UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	HIGHWAY TECHNOLOGY AND TRAFFIC MANAGEMENT
COURSE CODE	:	BNP20303
PROGRAMME	:	2 BNA, 2 BNB, 2 BNC
EXAMINATION DATE	:	JUNE / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER 3 QUESTIONS FROM **PART A** AND 2 QUESTIONS FROM **PART B**
		2. ATTACH SEMI-LOG PAPER

THIS QUESTION PAPER CONSISTS OF **FOURTEEN (14)** PAGES

PART A

Q1   (a)   The thickness of compacted subgrade in non problematic soil is in the range of 0.5 to 2.0 m.

   (i)   Identify the reason of this statement in the view of bearing capacity and settlement of the sub-grade soil.

   (ii)   In the condition where the road should pass through the problematic soil such as Peat and collapsible soil, give your evaluation.

(4 marks)

(b)   Answer the following :

   (i)   Define the CBR, M_R value and Aggregate Impact Value.

   (ii)   Plot the gradation limit of crushed aggregate road base type II as shown in the table Q(1) in provided semi log paper then plot the grading of sample A, what do you have to recommend in order to satisfy the requirement of gradation type II ?.

Table Q(1) : Gradation limit of road base

B.S Sieve	% Passing by Weight		
	Type I	Type II	Sample A
50.0 mm	100	100	100
37.5 mm	95 – 100	85 – 100	80
28.0 mm	-	70 – 100	60
20.0 mm	60 – 80	60 – 90	50
10.0 mm	40 – 60	40 – 65	-
5.00 mm	25 – 40	30 – 55	35
2.36 mm	15 – 30	-	-
2.00 mm	-	20 – 40	25
600 μm	8 – 22	-	15
425 μm	-	10 – 25	12
75 μm	0 – 8	2 – 10	5

(8 marks)

(c)   In the construction of asphalt concrete (AC) as parts of flexible pavement :

   (i)   Differentiate the function of prime coat and tack coat.

   (ii)   List FOUR (4) functions of wearing coarse.

(8 marks)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2014/2015	PROGRAMME : 2 BNA, 2 BNB, 2 BNC
COURSE : HIGHWAY TECHNOLOGY AND TRAFFIC MANAGEMENT	COURSE CODE : BNP 20303

Semi-log paper

Q2   (a)   Contrast between **TWO (2)** differences between flexible and rigid pavement.

(3 marks)

(b)   List **FOUR (4)** parameters to design flexible pavement by AASHTO 1993 method.

(2 marks)

(c)   Distinguish the function of T – bar and dowel in rigid pavement.

(4 marks)

(d)   In certain circumstances, the geotextile is used to cover subgrade soil in construction of pavement, evaluate **TWO (2)** functions of geotextile there.

(4 marks)

(e)   The flexible pavement is designed to serve total ESAL = 6×10^6. Sub-grade Modulus $Mr = 5000$ psi. Elastic resilient Modulus of surface layer $E_{AC} = 340,000$ psi, Base coarse of crushed stone has CBR = 85 % and sub base layer with CBR = 20 %. It is given that initial serviceability index $p_o = 4.2$ and terminal serviceability indeks $Pt = 2.2$. Reliability level R=95 % and Overall standard deviation $S_o = 0.30$. Determine the structural numbers of SN_1, SN_2 and SN_3 by AASHTO method by referring to **FIGURE Q2 (a,b,c,d).**
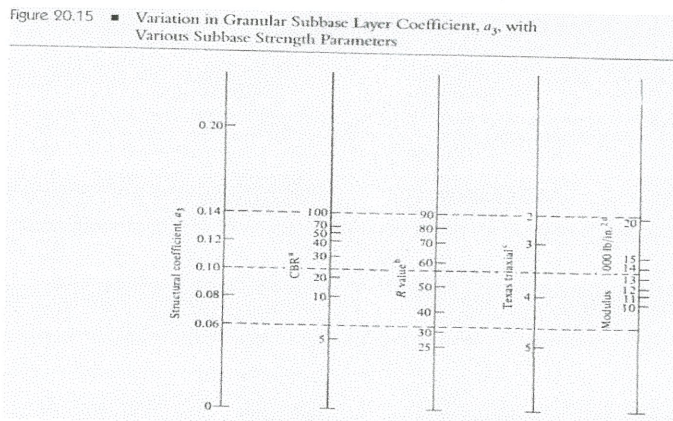
(7 marks)
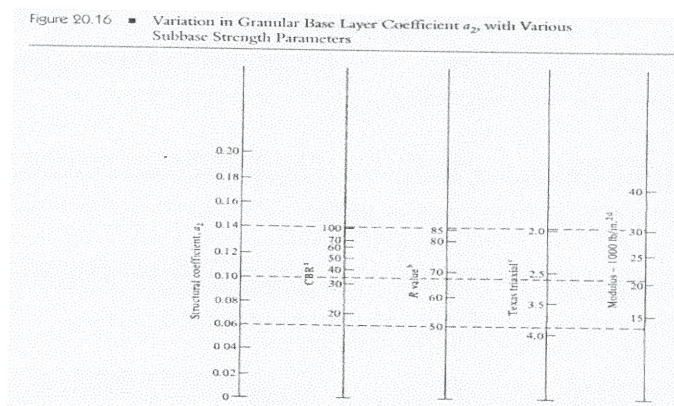
FINAL EXAMINATION

SEMESTER / SESSION   : SEM II / 2014/2015   PROGRAMME : 2 BNA, 2 BNB, 2 BNC
COURSE   : HIGHWAY TECHNOLOGY   COURSE CODE   : BNP 20303
                        AND TRAFFIC MANAGEMENT

Figure 20.15 ■ Variation in Granular Subbase Layer Coefficient, a_3, with Various Subbase Strength Parameters

FIGURE Q2(a)

Figure 20.16 ■ Variation in Granular Base Layer Coefficient a_2, with Various Subbase Strength Parameters

FIGURE Q2(b)

Figure 20.17 ■ Chart for Estimating Structural Layer Coefficient of Dense-Graded/Asphalt Concrete Based on the Elastic (Resilient) Modulus

FIGURE Q2(c)
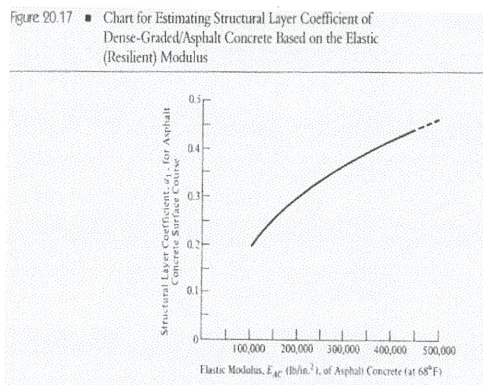
FINAL EXAMINATION

SEMESTER / SESSION   : SEM II / 2014/2015   PROGRAMME : 2 BNA, 2 BNB, 2 BNC
COURSE   : HIGHWAY TECHNOLOGY   COURSE CODE   : BNP 20303
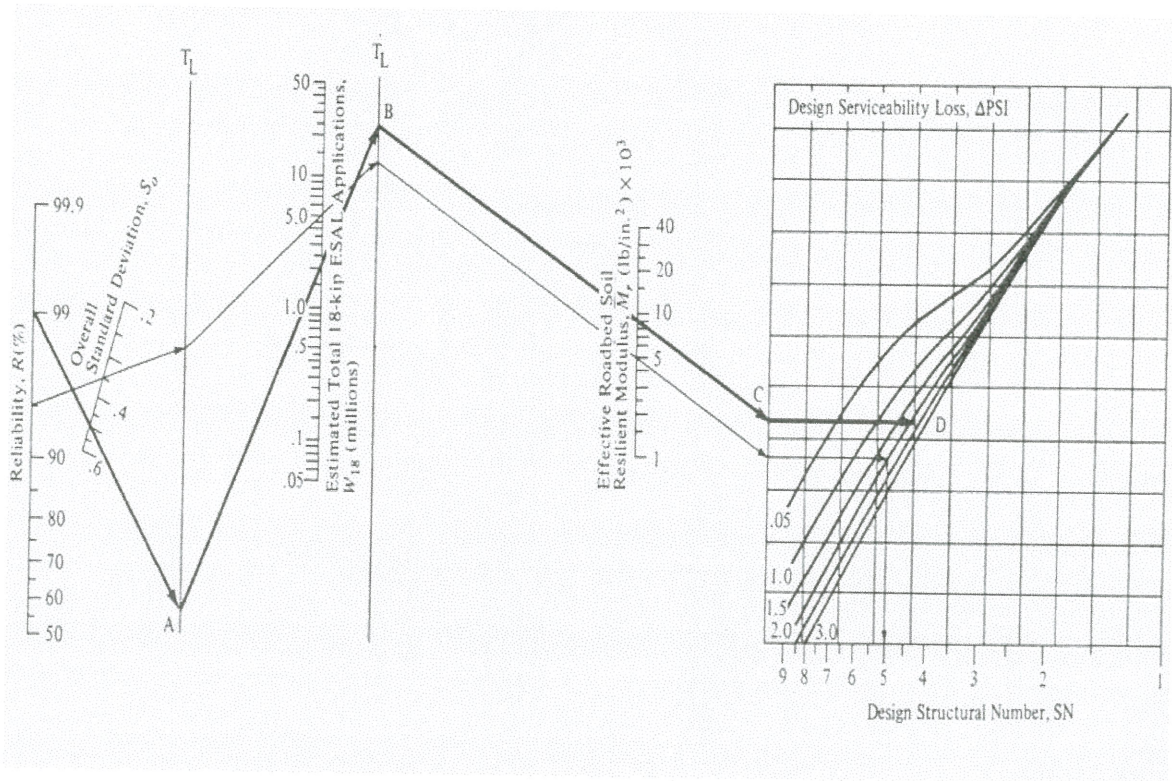   AND TRAFFIC MANAGEMENT

FIGURE Q2(d)

Q3   (a)   The diagram in **FIGURE Q3(a)** shows the proposed formation level and existing ground level for the construction of a road.

   (i)   Determine the volume of borrow or waste

   (ii)   Complete your answer using a mass haul diagram

(6 marks)

(b)   With the aid of rigid pavement sketch,

   (i)   List the necessary tests to control the quality of rigid pavement construction

   (ii)   Arrange the steps to construct rigid pavement

(6 marks)

(c)   Explain terms used in earthwork in construction of subgrade :

   (i)   clearing

   (ii)   grubbing
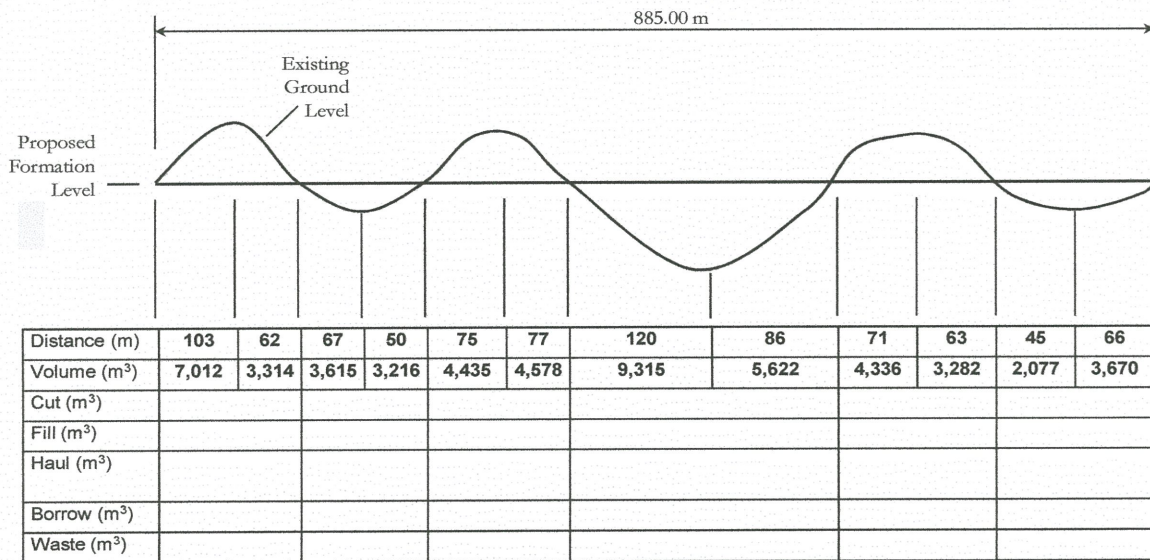
   (iii)   stripping.

(3 marks)

(d)   Suppose you are a Project Manager of the Contractor company to construct highway with flexible pavement from A to B (50 km away). Based on the fundamental concept of construction management which requires at least 5 m (man,material, machine, method, money), arrange the elements of 5 m in your planning.

(5 marks)

FINAL EXAMINATION

SEMESTER / SESSION	: SEM II / 2014/2015	PROGRAMME	: 2 BNA, 2 BNB, 2 BNC
COURSE	: HIGHWAY TECHNOLOGY AND TRAFFIC MANAGEMENT	COURSE CODE	: BNP 20303

885.00 m

Existing Ground Level

Proposed Formation Level

Distance (m)	103	62	67	50	75	77	120	86	71	63	45	66
Volume (m³)	7,012	3,314	3,615	3,216	4,435	4,578	9,315	5,622	4,336	3,282	2,077	3,670
Cut (m³)												
Fill (m³)												
Haul (m³)												
Borrow (m³)												
Waste (m³)												

FIGURES Q3(a)

Q4 (a) Differentiate the pavement structural evaluation and pavement functional evaluation.

(3 marks)

(b) Explain non destructive and destructive method in structural evaluation of pavement.

(4 marks)

(c) Pavement condition survey is used to obtain pavement rating to determine Pavement Condition Index (PCI) as mentioned in ASTM 6433-07. Arrange the procedure to determine PCI.

(4 marks)

(d) The asphalt pavement distress is tabulated in table Q(4), cross the right answer for the possibility of cause either column (2) or (3) and choose what is the suitable maintenance / rehabilitation method in column (4).

Table Q(4) : Asphalt pavement distress

Distress type (1)	Primarily caused by traffic (2)	Primarily caused by climate / material (3)	Maintenance / rehabilitation method (4)
Alligator cracking			
Bleeding			
Block cracking			
Depression			
Polished aggregate			
Pot holes			
Ravelling and weathering			
Rutting			
Swell			

(9 marks)

PART B

Q5 (a) Differentiate between Transportation System Management (TSM) and Transportation Demand Management (TDM).

(4 marks)

(b) List **FOUR (4)** reasons why management of traffic in town and cities is crucial.

(4 marks)

(c) Explain what is Integrated Transport Information System (ITIS).

(4 marks)

(d) Fill in the blank of the Table Q(5), each **ONE (1)** objective and **TWO (2)** techniques of Traffic Management.

Table Q(5) : Objectives and Technique of Traffic Management

Category	Objectives	Techniques
Capacity improvement		
Priority allocation		
Restraint		

(6 marks)

(e) Parking and Pedestrian are integral parts of Transport Management, why this is important, summarize each **TWO (2)** reasons.

(2 marks)

Q6 (a) Briefly explain **THREE (3)** warrants before come to a decision to install signal control.

(6 marks)

(b) Explain **FOUR (4)** principle ways of safe intersection design.

(4 marks)

(c) The following table Q(6) is a tabulation from data of traffic movement in the intersection, The 3-phase traffic signal as shown in **FIGURE Q6**,

Table Q(6) : Calculation of Y-value

Phase	Φ1		Φ2		Φ3	
Movement Identification	WL	EL	WR	ER	N	S
q	245	285	189	166	219	295
S	1781	1817	1628	1628	1889	1560
y=q/S						
Y						

(i) Complete the blank in Table Q(6).
(ii) Design the timing schedule.

(10 marks)

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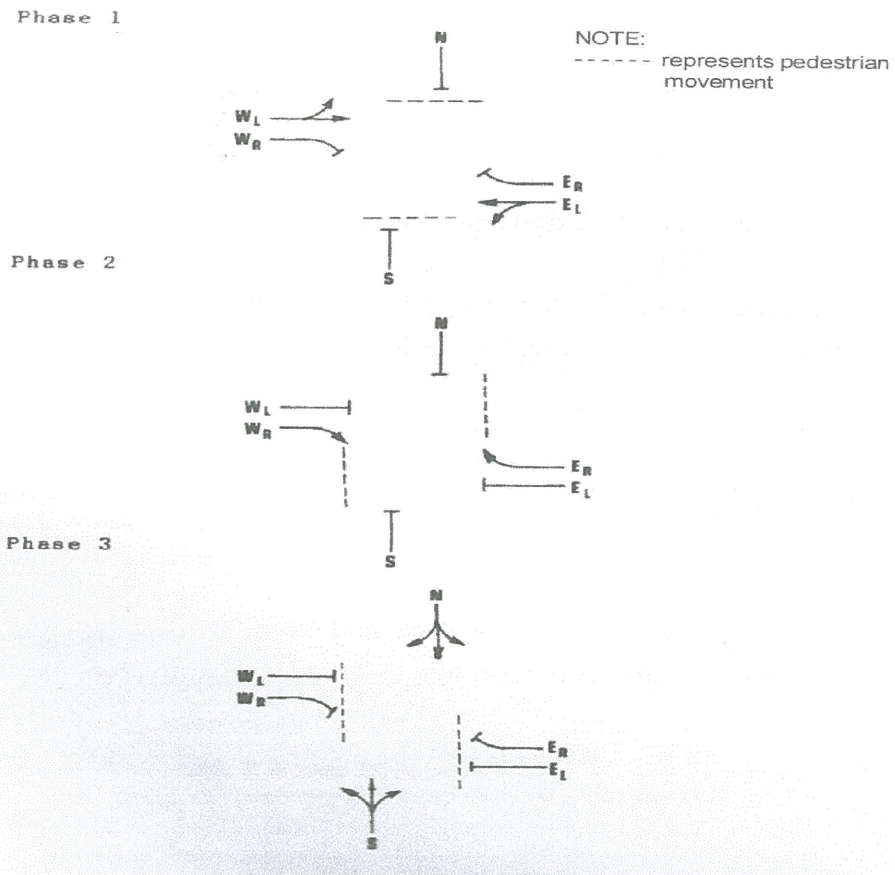|			
FINAL EXAMINATION			
SEMESTER / SESSION	: SEM II / 2014/2015	PROGRAMME	: 2 BNA, 2 BNB, 2 BNC
COURSE	: HIGHWAY TECHNOLOGY AND TRAFFIC MANAGEMENT	COURSE CODE	: BNP 20303

FIGURE Q6

Q7   (a)   Identify **TWO (2)** impacts of water to the following :

  (i)   Highway surface.
  (ii)   Highway structures.
  (iii)   Subgrade soil.

(6 marks)

  (b)   With the aids of sketches, contrast the surface, sub-surface and cross drainage.

(4 marks)

  (c)   With the aids of sketches, distinguish the following terms of maintenance work in hill roads :

  (i)   Slope maintenance
  (ii)   Drainage maintenance
  (iii)   Sub-surface drainage maintenance
  (iv)   Gutter maintenance
  (v)   Splash block maintenance

(10 marks)

Q8   (a)   Describe the stopping sight distance in road geometric design.

(4 marks)

  (b)   The **FIGURE Q8 (b)** illustrates the proposed site for the construction of a building that is adjacent to a horizontal curve section of a rural highway. The suggested offset clearance is 10 m.   The highway design speed is 110 km/hr, while the curve length and curve radius is 200 m and 600 m respectively. Drivers' perception-reaction time is taken as 2.5 seconds and the coefficient of friction   between the tyres and the road surface is 0.28. Evaluate the available clearance whether safe or not to stopping sight distance requirement ?

(8 marks)

  (c)   The following is a vertical alignment data :

  G1 = +3.0%   ;   G2 = -2.0%   ;   L = 300 m   ;   Interval = 50 m
  Elevation at   BVC = 19.00 m ; VIP = 22.00 m ; EVC = 17.50 m
  Determine the location of the interval point on the curve.
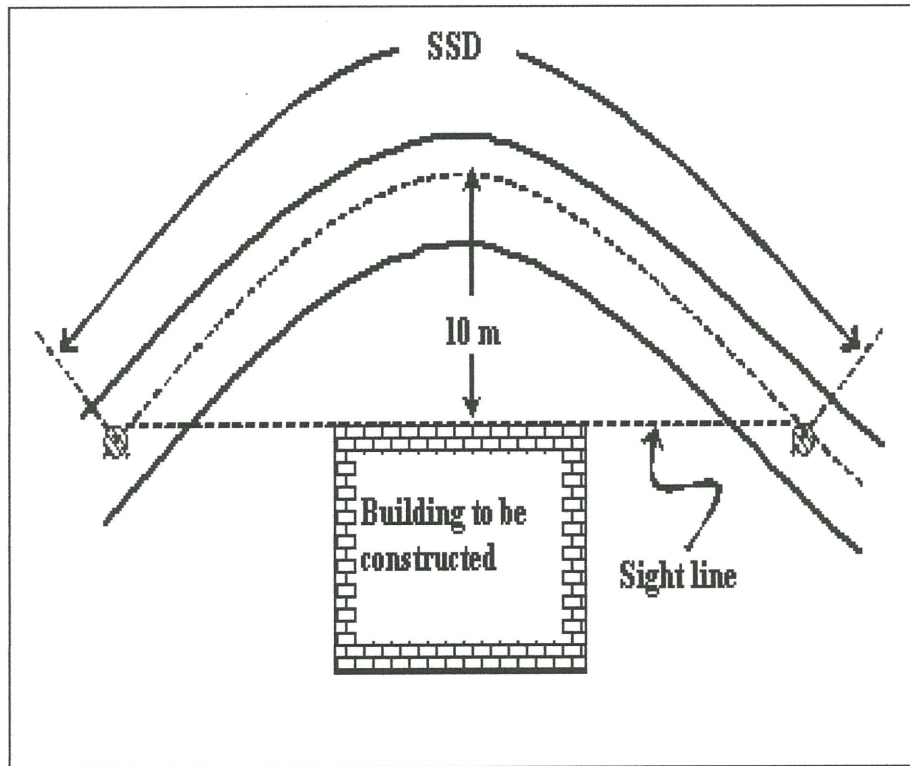
(8 marks)

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FIGURE Q8(b)

- END OF QUESTION -

Formula :

$I = a + R$; $L = \Sigma (I - a) + \Sigma \ell$

$C_o = (1.5L + 5)/(1-Y)$; $g_n = \dfrac{Y_n}{Y}(C_o - L)$

$e = AL/800$; $y_n = 4e(x/L)^2$; $Lx = LP - y_n$

$$SSD = 0.278 \, tV + \dfrac{V^2}{254 \left(f \pm \dfrac{n}{100} \right)}$$

$S > L$; $M = \dfrac{L(2S-L)}{8R}$

$S < L$; $M = \dfrac{S^2}{8R}$