

**SULIT**



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

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI II : 2021/2022**

**DCC30103 : HIGHWAY AND TRAFFIC ENGINEERING**

**TARIKH : 06 JUN 2022**

**MASA : 11.30 PAGI – 01.30 PETANG (2 JAM)**

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Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A: Struktur (3 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**SECTION A : 75 MARKS**  
**BAHAGIAN A : 75 MARKAH**

**INSTRUCTION:**

This section consists of **THREE (3)** structured questions. Answer **ALL** questions.

**ARAHAN:**

*Bahagian ini mengandungi **TIGA (3)** soalan berstruktur. Jawab **SEMUA** soalan.*

**QUESTION 1**

**SOALAN 1**

CLO1  
C2

- a) Transportation is part of the infrastructural development of a country. Identify **FIVE (5)** main structures in transportation.

*Pengangkutan adalah sebahagian daripada pembangunan infrastruktur sesebuah negara. Kenalpasti **LIMA (5)** struktur utama pengangkutan.*

[5 marks]

[5 markah]

CLO1  
C3

- b) Interpret **FOUR (4)** purposes of the Environmental Quality Act 1974 (EQA 1974) for transportation in Malaysia.

*Jelaskan **EMPAT (4)** tujuan Akta Kualiti Alam Sekeliling 1974 (EQA 1974) bagi pengangkutan di Malaysia*

[10 marks]

[10 markah]

CLO1  
C3

- c) Explain **THREE (3)** categories of traffic control devices.

*Terangkan **TIGA (3)** kategori peralatan kawalan trafik.*

[10 marks]

[10 markah]

**QUESTION 2****SOALAN 2**CLO1  
C2

- a) Explain the purpose of the following materials used in the road construction industry:

*Terangkan tujuan bahan-bahan berikut digunakan di dalam industri pembinaan jalan.*

- i) Aggregates

*Batu Baur*

- ii) Bitumen/Asphalt

*Bitumen/Asfalt*

[5 marks]

[5 markah]

- b) Sketch accurately the flexible pavement structure including relevant coating.

CLO1  
C3

*Lakarkan dengan jelas struktur turapan lentur berserta salutan yang berkaitan.*

[10 marks]

[10 markah]

CLO1  
C3

- c) Rigid pavement is the costliest among all other types of roads. It uses the term rigid pavement because it does not allow any flexibility. Explain **TWO (2)** types of rigid pavement below:

*Turapan tegar adalah yang paling mahal antara semua jenis jalan. Ia menggunakan istilah turapan tegar kerana ia tidak membenarkan sebarang fleksibiliti berlaku. Terangkan **DUA (2)** jenis turapan tegar berikut:*

- i) Mass Concrete (URC)

*Konkrit tanpa tetulang (URC)*

- ii) Joined Reinforced Concrete (JRC)

*Konkrit bertetulang bersambungan (JRC)*

[10 marks]

[10 markah]

**QUESTION 3****SOALAN 3**CLO2  
C3

- a) The design of flexible pavement is developed with the reference to factors that influence the thickness of pavement. Explain the factors that influence the thickness of pavement design.

*Rekabentuk turapan lentur dibangunkan dengan berpandukan faktor yang mempengaruhi ketebalan turapan. Huraikan faktor yang mempengaruhi ketebalan rekabentuk turapan.*

[5 marks]

[5 markah]

CLO2  
C4

- b) Concession toll-road of four-lane freeways are designed to be constructed using full-depth asphalt pavement. The average daily traffic is 9870 vehicles which 15% are commercial vehicles with an un-laden weight of more than 1.5 tons. Calculate the design traffic (traffic category) using the JKR 5/85 amendment 2013 method for over 20 years design life of flat terrain factor and 5% annual traffic growth by the given information below:

ADT based on HPU survey (from 06:00 to 22:00 hours)

Class	Traffic Count
CV1	850
CV2	650
CV3	430
CV4	96

*Lebuhraya konsesi bertol bagi empat lorong telah direkabentuk menggunakan turapan asphalt dengan kedalaman penuh. Julat trafik harian adalah melibatkan 9870 kenderaan dimana sejumlah 15% melibatkan kenderaan komersil dengan berat tanpa muatan melebihi 1.5 tan. Kira rekabentuk trafik (kategori trafik) menggunakan kaedah JKR ATJ 5/85 pindaan 2013 bagi rekabentuk 20 tahun dengan faktor muka bumi rata dan 5% pertumbuhan trafik tahunan menggunakan maklumat berikut:*

ADT berdasarkan cerapan HPU survey (dari 06:00 ke 22:00 jam)

Kelas	Kiraan Trafik
CV1	850
CV2	650
CV3	430
CV4	96

[10 marks]  
[10 markah]

CLO2  
C5

- c) Road pavement defects that occur after several usage is influenced by traffic load, weather, and maintenance. Recommend the restoration method for road pavement defects in the situation below:

*Kecacatan permukaan jalan berlaku setelah penggunaan yang disebabkan oleh beban trafik, cuaca dan penyenggaraan. Cadangkan kaedah pembaikan kecacatan permukaan jalan dalam situasi berikut:*

- i) Heavily cracked and broken surface  
*Permukaan retak dan pecah*
- ii) Lost stability and strength  
*Kehilangan kestabilan dan kekuatan*

[10 marks]  
[10 markah]

**SECTION B : 25 MARKS**  
**BAHAGIAN B : 25 MARKAH**

**INSTRUCTION:**

This section consists of **ONE (1)** essay question. Answer the question.

**ARAHAN:**

*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.*

**QUESTION 1**

**SOALAN 1**

- CLO2  
C4 (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]

- CLO2  
C5 (b) The town council of Petaling Jaya decided to upgrade the two-phase traffic light at junction A. Based on data collection of traffic flow as in the table below, determine:
- i. Maximum Saturation Flow,  $y_{\max}$
  - ii. Optimum Cycle Length,  $C_o$
  - iii. Effective green time for each phase
  - iv. Actual green time for each phase
  - v. Time phase diagram for each phase

Direction	North	South	East	West
Actual Flow (q)	750	650	900	550
Saturation Flow, S (pcu/hr)	2750	2600	2350	2880

Given Information:

Intergreen time,  $I = 5$  seconds

Amber period,  $a = 3$  seconds

Lost time,  $\ell = 2$  seconds

Majlis Perbandaran Petaling Jaya telah merancang untuk menaiktaraf lampu isyarat dua fasa pada persimpangan A. Berdasarkan cerapan data bagi aliran trafik seperti di jadual, tentukan:

- i. Aliran tepu maksimum,  $y_{max}$
- ii. Masa kitaran optimum,  $C_o$
- iii. Masa hijau efektif bagi setiap fasa
- iv. Masa hijau sebenar bagi setiap fasa
- v. Rajah masa setiap fasa

<b>Arah</b>	<b>Utara</b>	<b>Selatan</b>	<b>Timur</b>	<b>Barat</b>
<b>Kadar aliran sebenar (<math>q</math>)</b>	750	650	900	550
<b>Aliran tepu, <math>S</math> (pcu/hr)</b>	2750	2600	2350	2880

Maklumat berkaitan untuk rujukan:

Masa antara hijau,  $I = 5$  saat

Masa kuning,  $a = 3$  saat

Masa kehilangan,  $\ell = 2$  saat

[15 marks]  
[15 markah]

**SOALAN TAMAT**

## LAMPIRAN DAN FORMULA

### DCC30103 – HIGHWAY AND TRAFFIC ENGINEERING

#### Design Traffic

$$\text{a) } ESAL_{Y1} (\text{Base Year}) = [(ADT_{CV1} \times LEF_1) + (ADT_{CV2} \times LEF_2) + (ADT_{CV3} \times LEF_3) + (ADT_{CV4} \times LEF_4)] \times 365 \times L \times T$$

$$\text{b) } ESAL_{DES} = ESAL_{Y1} \times [(1 + r)^n - 1] / r$$

#### Design Procedure Recommended in this Manual

The procedure for calculating the **Traffic Category** to be used as design input (number of 80 kN ESALs over Design Period, see **Table 2.5**), is as follows: -

1. From traffic counts for the project under consideration (information provided by **HPU** for the past 5 or more years), determine: -
  - a. Initial **Average Daily Traffic in one direction (ADT)**; the average should be based on a minimum of 3 days, 24 hours per day. If traffic count covers a time period of 06:00 to 22:00 hours, multiply the traffic count reported by HPU with a factor of 1.2.
  - b. Percentage of **Commercial Vehicles (CV)** with an un-laden weight of more than 1.5 tons ( $P_{CV}$ ) and break-down into vehicle categories (shown in **Table 2.1**).
  - c. Average Annual **Traffic Growth Factor (r)** for CV.



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

Traffic Category	Design Traffic (ESAL x 10 <sup>6</sup> )	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%

*Note: Whenever feasible, statistical analysis shall be used to evaluate laboratory or field test results for use as input for pavement design (sub-grade, sub-base, road base and bituminous courses). The above probability values shall be applied to material strength and stiffness values as follows: -*

*Design Input Value = Mean – (Normal Deviate x Standard Deviation)*

### **Junction Design**

a)  $y = q/S$

b)  $Y = \sum y_{max}$

c)  $L = \sum \ell + \sum (I - a)$

d)  $C_o = (1.5 L + 5) / (1 - Y)$

e)  $g = C_o - L$

f)  $g_1 = (y(N/S) \times g) / Y$

g)  $g_2 = (y(E/W) \times g) / Y$

h)  $k = g + (\ell - a)$