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 I : 2023/2024

DCC30103: HIGHWAY AND TRAFFIC ENGINEERING

TARIKH : 04 JANUARI 2024
MASA : 02.30 PM - 04.30 PM (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (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** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO2

(a) Road pavement is regularly facing damages that reduce the structural integrity and service.Road maintenance activities must be done accordingly in order to prolong the durability of pavement. Explain **TWO (2)** methods of maintenance techniques for flexible pavement that can be done to restore the good condition of road pavement.

*Turapan jalan sering berhadapan dengan kerosakan yang akan mengurangkan integriti dan servis. Aktiviti penyenggaraan jalan perlu dilaksanakan sewajarnya untuk memanjangkan ketahanan turapan. Terangkan **DUA (2)** kaedah teknik penyenggaraan bagi turapan lentur yang boleh dilaksanakan untuk memulihkan turapan jalan supaya berada dalam keadaan baik.*

[10 marks]

[*10 markah*]

CLO2 (b) Road pavements of concession toll road are planning to design a 4-lane freeway. The average daily traffic of vehicles is 8890 with 20% are commercial vehicles with weight more than 1.5 tons. Decide the traffic category and subgrade category for the planning road using JKR 5/85 amendment 2013 method with full-depth asphalt pavement.

Given Information:

- ADT based on HPU survey from 06.00 to 22:00 hours – CV1 = 895, CV2 = 345, CV3 = 440 and CV4 = 98
- Terrain Factor, T = Flat
- Design Life, n = 20 years
- Annual Traffic Growth Rate, r = 5.0%
- Mean Modulus (H-FWD) = 175 MPa
- Standard Deviation (H-FWD) = 38 MPa
- Reliability 95% (Normal Deviate = 1.675)

Turapan jalan bagi jalan raya bertol di bawah konsessi telah dirancang untuk rekabentuk empat lorong. Purata trafik harian kenderaan adalah berjumlah 8890 dengan 20% pengguna jalan raya terdiri daripada kenderaan komersil dengan jumlah berat melebihi 1.5 tan. Cadangkan kategori trafik dan kategori subgred bagi jalan yang dirancang dengan menggunakan kaedah JKR 5/85 pindaan 2013 bagi asfalt dengan kedalaman penuh.

Maklumat berkaitan untuk rujukan:

- *ADT berdasarkan tinjauan HPU dari jam 06.00 to 22:00– CV1 = 895, CV2 = 345, CV3 = 440 and CV4 = 98*
- *Bentuk Muka Bumi, T = Rata*
- *Hayat Rekabentuk, n = 20 tahun*
- *Pertumbuhan lalulintas tahunan, r = 5.0%*
- *Purata Modulus (H-FWD) = 175 MPa*
- *Sisihan piawai (H-FWD) = 38 MPa*
- *Kebolehpercayaan 95% (Sisihan Normal = 1.675)*

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO2 (a) Based on value of statistical life' (VSOL) in 2018 by MIROS, the Malaysian government has lost at least 3.12 million for each life. With an average of 18 persons killed in road accidents every day in Malaysia, road accidents constitute a serious public health challenge to the nation. Explain **THREE (3)** factors that cause accident.

*Berdasarkan statistik nilai kehidupan (VSOL) tahun 2018 oleh MIROS, Kerajaan Malaysia telah kehilangan sekurang-kurangnya 3.12 juta untuk setiap nyawa. Dengan purata 18 orang terbunuh dalam kemalangan jalan raya setiap hari di Malaysia, kemalangan jalan raya merupakan cabaran kesihatan awam yang serius bagi negara. Terangkan **TIGA (3)** faktor yang menyebabkan kemalangan.*

[10 marks]

[*10 markah*]

CLO2 (b) 2-Phase traffic signal will be installed at the intersection in Putrajaya City. Given Intergreen Interval (I) – 5 seconds, Lost Time (ℓ)-2s and Amber (a) - 3 seconds. Estimate the time phase diagram for each phase based on Saturation Flow (S) and Actual Flow (q) data as shown in the Table A2(b).

Lampu isyarat 2-fasa akan dipasang pada persimpangan di dalam bandar Putrajaya.). Diberi masa antara hijau (I)-5 saat, Masa Hilang (ℓ)- 2 saat dan Masa Kuning (a) – 3 saat. Anggarkan masa setiap fasa berdasarkan data Aliran Tepu (S) dan Aliran Sebenar (q) seperti yang ditunjukkan di Jadual A2(b).

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

Direction/*Cabang*	**North/*Utara***	**South/*Selatan***	**East/*Timur***	**West/*Barat***
S,Saturation Flow (pcu/hr)/ *S, Aliran Tepu (ukp/j)*	1800	1800	3150	3150
q,Actual flow (pcu/hr)/q, *Aliran Sebenar (ukp/j)*	620	550	750	950

[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

CLO1 (a) The development of highway and traffic in Malaysia were successfully constructed due to the involvement of agencies to ensure all relevant need complied. Identify the function of related agencies in the development of highway and traffic in Malaysia.
Pembangunan jalan raya dan lalulintas di Malaysia telah dibina dengan jayanya dengan penglibatan agensi bagi memastikan keperluan berkaitan pembangunan jalan dipatuhi. Kenal pasti fungsi agensi-agensi berkaitan dalam pembangunan jalan raya dan lalulintas di Malaysia.

[5 marks]
[*5 markah*]

CLO1 (b) Road pavement performance depends on the quality of the asphaltic concrete mix. Explain **FIVE (5)** characteristics of asphaltic concrete mix in road construction.
*Prestasi turapan jalan bergantung kepada kualiti campuran konkrit asphalt. Terangkan **LIMA (5)** ciri-ciri campuran konkrit asfalt dalam pembinaan jalan.*

[10 marks]
[*10 markah*]

CLO1 (c) Road construction materials must be examined to ensure the quality of materials for durability of road pavement. Explain the objectives of **FOUR (4)** types for aggregate properties test in road construction.
*Bahan binaan jalan perlu dikaji bagi memastikan kualiti bahan untuk ketahan turapan jalan. Terangkan objektif **EMPAT (4)** jenis ujian bagi batu baur dalam pembinaan jalan.*

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

CLO1 (a) Describe the flexible pavement with the aid of diagram.
Huraikan turapan lentur menggunakan bantuan gambarajah.

[5 marks]
[*5 markah*]

CLO1 (b) Explain method preparation materials for subbase layer, road base layer and road surface.
Terangkan kaedah persediaan bahan binaan bagi lapisan sub tapak, lapisan tapak jalan dan permukaan jalan.

[10 marks]
[*10 markah*]

CLO1 (c) A Flexible pavement structured is composed of several layers to achieve the function for traffic load distribution and smooth vehicles riding. Explain in order the construction process of flexible pavement.
Turapan lentur merupakan sturktur yang dibina secara lapisan bagi mencapai fungsi sebagai agihan beban trafik dan perjalanan kenderaan yang lancar. Terangkan proses pembinaan turapan lentur secara berturutan.

[10 marks]
[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Identify **FIVE (5)** characteristics of good rigid pavement construction.

*Kenal pasti **LIMA (5)** ciri pembinaan turapan tegar yang baik.*

[5 marks]

[*5 markah*]

CLO1 (b) Rigid pavement is more expensive among all other types of roads. It uses the term rigid pavements because it does not allow any flexibility. With the aid of a diagrams, explain the types of rigid pavement for Joined Reinforced Concrete (JRC) and Continuous Reinforced Concrete (CRCP).

Turapan tegar menggunakan kos yang lebih tinggi berbanding jenis turapan yang yang lain. Ia dikenali sebagai turapan tegar kerana tidak membenarkan sebarang lenturan. Dengan bantuan gambar rajah, terangkan turapan tegar jenis Konkrit Tetulang Sambungan dan Konkrit Tetulang Berterusan.

[10 marks]

[*10 markah*]

CLO1 (c) Explain **THREE (3)** types of joints in rigid pavement.

*Terangkan **TIGA (3)** jenis sambungan dalam turapan tegar.*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Describe the functions of traffic control device.

Huraikan fungsi alat kawalan trafik.

[5 marks]

[*5 markah*]

CLO1 (b) The purpose of road sign is to promote road safety and efficiency by providing orderly movement for all road users. Identify **FIVE (5)** basic principles of road sign.

*Papan tanda jalan bertujuan untuk menggalakkan keselamatan dan kecekapan jalan raya dengan menyediakan pergerakan yang teratur untuk semua pengguna jalan raya Kenal pasti **LIMA (5)** prinsip asas papan tanda jalan.*

[10 marks]

[*10 markah*]

CLO1 (c) Road studs can be installed temporary or permanent, but both require of excellent adhesion to the road surface Determine the advantages and disadvantages of road stud.

Kancing jalan boleh dipasang sementara atau kekal, tetapi kedua-duanya memerlukan lekatan yang sangat baik ke atas permukaan jalan.Tentukan kelebihan dan kekurangan kancing jalan.

[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

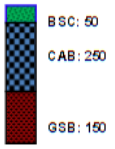
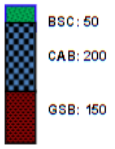
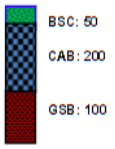
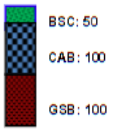
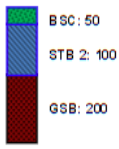
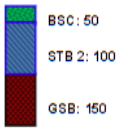
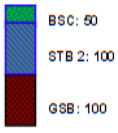
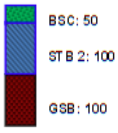
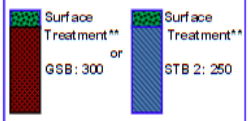
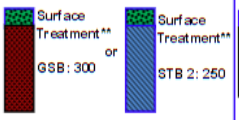
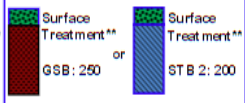
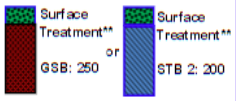
TABLE 2.5: Traffic Categories used in this Manual (ESAL = 80 kN)

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)

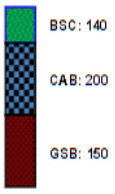
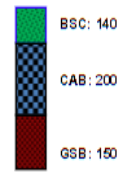
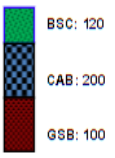
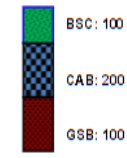
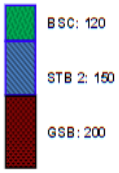
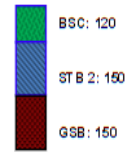
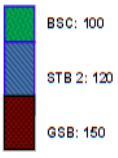
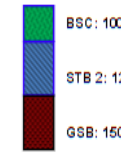
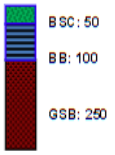
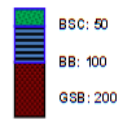
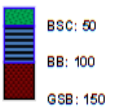
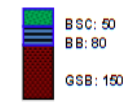
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

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

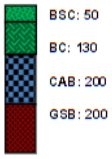
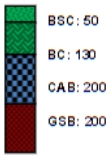
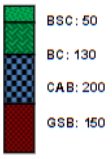
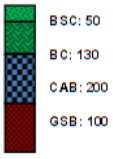
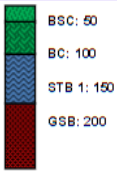
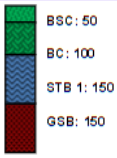
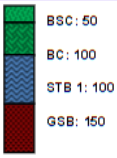
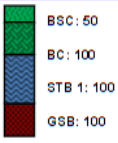
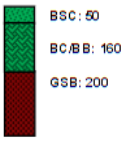
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

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

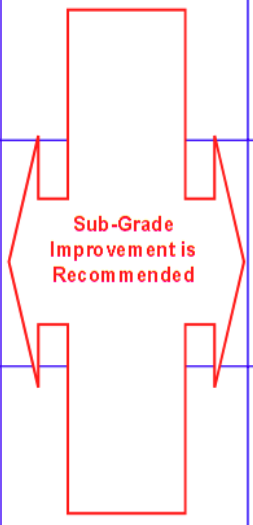
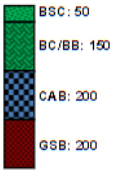
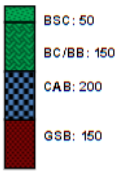
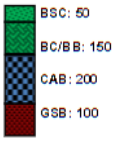
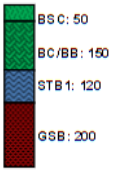
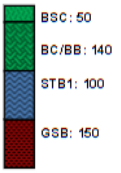
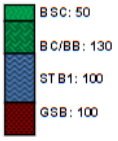
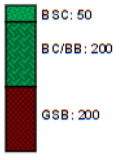
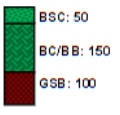
Pavement Type	Sub-Grade Category			
	SG 1: CBR 5 to 12	SG 2: CBR 12.1 to 20	SG 3: CBR 20.1 to 30	SG 4: CBR > 30
Conventional Flexible: Granular Base				
Deep Strength: Stabilised Base				
Full Depth: Asphalt Concrete Base				

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

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	Sub-Grade Improvement is Recommended	BSC: 50 BC/BB: 190 CAB: 200 GSB: 200	BSC: 50 BC/BB: 190 CAB: 200 GSB: 150	BSC: 50 BC/BB: 190 CAB: 200 GSB: 100
Deep Strength: Stabilized Base		BSC: 50 BC/BB: 160 STB1: 150 GSB: 200	BSC: 50 BC/BB: 140 STB1: 150 GSB: 150	BSC: 50 BC/BB: 140 STB 1: 150 GSB: 100
Full Depth: Asphalt Concrete Base		BSC: 50 BC/BB: 210 GSB: 200	BSC: 50 BC/BB: 200 GSB: 150	BSC: 50 BC/BB: 180 GSB: 100

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

(Use of Polymer Modified Asphalt)

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
Special Purpose Surface Course	Sub-Grade Improvement is Recommended	SMA, PA, FC or PMA: 50 BC/BB: 170 OR PMA : 140 CAB: 200 GSB: 200	SMA, PA, FC or PMA: 50 BC/BB: 160 OR PMA : 130 CAB: 150 GSB: 150	SMA, PA, FC or PMA: 50 BC/BB: 150 OR PMA : 120 CAB: 100 GSB: 100
Deep Strength High-Modulus Base Course		BSC: 50 PMA Base: 250 GSB: 200	BSC: 5 PMA Base: 220 GSB: 15	BSC: 50 PMA Base: 200 GSB: 100