Iqra National University Peshawar

Transportation Planning and Management

PAPER

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ANSWER NO 1

1. **Introduction**

Planning: It is the process of development of strategic for achievement of targeted goals, solution of problems and facilitation of practical steps.

2. **Planning studies and methods**.

- Antecedent to planning studies
- Planning for future needs
- Large-scale Urban Travel Surveys
- Travel-Demand Forecast

3. **Planning Issues / Limitations**

- Transportation and Land use
- Operational Land-use Models
- Project, System, and Operational Planning
- Planning at the statewide Level

4. **Conclusion**

References:

Planning:

It is the process of development of strategic for achievement of targeted goals, solution of problems and facilitation of practical steps.

A Planner works for future development, predicts the future and provides guidelines to achieve that.

Planning studies and methods:

Transportation planning is a part of institutionalized procedures to conduct supportive planning studies that assist in the modeling and estimation of the many travel, economic , social and environmental factors that are essential to transport planning Below is a brief description of the studies carried out in the scopes of transport planning and the various limitation / issues comforting transportation planning.1.2:

Antecedent to planning studies: The contemporary transportation planning methodology can be traced back to three developmental steps.

First Step:

Land surveys conducted for layouts of cities and towns, canals and rail roads.

Second Step:

The conduction of facility inventories, such as the first national inventory of 1807.

Third Step:

The creation of Office of road inquiry towards the end of 19th century. It assisted data collection for information about futility use i-e traffic levels, trip lengths end user costs.

1.3 Planning for future needs:

In 1930 and 1940, there was a breakthrough in the recognition of continues efforts to predict future demands for travel in planning highway network extension. This was achieved by projecting the current traffic measurements into the future.

1.4 Large-Scale Urban Travel Surveys:

More advanced techniques were adopted owing to the significant differences in the patterns of Urban travel, Street capacities in cities involve multiple routes. To obtain a broader data base, new techniques of travel survey and data reduction were developed in 1940. For instance, the Origin-and-Destination (O-D) surveys. These consisted of home interviews and trucks interviews parking surveys. Detroit was the first to conduct such large scale survey. Today travel surveys have become indispensable tool for planning.

1.5 Travel-Demand Forecasts:

In contrast to the initial techniques of projections, the planning has become customized throughout the regions depending on the specific types (residential, commercial or industrial) and intensities (residential density, workers per area shopping floor space etc.) and the land uses found in each zone. The first computer-based quantitative land use and socioeconomic projection.

Models were developed by transportation planners in this connection followed by others. Mathematical trip-generation models were introduced.

Model split Models divided the commutative flows between the two modes of highway and transit. The model of arterial street traffic and freeways was extended and became known as Traffic Assignment Models. Consequently, trip generation, trip distribution, mode choice and traffic assignment models evolved.

The Chicago Area Transportation Study (CATS) led the way in bringing together land-use and socio-economic projection models with these travel demand models to analyze regional long-range transportation alternatives.

Given below are the steps involved.

Step I:

Forecasts of the regional populations and economic growth for the intended metropolitan area and target year.

Step II:

Allocation of land uses and socio-economic projections to individual analyses Zones according to land availability, local Zoning, and related public policies.

Step III:

Specification of alternative transportation plans, partially inclined to the results of both prior steps i-e A and Z.

Step IV:

Specification of capital and maintenance costs for each plan.

Step V:

Application of calibrated demand-forecasting models.

Step VI:

Conversion of equilibrium flows to direct user benefits.

Step VII:

Comparative evaluation and selection of the best alternatives analyzed based on estimated costs.

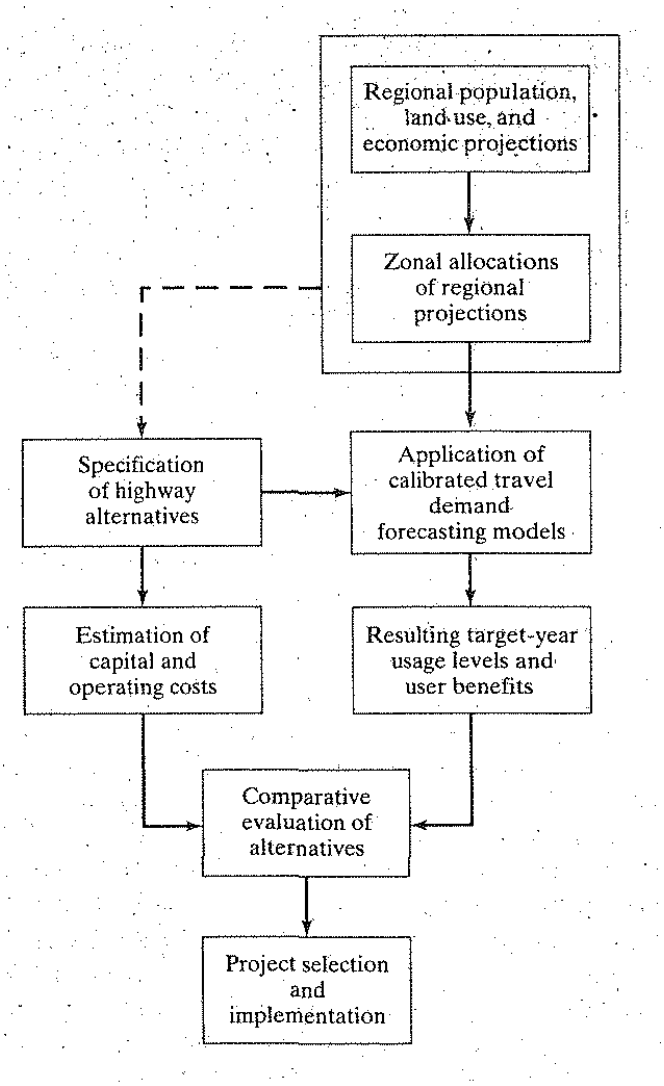


Fig 7.4.2 from book.

Planning Issues / Limitations:

Certain issues prevailed in transportation planning in 1960s and early 1970s. The prevailing issues were:

- Joint transportation and land-use planning
- The treatment of uncertainty
- The problems of coordinating long range and on-going planning
- Transportation and land use:

There is a close relation between transportation and land use and it is known for centuries.

An understanding of this is manifested in the principles of the city practical approach. Today zoning maps are accompanied by zoning ordinances and other land-use policies are the base tools of this approach. Additionally, major changes in land development policies take place in response to changing economic, social and political conditions. The land use and transportation planning practice begun in California.

- Operational Land-Use Models:

  Land use allocation models were primarily used to give input to the travel demand forecasting models Lowry model 1964 was the most noticeable. This model views metropolis as consisting of three sectors: the basic (or export) sector, the nonbasic sector, and the population sector. Although all land use models have strength and weaknesses, however, there are constant improvements in the development of there techniques and models.

- Project, system and Operational planning:

  In long-term regional strategic planning, there is a need to improve the capacity in general or in terms of highways or transit in specific. Detailed informationfor project-level planning may not be provider sufficiently. Depending on the expression of the problem, a series of increasingly detailed planning studies leading to the stage of final design would normally be undertaken.

- Planning at the statewide Level:

  The previous examples were drawn from the urban context. Planning for single-mode and multimodal transportation systems in larger areas are considered by a variety of planning entities.

Conclusion:

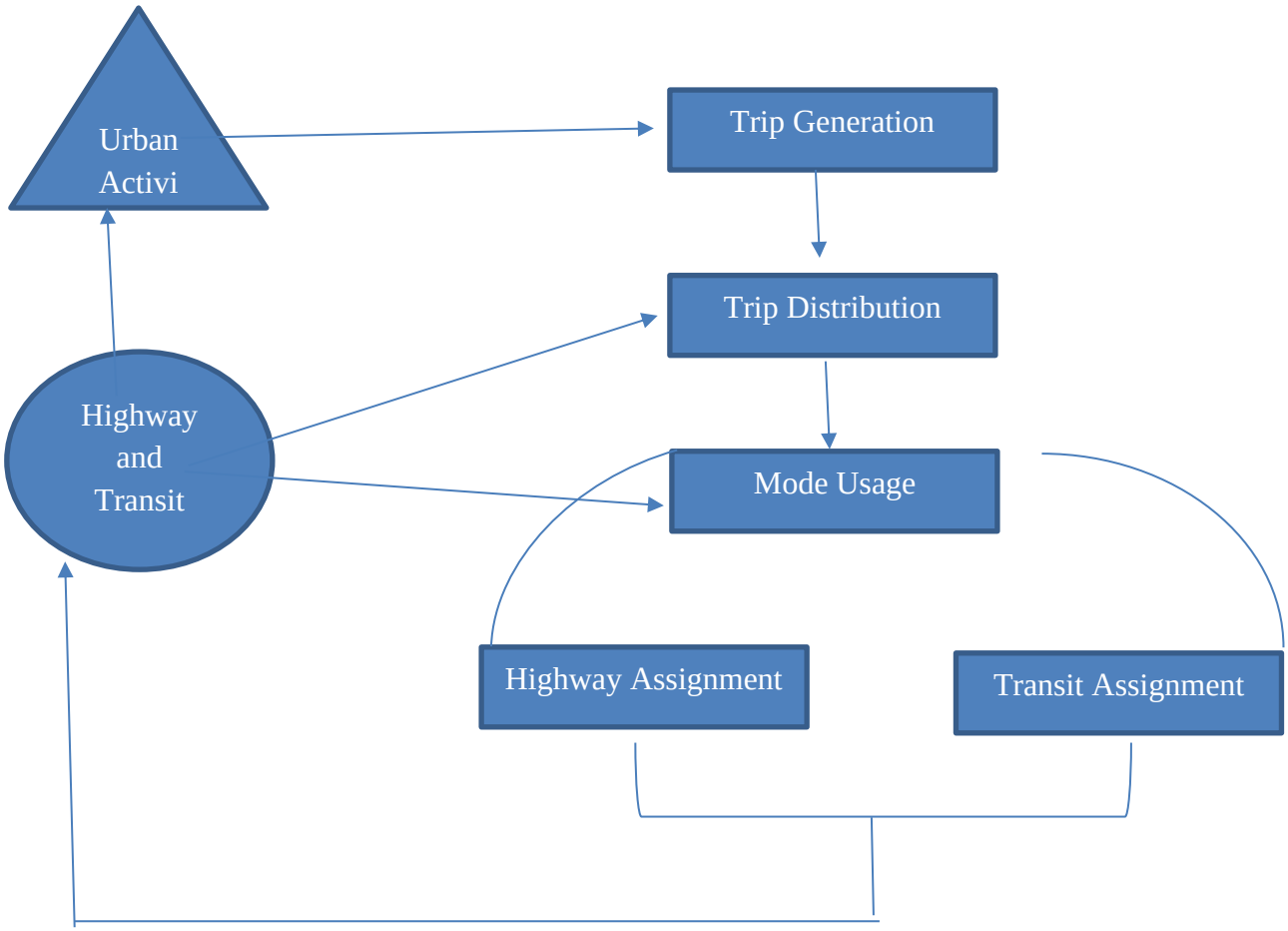
This is a brief description of the studies of the scope of transportation planning strategies. The development of transportation planning models through its developmental phases is discussed. These models have evolved through research and experiments. Travel surveys and future projections played significant role in enhancing transportation planning capacities. Though, there exist certain limitations and issues, however, transportation engineers and researcher are striving hand to smooth the way forward for development.

Answer: 02

There are four steps involved in conventional transportation modelling:

1. Trip generation forecasts the number of trips.
2. Trip distribution determines the destination of the trip.
3. Mode usage predicts the division among the available modes of travel.
4. Trip assignment predicts the routes that the trips will take.

The diagrammatic representation below shows how these phases fit together into the travel forecasting process.



Urban Activity Forecasts:

Urban activity forecasts predict the direction of where people will live and the location of businesses in future including the intensity of activity such as the number of households and the number of employees in businesses. Zone activities are residential population, average income, employment (white color and blue color). The additional factors may include car ownership, residential density, and amount of vacant land.

Zone:

Forecasts are made for small parts of land known as zones. These vary in size, from a block to several square miles area. An area with a million people could have 700 to 800 zones. Zonal urban activity forecasts are based on the following:

1. Cumulative population of the urban area and employment estimation
2. Location behavior of people and businesses
3. Residential policies of land development, transportation, zoning and so on.

The results show projections into future levels. These provide direct input into the next stage of processes.

1. Trip Generation:

It is a process that converts urban activity into number of trips. For instance, shopping centers generate varying number of trips than an industrial complex for the same space taken. In this approach, the link between urban activity and travel is quantified.

As we know that the study area is divided into zones for analysis, a planer has the knowledge of trips produced and attracted by each zone. The planer knows about the purpose of the trips too, put into several categories including trips from home to office, shop, or school. The purpose reflects behavior of the trip.

An equation for estimated trips generated by residential zone is:

$$Y = A + B1\text{X}1 + B2X2 + B3X3$$

Y=trips/household

X_1= car ownership

X_2= family income

X_3= family size

A, B_i= parameters determined through a calibration process

The data of model parameters and variables varies from study to study, from area to area using base-year information. When the equations are produced once, these can be applied for anticipation of future travel for a target year. The assumptions for regression equations are;

1. All the independent variables are independent of each other.
2. They are normally distributed.
3. They are continuous variables.

Appropriate estimates of X_1, X_2, X_3 and X_4 are substituted to solve the equation for Y for a zone for a future year.

2. Trip Distribution:

This approach gives insight into where will the trips generated would go in each zone and their distribution among other zones. A table (output) shows travel flow between different pairs of zones. Assume a city of five zones with 2000 trips. Zones 1,2,3,4 and 5 may attract 300, 400, 700, 500 and 100 trips respectively.

The comparison of relative attractiveness and accessibility of sum of the zones of the area provides direction to the trips. The methods used for trip distribution analysis are;

i. The Farter Method
ii. The Intervening opportunity Model
iii. The Gravity Model

3. Mode Usage:

It is to analyze people's choice of travel; bus. auto, train etc. It can be placed anywhere in the forecast flowchart but normally it is placed after trip distribution. People's choice may be affected by the following three categories;

i. Trip maker's characteristics (family income, autos quantity, family size, residential density).
ii. Trip's characteristics (distance, time, duration)
iii. Transportation system characteristics (riding or excess time)

Interaction among the characteristics is considered in decision of choice of mode. It would be predictable what choice would the population make in the future. The modes used are;

i. Direct-Generation Usage Mode
ii. Trip-Interchange Mode Usage Models

4. Trip Assignment:

It anticipates the paths of the trips that are going to be taken. For instance, if there is a trip from a suburb to downtown, the streets or routes would be predictable by the model. The vehicles and transit networks in the targeted area are represented by a map that predicts the possible paths for trips. Nodes are the intersections on the network map that are identified. The sections known as links are then identified with the help of nodes so that the length, type of facility, location in the area, number of lanes, speed, and travel time are identified for each link. With the addition of information about fares, headways, and route description, the computer-based model can even determine the paths that the traveler would choose between two known points. Techniques available are;

i. Minimum-Path Techniques
ii. Minimum Path with Capacity Restraints
iii. Flows in Networks
iv. Transport Networks with a Demand Function

With the help of trip generation, trip distribution, mode usage, and trip assignment, effective travel demand policies and programs could be formulated. Once we know the demand, other transportation systems performances could be assessed to identify varying impacts of the system on urban area, for instance, energy consumption, pollution and accidents. It would help the decision makers with the choices of transportation systems for a community.

ANSWER 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 DATA***

Calculate the Trip Generation and Attraction of each Zones.

- ***SOLUTION***

First of all we find the values of Trip Generation of each Zones, by using the formula also given below

Trip Generation per Zone = Person Trips x Trips per Thousand
Zone 1

LAND USE CATEGORY	ZONE 1	PERSON TRIP	TRIP PER THOUSAND	ZONE 2	PERSON TRIP	TRIP PER THOUSAND
RESIDENTIAL	7740	6574	849.3540052	24900	6574	264.0160643
RETAIL	6972	54833	7864.744693	5688	54833	9640.11955
WHOLESALES	14940	3162	211.6465863	10744	3162	294.3037975
SERVICE	5976	70014	11715.86345	2528	70014	27695.41139
MANUFACTURING	1290	1335	1034.883721	4980	1335	268.0722892
TRANSPORTATION	1935	5630	2909.560724	8964	5630	628.0678269
PUBLIC BUILDING	2580	11744	4551.937984	9960	11744	1179.116466
PUBLIC OPEN SPACE	3010	25886	8600	22908	25886	1129.998254
TOTAL	**44443**	**179178**	**37737.99117**	**90672**	**179178**	**41099.10564**
AVERAGE	**5555.4**	**22397.25**	**4717.248896**	**11334**	**22397.25**	**5137.388205**

LAND USE CATEGORY	ZONE 3	PERSON TRIP	TRIP PER THOUSAND	ZONE 4	PERSON TRIPS	TRIP PER Thousand
RESIDENTIAL	**17064**	**6574**	**385.255509**	**42204**	**6574**	**155.7672259**
RETAIL	**26220**	**54833**	**2091.266209**	**6172**	**54833**	**8884.154245**
WHOLESALES	**20976**	**3162**	**150.743707**	**7715**	**3162**	**409.8509397**
SERVICE	**1748**	**70014**	**40053.775744**	**6172**	**70014**	**11343.81076**
MANUFACTURING	**1264**	**1335**	**1056.170886**	**1748**	**1335**	**763.7299771**
TRANSPORTATION	**5688**	**5630**	**989.803094**	**5244**	**5630**	**1073.607933**
PUBLIC BUILDING	**4424**	**11744**	**2654.611212**	**6992**	**11744**	**1679.633867**
PUBLIC OPEN SPACE	**15800**	**25886**	**1638.354430**	**71668**	**25886**	**361.1932801**
TOTAL	**93184**	**179178**	**49019.980791**	**147915**	**179178**	**24671.74823**
AVERAGE	**11648**	**22397.25**	**6127.497599**	**18489**	**22397.25**	**3083.968528**

LAND USE CATEGORY	ZONE 5	PERSON TRIP	TRIP PER THOUSAND	ZONE 6	PERSON TRIP	TRIP PER THOUSAND
RESIDENTIAL	29317	6574	224.2384964	576416	6574	11.40495753
RETAIL	126091	54833	434.868468	15270	54833	3590.897184
WHOLESALES	90065	3162	35.10797757	7635	3162	414.1453831
SERVICE	162117	70014	431.8732767	10180	70014	6877.603143
MANUFACTURING	4629	1335	288.3992223	36026	1335	37.05657025
TRANSPORTATION	4629	5630	1216.245409	90065	5630	62.51040915
PUBLIC BUILDING	3086	11744	3805.573558	252182	11744	46.56954105
PUBLIC OPEN SPACE	92580	25886	279.6068265	468338	25886	55.27204711
TOTAL	**512514**	**179178**	**6715.913235**	**1456112**	**179178**	**11095.45924**
AVERAGE	**64064.25**	**22397.25**	**839.4891544**	**182014**	**22397.25**	**1386.932404**

LAND USE CATEGORY	ZONE 7	PERSON TRIP	TRIP PER THOUSAND
RESIDENTIAL	53445	6574	123.0049584
RETAIL	1290	54833	42506.20155
WHOLESALES	1935	3162	1634.108527
SERVICE	1720	70014	40705.81395
MANUFACTURING	12725	1335	104.9115914
TRANSPORTATION	10180	5630	553.0451866
PUBLIC BUILDING	30540	11744	384.5448592
PUBLIC OPEN SPACE	114525	25886	226.0292513
TOTAL	**226360**	**179178**	**86237.65988**
AVERAGE	**28295**	**22397.25**	**10779.70748**

Now we find the values of Trip Attraction of each Zones, by using the formula's given below:

Trip attraction = 1.213 (x) + 106.213 (x is in 1000 sq-ft of gross area)

By putting the values

Zone-1 = 5828.23

Trip attraction = 1.213 (x) + 106.213 (x is in 1000 sq-ft of gross area)

By putting the values

Zone-2 =6337.86

Trip attraction = 1.213 (x) + 106.213 (x is in 1000 sq-ft of gross area)

By putting the values

Zone-3 =7538.867

Trip attraction = 1.213 (x) + 106.213 (x is in 1000 sq-ft of gross area)

By putting the values

Zone-4 =3847.067

Trip attraction = 1.213 (x) + 106.213 (x is in 1000 sq-ft of gross area)

By putting the values

Zone-5 =1124.51

Zone-6 =1788.562

Zone-7 = 13181.99

Total = (39647.09) ANS

TRIP PER THOUSAND