UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	TRANSPORTATION ENGINEERING
COURSE CODE	:	BFT 40303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) Transportation is the movement of people and goods to meet the basic needs of society. Discuss **TWO (2)** key issues in transportation.

(5 marks)

(b) Intelligent Transportation System (ITS) aims to improve traffic operations by using information technology including computers, electronics and communication. Explain **FOUR (4)** areas in transportation where ITScould be applied and elaborate each one of them.

(8 marks)

(c) As a transport engineer, you are required to propose the most appropriate solution in accordance to Arterial and Freeway Management System for the following transportation issues. Name the solution and discuss **TWO (2)** benefits for each solution.

(i) Long queue and delay at Pura Kencana traffic signal intersection.

(3 marks)

(ii) Frequent traffic disruption due to merging traffic that coming from on-ramp and freeway in DUKE Expressway

(3 marks)

(iii) Road congestion in a city road in Kuala Lumpur due to flash flood. It is necessary for the flash flood to be controlled immediately.

(3 marks)

(iv) High accident risk due to vehicle breakdown at the fast lane of East Coast Expressway. It is necessary to inform drivers about the incident ahead.

(3 marks)

Q2 (a) A new railway track is designed to has super elevated curve of 1400 m radius. It is proposed that the design speed at the area is 200 km/h. Refer **Table 1** for your calculation.

(i) Analyze and evaluate whether the superelevated curve is adequate.

(7 marks)

(ii) Suggest the minimum length of spiral curve that is required to connect a straight rail line with the horizontal curve of the track.

(5 marks)

(b) Given that Points of Vertical Intersection (PVIs) of two vertical curves, a crest curve followed by a sag curve, on a light rail transit main line track has distance of 800 m. The grade of the approaching tangent of the crest curve is 3% and that of the departing tangent of the sag curve is 6%. Determine the preferred minimum and absolute minimum lengths of each

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of these curves if the design speed of the track is 120 km/h.

(13 marks)

Q3 (a) A new airport is going to be built in Kulim, Kedah. From site investigation, the land strip site is 950 m AD. Centerline elevation contains difference in runway high and low points of 7m. The airport will serve 100% fleet and 60% useful load of a family of airplanes having a maximum certificated load of 300,000 N. Refer **Figure Q3(a)** for your calculation. (AD = Above Datum)

(i) Determine the unadjusted minimum primary runway length.

(2 marks)

(ii) Calculate the minimum primary runway length, considering wet and slippery conditions during air craft landing, and difference in centerline elevation during air craft take-off.

(8 marks)

(ii) Estimate the minimum required length for the crosswind runway.

(2 marks)

(b) A Boeing aircraft in which categorized in design group V with the following dimensions is moving between two parallel taxiways through a connecting taxiway that has a centerline perpendicular to the parallel taxiways.

Distance between undercarriage and cockpit (d)	=	25 m
Wheelbase (w)	=	18 m
Undercarriage width (u)	=	6 m

(i) Recommend appropriate values to be used for the taxiway width (W), edge safety margin (M) and centerline radius (R).

(3 marks)

(ii) Check the adequacy of the maximum nose wheel steering angle (B_{max}).

(6 marks)

(iii) Calculate the required lead-in (L) and radius of the fillet (F) to maintain the aircraft cockpit over the centerline.

(4 marks)

Q4 (a) Sketch and describe briefly the following facilitiesthat can be commonly found at ferry terminals:

(i) Vehicle staging area.

(3 marks)

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(ii) Passenger loading area.

(4 marks)

(b) A ferry docking at a berth in a ferry terminal has a50-person capacity and one doorway. The berth has ticket machines located on-shore, a single channel gangway and a sloped walkway 15 m in length that ends in a pair of free-swinging gates. Tickets are collected manually at the gangway. The following were observed:

Capacity for ticket collection (C_f)	= 20 passengers/min
Capacity for walkway exit gate (C_x)	= 25 passengers/min/channel
Capacity for gangway (C_g)	= 35 passengers/min/channel
Passenger walking speed (v_e, v_d)	= 1.2 m/s
Clearance time (t_c)	= 6 min
Operating margin (t_{om})	= 4 min

Assuming that passenger volume is at maximum during peak hours,

(i) Calculate the embarking capacity (C_e) and disembarking capacity (C_d).

(10 marks)

(ii) Determine the total embarking and disembarking time (t_{ed}).

(4 marks)

(iii) Estimate the maximum number of ferries per hour (V_b) that the berth can accommodate during peak hours.

(4 marks)

- END OF QUESTIONS -

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TABLE 1

I. Maximum grades for light rail main line railway tracks

Distance between points of vertical intersection	Maximum sustained grade (%)
More than 750 m	4
Up to 750 m	6
Up to 150 m	7

II. Taxiway dimensional standards (in meters)

Item	Airplane Design Group					
	I	II	III	IV	V	VI
Width	7.6	10.7	15.2	22.9	22.9	30.5
Edge safety margin	1.5	2.3	3.1	4.6	4.6	6.1
Shoulder width	3.1	3.1	6.1	7.6	10.7	12.2
Safety area width	14.9	24.1	36.0	52.1	65.2	79.9

III. Taxiway curvature dimensional standards (in meters)

Item	Airplane design group					
	I	II	III[b]	IV	V	VI
Radius of taxiway turn[a] (R)	22.9	22.9	30.5	45.7	45.7	51.8
Length of lead-in to fillet (L)	15.2	15.2	45.7	76.2	76.2	76.2
Fillet radius for tracking centerline (F)	18.3	16.8	16.8	25.9	25.9	25.9
Fillet radius for judgmental oversteering symmetrical widening (F)	19.1	17.5	20.7	32.0	32.0	33.5
Fillet radius for judgmental oversteering one side widening (F)	19.1	17.5	18.3	29.6	29.6	30.5

Notes:
a Dimensions for taxiway fillet designs relate to the radius of taxiway turns specified.
b Airplanes in airplane design group III with a wheelbase equal to or greater than 18.3 m should use a fillet radius of 15.2 m.

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Runway length to serve 100% of large planes of 272,000 N or less

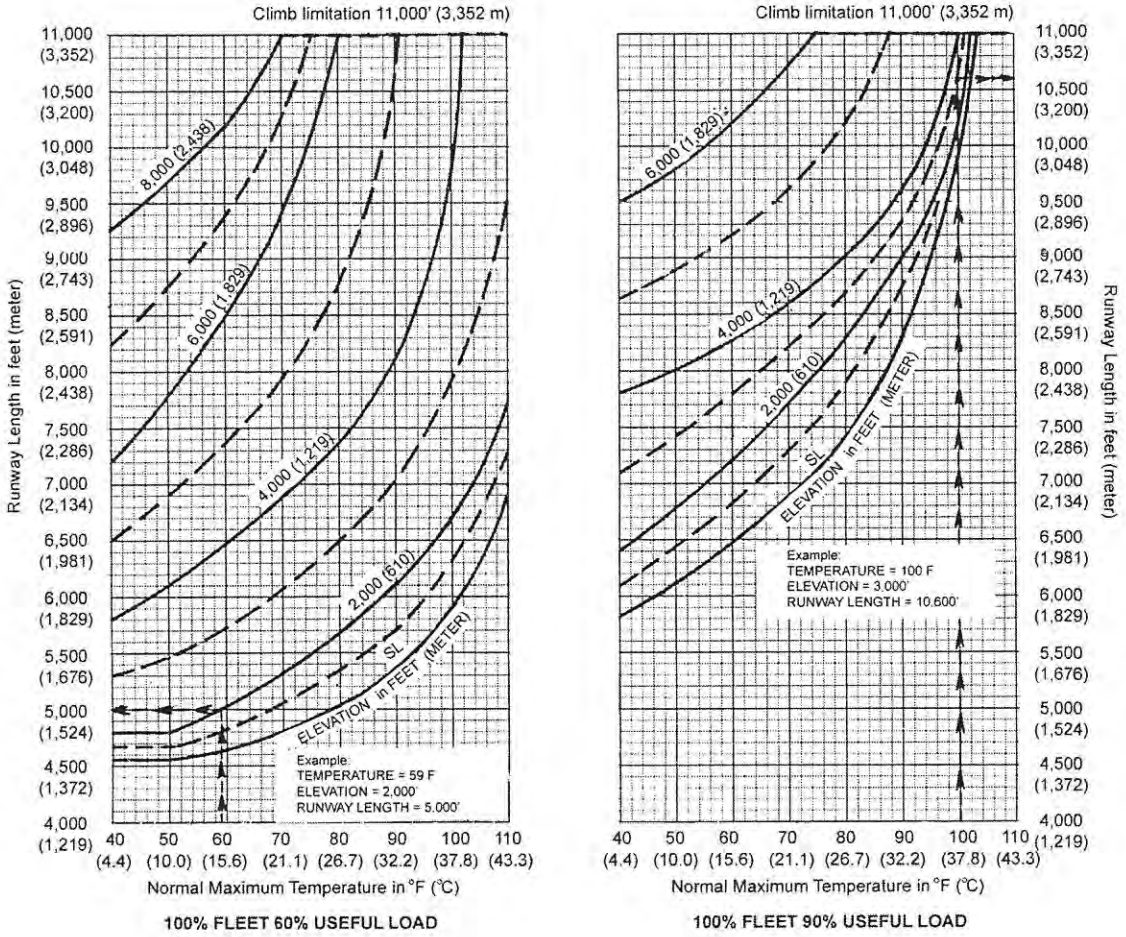

FIGURE Q3(a)

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Design Formulas

The following information may be useful. The symbols have their usual meaning.

$$LVC_{des} = 60A \qquad LVC_{min\,pref} = 30A \qquad LVC_{min\,abs(crest)} = \frac{Au^2}{212}$$

$$LVC_{min\,abs(sag)} = \frac{Au^2}{382} \qquad R = \frac{1718.89}{D_c} \qquad e_a = 0.79\left(\frac{u^2}{R}\right) - 1.68$$

$$e_q = e_a + e_u \qquad e_q = 0.00068u^2 D_c$$

$L_{min\,spiral} = 0.122 e_u u$ to satisfy unbalanced acceleration

$L_{min\,spiral} = 7.44 e_a$ to satisfy racking and torsional forces

$$A_{max} = \sin^{-1}\left(\frac{d}{R}\right) \qquad L = d * ln\left[\frac{4d\tan\left(\frac{A_{max}}{2}\right)}{W - u - 2M}\right] - d$$

$$B_{max} = \tan^{-1}\left[\left(\frac{w}{d}\right)\tan A_{max}\right] \qquad F = \left(R^2 + d^2 - 2Rd\sin A_{max}\right)^{0.5} - 0.5u - M$$

$$C_d = min\begin{Bmatrix} C_g N_{cg} \\ C_x N_{ce} \end{Bmatrix} \qquad C_e = min\begin{Bmatrix} C_g N_{cg} \\ C_g N_f / t_f \\ C_x N_{ce} \end{Bmatrix} \qquad t_{ed} = 60\left(\frac{P_d}{C_d} + \frac{L_w}{v_d} + \frac{P_e}{C_e} + \frac{L_w}{v_e}\right)$$

$$t_v = t_{ed} + t_c + t_{om} \qquad V_b = \frac{3600}{t_v}$$

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