National Exams May 2008

98 Civ B10 Traffic Engineering

3 hours duration

NOTES

1. If doubt exists as to the interpretation of any question the candidate is urged to submit with the answer paper a clear statement of any assumptions made
2. This is a closed book exam Only the approved Casio or Sharp calculators are permitted
3. This exam has **Three PARTS, PART A, PART B** and **PART C** Answer two questions from each part
4. Six Questions constitute a complete exam paper The first Six questions as they appear in the answer book will be marked
5. The value of each question is shown

PART A

A 1 Discuss in detail the difference between Growth and Theoretical Trip Distribution Models Give examples of each Describe the advantages and disadvantages of each type of model

Marks 15

A 2 Describe what Modal Split means What model types are generally used to determine modal split? What is meant by model calibration in terms of modal split and how is it done The key variable in modal split is also used in two other sub models of the Urban Transportation Modelling System (UTMS) Describe how it interacts with each of these two sub models and how should this interaction be accounted for

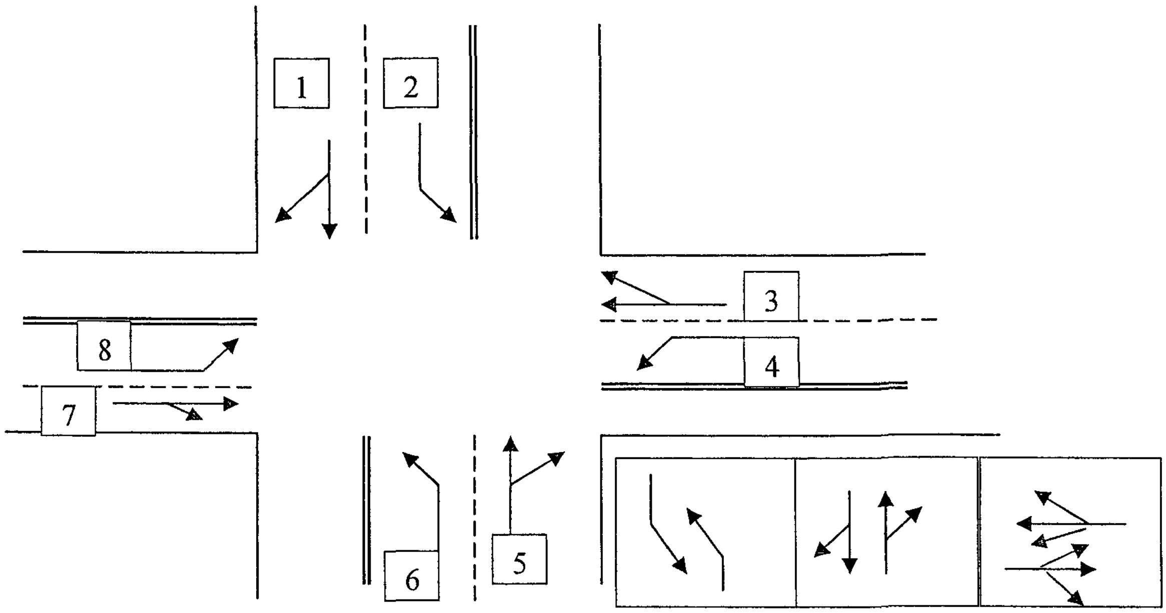
Marks 15

A 3 What are the three main requirements for performing Traffic Assignment? Describe each in detail What are Wardrop s two principles? Describe two traffic assignment techniques

Marks 15

PART B

B 1 For the following intersection and demand table determine the minimum and optimum cycle time and the green split Assume a three phase timing plan as shown with 5 seconds of intergreen per phase and a maximum cycle length of 240 seconds



Ignore left turn sneakers and Right Turn on Red Using a queuing diagram calculate the delay for lane 4

Lane	1	2	3	4	5	6	7	8
Volume	500	200	300	75	450	150	450	100
Saturation Flow	1700	1440	1600	350	1550	1350	1750	400

Marks 20

B 2 An approach has a demand of 480 vph a mınımum headway of 1 8 seconds per veh a cycle tıme of 100s and a dısplayed green of 64 seconds If the amber ıs 3 seconds the all red ıs 2 seconds the start loss ıs 2 seconds and the end gaın ıs 3 seconds calculate and ıllustrate wıth a queuıng dıagram

a Effectıve green

b Effectıve red

c Capacıty of approach

d Total and average vehıcle delay

e Maxımum queue sıze

f Delay to a vehıcle that arrıves 15 seconds after the lıght turns red

g Delay to a vehıcle that arrıves 10 seconds after the lıght turns green

Marks 20

B 3 Descrıbe ın detaıl one of the Canadıan Capacıty Guıde for Sıgnalısed Intersectıons analysıs procedure or the HCM Sıgnalızed Intersectıon Analysıs Procedure

Marks 20

PART C

C 1 For the following u q relationship determine maximum flow speed and density at the maximum flow free flow speed and jam density

$$q = 280u - 72u \ln u$$

Marks 15

C 2 A traffic stream travelling at 80 kph and a flow of 1000 vph encounters an accident that blocks their lane This condition lasts for 15 minutes after which the accident is cleared and the traffic is allowed to discharge from the queue at rate of 2000 vph at 50 kph If the jam density is 100 vpk calculate

a maximum number of vehicles in the queue

b maximum length of queue

c time to dissipate the queue

d time until upstream conditions reach site of accident

Marks 15

C 3 Speed flow speed density and flow density relationships are based on car following behaviour Describe in detail how the theoretical safe following distance s as shown below is determined What impact do the assumptions regarding expected deceleration rates have on s Draw and label typical speed flow speed density and flow density curves

$$s = v\delta + \frac{v^2}{2d_f} - \frac{v^2}{2d_l} + NL + x$$

Marks 15

SOME USEFUL EQUATIONS

$$\frac{d(uv)}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$$

$$\frac{d(\ln u)}{dx} = \frac{1}{u}\frac{du}{dx}$$

$$\frac{d(e\ \ )}{dx} = e\ \ \frac{du}{dx}$$

$$F = \frac{T}{T}$$

$$F^k = \frac{T}{T^k}$$

$$F = \frac{\sum T}{\sum T}$$

$$F^k = \frac{\sum T}{\sum T^k}$$

$$t_J^I = t_J \frac{F\ F_J}{F}$$

$$t_J^k = t_J^{k\ 1} \frac{F^{k\ 1} F_J^{k\ 1}}{F^{k\ 1}}$$

$$U_{sw} = \frac{q_b - q}{k_b - k}$$

$$Q_I(t) = G_I\left[Q_I(b)\right]$$

$$R_I = \frac{Q_I(t)}{Q_I(current)}$$

$$Q_{IJ}(new) = \frac{[Q_{IJ}(current)]R_J}{\sum[Q_I\ (current)]R}Q_I(t)$$

$$Q_{IJ}(current) = Q_{JI}(current) = \frac{Q_{IJ}(new) + Q_{JI}(new)}{2}$$

$$P(x \perp t) = \frac{(qt)\ e^{-qt}}{x^!}$$

$$c_{pt} = \frac{1\ 5L + 5}{(1 - \sum y\ )}$$

$$c_{m\imath} = \frac{L}{(1 - \sum y\ )}$$

$$C = \frac{g}{c}S$$

$$y = \frac{V}{S}$$

$$g = g_d - SL + EG$$