SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2022/2023

DCC30103: HIGHWAY AND TRAFFIC ENGINEERING

TARIKH : 12 JUN 2023
MASA : 2.30 PTG – 4.30 PTG (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Bahagian A: Subjektif (2 soalan)
Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Buku Rumus

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 50 MARKS

BAHAGIAN A: 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** subjective questions. Answer **ALL** the questions.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO 2

(a) Road pavement defects that occur after several usage is influenced by traffic load, weather and maintenance. Determine the maintenance method for road pavement defect in the situation as Table A1(a) below:
Kecacatan permukaan jalan berlaku setelah penggunaan yang di sebabkan oleh beban trafik, cuaca dan penyenggaraan. Tentukan kaedah pembaikan kecacatan permukaan jalan dalam situasi seperti Jadual A1(a) di bawah:

Table A1(a) / *Jadual A1(a)*

Site / *Tapak*	Defect Situation / *Keadaan Kecacatan*
Site A *Tapak A*	Heavily cracked and broken surface *Permukaan retak dan pecah*
Site B *Tapak B*	Lost stability and strength *Kehilangan kestabilan dan kekuatan*

[10 marks]
[*10 markah*]

CLO 2

(b) As an engineer, you required to recommend the pavement thickness for a two lane highway projek using ATJ 5/85 design method (2013 REVISION) based on the following data:

- Average commercial vehicle per day per direction of 500 vehicle, 15% of which are commercial vehicles with an un-laden weight > 1.5 tons.
- Annual traffic growth = 15%
- Design life = 20 years
- Terrain: Flat
- Result from subgrade testing:
  -CBR Mean = 20%
  -CBR Standard Deviation = 6.0%
  -Probability 85% (Normal Deviate = 1.00)

Based on requirement above, recommend the design thickness.

Sebagai seorang jurutera, anda dikehendaki mencadangkan ketebalan turapan jalan raya untuk lebuh raya dua lorong mengunakan ATJ 5/85(Pindaan 2013) berdasarkan data yang diberi:

- *Purata lalulintas harian searah 500 kenderaan , 15% daripadanya adalah kenderaan komersial dengan berat yg tidak di pikul > 1.5 tan.*
- *Pertumbuhan lalulintas tahunan = 15%*
- *Hayat reka bentuk = 20 tahun*
- *Faktor muka bumi = Rata*
- *Keputusan ujian subgred:*
  -Purata CBR = 20%
  -Sisihan piawai CBR = 6.0%
  -Kebolehpercayaan 85% (sisihan normal = 1.00)

Berdasarkan keperluan di atas, cadangkan ketebalan turapan rekabentuk .

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO 2 (a) Road accidents gives traumatic effects on victims. Explain briefly **THREE (3)** factors that cause road accidents.

*Kemalangan jalanraya memberi kesan trauma kepada mangsa kemalangan. Terangkan dengan jelas **TIGA (3)** faktor yang menyebabkan berlakunya kemalangan jalanraya*

[10 marks]

[*10 markah*]

CLO 2 (b) The 2-phase traffic signal will be installed at the crossroad intersection and the traffic flow is shown in the table below. Given, Intergreen Interval (I)- 4 seconds, Amber (a)- 3 seconds and Lost Time (ℓ)- 5 seconds. Estimate the time phase diagram for each phase based on data collection of traffic flow as in the Table A2(b) below.

Satu lampu isyarat dua fasa akan di letakkan di satu persimpangan dan data aliran trafik di tunjukkan seperti di dalam jadual di bawah. Di beri masa antara hijau (I)- 4 saat, masa kuning (a)- 3 saat dan masa hilang (ℓ)- 5 saat. Anggarkan masa setiap fasa berdasarkan data aliran trafik yang ditunjukkan dalam Jadual A2(b) di bawah,

Table A2(b) */ Jadual A2(b)*

Flow/ *Aliran*	**North / *Utara***	**South / *Selatan***	**East/ *Timur***	**West/ *Barat***
Actual flow,Q (pcu/hr) *Aliran Sebenar,Q (ukp/j)*	780	550	980	700
Saturation flow,S (pcu/hr) *Aliran Tepu,S (ukp/j)*	3,675	3,675	3,938	3,938

[15 marks]

[*15 markah*]

SECTION B: 50 MARKS

BAHAGIAN B: 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** subjective questions. Answer **TWO (2)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO 1 (a) Traffic is generally defined as the movement of vehicles, ships, persons, animals, and goods in an area, along a street, through an air route or over a water route. Explain the meaning of Traffic Engineering.
Trafik ditakrifkan sebagai pergerakan kenderaan, kapal, orang, haiwan dan barangan dalam kawasan, di sepanjang jalan, melalui lorong udara, atau di atas laluan air.Terangkan maksud Kejuruteraan Trafik.

[5 marks]
[*5 markah*]

CLO 1 (b) Other than aggregates, bitumen also plays an important role in road constructions. Determine **FOUR (4)** functions of bitumen in road constructions process.
*Selain daripada batu baur,bitumen juga memainkan peranan penting dalam pembinaan jalan. Tentukan **EMPAT (4)** fungsi bitumen dalam proses pembinaan jalan.*

[10 marks]
[*10 markah*]

CLO 1 (c) Identify **TWO (2)** types of bitumen testing in laboratory with their objective to evaluate the difference properties of bituminous materials.
*Kenal pasti **DUA (2)** jenis ujian makmal ke atas bitumen beserta dengan objektifnya untuk mengetahui perbezaan sifat bahan berbitumen.*

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

CLO 1 (a) Explain the differences between base course and wearing course in the surface layer.
Terangkan perbezaan antara lapisan tapak dan lapisan haus dalam lapisan permukaan.

[5 marks]
[*5 markah*]

CLO 1 (b) With and aid of diagrams, determine the functions of flexible pavement by each layer.
Dengan bantuan gambar rajah, tentukan fungsi turapan lentur bagi setiap lapisan.

[10 marks]
[*10 markah*]

CLO 1 (c) The road surface is constructed with bitumen material. Identify the road surface construction process in order including the compaction work.
Permukaan jalan dibina dengan menggunakan bahan berbitumen. Kenal pasti proses pembinaan permukaan jalan termasuk kerja pemadatan secara berturutan.

[10 marks]
[*10 markah*]

QUESTION 3

SOALAN 3

CLO 1 (a) Recognize **FIVE (5)** advantages of cement concrete roads.
*Kenal pasti **LIMA (5)** kelebihan jalan konkrit simen.*

[5 marks]
[*5 markah*]

CLO 1 (b) Explain the procedure to prepare of a good subgrade for rigid pavement.
Terangkan prosedur penyediaan subgred yang baik bagi turapan tegar.

[10 marks]
[*10 markah*]

CLO 1 (c) Interpret **THREE (3)** categories of joints in cement concrete pavements.
*Tafsirkan **TIGA (3)** kategori sambungan dalam turapan konkrit simen.*

[10 marks]
[*10 markah*]

QUESTION 4

SOALAN 4

CLO 1 (a) Explain the **FIVE (5)** functions of traffic control device.
*Terangkan **LIMA (5)** fungsi peranti kawalan trafik.*

[5 marks]
[*5 markah*]

CLO 1 (b) Regulation traffic devices are divided by two sub-categories. Identify both sub-categories with an example for each subcategory.
Peranti kawalan trafik terbahagi kepada dua sub kategori. Kenal pasti kedua-dua sub kategori berserta contoh untuk setiap sub kategori.

[10 marks]
[*10 markah*]

CLO 1

(c) When driving at night and in the rainy day, the driver's vision is quite limited, so road studs is required. Show **TWO (2)** advantages and **TWO (2)** disadvantages of using road stud as traffic control device.

*Ketika memandu pada waktu malam dan pada waktu hujan, tahap penglihatan pemandu agak terhad, maka stad jalan diperlukan. Tunjukkan **DUA (2)** kelebihan dan **DUA (2)** kekurangan menggunakan stad jalan sebagai peranti kawalan lalulintas.*

[10 marks]

[*10 markah*]

SOALAN TAMAT

BUKU RUMUS DCC30103- HIGHWAY AND TRAFFIC ENGINEERING

LIST FORMULA
Junction Design
S = 525W or S = 160W L = Total Lost time + [Total (inter green-yellow time)] $Co = \frac{1.5L + 5}{1 - Y}$ y = Q/S $g\ phase = \frac{(y\ phase)}{Y} \times (Co - L)$ G phase = g phase + loss time – yellow time
Flexible Pavement Design
$ESALY1 = ADT \times 365 \times PCV \times 3.7 \times L \times T$
$ESALY1 = [ADTvc_1 \times LEF_1 + ADTvc_2 \times LEF_2 + \ldots + ADTvc_4 \times LEF_4] \times 365 \times L \times T$
$\text{Design Traffic } ESAL_{DES} = ESAL_{Y1} \times \frac{[(1 + r)^n - 1]}{r}$
Design Input Value = Mean – (Normal Deviate x Standard Deviation)
$\text{Design Traffic } ESAL_{DES} = ESAL_{Y1} \times TGF$

TABLE 2.1: Axle Configuration and Load Equivalence Factors (LEF) based on Traffic Categories used by HPU

Vehicle		Load Equivalence Factor (LEF)
HPU Class Designation	Class	
Cars and Taxis	C	0
Small Lorries and Vans (2 Axles)	CV1	0.1
Large Lorries (2 to 4 Axles)	CV2	4.0
Articulated Lorries (3 or more Axles)	CV3	4.4
Buses (2 or 3 Axles)	CV4	1.8
Motorcycles	MC	0
Commercial Traffic (Mixed)	CV%	3.7

TABLE 2.2: Lane Distribution Factors

Number of Lanes (in ONE direction)	Lane Distribution Factor, L
One	**1.0**
Two	**0.9**
Three or more	**0.7**

Note: *Traffic in the primary design lane (one direction) decreases with increasing number of lanes.*

TABLE 2.3: Terrain Factors

Type of Terrain	Terrain Factor, T
Flat	**1.0**
Rolling	**1.1**
Mountainous/Steep	**1.3**

TABLE 2.4: Total Growth Factors (TGF)

Design Period (Years)	Annual Growth Rate (%)					
	2	3	4	5	6	7
10	10.95	11.46	12.01	12.58	13.18	13.82
15	17.29	18.60	20.02	21.58	23.28	25.13
20	24.30	26.87	29.78	33.06	36.79	41.00
25	32.03	36.46	41.65	47.73	54.86	63.25
30	40.57	47.58	56.08	66.44	79.06	94.46

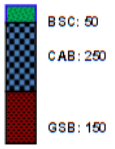
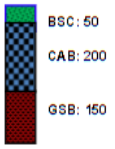
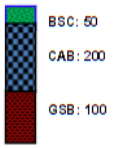
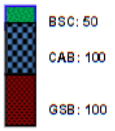
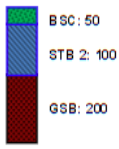
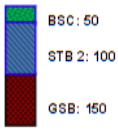
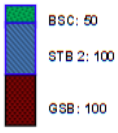
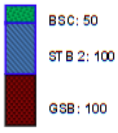
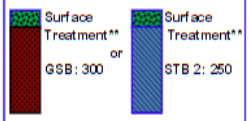
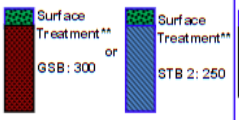
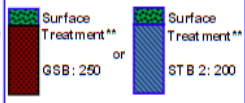
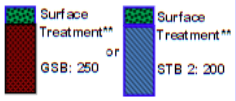
TABLE 2.5: Traffic Categories used in this Manual (ESAL = 80 kN)

Traffic Category	Design Traffic (ESAL x 10^6)	Probability (Percentile) Applied to Properties of Sub-Grade Materials
▪ T 1	**≤ 1.0**	≥ 60%
▪ T 2	**1.1 to 2.0**	≥ 70%
▪ T 3	**2.1 to 10.0**	≥ 85%
▪ T 4	**10.1 to 30.0**	≥ 85%
▪ T 5	**> 30.0**	≥ 85%

TABLE 2.6: Classes of Sub-Grade Strength (based on CBR) used as Input in the Pavement Catalogue of this Manual

Sub-Grade Category	CBR (%)	Elastic Modulus (MPa)	
		Range	Design Input Value
▪ SG 1	**5 to 12**	50 to 120	**60**
▪ SG 2	**12.1 to 20**	80 to 140	**120**
▪ SG 3	**20.1 to 30.0**	100 to 160	**140**
▪ SG 4	**> 30.0**	120 to 180	**180**

FIGURE 3.1: Pavement Structures for Traffic Category T 1: < 1.0 million ESALs (80 kN)

Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Stabilised Base with Surface Treatment*				

Notes:

* *Full Depth Asphalt Concrete Pavement is not recommended for this Traffic Category.*

** *Single or Double Layer Chip Seal or Micro-Surfacing.*

FIGURE 3.2: Pavement Structures for Traffic Category T 2: 1.0 to 2.0 million ESALs (80 kN)

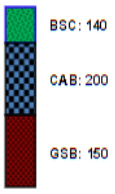
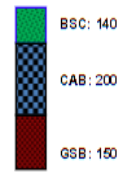
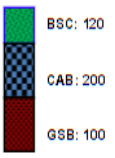
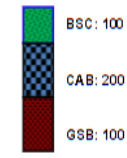
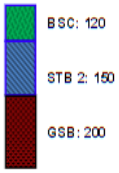
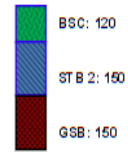
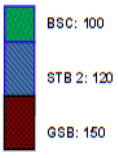
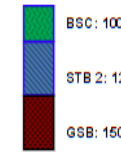
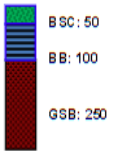
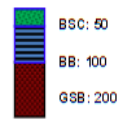
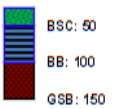
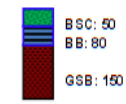
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

FIGURE 3.3: Pavement Structures for Traffic Category T 3: 2.0 to 10.0 million ESALs (80 kN)

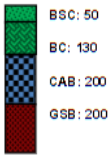
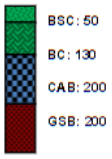
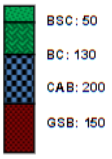
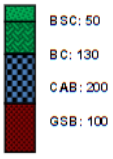
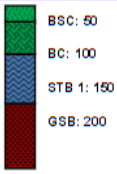
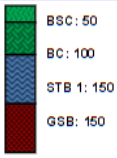
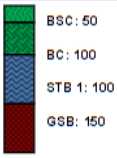
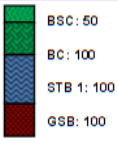
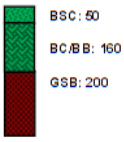
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

FIGURE 3.4: Pavement Structures for Traffic Category T 4: 10.0 to 30.0 million ESALs (80 kN)

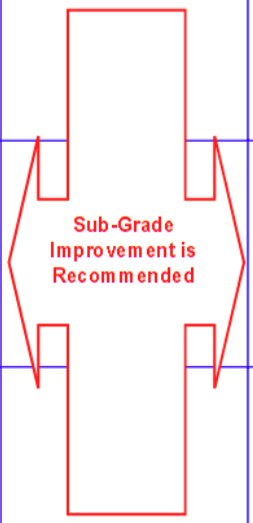
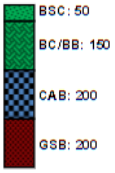
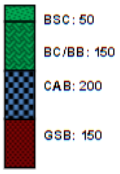
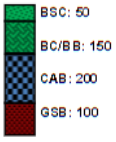
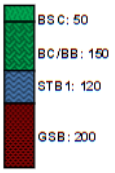
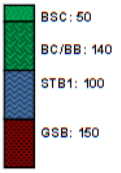
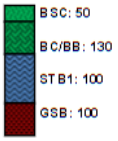
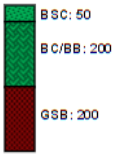
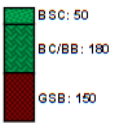
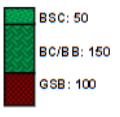
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

FIGURE 3.5: Pavement Structures for Traffic Category T 5: > 30.0 million ESALs (80 kN)

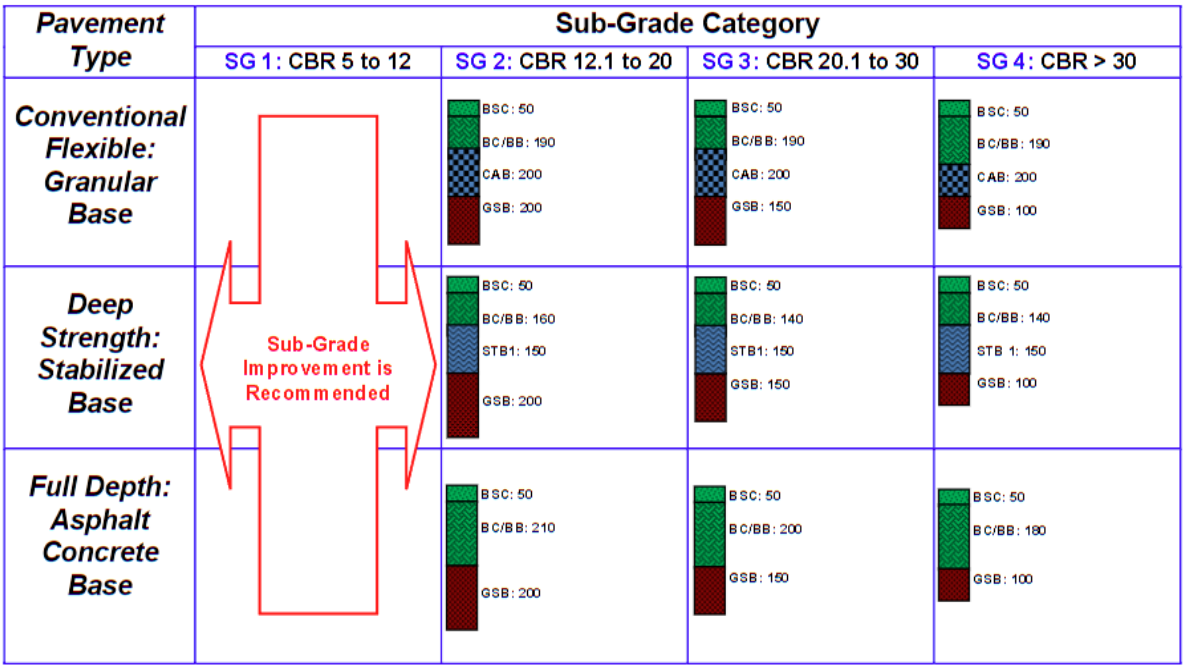


FIGURE 3.6: Pavement Structures for Traffic Category T 5: > 30.0 million ESALs (80 kN)

(Use of Polymer Modified Asphalt)