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CEL 241: TRANSPORTATION ENGINEERING-I
Maximum Marks: 20

19.5/20

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structions: i) This paper contains seven (7) questions, ii) answer ALL the questions in the space provided,) Assume any data required suitably, and iv) Some useful formulas are given at the end

. Explain on what you understand by the term 'transportation systems'. (2)

Transportation system may be defined as consisting of fixed facilities, flow entities and control capacity that permits people and goods to overcome the fiction of geographical space in order to participate in timely manner for desired activities.

2. Having understood the 'transportation systems', list the most adverse (negative) externalities of the system. (2)

) Health
) Quiet Environment
i) Environment
v) Safety

Since transportation system is very much responsible for pollution, it consumes health.

It makes noise pollution which consume Quiet Environment.

Environment: Transportation vehicles generates carbon and hence degrading the quality of Environment.

) Being dangerous, they consume safety of people

A toll road carries 10,000 veh/day. The current toll is Rs 3/vehicle. Studies have shown that for each increase in toll by Rs. 0.50, the traffic volume decreases by 1,000 veh/day. It is desired to increase the toll to a point where the revenue will be maximized. a) Write an equation for travel demand on the road related to toll increase and current volume, b) determine the toll charge to maximize the revenues, c) determine the traffic in veh/day after toll increase, d) determine the total increase in toll revenue with new toll. (4)

$V_i = 10{,}000$ veh/day

$C_i =$ Rs 3/vehicle.

$m = \dfrac{-1000}{.50} = -2000$.

Let x amount of toll is increased

$C_f = 3 + x$

$V_f = 10{,}000 - 2000x$.

...l demand $= C_f V_f = (3+x)(10{,}000 - 2000x)$.

$= 30{,}000 - 6000x + 10{,}000x - 2000x^2$

$-6000 + 10{,}000 - 4000x = 0$

$\dfrac{-6000 + 10{,}000}{4000} = x$

$x = 1$/vehicle

so

$\boxed{\text{Rs 1/vehicle is the toll charge to maximise the revenue.}}$

$V_f = 10{,}000 - 2000(1)$

$= 8{,}000$ veh/day.

new toll $=$ Rs. $3+1$

$=$ Rs 4/vehicle

Additional revenue

$C_0V_0 = 30{,}000$

$C_fV_f = 4 \times 8000$

$= 32{,}000$

$C_fV_f - C_0V_0 =$

Rs 2,000 /veh

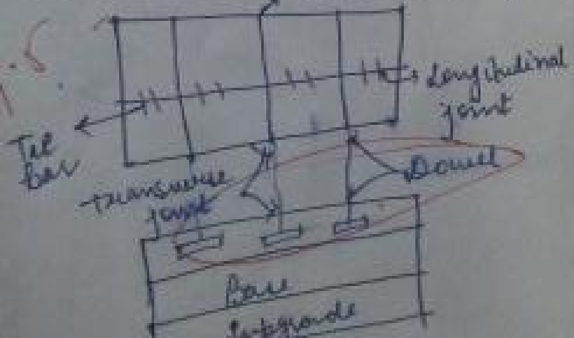
↓

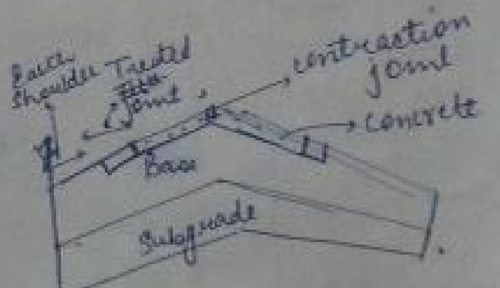
Addition revenue

4. In a rigid pavement, illustrate various types of joints and the type of reinforcement used therein. (2)

37-6.1 mm

In rigid pavement Portland cement concrete is used.





If you are driving on a road at 80 km/h speed and you see that there is a broken down truck at some distance. What would be your reaction distance? Would this reaction distance change if you had to stop at a traffic light at the same speed? (Perception-reaction times on highways and traffic signals are 2.5 and 1.0 s respectively). (3)

~~d = ...~~ $m = 1.47 \times \cancel{80 \times \frac{5}{18} \times 1 = 32.66 m}$.

(i) $d = 2.5 \times 80 \times \frac{5}{18} = 55.556\ m$

(ii) Yes since the reaction time has changed i.e 1s.

so $d = 1s \times 80 \times \frac{5}{18} = 22.22\ m$.

$\hat{y} = .495 + 1.7$

6. The following trips were observed in the new housing scheme developed near Gurgaon, Haryana. Set up a relationship to predict the trips/day given the household size. Find the predicted number of trips/day if the household size is $\boxed{4.5}$. (5)

y Stand error

Household size	1	1	1	2	2	2	3	3	3	4	4	4
Trips/day	3	1	2	5	4	3	5	7	8	6	8	7

So Regression $\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} = \dfrac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$

Std err $= \frac{SSE}{n-2} = \frac{\Sigma(y-\hat{y})^2}{(n-2)}$

$R^2 = \frac{SSE}{S_{yy}} = \frac{\Sigma(y-\hat{y})^2}{\Sigma y^2 - \frac{(\Sigma y)^2}{n}}$

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$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$

$\hat{y} = \beta_0 + \beta_1 x$

$\boxed{=12}$

(x) Household size	(y) Trips/day	x^2	y^2	xy	$\hat{y}$	$\hat{y}$	$(y-\hat{y})^2$
1	3	1	9	3	160/52	2.265	.54
1	1	1	1	1	160/52	2.265	1.61
1	2	1	4	2	160/52	2.265	.07
2	5	4	25	10		4.035	.93
2	4	4	16	8		4.035	.0012
2	3	9	9	6		4.035	1.07
3	5	9	25	15		5.805	.64
3	7	9	49	21		5.805	1.42
3	8	16	64	24		5.805	4.81
			36	24		7.575	2.48
				32		7.575	.18

$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 \hat{x}$

$\boxed{\hat{y} = 270.92 - 106.4x}$

$\hat{y} = 270.92 - 106.4(4.5)$

$\hat{y} = -207.88$

How do you correct the trip productions and attractions with external zones using control totals for productions? (2)

$CT_P = \Sigma P_e + \Sigma P_z - \Sigma A_e$

$$factor = \frac{CT_P}{\Sigma A_z}$$

so two Trip productions and attractions must be same if there is lot of difference between trip production and Attraction then the one with less is multiplied by factor to make them approximately same.

2

ome useful formulas:

$=vt;$

$_1 = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{n\sum x_i^2 - (\sum x_i)^2}; \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}; \hat{\sigma}^2 = \frac{\sum (y_i - \hat{y})^2}{n-2}$