Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2023/2024

COURSE NAME	:	ROAD SAFETY ENGINEERING
COURSE CODE	:	BFT 40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY/FEBRUARY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS

2. THIS TEST IS CONDUCTED VIA
   - ☐ Open book
   - ☒ Closed book
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE TEST CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

Q1 (a) The Ministry of Transportation (MOT) recently announced that it will set a new minimum age of 15 for motorcycles in the B2 Class and 16 for motorcars in the D Class for those who want to obtain a driver's license. Discuss the advantages and disadvantages of this measure in terms of road safety issues.

(9 marks)

(b) Road and traffic signage is an important tool to ensure traffic movement and operation should be smooth and safe for road users. Draw and illustrate required the road signages for a major urban junction according to Public Works Department practice.

(10 marks)

(c) Explain the role and function of the following agencies responsible for accident database systems:

(i) Traffic Police Branch.

(3 marks)

(iii) Public Works Department (JKR).

(3 marks)

Q2 (a) Batu Pahat-Pontian Federal Road (F005) is known as an accident accident-prone area in Johor State. As a traffic safety engineer, you must carry out accident data analysis based on the given accident data record in **Table Q2.1**. Notes: Accident Point = Fatal (6), Seriously injured (4), Slightly injured (2) and Damage-only (1).

Table Q2.1 Accident data by type of vehicles at KM 5 (Batu Pahat-Pontian, F005)

Type of Vehicles	Fatal	Serious	Minor	Damage	Accident Total
Motorcar	3	5	20	85	113
Motorcycle	10	16	18	8	52
Lorry	1	0	2	6	9
Pedestrian	3	0	1	0	4
Van/Small Lorry	0	0	1	11	12
Bicycle	1	0	3	0	4
Bus	0	0	0	3	3
Other	0	1	0	1	2

(i) Calculate the Accident Point Weightage (APW).

(5 marks)

(ii) Ranking the APW by type of vehicles.

(3 marks)

(b) **Table Q2.2** shows data on accident numbers and hourly traffic volume from KM31 to KM40 along Federal Route F050 (Air Hitam – Kluang). The data are needed to study whether the traffic volume might contribute to the number of accidents.

Table Q2.2 Number of accidents and hourly traffic volume

Section (KM)	Accident No.	Hourly Traffic Volume
31	68	1453
32	88	1762
33	79	1623
34	77	1756
35	65	1890
36	83	2295
37	72	2285
38	96	2328
39	98	2443
40	101	2475

(i) Calculate the coefficients of correlation.

(8 marks)

(ii) Develop a simple linear regression model to determine the relationship.

(6 marks)

(iii) Evaluate the coefficient of determination (R^2) of the model.

(3 marks)

Q3 (a) **Figure APPENDIX A.1** shows a collision diagram at a selected blackspot location on Federal Road F050 in Johor. As a road safety engineer, you are assigned to look further at the selected blackspot.

(i) Perform a preliminary accident diagnosis.

(6 marks)

(ii) Suggest an in-depth site investigation.

(4 marks)

(iii) Propose an appropriate countermeasure to improve the blackspot location.

(4 marks)

(b) Before carrying out an in-depth investigation at any site of the blackspot location, it is needed to check whether the site has a higher accident number than average. **Table Q3.1** shows accident frequency along KM 21 to KM 36 of Federal Route F050 in 3 years.

Table Q3.1 Accident frequency along KM 21 to KM 36 (F050 in 3 years)

KM Post	Total (Accidents)	KM Post	Total (Accidents)
21	0	29	0
22	4	30	16
23	12	31	9
24	1	32	7
25	28	33	2
26	3	34	11
27	16	35	5
28	12	36	2
29	0	29	0

(i) Calculate the coefficient of variation.

(8 marks)

(ii) Examine whether there is a need for further investigation.

(3 marks)

Q4 (a) A new area is to be developed into a residential and institutional area in Muar District. It is a requirement to undertake the Road Safety Audit (RSA) activity of the new road project before proceeding with details on road design and infrastructure. As a traffic safety engineer, propose the lists on RSA activity for Stage 1 and Stage 2.

(8 marks)

(b) There are two accident treatments schemes to be proposed at a junction with a high rate of accidents as follows:

Scheme A:

- Cost of junction redesign is RM 150,000 within 1 year of completion,
- Annual maintenance cost is RM 10,000 for the next 4 years after installation,
- Estimated benefit of treatment around RM 66,000 for 2 years followed by RM 33,000 for the remaining 2 years.

Scheme B:

- Cost of junction redesign is RM 100,000 within 1-year completion,
- Annual maintenance cost is RM 15,000 for the next 4 years after installation,
- Estimated benefit of treatment around RM 60,000 for 2 years followed by RM 30,000 for the remaining 2 years.

If the interest rate of 10% within 5 years,

(i) Calculate the Net Present Value (NPV).

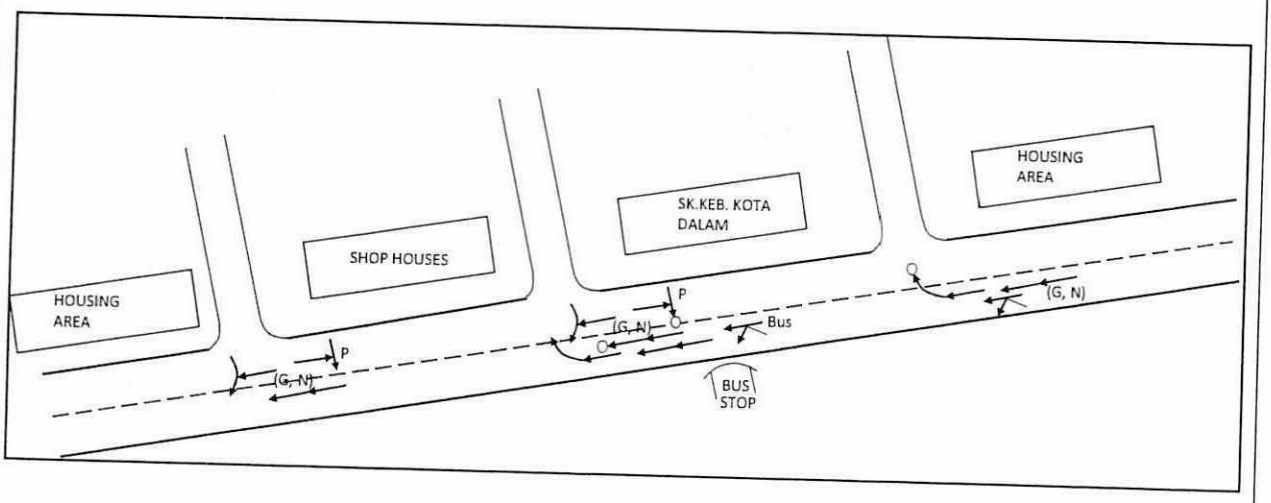
(14 marks)

(ii) Decide which scheme will be selected.

(3 marks)

- END OF QUESTIONS –

APPENDIX A



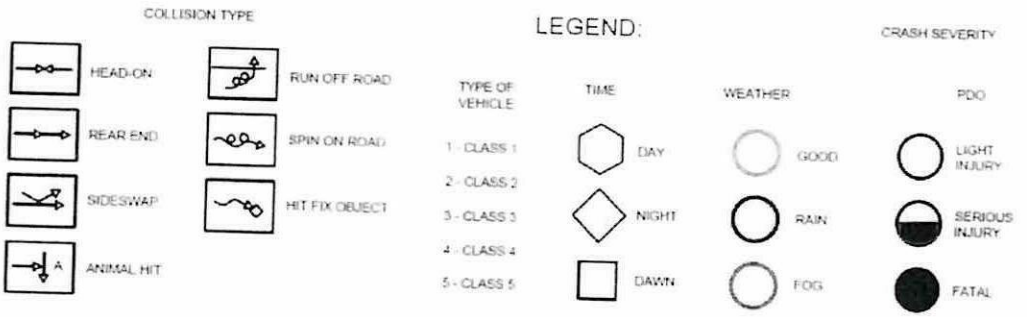


Figure APPENDIX A.1 A collision diagram on a blackspot area

APPENDIX B

Formulas

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

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

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

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

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

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

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

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

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

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