Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	TRANSPORTATION SYSTEM AND PLANNING
COURSE CODE	:	BNT 10502
PROGRAMME CODE	:	BNT
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
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 **EIGHT (8)** PAGES

Q1 Travel demand forecasting concept is the fundamental transportation planning process. **FOUR (4)** – stages travel demand forecasting is the one of transportation demand – supply planning. It allows the engineer to predict the volume of traffic that given transportation element in the future, whether that element is an existing highway or a potential light-rail route. Batu Pahat district is an example of the following planning process. The district has been divided into three (3) traffic zones. An origin-destination survey was conducted this year and yielded the number of trips between each zone as shown in the **Table Q1(i)**. Travel times between zones were also determined as in **Table Q1(ii)**. Socioeconomic adjustment factor of K_{ij} = 1.2, calibration factor c = 1.0 and travel time factors are defined as in **Table Q1(iii)**.

(a) Explain briefly **FOUR (4)** – stages travel demand forecasting process by giving an example for each stage with the sketch.

(5 marks)

(b) Apply Gravity Model to find number of trip distributions between zone i and j, T_{ij} for 1-iteration only.

(16 marks)

(c) Compare the results of Computed Attractions, Given Attractions and Productions by using a table.

(4 marks)

Q2 The Johor Bahru Transport Authority is planning to develop six (6) zones centroids in the area of Batu Pahat. The Railway Transit System (RTS) networks will be connected through these zones (**Figure Q2**). The travel times (minutes) between zones are estimated as at **Figure Q2**. The trips (number of passengers) from zone to zone are presented in **Table Q2**.

(a) Sketch the minimum path from zone to other zones (zone 1 to other zones, zone 2 to other zones, zone 3 to others, zone 4 to others, and zone 5 to others).

(6 marks)

(b) Determine the total trips for each link by using the All-or-Nothing trip assignment method.

(10 marks)

(c) Sketch the new minimum path if routes of 1 – 6 (6 – 1) and 3 – 6 (6 – 3) are closed.

(6 marks)

(d) Briefly explain your findings from **Q2(c)**.

(3 marks)

Q3 Economic feasibility studies have been conducted on the Mass Rapid Transit (MRT) 3 project and Bus Rapid Transit (BRT) operations in Lembah Klang. Suppose the demand for ridership/passengers is given by the following equation:

$$Q^d = 4000 - 100P + 500P_R$$

with P is the price of MRT 3 ticket and P_R is the price of Bus Rapid Transit ticket.

(a) Explain briefly, what happened to the demand for MRT 3 when the price of Bus Rapid Transit ticket goes up.

(2 marks)

(b) Explain briefly whether MRT 3 and Bus Rapid Transit are substitutes or compliments.

(2 marks)

(c) Sketch graph the demand curve for MRT 3 when $P_R = 2$.

(5 marks)

Suppose that the quantity of MRT 3 supplied is given by the following equation:

$$Q^S = 1500P - 60W$$

where W is the number of wagons.

(d) Draw the graph of supply curve for MRT 3 when number of wagons = 50. Label the equilibrium price and quantity with P* and Q* respectively.

(5 marks)

(e) Calculate the equilibrium ticket price and quantity of MRT 3.

(5 marks)

(f) The graph of demand – supply is at the equilibrium values. Apply the equilibrium concept to find the price elasticity of demand and explain briefly whether the demand of MRT 3 elastic, unit elastic or inelastic.

(6 marks)

Q4 Railway noise is one of the issues in environmental impacts of railway operations and maintenance. Noise is commonly measured as a pressure in decibel (dB). Every human activities contribute to the noise level (dB).

(a) Describe briefly the following terms:
(i) Noise sources from the train with the sketch. (2 marks)
(ii) Intensity of Sound with the formula. (2 marks)
(iii) dBA scale with the range for human activities. (2 marks)

Noise measurement was conducted along the turnouts track of railway at the distance of 45 meters (sources – reception point) with the position of view angle (θ) 15° (**Figure Q4(b)**). The track is used for trains with the type of 210 meters length and average speed of 120 km/hr (**Figure Q4(c)**). The sound level measurement and Maximum Sound Level, Lmax can be seen in **Figure Q4(d)**.

(b) Calculate Maximum Sound Level, Lmax correction for the distances and speed.

(6 marks)

(c) Calculate Sound Exposure Level (SEL) at 61 meters from turnouts track using correction factors from the result Q4(b).

(7 marks)

(d) Estimate Equivalent Sound Level (Leq) at position view angle (θ') of 30° in 24 hours with 20 trains per day.

(6 marks)

– END OF QUESTIONS –

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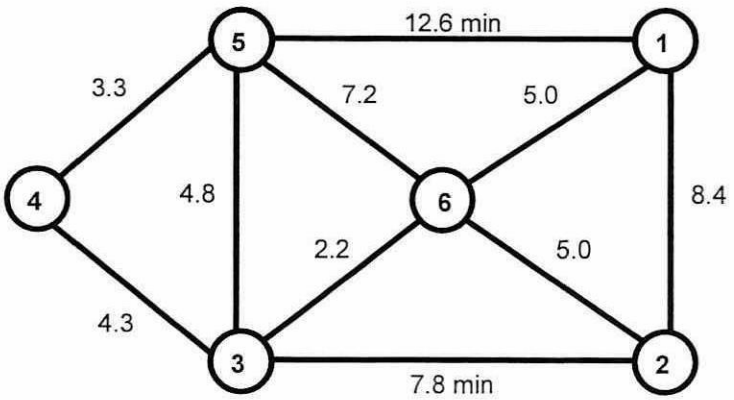

Figure Q2

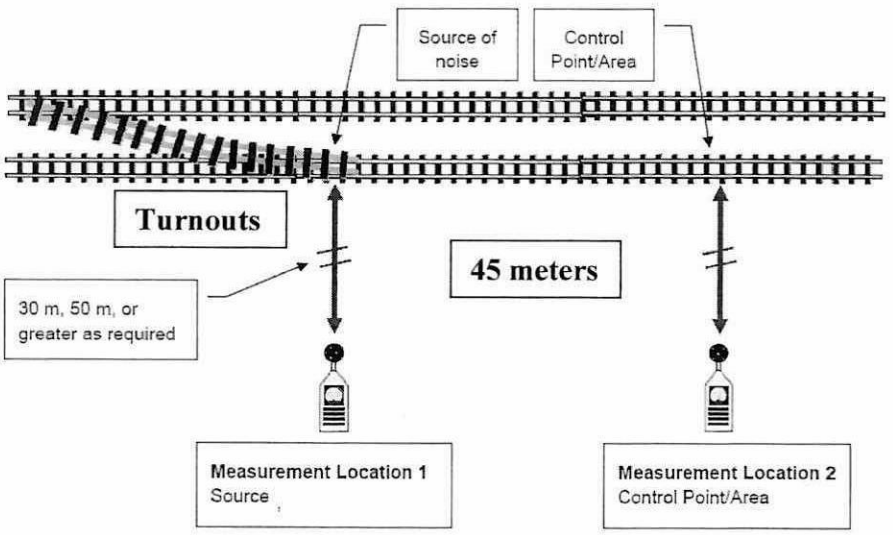

Figure Q4(b)

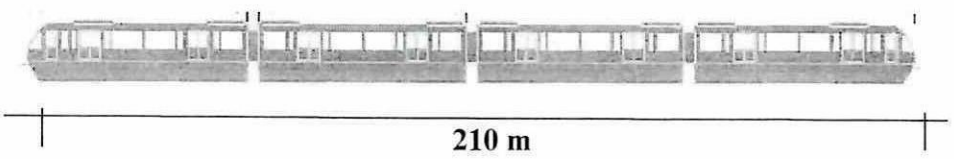

Figure Q4(c)

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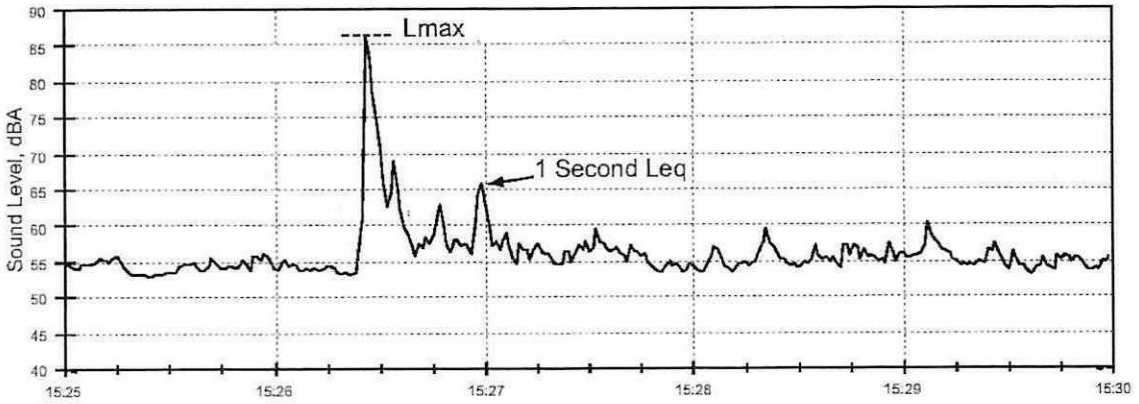

Figure Q4(d)

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Table Q1(i)

Zone	1	2	3	Total
Productions	250	450	300	1000
Attractions	395	180	425	1100

Table Q1(ii)

Zone	1	2	3
1	6	4	2
2	2	8	3
3	1	3	5

Table Q1(iii)

Time (min)	1	2	3	4	5	6	7	8
Friction factor	82	52	50	41	39	26	20	13

Table Q2

From zone	To zones					
	1	**2**	**3**	**4**	**5**	**6**
1	0	550	500	200	500	650
2	550	0	525	350	550	600
3	500	525	0	600	575	800
4	200	350	600	0	400	200
5	500	550	575	400	0	350
6	650	600	800	200	350	0

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FORMULA:

$$T_{ij} = P_i \frac{(A_j \ F_{ij} \ K_{ij})}{\sum(A_j \ F_{ij} \ K_{ij})}$$

$$F_{ij} = \frac{1}{W_{ij}^{\varepsilon}}$$

$$\Delta SEL_{distance} = 10 \ log_{10}\left(\frac{D}{d_1}\right) = 10 \ log_{10}\left(\frac{\frac{d}{M}}{d_1}\right)$$

$$\Delta SEL_{speed} = 30 \log\left(\frac{V}{130}\right)$$

$$SEL = L_{max} + 10 \ log_{10}\left(\frac{M}{V}\right) + 10.5 - 10 \ log_{10}((4D + (4D^2 + 1) + 2 \ tan^{-1}\left(\frac{1}{2D}\right))$$

$$\Delta\theta = 10 \ log_{10}\left(\frac{\theta}{\theta_1}\right),$$