of planning. This technique is used in traffic assignment, quality of the traffic route and effect of traffic engineering techniques before and after. Delay study is employed for the location and cause of the congestion identification and for finding out its remedial measure.

(6) PARKING STUDIES:

Parking studies are carried out to take assistance in cordon counts the number and location of existing parking spaces both kerbs side and off-street. It is also used for the existing parking practices including usage of

available spaces, parking duration and to minimize illegal parking in the area. Parking time limits are determined by using this model and how n where to install parking meter may easily be identified. For larger cities a comprehensive parking demand study is required which includes the determination of parking usage, parking habits as well as the origin and destination and purpose of trip of drivers parking in the area.
Survey is carried out in the form of questionnaire cards or direct interviews in the proposed areas for parking lots.

(7) OTHER TRAFFIC STUDIES:

- Turning movement counts
- Vehicle delay studies
- Saturation flow rate
- Queue lengths
- Gap study
- Vehicle occupancy study
- Commercial vehicle survey
- Trip generation study

QUESTION NO. 2

WHAT ARE THE BASIC ACTIVITIES IN CONVENTIONAL TRANSPORTATION MODELING?

Following activities are considered for transportation planning which may be based for four step conventional modeling.

(1) Travel information collection from the proposed planning area
(2) Identification of the different performance levels from the existing system
(3) Estimation of future travel demand
(4) Performance level forecasting for future system.
(5) Identification of different alternative solutions

STRATEGY FOR PLANNING OR WHAT SHOULD BE THE STUDY AREA:

Following guidelines may be adopted for planning transportation modeling.

- Clearly define the area under consideration
- May be country
- May be regional
- Metropolitan area
- Overall impact to major street/highway network
- Local
- Divide study area into study zones, TAZs (Travel Analysis Zones)
- Homogenous urban activities (generate same types of trips)
- Residential
- Commercial
- Industrial

WHAT IS TRAVEL ANALYSIS ZONE (TAZ)

This is basically zoning of area in specific model having defined area for analysis of various parameters. The particular zone may be as small as one city block or as large as 10 sq. miles. It should have natural boundaries in order to simplify the analysis that is major roads, rivers; airport boundaries in order to ensure only 10-15% of trips may be intra zonal. Links may take as sections of roadway and nodes may be the intersection of those roads. Centroid connectors are centroid to roadway network where trips load onto the network.

FOUR STEP CONVENTIONAL TRANSPORTATION MODELIONG:

The second stage of the transportation planning process is to use the collected data to build up a ***Transportation Model***. This model is the key to predicting future travel demands and network needs.

Model is derived into following four steps.

(1) Trip Generation
(2) Trip Distribution
(3) Traffic Assignment
(4) Model Split.

Trip Generation:

The first stage of model building process is that of trip generation. Trips are made for a variety of purposes and for various land uses. For convenience, trips are often split into two groups:

(i) Home-based trips:

Such trips have one trip end at the home of the person making the trip, which may be either the origin or destination of the given trip.

(ii) Non-home-based trips:

These have neither origin nor destination trip-end at the home of the person making the trip.

This initial part of the transport model expresses trip-making relationships in a mathematical form so that ultimately we can calculate the total number of trips-ends originating from the defined survey zones.

Multiple regression technique is often used to calibrate a trip-generation model incorporating the above household variables. This model takes the following general form:

$Y = a + b_1 x_1 + b_2 x_2 + \ldots\ldots + b_n x_n$

Where Y = number of trips (by mode and purpose) generated in a given zone

a = constant term

$b_1 \ldots b_n$ = regression coefficients relating to independent variables (e.g. household income, car-owner- ship, house-hold structure, etc.)

Trip Distribution:

This is the next stage in the transportation model; it involves an analysis of trips between zones. It is the function of trip distribution to calculate the number of trips between one zone and another, given the previously determined numbers of trip ends in each zone together with further information on the transport facilities available between these zones.

For example, given that in zone I, g_i trip ends are generated and that in zone j, a_i trip ends are attracted, it is the purpose of the trip distribution model to determine the number of trips (t_{ij}) which would go from zones i to zone j. That is, the trip distribution model calculates the proportion of trip ends generated in zone i which would travel between i and j and so take up a certain proportion of the available attractions in zone j.

$T_{ij} = t_{jj} \times E$

Where T_{ij} = future flow from zone i to zone j

t_{jj} = base year flow from zone i to zone j

E = agreed expansion factor

Traffic Assignment:

The third stage of the modeling process is that of traffic assignment. It is necessary to define the transport network and determine criteria for route choice through the network. Using the inter-zonal trip matrix as the input data, trips are assigned to this network.

When future trip levels are assigned it is possible to assess deficiencies in the existing transport network and so determine a list of construction priorities. Network description refers to the process where the highway network is broken down into links and nodes. For each link, data is required on its length, road type, and vehicle travel time and traffic capacity. When coding the road network, links are usually identified by the node numbers at each of its ends. In addition to such route-intersection nodes, zone-centroid nodes are also defined. In the assignment process, all traffic originating in a particular traffic zone is assumed to be loaded on to the network at this latter type of node.

For deriving minimum route paths through the network, it is normally assumed that travellers choose the path, which minimizes travel time. This applies for both private and public transport journeys.

A more recent and more realistic assignment procedure is that of capacity restraint. This may be used, with or without diversion curves, for assignments to road and public transport networks. After the initial assignment to the given network, new travel times are calculated for each link. New minimum path trees are then calculated and the assignment procedure reiterated.

The assignment stage of the transportation model therefore is the process by which trips are assigned or loaded on to the road network.

Model Split:

This term is used to describe the phase where the choice of travel mode is incorporated into the model. The main purpose of the model-split stage is to determine the trip shares of public, as against private, transport.

Question No.3

Given Data:

Land use category		Area (Ha)						
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Residential		7740	24900	17064	40204	29317	576416	53445
Commercial	Retail	6972	5688	26220	6172	126091	15270	1290
	Wholesale	14940	10744	20976	7715	90065	7635	1935
	Services	5976	2528	1748	6172	162117	10180	1720
Manufacturing		1290	4980	1264	1748	4629	36026	12725
Transportation		1935	8964	5688	5244	4629	90065	10180
Public Buildings		2580	9960	4424	6992	3086	252182	30540
Public open space		3010	22908	15800	71668	92580	468338	114525

Required:

(1) Trip generations of each zones
(2) Attractions of each zones

Solution:

Seven Zones are given in table showing area of each zone in HA units. Here, we assume each district as an independent zone.

Part No: 1

To calculate the Trip Generations of each Zone:

Adding column of zone 1 & others we will get the following values:

(1) Zone 1 : 13739915
(2) Zone 2 : 9970972
(3) Zone 3 : 21764784
(4) Zone 4 : 12420039
(5) Zone 5 : 125624585
(6) Zone 6 : 54192288
(7) Zone 7 : 4409720

To calculate the Trip Productions*:*

Now, by putting residential value of each zone

(1) Zone 1 : 990720
(2) Zone 2 : 2689200
(3) Zone 3 : 1586952
(4) Zone 4 : 3015300
(5) Zone 5 : 1612435
(6) Zone 6 : 25938720
(7) Zone 7 : 2030910

Part 2:

To calculate the Trip Attractions:

Adding all except residential value

(1) Zone 1 : 12749195
(2) Zone 2 : 7281772
(3) Zone 3 : 20177832
(4) Zone 4 : 9764739
(5) Zone 5 : 124012150
(6) Zone 6 : 28253563
(7) Zone 7 : 2378810

Solution in Tabulated form is given as under:

Land Use Category		Area (Ha)						
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Residential		990720	2689200	1586952	3015300	1612435	25938720	2030910
Commercial	Retail	5926200	2406024	14761860	4135240	58380133	7405950	490200
	Wholesale	2016900	966960	2412240	563195	5403900	366480	77400
	Services	2659320	65224	882740	2376220	59172705	3440840	564160
Manufacturing		455370	911340	104912	127604	254595	1909378	445375
Transportation		141255	224100	199080	131100	60177	1621170	152700
Public Buildings		1535100	2639400	1659000	1713040	277740	12104736	305400
Public Open Space		15050	68724	158000	358340	462900	1405014	343575