Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ROAD SAFETY ENGINEERING
COURSE CODE	:	BFT 40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) The Global Plan for the Second Decade of Action for Road Safety 2021-2030 was launched on 31st August 2021. Discuss **THREE (3)** safety system approaches that most concern road safety in Malaysia.

(9 marks)

(b) Two people were traveling at 120-130 km/h for the past 10km since leaving a bar where they had an excessive drink. The driver loses control on a sharp curve and the vehicle strikes a tree. The passenger is partly ejected and killed. The driver had minor injuries. The rescue team arrived within one hour later. Based on the above statement, analyze the incident using the Haddon Safety Planning Matrix.

(10 marks)

(c) Explain briefly the function of the following agencies involved in road safety:

(i) Road Safety Department.

(ii) Highway Planning Unit.

(6 marks)

Q2 (a) Explain the following techniques that are used in prioritization and ranking of blackspot location:

(i) Nodal Analysis.

(ii) Cost Analysis.

(6 marks)

(b) Discuss **THREE (3)** independent variables that may be applied in the accident prediction model.

(6 marks)

(c) **Table Q2 (c)** shows some data on accidents number, vehicle gap and 85th percentile speed at KM71 to KM77 along Federal Route F001 (Simpang Renggam – Air Hitam). The data are needed to study whether the gap and speed have a significant correlation with the number of accidents. Determine the correlation coefficient and comment on the finding.

(13 marks)

Q3 (a) **Figure Q3 (a)** shows a collision diagram on a blackspot area. As traffic safety engineer, carry out a preliminary accident diagnosis and propose a functional design as the treatment to mitigate the problem.

(13 marks)

(b) Prior to carrying out in-depth investigation at any site of blackspot location, it is needed to check whether that the site has higher accident number than average. **Table Q3 (b)** shows accident frequency along KM 26 to KM 50 of Federal Route F050 in 5 years period.

(i) Calculate the coefficient of variation.

(9 marks)

(ii) Examine which section is needed for further investigation.

(3 marks)

Q4 (a) In new road project, it will be involved four of the five Road Safety Audit (RSA) stages. You are being appoint as a team in RSA auditor for this new road project in 28 KM total length. The road is designed for Rural standard with 70 to 90 km/h in speed limit and it is dual carriageway road. Propose RSA activity for each stage that you will involve and what should you do as road engineer in the team of auditor RSA.

(10 marks)

(b) **Table Q4 (b)** shows accident numbers before and after engineering treatments at selected blackpot area and control areas. By using Chi Square test, determine if there are any significant changes due to the treatment.

(7 marks)

(c) After an accident investigation was carried out at several primary school areas along State Road, there were three proposals to improve road safety among the school students:

Treatment A: Introduce vertical traffic calming
Cost of treatment = RM 500,000
No. of casualties saved = 12 cases over 3 years,

Treatment B: Introduce signalized pedestrian crossing
Cost of treatment = RM 1,450,000
No. of casualties saved = 21 cases over 3 years,

Treatment C: Introduce pedestrian foot path
Cost of treatment = RM 700,000
No. of casualties saved = 15 cases over 3 years,

If the single cost of casualties worth at RM 200,000:

(i) Calculate the percentage First Year Rate of Return (FYRR).

(6 marks)

(ii) Determine which treatment would provide the most benefit.

(2 marks)

- END OF QUESTIONS -

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TABLE Q2 (c): Accidents, average vehicle gap and 85th percentile speed

Section (KM)	Accident Frequency	Average Vehicle Gap	85th Percentile Speed
71	32	8	65
72	38	6	82
73	22	10	73
74	42	5	81
75	30	9	81
76	35	7	67
77	25	12	67

TABLE Q3 (b): Accident frequency along KM 25 to KM 50 (F050 in 5 years)

KM Post	Total (Accidents)	KM Post	Total (Accidents)
25	3	38	8
26	5	39	6
27	11	40	9
28	3	41	4
29	21	42	9
30	6	43	7
31	18	44	2
32	15	45	13
33	2	46	6
34	16	47	3
35	4	48	8
36	5	49	1
37	1	50	3

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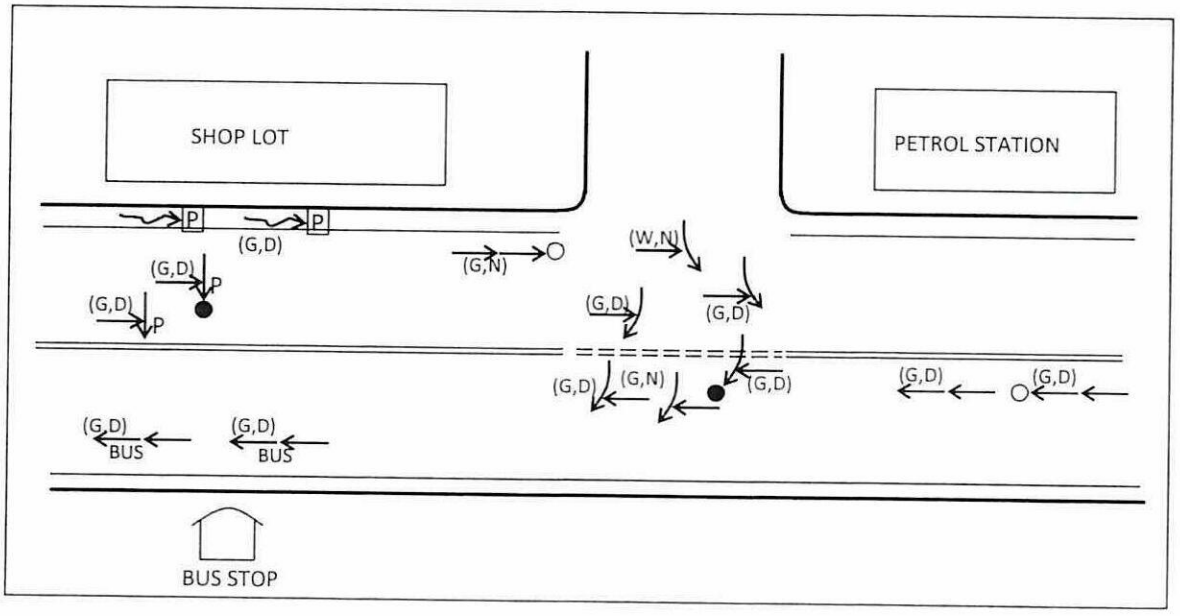

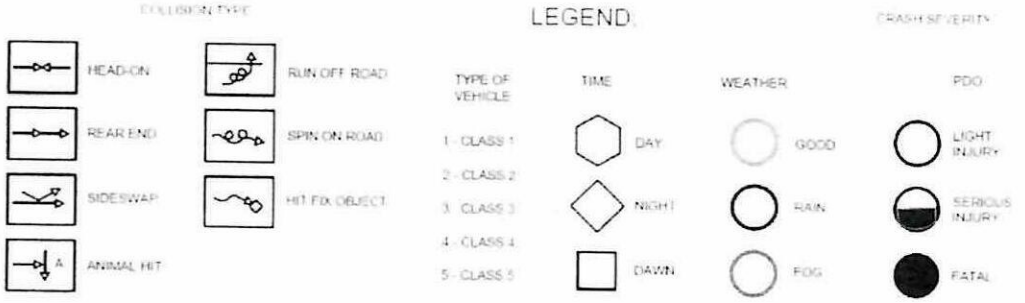

FIGURE Q3(a): A collision diagram on a blackspot area

TABLE Q4 (b): Accident data record before and after treatment

	Blackspot location	Control location
Before Treatment	33	290
After Treatment	13	189

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Appendix A: Formulas

$$b = \frac{SS_{xy}}{SS_{xx}} \qquad a = \bar{y} - b\bar{x}$$

$$SS_{xy} = \sum xy - \frac{\left(\sum x\right)\left(\sum y\right)}{n} \qquad SS_{xx} = \sum x^2 - \frac{\left(\sum x\right)^2}{n}$$

$$\bar{x} = \frac{\sum x_i}{n}$$

$$SS_{yy} = \sum y^2 - \frac{\left(\sum y\right)^2}{n}$$

$$R^2 = \frac{b \times SS_{xy}}{SS_{yy}} \qquad \sigma = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}} \qquad C_v = \frac{\sigma}{\bar{x}}$$

$$\chi^2 = \frac{\left(|ad - bc| - \frac{n}{2}\right)^2 n}{efgh} \qquad r = \frac{SS_{xy}}{\sqrt{SS_{xx} SS_{yy}}}$$

$$(F/P) = (1+i)^n \qquad (P/F) = \frac{1}{(1+i)^n}$$

$$(A/P) = \frac{i(1+i)^n}{(1+i)^n - 1} \qquad (P/A) = \frac{(1+i)^n - 1}{i(1+i)^n}$$

$$NPV = \sum_{t=1}^{t=n} \frac{(Benefit - Cost\ )}{(1+r)^n} \qquad BCR = \frac{\sum_{t=1}^{t=n} \frac{(Benefit)}{(1+r)^n}}{\sum_{t=1}^{t=n} \frac{(Cost)}{(1+r)^n}}$$