CMR INSTITUTE OF TECHNOLOGY

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Improvement Test

Sub:	Traffic Engineering							Code:	10CV667
Date:	31/05 / 2017	Duration:	90 mins	Max Marks:	50	Sem:	VI	Branch:	CIVIL

Note: Q1 is compulsory. Answer any four full questions from Q2 to Q6.

		Marks	OBE	
			CO	RBT
1.	Given below is the occupancy of parking spaces in a parkinglot of 50 parking spaces. The count was taken at 15 minute intervals during 4 hours on 6 week days. Find whether the number of vacant spaces during any count follows a Poisson's distribution.	[10]	CIV609.4	L3
2.	Explain the Speed and Delay study by Moving Car Observer Method.	[10]	CIV609.1	L1
3.	The spot speeds at a location are normally distributed with a mean of 51.7kmph and a standard deviation of 8.3kmph. What is the probability that (i) Speeds exceed 65kmph (ii) Speeds are in between 40kmph and 70 kmph (iii) What is 85th percentile speed?	[10]	CIV609.4	L3
4.	With a neat sketch explain the concept of origin and destination survey and presentation of results of the OD survey.	[10]	CIV609.1	L2
5. (a)	Write short notes on Traffic Simulation.	[05]	CIV609.5	L1
(b)	Mention the advantages and disadvantages of one way streets.	[05]	CIV609.5	L1
6. (a)	Define Basic capacity, Practical capacity and possible capacity.	[05]	CIV609.1	L1
(b)	Briefly explain Mandatory signs with neat sketches.	[05]	CIV609.5	L2

Occupancy	50	49	48	47	46	45	44	43	42	41	≤ 40
Frequency	6	15	21	20	15	10	5	2	1	1	0

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Improvement Test
Solutions

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1.

No. of vacant spaces	Observed Frequency	Total no. of vacant spaces	Theoretical Probability of stated no. of vacant spaces	Theoretical frequency of no. of vacant spaces
0	6	0	0.0498	4.8
1	15	15	0.1494	14.3
2	21	42	0.2241	21.5
3	20	60	0.2241	21.5
4	15	60	0.1681	16.5
5	10	50	0.1009	9.6
6	5	30	0.0505	4.8
7	2	14	0.0216	2.1
8	1	8	0.0081	0.8
9	1	9	0.0027	0.3
10 or more	0	0	0.0007	0.1
Total	96	288	1.0000	96.0

Inspection of columns indicates a fair agreement between observed and theoretical frequencies. Hence it can be concluded that the number of vacant spaces follows Poisson distribution.

2. **Moving car observer method:**
Procedure

A small, preferably even number of test cars is required. Each car carries a driver and three observers. One observer in the car counts opposing traffic, using hand tallies. Another observer carries a recording board on which a watch is mounted. The recording board carries a journey log prepared in advance, on which the observer records the totals from the hand tallies and times at predetermined points en-route including times of stopping and starting at intersections. It is desirable to have two stop watches, one for recording the continuous time at different point's en-route and the other for measuring the individual stopped time delays. The second stop watch can accumulate the delay time as the observer operates buttons. A third observer records the number of overtaking and overtaken vehicles and parked vehicles if required.

The route is divided in to convenient sections, say 0.75 to 1.5km in length and mostly closed circuits in either directions. A journey log is prepared after a survey of the route is made. It is desirable to have twelve to sixteen runs in each direction along the route and the results are averaged to get an accurate estimate of the speed and flow.

3. A) Probability that speed exceeds 65kmph is the area under the normal curve to the right of x=65 kmph

The standard normal variable $z = (x - \mu) / \sigma$
$= (65-51.7) / 8.3 = 1.6$

From the statistical table, $\Phi(Z) = \Phi(1.6)$

$\Phi(1.6) = 0.9542$

$P(x \geq 65) = 1 - 0.9452 = 0.0548 = 5.48$ percent

B) Probability that speeds lie between 40 and 70 kmph

$= P(40 < x < 70) = \Phi(Z_2) - \Phi(Z_1)$

$Z_2 = (70 + 51.7) / 8.3 = 2.21$

$Z_1 = (40 - 51.7) / 8.3 = (-1.41)$

From the statistical table,

$\Phi(Z_2) = \Phi(2.21) = 0.9864$

$\Phi(Z_1) = \Phi(-1.41) = 1 - \Phi(1.41) = 1 - 0.9207 = 0.0793$

$P(40 < x < 70) = \Phi(Z_2) - \Phi(Z_1)$

$= 0.9864 - 0.0793 = 0.9071 = 90.71$ percent

C) 85^{th} percentile speed

$\Phi(Z) = 0.85$

From the statistical table, $Z = 1.04$

$Z = (x - \mu) / \sigma$

$1.04 = (x - 51.7) / 8.3$

$X = 60.3$ kmph

Hence the 85^{th} percentile speed is 60.3 kmph

4. Origin and destination study :

Need of OD study:

- To know the exact origin and destination of the trips
- Along with the number of trips grouping of trips also can be done

Uses of OD data:

- To determine the amount of by-passable traffic that enters a town ---need for a by-pass
- To develop trip generation and trip distribution models in transport planning process
- To determine the extent to which the present highway system is adequate and to plan for new facilities
- To assess the adequacy of parking facilities and to plan for future

Survey methods:

The following survey methods are adopted to carry out OD study.

- ✓ Home interview survey
- Full interview technique
- Home-questionnaire technique
- ✓ Road-side interview survey
- ✓ Post-card questionnaire survey
- ✓ Registration number plate survey
- ✓ Tags on vehicles

Presentation of results

OD survey yields a vast amount of data. To understand the data easily it is preferable to represent it in the form of table or pictorial form.Most convenient from is an O-D matrix – representing origin and destination where the Horizontal axis represents destination zones and the vertical axis represents origin zones. The zones may be further classified into internal and external zones. The number of trips are entered in the cells of the matrix known as an OD matrix.

OD matrix

In the matrix below ,t2-3 represents number of trips originating in zone 2 and terminating at zone 3.

			DESTINATION ZONES							
			INTERNAL				EXTERNAL			
			1	2	3			72	73	74
ORIGIN ZONES	INTERNAL	1								
		2			t2-3					
		3								
	EXTERNAL	72								
		73								
		74								

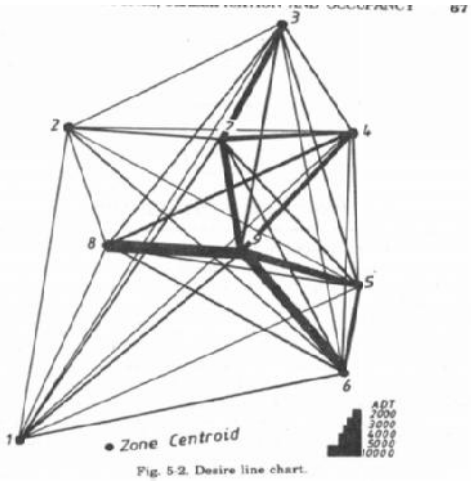

Fig. 5-2. Desire line chart.

Desire line chart

The most popular pictorial representation is by means of a desire line chart. In this chart, the trips between any pair of zones are represented by a straight line connecting

the centroids of the two zones and having a band width drawn to a suitable scale to represent the actual volume of trips. A typical desire line chart is as shown above.

5. A) **Traffic simulation:**

Traffic simulation or the simulation of transportation systems is the mathematical modeling of transportation systems (e.g., freeway junctions, arterial routes, roundabouts, downtown grid systems, etc.) through the application of computer software to better help plan, design and operate transportation systems.

Applications:

- When mathematical or analytical treatment of a problem is found infeasible or inadequate due to its complex nature.
- When there is some doubt in the mathematical formulation or results.
- When there is a need of an animated view of flow of vehicles to study their behaviour.
- Cheaper than field/analytical modeling
- Powerful tool to compare alternate strategies and improvement plans
- Allows for controlled experimentation
- Assumptions can be minimized since they are transparent.

Steps in simulation:

1. Define the problem and the model objectives Speed-flow relationship, queuing problem, bus route scheduling, accident occurrence, gap acceptance, predictio n on fuel consumption and so on.
2. Define the system to be studied - Roadway, Vehicle and Driver characteristics- Actual flow situations, real time data including roadway condition, driver behaviour and so on
3. Development of logic
4. Development of simulation programme - Model development Using any programming language
5. Model calibration
6. Model verification
7. Model validation
8. Documentation

B) **Advantages of one way streets**

- Reduction in the points of conflict
- Increased capacity
- Increased speed
- Facilitating the operations of signals
- Improvement in parking facilities
- Elimination of head-on collision

Disadvantages of one-way streets

- Actual distance to be covered increases
- Bus stops to be Relocated
- Tendency to over-speed
- Affects the residential area
- Affects the business of the area

- Availability of existing street systems
- Emergency vehicles

6. **A) Basic capacity:**
   Maximum number of passenger cars that can pass a point on a lane or a roadway during one hour under the most nearly ideal roadway and traffic conditions which can possibly be attained.

   Practical capacity:

   The maximum number of vehicles that can pass a given point on a lane or roadway during one hour, under prevailing roadway and traffic conditions.

   Possible capacity:
   The maximum number of vehicles that can pass a given point on a lane or roadway during one hour, without the traffic density being so great as to cause unreasonable delay, hazard or restriction to the driver's freedom to manoeuvre under prevailing roadway and traffic conditions. This term is referred to as the design capacity.

6.B) Mandatory signs:

These signs are definite positive instructions to be followed by the road user. They are of two signs.

✓ Stop sign
✓ Yield or give way sign

STOP sign

- Shape : Octagon
- Border- white
- Background – red
- Side of octagon - Std size – 900mm
  - Reduced size – 600mm
- Definition plate – STOP sign message

Yield or give way signs

- To assign right of way to traffic on certain approaches to an intersection
- To avoid interference with other traffic that is given right of way

- Downward pointing equilateral triangle

- Border – red
- Background – white
- Side – Standard size – 900 mm

- REDUCED SIZE – 600mm

- Definition Plate – GIVE WAY MESSAGE