Mid term exam paper

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Subject: Transportation planning and management

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Qustion`#1:

A-Planning definition: An activity or process that examines the potential of future actions to guide a situation or system toward a desired direction. it Occurs in present but is oriented towards the future, the major purpose as below:

- To achieve positive goals
- To avoid negative consequences
- Or both

Or planning is the process of thinking about the activity required to achieve a desire goal.

In transportation we can say that the process of defining future policies, goals, investments and design to prepare for future needs to move people and goods to destination.

And also planning helps us and important as below:

- Congestion problems with traffic movement, particularly during peak hours, cause severe delay to the system's users.
- Fatal accidents, injuries, and property damage.
- Public transportation usage, infrequent service, unreliable schedules, and rising fares.
- Pedestrians and bicyclists, being treated as low-class citizens.
- Imposed noise and pollution of the atmosphere, because of automobile traffic.
- Poor generally feel that public moneys are spent on providing the maximum benefits to the rich at the expense of the poor.

- Energy prices seem to be constantly on the rise and the public appears to blame the government for not intervening in curbing automobile ownership.

With considering of mentioned definition and impotency we are solving the second part of question as blow:

B-Briefly describe the studies carried out in the scope of transportation planning strategies in their modeling with assumptions & limitations? B part 2nd question should be present in form of technical report.

Title: Technical Report

Content: Introduction, Theory or background, Methodology and conclusion.

Introduction: Transportation planning strategy in their modeling with assumption and limitation.

Theory or Background: As we know from scope transportation plan that all man-made projects should start with a plan, the more significant the project, the more intensive and long term the planning and even for large transportation projects, planning starts 20 years before construction.

For a tile contemporary transportation planning methodology we should have a lot information such as land survey that support the, layouts of , cities and towns and the locations of turnpikes, canals, and, later, railroads and information relating to facility use, that is, traffic levels, trip lengths, and user costs.

Planning should be for future needs and anticipate future travel demand, initially this was accomplished by projecting current traffic measurements into the future using traffic growth factors based on discerned relationships between population and economic growth on one hand and traffic levels on the other. So we can check the annual grow rates of population, traffic and economics against the capacity of existing highway to anticipate future capacity deficiencies and, within financial constraints, to plan and schedule capacity improvements accordingly.

Large scale urban travel should be done and difference study should be carried out such us traffic study, O-D study, Parking study and etc.

Travel demand-forecast survey should be done, thus trip-generation, trip-distribution, mode choice, and traffic assignment models evolved, each intended to describe and forecast a different component of travel behavior.

Methadology:

Strategic transportation planning:

- Capital intensive improvement
    - Major S&M synonymous to small strategic plan
    - Recycling of S&M during long time possible
- New facilities.
- Major changes in existing facilities.
- Long range policy actions.

- Future land development policies, adding highway link, bus transit system.
- Travel demand forecasting play an important role

For receiving above destinations and transportation modeling we should studies as blow:

<u>Traffic studies:</u>

- <u>Traffic volume count:</u>
- Number of vehicles passing a point.
- May be comprehensive counts covering the entire main road system in an area.
- Counts on all roads intersecting a cordon line which encircles a particular area.
- Counts on screen line(s) which divide a city into two or more parts.
- Counts at specific points.
- The information sought
  - Traffic volume and the direction.
  - Volume of turning traffic at intersections.
  - Hourly, daily, and seasonal variations of traffic
- **<u>Origin and destination survey:</u>**
- Traffic counts give the amount of traffic passing specified points on the road but they do not indicate where traffic desires to travel, i.e. its origin and its destination.

- The survey is primarily for transportation planning, particularly the location, design, and programming of new or improved highways, public transport, and
- 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.

- **Methods include**
  - Recording registration numbers
  - Handing postcards to drivers
  - Roadside interviews
  - Tag-on-vehicle surveys
  - Home interview surveys

Speed studies:

- Using a radar meter, which gives a direct reading of speed.
- Taking photographs of a section of road at a predetermined time interval and measuring the distance
- Results may be presented in tables, graphs and diagrams.
- These may include
  - Speed distribution and cumulative frequency distribution curves.
  - The mean speed (TMS & SMS)
  - The 85^{th} percentile Speed

Travel time and delay studies:

- Travel time measures the average journey time and journey speed on sections
  - Used in traffic assignment
  - Quality of the traffic route
  - Before and after effect of traffic engineering techniques
- Delay study
  - By analyzing the delays, the location and cause of the congestion can be

Parking studies:

- Carried out to
- Assist in cordon counts
- the number and location of existing parking spaces, both kerbside and off-street;

- existing parking practices, including usage of available spaces, parking duration, illegal parking;
- the need to impose or vary parking time limits or to install parking meters;
- The adequacy of existing enforcement measures.
- For larger cities, a comprehensive parking demand study is required
- It includes the determination of parking usage, parking habits as well as the origin, destination and purpose of trip of drivers parking in the area.
- It is used primarily in determining the demand for parking space by evaluating the individual parker's desires.
- The actual survey is carried out in the form of questionnaire cards or direct interviews.

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

Transportation planning process:

There are 3 stages of basic frame work as below:

- Stage-1. A survey and analysis stage which establish the present demand for movement and how it is met, and relationship between this demand of movement in rural and urban environments.
- Stage-2. A prediction and plan formulation stage, which projects for some future date the likely travel demand, based on the data collected and the relationship established in the

survey and analysis stage, and puts forward proposal to meet this demand.

- Stage-3. An evaluation stage, which attempts to assess whether the transportation proposals put forward satisfy the projected demand for travel with adequate safety, capacity and Level of Service.
- Also either it provides the maximum benefits to the community for minimum cost or not.

Principle stages:

- Explicit formulation of goals and objective
- Collection of land use, population, economic and travel pattern data for the present day situation.
- The establishment of quantifiable relationship between present day movements, land use, population and economic factors.
- The prediction of land-use, population and economic factors to target date for study and development of land use plans.
- The prediction of origins, destinations and distribution of future movement demands, using the relationship established for present day situation and the predicted land use, population and economic factors (Trip generation and distribution)
- Prediction of person movements likely to be carries out by the different modes of travel at the target date (Modal split)
- The development of alternative highway and public transport networks to fit the predicted land use plan and accommodate the assignment of predicted trips to alternative co-ordinated transport network? Systems. (Traffic Assignment)

- The evaluation the efficiency and economic viability of the alternative transport networks in terms of both economic and social costs and benefits.
- The selection and implementation of the most appropriate transport networks.
- Date the estimated pattern of movements.

A clear understanding of the modeling process and assumptions is essential to understanding transportation plans and studies as we described above.

All above studies, planning process and principle stages are fundamentals for a comprehensive strategic plan and their modeling because Models are important in transportation plans and investment are based on what the models say about future travel models are used to estimate that what our community will look like in the future? It means population forecasts, economic forecasts and land use pattern.

What the travel pattern in the future? It means trip generation, trip distribution, mode split, traffic assignment and impact analysis.

The below studies also important for a transportation plan and their modeling:

- **Also we should know and study about some** forecasting as below:
  - Population forecasting:
    - Birth rates
    - Death rates
    - Migration rates
    - Ages

- Often use forecasts from other agencies

- **Economic forecasting:**
  - Employment levels
  - Forecasted in conjunction with population
  - Employment
  - Often use forecasts from other agencies

- **Land use forecasting:**
  - ➢ Allocate population and economic growth
  - Establish land use goals and land use rates
  - Allocate to specific locations—models can be used to predict
  - Strict and loose government control

1. **Limitations:**
2. No feedback with transportation plans
3. Current development is fixed – considers only vacant land
4. Mixed-use benefits not considered

Some assumption and limitation are required as below:

- **Assumptions:**
- First developed in the late 1950s
- Helps make decision on future development of (urban) transport systems
- Forecasts travel patterns 15-25 years ahead

- A clear understanding of the modeling process and assumptions is essential to understanding transportation plans**.**

- **<u>Limitations of Urban Transport Modeling</u>**
- Only considers factors and alternatives explicitly included in the equations.
- If models are not sensitive to certain factors, they will not show any effect of them.
- This could lead to a conclusion that the factors are ineffective. E.g., bicycle or pedestrian
- It is therefore critical to consider the assumptions before decisions are made.

<u>Conclusion:</u>

In this report we defined strategic transportation planning to applicable for future improvement and modeling, described studies, planning process, principle planning stages, described the modeling such as trip generation, trip distribution, mode choice and tripe assignment and described studies, assumptions and limitation regarding to transportation model to prepare a comprehensive transportation plan to respondent for future improvement and models.

<u>Question#2:</u>

<u>FOUR STEPS OF CONVENTIONAL TRANSPORTATION MODELING:</u>

Four step transportation planning process (FSTP) In order to carry out Modeling and we know that the major components of travel behavior are FSTP therefore will be discussed as below:

Step1-Trip generation:

Trip generation means travel for specific purpose.

Study in trip generation should be carried out as per zone as below:

- Calculate number of trips generated/ produced in each zone
- Calculate number of trips attracted to each zone
- Number of trips that begin from or end in each TAZ
- Trips for a "typical" day
- Trips are produced or attracted
- # of trips is a function of:
    - TAZs land use activities
    - Socioeconomic characteristics of TAZ
    - Population

We should forecast number of trips that produced or attracted by each TAZ for typical day

Trip generation also belonging to functions of other variable.

Attraction and production has own effect of trip generation as below:

B-Attraction and production:

As we know that trips are predicted by trip generation model in each zone often like trip in each zone. These trips end may origin-destination (O-D) or productions-attractions (P-A), for understanding of these two difference we will consider two zones S and D these two zones will contain residence and non residential land uses, such as place of business, schools, markets and etc.

Suppose that zone S is residential and D is nonresidential area, in case of (O-D) if a traveler make trip in the morning from zone S to zone D and back make trip from zone D to zone s in the evening ,so we can say zone S become origin and zone D become destination in the morning but in the evening the zone D become origin and zone S destination, Thus origins and destinations are defined. in terms of the direction of a given Impersonal trip.

Now we will discuss the term of production and attraction which are define in term of direction but they are in term of the land use associated with each trip end. In this case trip production is defined as a trip end connected with a residential land use in a zone, and a trip attraction is defined as a trip end connected to nonresidential land use in a zone as per this definition zone S (residential) has produced two trips and zone D(nonresidential) attracted two trips, This distinction is made because the zonal trip productions can be more easily estimated from the socioeconomic characteristics of the zone's population and the related travel needs of the population for various purposes, whereas the zonal trip attractions depend on the availability and intensity of nonresidential opportunities found within the zone. For example, if a significant portion of the population of a zone consisted of working-age adults, that zone would produce a high number of work trips. If a zone were predominantly nonresidential (a downtown employment zone), it would be likely to attract many work trips produced by zones that are dispersed throughout the region. Thus a typical trip-generation study involves the application of residential trip-production and nonresidential trip-attraction models. The former contain a set of explanatory variables that describe the demographic makeup of the zone's population. The latter rely on a set of explanatory variables that capture the type and intensity of nonresidential activities within the zone. In the general case each zone S will have a number of productions P1 and a number of attractions A1.

Some time above definition is not applicable on sum trips like trip in non residential area like from office to market so these types of trips will be classified home based trip (HB) and non home based trips (NHB).

The former category consists of trips that either begin or end at a residence, whereas the latter neither begin nor .end at a residence. This leaves a small percentage of trips usually occurring during the noncritical off-peak periods of the day that have both their origins and their destinations in a residence (a trip to a friend's house). To account for NHB trips in a production-attraction format, their zone of origin is assumed to be the producing zone and the zone of destination is considered to be the attracting zone. The three most common mathematical formulations of trip generation are regression models, trip-rate analysis models, and cross classification models.

Trip generation is belonging to trip purpose too:

Purpose:

- Trips are estimated by purpose (categories)
- Travel behavior of trip-makers depends somewhat on trip purpose
    - Work trips

    - regular
    - Often during peak periods
    - Usually same origin/destination
  - School trips
    - Regular
    - Same origin/destination
  - Shopping recreational
    - Highly variable by origin and destination, number, and time of day

House hold based survey:

- **Trips based on "households" rather than individual**
- **Individual too complex**
- **Theory assumes households with similar characteristics have similar trip making characteristics**
- **However**
  - **Concept of what constitutes a "household"**
  - **Changed dramatically outside Pakistan**

What in Pakistan

Step2-Trip distribution:

Trip distribution is the second step of conventional transportation modeling which means choice of destination that traveler will select the destination optionally.

In this stage we should exercise and predicts in each TAZ where trips go from, Determines trips between pairs of zones, Function of attractiveness of TAZ , for example if *2 malls are similar (in the same trip purpose), travelers will tend to go to closest*

Different methods but gravity model is most popular

Step3-Mode choice:

In this step we should know about travelers mode choice in a TAZ.

- In most situations, a traveler has a choice of modes
  - Transit, walk, bike, carpool, motorcycle, drive alone

- Mode choice determines # of trips between zones made by auto or other mode, usually transit

CHARACTERISTICS INFLUENCING MODE CHOICE:

- Availability of parking
- Income
- Availability of transit
- Auto ownership
- Type of trip
  - **Work trip more likely transit**
  - **Special trip – trip to airport or baseball stadium served by transit**
  - **Shopping, recreational trips by auto**
- **Stage in life**
  - **Old and young are more likely to be transit dependent**
- **Cost**
  - **Parking costs, gas prices, maintenance?**

- **Transit fare**

- **Safety**
- **Time**
  - **Transit usually more time consuming (LBS)**

- **Image**
  - **In some areas perception is that only poor ride transit**

  - **In others (NY) everyone rides transit (Not in Pakistan)**

Above characteristics have effect on mode choice.

- **MODE CHOICE MODELING:**
- A numerical method to describe how people choose among competing alternatives
- Highly dependent on characteristics of region
- Model may be separated by trip purposes

Step4-Network assignment:

In this step we should know about choice of rout or path as below:

- Trip makers choice of path between origin and destination
- Path: streets selected
- Transit: usually set by route
- Results in estimate of traffic volumes on each roadway in the network
- **PERSON TRIPS VS VEHICLE TRIPS:**
- Trip generation – total person trips
- Trip assignment – volume (not person) trips
- Need to adjust person trips to reflect vehicle trips
- Understand units during trip generation phase
- **TIME OF DAY PATTERNS:**
- Trip generation usually based on 24-hour period
- LOS calculations usually based on hourly time period

- Hour, particularly peak, is often of more interest than daily
- **Common time periods**
  - **Morning peak**
  - **Afternoon peak**
  - **Off-peak**
- **Calculation of trips by time of day**
  - **Use of factors (e.g., morning peak may be 11% of daily traffic)**
  - **Estimate trip generation by hour**

MINIMUM PATH:

- Theory: users will select the *quickest* route between any origin and destination
- Several route choice models (all based on some "minimum" path)
  - All or nothing
  - Multipath
  - Capacity restraint

Above study and exercise should help us in providing of a good plan regarding to transportation modeling.

Qustion#3:

Land Use Category	Area(ha)						
	Peshawar	Charsadda	Mardan	Nowshera	Swabi	Abbottabad	Kohat
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
	Service	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

As per table 2 Person trips per hectare by land use and zone:

Zone#1: Person trip per hectare residential land use and zone is 128, as given area in zone1 (Peshawar) is 7740 ha so trip generation and attraction in Peshawar is 7740*128=16384

Zone#2:

Land use: Residential, Person trip per hectare=108, Area=24900 ha

Trips=24900*108=2689200

Zone#3:

Land use: Residential, Person trip per hectare=93, Area=17064 ha

Trips=17064*93=1586952

Zone#4:

Land use: Residential, Person trip per hectare=75, Area=40204 ha

Trips=40204*75=3015300

Zone#5:

Land use: Residential, Person trip per hectare=55, Area=29317 ha

Trips=29317*55=1612435

Zone#6:

Land use: Residential, Person trip per hectare=45, Area=576416 ha

Trips=576416*45=25938720

Zone#7:

Land use: Residential, Person trip per hectare=38, Area=53445 ha

Trips=53445*38=2030910

Zone#1:

Land use: Retail, Person trip per hectare=850, Area=6972 ha

Trips=6972*850=5926200

Zone#2:

Land use: Retail, Person trip per hectare=423, Area=5688 ha

Trips=5688*423=2406024

Zone#3:

Land use: Retail, Person trip per hectare=563, Area=26220ha

Trips=26220*563=14761860

Zone#4:

Land use: Retail, Person trip per hectare=670, Area=6172ha

Trips=6172*670=4135240

Zone#5:

Land use: Retail, Person trip per hectare=463, Area=126091ha

Trips=126091*463=58380133

Zone#6:

Land use: Retail, Person trip per hectare=485, Area= 15270ha

Trips=15270*485=7405950

Zone#7:

Land use: Retail, Person trip per hectare=380, Area=1290 ha

Trips=1290*380=490200

Zone#1:

Land use: wholesale, Person trip per hectare=135, Area=14940 ha

Trips=14940*135=2016900

Zone#2:

Land use: wholesale, Person trip per hectare=90, Area=10744 ha

Trips=10744*90=966960

Zone#3:

Land use: wholesale, Person trip per hectare=115, Area=20967 ha

Trips=20967*115=2411205

Zone#4:

Land use: wholesale, Person trip per hectare=73, Area=7715 ha

Trips=7715*73=563195

Zone#5:

Land use: wholesale, Person trip per hectare=60, Area=90065 ha

Trips=90065*60=5403900

Zone#6:

Land use: wholesale, Person trip per hectare=48, Area=7635 ha

Trips=7635*48=366480

Zone#7:

Land use: wholesale, Person trip per hectare=40, Area=1935 ha

Trips=1935*40=77400

Zone#1:

Land use: Service, Person trip per hectare=445, Area=5976 ha

Trips=5976*445=2659320

Zone#2:

Land use: Service, Person trip per hectare=258, Area=2528 ha

Trips=2528*258=652224

Zone#3:

Land use: Service, Person trip per hectare=505, Area=1748 ha

Trips=1748*505=882740

Zone#4:

Land use: Service, Person trip per hectare=385, Area=6172 ha

Trips=6172*385=2376220

Zone#5:

Land use: Service, Person trip per hectare=365, Area=162117 ha

Trips=162117*365=59172705

Zone#6:

Land use: Service, Person trip per hectare=338, Area=10180 ha

Trips=10180*338=2440840

Zone#:7

Land use: Service, Person trip per hectare=328, Area= 1720ha

Trips=1720*328=564160

Zone#1:

Land use: Manufacturing, Person trip per hectare=353, Area=1290ha

Trips=1290*353=455370

Zone#2:

Land use: Manufacturing, Person trip per hectare=183, Area=4980ha

Trips=4980*183=911340

Zone#3:

Land use: Manufacturing, Person trip per hectare=83, Area=1264ha

Trips=1264*83=104912

Zone#4:

Land use: Manufacturing, Person trip per hectare=73, Area=1748ha

Trips=1748*73=127604

Zone#5:

Land use: Manufacturing, Person trip per hectare=55, Area=4629ha

Trips=4629*55=254595

Zone#6:

Land use: Manufacturing, Person trip per hectare=53, Area=36026ha

Trips=36026*53=1909378

Zone#7:

Land use: Manufacturing, Person trip per hectare=35, Area=12725ha

Trips=12725*35=445375

Zone#1:

Land use: Transportation, Person trip per hectare=73, Area=1935ha

Trips=1935*73=141255

Zone#2:

Land use: Transportation, Person trip per hectare=25, Area=8964ha

Trips=8964*25=224100

Zone#3:

Land use: Transportation, Person trip per hectare=35, Area=5688ha

Trips=5688*35=199080

Zone#4:

Land use: Transportation, Person trip per hectare=25, Area=5244ha

Trips=5244*25=131100

Zone#5:

Land use: Transportation, Person trip per hectare=13, Area=4629ha

Trips=4629*13=60177

Zone#6:

Land use: Transportation, Person trip per hectare=18, Area=90065ha

Trips=90065*18=1621170

Zone#7:

Land use: Transportation, Person trip per hectare=15, Area=10180ha

Trips=10180*15=152700

Zone#1:

Land use: Public building, Person trip per hectare=595, Area=2580ha

Trips=2580*595=2474220

Zone#2:

Land use: Public building, Person trip per hectare=265, Area=9960ha

Trips=9960*265=2639400

Zone#3:

Land use: Public building, Person trip per hectare=275, Area=4424ha

Trips=4424*275=1216600

Zone#4:

Land use: Public building, Person trip per hectare=245, Area=6992ha

Trips=6992*245=1713040

Zone#5:

Land use: Public building, Person trip per hectare=90, Area=3086ha

Trips=3086*90=277740

Zone#6:

Land use: Public building, Person trip per hectare=48, Area=252182ha

Trips=252182*48=12104736

Zone#7:

Land use: Public building, Person trip per hectare=10, Area=30540ha

Trips=30540*10=305400

Zone#1:

Land use: Public open space, Person trip per hectare=5, Area=3010ha

Trips=3010*5=15050

Zone#2:

Land use: Public open space, Person trip per hectare=3, Area=22908ha

Trips=22908*3=68724

Zone#3:

Land use: Public open space, Person trip per hectare=10, Area=15800ha

Trips=15800*10=158000

Zone#4:

Land use: Public open space, Person trip per hectare=5, Area=71668ha

Trips=71668*5=358340

Zone#5:

Land use: Public open space, Person trip per hectare=5, Area=92580ha

Trips=92580*5=462900

Zone#6:

Land use: Public open space, Person trip per hectare=3, Area=468338ha

Trips=468338*3=1405014

Zone#7:

Land use: Public open space, Person trip per hectare=3, Area=114525ha

Trips=114525*3=343575