UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	ADVANCED TRAFFIC ENGINEERING
COURSE CODE	:	BFT 40503
PROGRAMME CODE	:	BFF
DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 A researcher obtained traffic data as shown in **Table 1** to develop a mathematical relationship between speed, *v* and density, *k* of a suburban multilane highway.

Table 1: Speed and density data

Speed (km/h)	Density (veh/km)
40	25
56	15
80	10
53	18
36	22
65	12
45	21
73	14

(a) Using simple linear regression analysis, determine the mathematical relationship between speed and density.

(12 marks)

(b) Calculate the coefficient of correlation and comment on the value.

(4 marks)

(c) Based on your findings, determine the
(i) Jam density
(ii) Free flow speed
(iii) Maximum flow

(5 marks)

(d) Based on your answer in **Q1(a)**, develop an equation relating flow, *q* and density, *k*. Determine the corresponding speed and flow when density is equal to 5 veh/km.

(4 marks)

Q2 (a) Explain the function of road hierarchy.

(4 marks)

(b) Discuss **FOUR (4)** ways, how a well formed road hierarchy can reduce overall impact of traffic.

(12 marks)

(c) Government has projected that the traffic entering city center of Johor Bahru increases 7% by year 2018. It was expected that the congestion problem will become a major concern in the city. Suggest **THREE (3)** strategies that can be used to manage the congestion and minimizing the traffic impact.

(9 marks)

Q3 (a) The purpose of traffic control is to assign the right of way to drivers, facilitate highway safety by ensuring the orderly and predictable movement of all traffic on highways. Discuss any **TWO (2)** factors to be considered to ensure that the device would operate as it needs.

(7 marks)

(b) Briefly explain about the characteristics of an isolated intersection.

(5 marks)

(c) **Figure Q3 (c)** highlights a situation (labelled as 'A') which can occur at an isolated intersection.

(i) Describe about situation of 'A' and its relationship with the yellow interval of traffic light.

(3 marks)

(ii) Explain how 'A' can be eliminated for safety reason.

(4 marks)

(d) Determine the optimal duration for the yellow phase to eliminate the dilemma zone at an intersection. Consider the following information in your calculation.

Intersection width	= 12.2 m
Maximum allowable speed on intersection approach	= 50 km/h (13.9 m/s)
Average vehicle length	= 6 m
Deceleration rate	= 3.4 m/s^2
Perception reaction time	= 1.0 s

(6 marks)

Q4 (a) Describe the advantages of computer application in transportation engineering, design and management.

(10 marks)

(b) Geographical Information System (GIS) has a great potential in transportation system management. Report **FIVE (5)** examples of GIS technology that are currently being used to improve the quality and security of transportation especially in urban areas.

(15 marks)

- END OF QUESTIONS -

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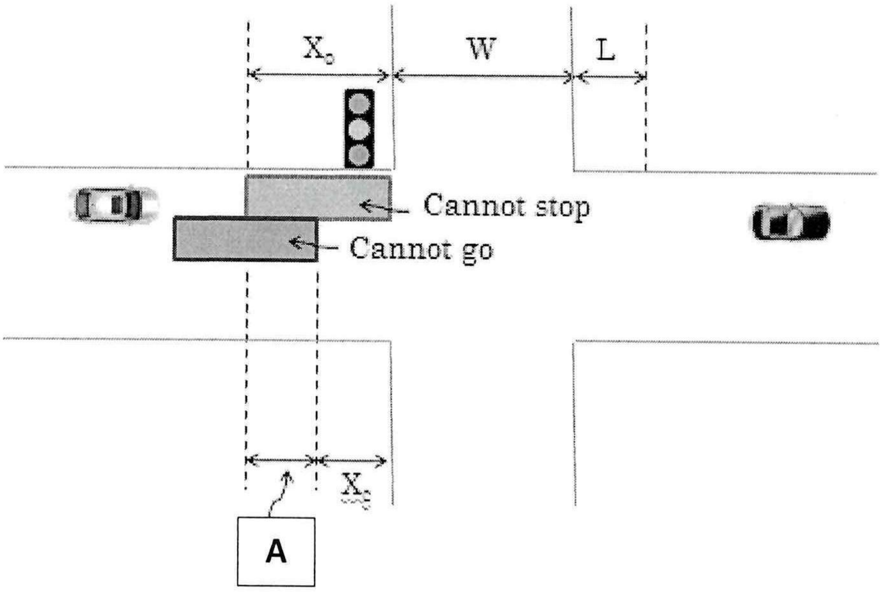

FIGURE Q3(c)

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The following equations may be useful to you:

$$\text{DDHV} = \text{AADT} \times \text{K} \times \text{D}, \quad D = \frac{5280 \times O}{L_v + L_d},$$

$$v = v_f - \frac{v_f}{k_j}k \qquad v = v_f e^{\left(\frac{-k}{k_j}\right)} \qquad v = C\ln\left(\frac{k_j}{k}\right) \qquad Y = a - bX \qquad a = \frac{\sum Y}{n} - b\frac{\sum X}{n}$$

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2} \qquad r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{\left(n(\sum X^2) - (\sum X)^2\right)\left(n(\sum Y^2) - (\sum Y)^2\right)}}$$

$$S_A = \frac{3600L}{T_R + d} \qquad d = d_1 * PF + d_2 + d_3 \qquad d_1 = \frac{0.5C\left(1 - \frac{g}{C}\right)^2}{1 - \left(\frac{g}{C}\right)min(X, 1.0)}$$

$$d_2 = 900T\left[(X-1) + \sqrt{(X-1)^2 + \frac{8kIX}{cT}}\right] \qquad I = 1.0 - 0.91X_u^{2.68} \qquad d_3 = \frac{1800Q_b(1+u)t}{cT}$$

$$t = 0 \; if \; Q_b = 0, \quad else \quad t = min\left(T, \frac{Q_b}{c[1 - min(1, X)]}\right)$$

$$u = 0 \; if \; t < T, \quad else \quad u = 1 - \frac{cT}{Q_b[1 - min(1, X)]} \qquad v_w = \frac{q_2 - q_1}{k_2 - k_1} \qquad X = \frac{v}{c}$$

$$c = s \times N \times \left(\frac{g}{C}\right) \qquad \tau_{\min} = \delta + \frac{W + L}{v_o} + \frac{v_o}{2a} \qquad C_o = \frac{1.5L + 5}{1 - Y}$$

$$L = \sum l + R \qquad G_e = \frac{y}{Y}(C - L) \qquad G_a = G_e + l - \tau \qquad \tau_{\min} = t_{pr} + \frac{W + L}{v_o} + \frac{v_o}{2a}$$

$$If \; W_E > 3, \quad G_p = 3.2 + \frac{L}{S_p} + \left(2.7\frac{N_{ped}}{W_E}\right) \qquad If \; W_E \le 3, \quad G_p = 3.2 + \frac{L}{S_p} + \left(0.27N_{ped}\right)$$

$$X_c = \sum\left(\frac{v}{s}\right)_c * \frac{C}{C - L} \qquad t_c = t_1 + \frac{(t_2 - t_1)(p - q)}{(r - s) + (p - q)} \qquad \lambda = \frac{V}{T} \qquad \mu = \lambda t$$

$$P(h \ge t) = e^{-\lambda t} \qquad P(h < t) = 1 - e^{-\lambda t}$$

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