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POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

CIVIL ENGINEERING DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

CN502 : HIGHWAY AND TRANSPORTATION IN ENVIRONMENTAL ENGINEERING

DATE : 20 NOVEMBER 2012
DURATION : 2 HOURS (8.30AM- 10.30AM)

This paper consisting of **NINE (9)** pages including the front page.

This paper contains SIX (6) questions.
Answer FOUR (4) questions only.

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INSTRUCTION:

This section consists of **SIX (6)** essay questions. Answer **FOUR (4)** questions only. Write your answer's in the answer booklet.

QUESTION 1

a) Identify the differences comparison between Macadam Road and Telford Road.

[CLO 1: C4]
(10 marks)

b) Explain general applications of road in Malaysia below:

i. Expressway
ii. Highways
iii. Primary Roads
iv. Secondary Roads
v. Minor Roads

[CLO 2: C4]
(15 marks)

QUESTION 2

a) Describe the characteristic of Mass Haul Diagram.

[CLO 1: C4]
(8 marks)

b) Describe 2 (TWO) chemical admixture stabilization

[CLO 1: C4]
(8 marks)

c) Explain **2 (TWO)** road construction equipment.

[CLO 1: C4]
(9 marks)

QUESTION 3

a) Explain the softening point test and penetration test for bitumen

[CLO 2: C3]

(10 marks)

b) The result of the sieves analysis of the aggregate for the road base material is given in **Table 1**. Determine either the material is suitable or not for the work purpose by calculating and plotting on the graph in **Appendix: Question 3 (b)**.

Table 1

Sieves Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Passing (%)	Road Base Gradation Limit (Types 1)
50	0	16000		100- 100
37.5	647.7			95-100
20	3543.4			60-80
10	3393			40-80
5	1718			25-40
2.36	2574			15-30
0.600	2798.7			8-22
0.075	1070.7			0-8
Pan	254.5			

[CLO 2: C3]

(15 marks)

QUESTION 4

a) Explain **(5) FIVE** advantages of cement concrete roads.

[CLO 2: C3]
(10 marks)

b) Design a flexible pavement for the road using the *JKR Arahan Teknik (Jalan)* 5/85 Design Method). Give n information :-

Chess of road = JKR 05

Initial daily traffic volume (ADT) = 6,000

Percentage of commercial vehicles = 15%

Annual growth rate = 7%

Equivalence factor = 2.0

Subgrade CBR = 5%

Rolling terrain

Requirement of pavement layers:

i. Wearing Course = Asphalt Concrete.
ii. Road-Base Course = Cement stabilized.
iii. Sub-Base Course = Cement stabilized.

[CLO 2: C3]
(15 marks)

QUESTION 5

a) Indentify **3(THREE)** levels of the driving task.

[CLO 2: C3]
(6 marks)

b) Two platoons of cars are timed over a distance of 0.75 km and their flows are recorded. The first group takes 55 seconds, with the flow of 1975vehicles per hour. The second group takes 45 seconds, with a flow of 2475 vehicles per hour. Determine the maximum flow of the traffic stream.

[CLO 2: C3]
(9 marks)

c) Explain **5 (FIVE)** characteristics of visual reception in highway.

[CLO 2 : C3]
(10 marks)

QUESTION 6

a) State **3(THREE)** effects of transportation to air quality.

[CLO 1: C3]
(6 marks)

b) Explain the effect of traffic induced vibration in building.

i. Airborne vibration
ii. Groundborne vibrations

[CLO 1: C3]
(8 marks)

c) Identify **3(THREE)** function for:

i. Transversal drainage
ii. Longitudinal drainage

[CLO 1: C3]
(12 marks)

APPENDIX

$V_o = ADT \times 0.5 \times 365 \, Pc/100$

$$V_c = \frac{V_o (1 + r)^x - 1}{r}$$

$ESA = V \times e$

$c = I \times R \times T$

$SN = a_1D_1 + a_2D_2 + a_3D_3$

Table 3.1 Guide for Equivalence Factor

Percentage of selected heavy goods vehicles*	0-15%		16-50%	51-100%
Type of road Equivalence Factor	local 1.2	trunk 2.0	3.0	3.7

* Selected heavy goods vehicles refer to those conveying timber and quarry materials.

Table 3.2 Maximum Hourly Capacity Under Ideal Conditions

Road Type	Passenger Vehicle Units per hour
Multi lane Two lanes (bothways) Three lanes (bothways)	2000 per lane 2000 total for bothways 4000 total for bothways

Table 3.3 Carriageway Roadway Reduction Factor

Carriageway Width	Shoulder Width			
	2.00m	1.50m	1.25m	1.00m
7.5m 7.Om 6.Om 5.Om	1.00 0.88 0.81 0.72	0.97 0.86 0.78 0.70	0.94 0.83 0.76 0.67	0.90 0.79 0.73 0.64

Table 3.4 Traffic Reduction Factor

Type of Terrain	Factor*
Flat	T = 100/(100+Pc)
Rolling	T = 100/(100+2Pc)
Mountainous	T = 100/(100+5Pc)

* Nota Bene: Pc is as per 3.3.2

Table 3.5 Structural Layer Coefficients

Component	Type of Layer	Property	Coefficient
Wearing and Binder Course	Asphalt Concrete		1.00
Base Course	Dense Bituminous Macadam	Type 1:Stability > 400 kg	0.80
		Type 2:Stability > 300 kg	0.55
	Cement Stabilized	Unconfined Compressive strength(7 days) 30-40 kg/cm2	0.45
	Mechanically Stabilized crushed aggregate	CBR ≥ 80%	0.32
Subbase	Sand,laterite etc.	CBR ≥ 20%	0.23
	Crushed aggregate	CBR ≥ 30%	0.25
	Cement Stabilized	CBR ≥ 60%	0.28

Table 3.6 Minimum Layer Thickness

Type of Layer		Minimum Thickness
Wearing Course		4 cm
Binder Course		5 cm
Base Course	Bituminous	5 cm
	Wet Mix	10 cm
	Cement treated*	10 cm
Subbase Course	Granular	10 cm
	Cement treated	15 cm

* No to Bene

Table 3.8 Minimum Thickness of Bituminous Layer

T_A	Total thickness of bituminous layer
< 17.5 cm	5.0 cm
17.5 - 22.5 cm	10.0 cm
23.0 - 29.5 cm	15.0 cm
> 30.0 cm	17.5 cm

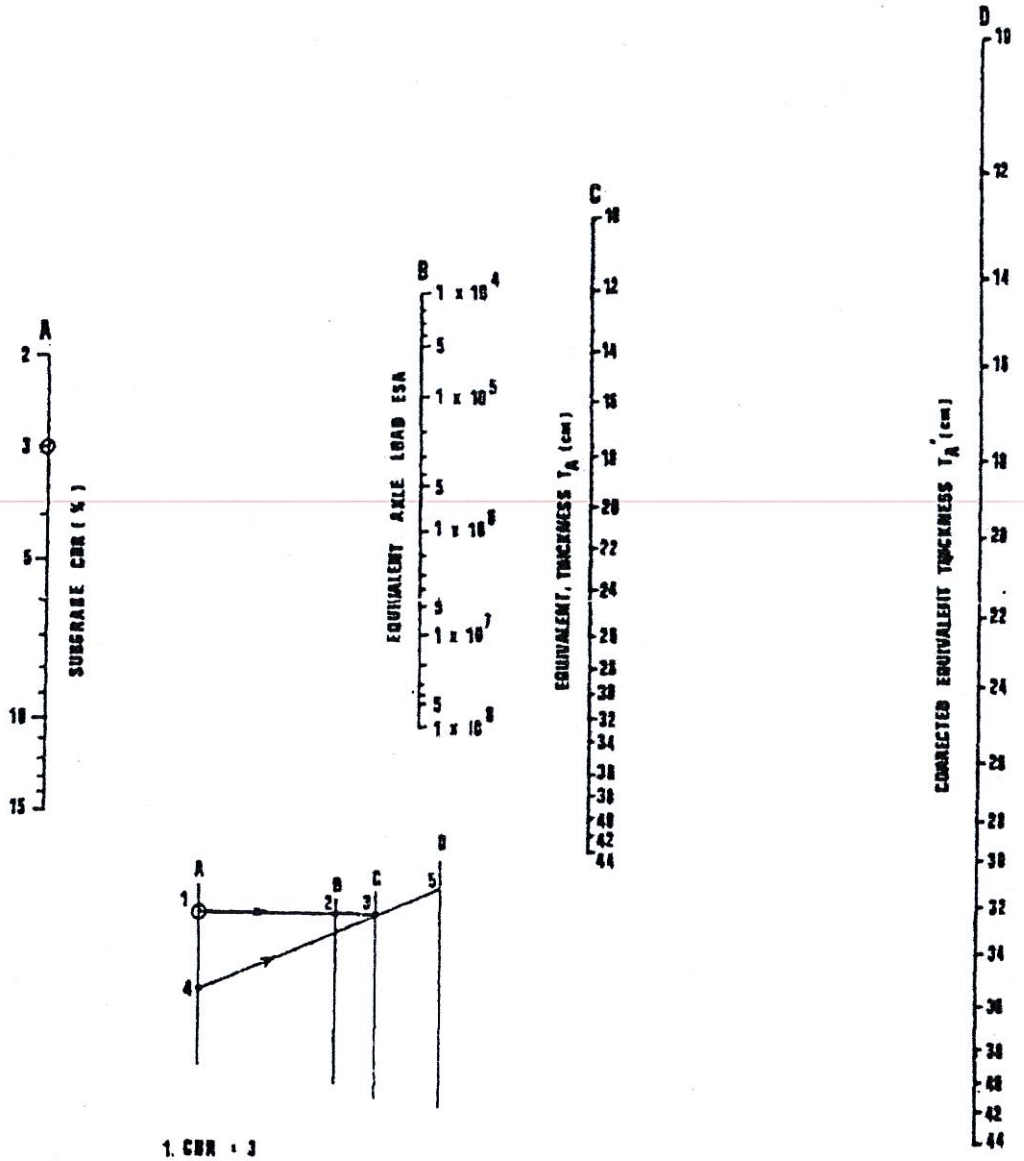
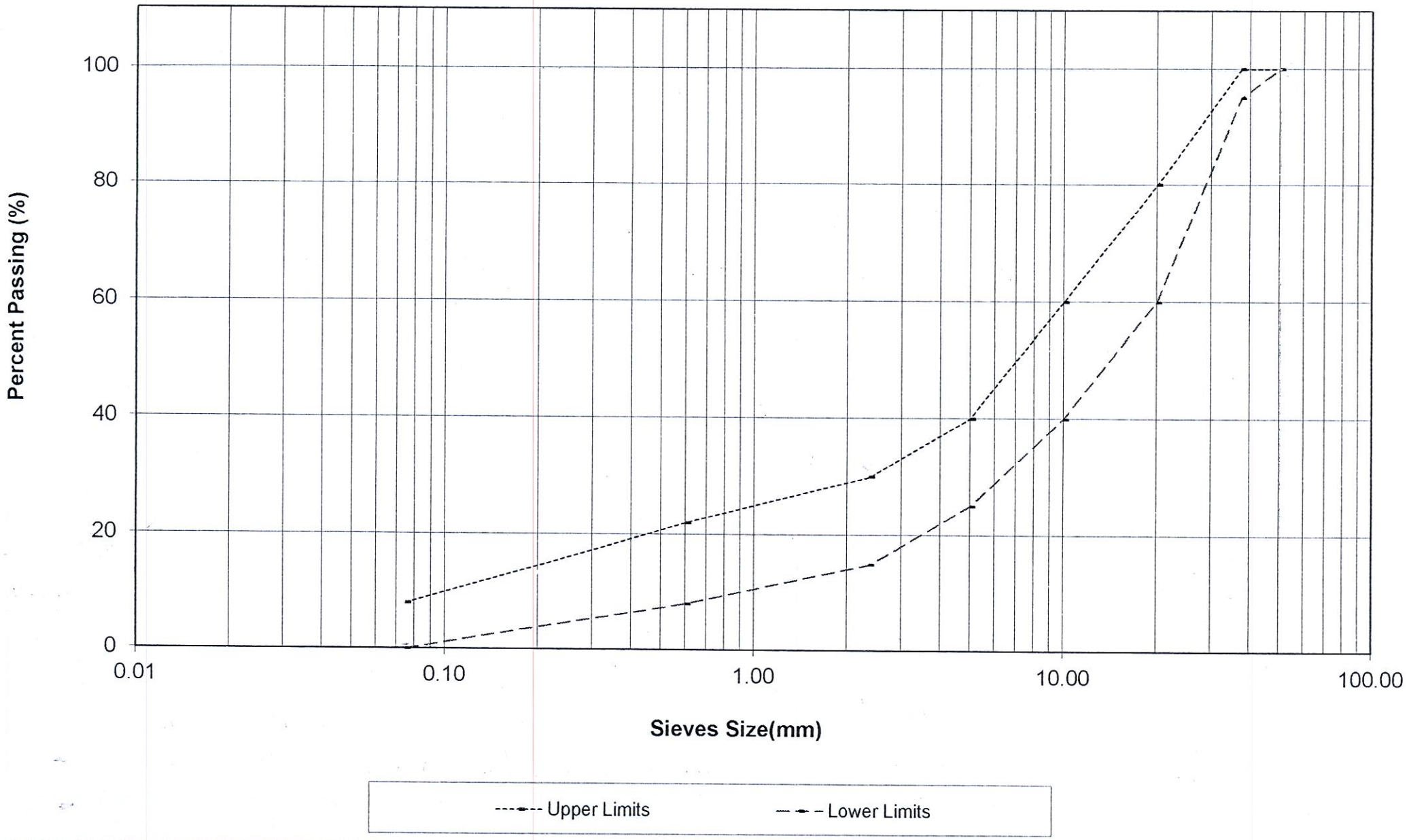


FIG-2 THICKNESS DESIGN NOMOGRAPH

Roadbase Gradation Limit (Wet Mix)



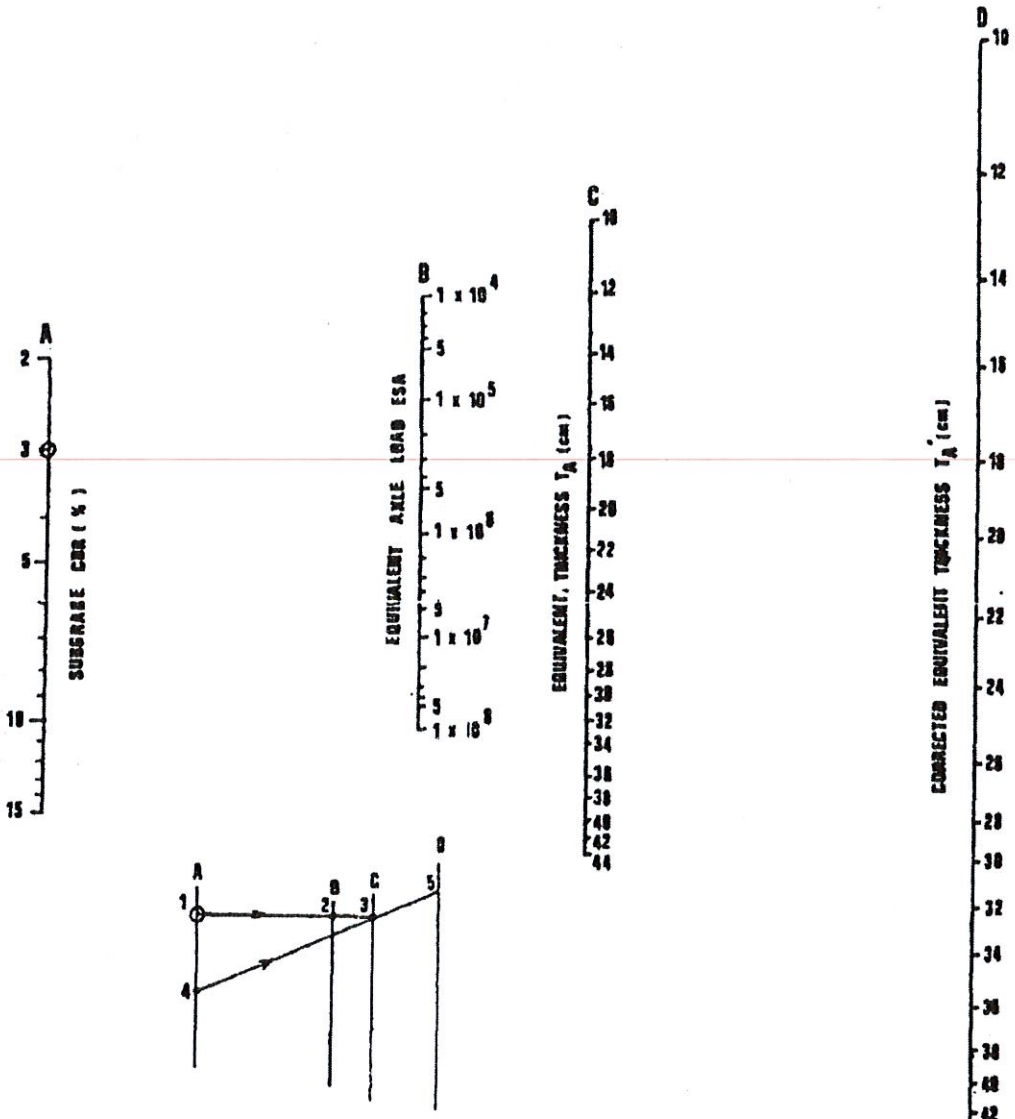


FIG-2 THICKNESS DESIGN NOMOGRAPH

Apendix :Question 3 (b)