SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2017

DCC3113 : HIGHWAY AND TRAFFIC ENGINEERING

TARIKH : 31 OKTOBER 2017
MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)

Kertas ini mengandungi **SEPULUH(10)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Appendix

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)** structured questions. Answer ALL the questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1
C1

(a) Identify **FIVE (5)** categories of roads in Malaysia.

*Kenalpasti **LIMA (5)** kategori jalanraya di Malaysia.*

[10 marks]
[*10 markah*]

CLO1
C2

(b) Describe **THREE (3)** categories of transportation.

*Jelaskan **TIGA (3)** kategori pengangkutan.*

[15 marks]
[*15 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

(a) Define Junction.

Definisi persimpangan.

[4 marks]
[*4 markah*]

CLO1
C2

(b) Identify **SIX (6)** types of at grade junction.

*Kenalpasti **ENAM (6)** jenis persimpangan searas/separa.*

[6 marks]
[*6 markah*]

CLO1
C3

(c) A two phase traffic light system will be installed at PSMZA intersection. The flow volume (Q) and Saturated flow (S) of the intersection are shown in **Table B1.**

*Satu sistem lampu isyarat 2 fasa akan dipasang di persimpangan PSMZA . Isipadu aliran (Q) dan aliran tepu (S) persimpangan tersebut adalah seperti dalam **Jadual B1.***

Table B1: PSMZA Intersection Flow Volume (Q) and Saturated Flow (S)

Jadual B1: Isipada Aliran (Q) dan Aliran Tepu (S) di Persimpangan PSMZA

Phase/Fasa	**Phase 1 / Fasa 1**		**Phase 2/Fasa 2**	
Approach/Arah	**N**	**S**	**E**	**W**
Flow Volume/Isipadu aliran (Q)(pcu/hr)	**412**	**351**	**781**	**1450**
Saturated Flow/Aliran Tepu (S) (pcu/hr)	**1970**	**1970**	**3161**	**3160**

Based on the data, calculate the followings:

Berdasarkan data tersebut, kirakan data yang berikut:

i. Optimal cycle time, C_o

Masa kitaran optima, C_o

ii. Actual green time, G

Masa hijau sebenar, G

Assume/*Anggap*:

Inter-green time/*Masa antara hijau* = 4 sec

Amber time/ *Masa lampu kuning*= 3 sec

And loss time/ *dan masa hilang* = 2 sec

[15 marks]
[*15 markah*]

SECTION B : 50 MARKS

BAHAGIAN B : 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2
C2

(a) Road surface is an important element in a highway system. Explain the construction of road surface.

Permukaan jalan merupakan elemen yang penting di dalam sistem jalanraya. Terangkan pembinaan permukaan jalan.

[5 marks]
[*5 markah*]

CLO2
C3

(b) By referring to the **Figure B1,** complete each section of the road pavement construction using the attachment given.

*Menggunakan gambarajah dalam **Rajah B1**, lengkapkan setiap bahagian pembinaan permukaan turapan menggunakan lampiran yang disediakan.*

[10 marks]
[*10 markah*]

CLO2 C5

(c) Rigid pavement road is a very high standard. It is the most costly among all other types of road. Propose **FOUR (4)** types of rigid pavement below:

*Jalan turapan tegar mempunyai standard yang sangat tinggi. Ia adalah paling mahal di kalangan semua jenis jalan lain. Cadangkan **EMPAT (4)** jenis turapan tegar di bawah:*

i) Mass Concrete / Un-reinforce Concrete (URC)
Konkrit Tanpa Tetulang

ii) Jointed Reinforced Concrete (JRC)
Konkrit Tetulang Bersambungan

iii) Continuous Reinforced Concrete (CRCP)
Konkrit Tetulang Berterusan

iv) Pre Stress Concrete (PSC)
Konkrit Pra Tegasan

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

CLO2 C2

(a) There are many colour that have been used in classification of traffic signboard based on their functions. Describe the meaning of **FIVE (5)** colour used for traffic control devices.

*Terdapat banyak warna yang digunakan dalam mengelaskan papan tanda trafik mengikut fungsinya. Jelaskan maksud **LIMA (5)** warna yang digunakan dalam peranti kawalan lalulintas.*

[5 marks]
[*5 markah*]

CLO2 C3

(b) The new main road with hierarchy JKR 05 was proposed to connect between Town A and Town B as shown in **Table 2b**. The information related to design of thickness are given as follows:

Sebuah jalan raya utama berhierarki JKR 05 telah dicadangkan untuk dibina bagi menghubungkan Bandar A dan Bandar B. Maklumat berkenaan rekabentuk ketebalan diberikan seperti berikut:

Table 2B : The information design of thickness
Jadual 2B : *Maklumat rekabentuk ketebalan*

Initial daily traffic volume (ADT) *Purata Lalulintas Harian awalan (PLH)*	7000 *7000*
Percentage of commercial vehicles (%) *Peratus kenderaan perdagangan (%)*	13 *13*
Annual growth rate (%) *Kadar pertumbuhan tahunan (%)*	5 *5*
Subgrade CBR (%) *CBR subgred (%)*	5 *5*
Design period (Years) *Hayat rekabentuk (Tahun)*	10 *10*
Carriageway width (m) *Lebar lorong (m)*	7.5 *7.5*
Shoulder width (m) *Lebar bahu jalan (m)*	2.0 *2.0*
Type of terrain *Jenis muka bumi*	Mountainous *Berbukit*

Calculate the thickness of all layers for flexible pavement.
Kirakan ketebalan setiap lapisan untuk turapan lentur.

[15 marks]
[*15 markah*]

CLO2
C5

(c) One lorry carried gravel with total weight 240kN. It has two axles as shown in **Figure 2B(c)i.** Predict the reduction of equivalent load factors if the same gravel was transferred to another lorry with three axles as shown in **Figure 2B(c)ii.**

Sebuah lori membawa batu baur dengan jumlah berat 240kN. Lori ini mempunyai dua gandar seperti Rajah 2B(c)i. Kirakan pengurangan faktor setaraan jika batu baur itu dipindahkan ke lori yang lain yang mempunyai tiga gandar seperti Rajah 2B(c)ii.

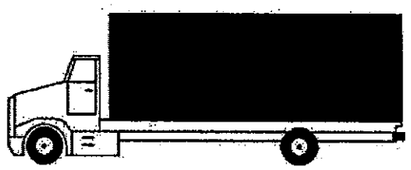
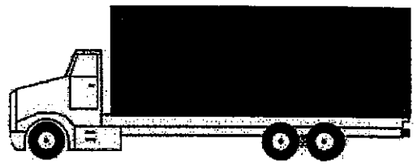


Figure 2B(c)i/ Rajah 2B(c)i



Rajah 2B(c)ii/ Rajah 2B(c)ii

[5 marks]
[*5 markah*]

QUESTION 3

SOALAN 3

CLO2
C2

(a) Explain **FIVE (5)** characteristic of asphaltic concrete mix to be achieved in order to obtain optimum quality of mixes.

*Terangkan **LIMA (5)** ciri-ciri campuran konkrit asfal yang berkualiti.*

[5 marks]
[*5 markah*]

CLO2
C4

(b) Designated mix formula for each type of asphaltic concrete mix shall be prepared based on of testing several laboratory design mix aggregate gradations at an appropriate range of bitumen content according to Marshall Test Procedures. **Table 3.1** in attachment **B3.1** shows a result of Marshall Test of an Asphaltic Concrete Wearing Course (ACW20) that had been done in laboratory. Based on the result, determine the Optimum Bitumen Content by plotting and using the:

*Rekabentuk campuran setiap jenis konkrit asfal perlu disediakan berdasarkan ujikaji makmal yang menggunakan beberapa nisbah campuran aggregate pada kandungan bitumen yang tertentu mengikut prosedur Ujikaji Marshall. **Jadual 3.1** dalam Lampiran **B3.1** menunjukkan keputusan yang didapati hasil daripada ujian makmal terhadap Campuran Konkrit Asfal Untuk Lapisan Haus (ACW20). Berdasarkan keputusan tersebut, tentukan Kandungan Bitumen Optima dengan membina dan menggunakan graf:*

i. Graph of Density versus Bitumen Content
Graf Ketumpatan lawan Kandungan Bitumen

ii. Graph of Stability versus Bitumen Content
Graf Kestabilan lawan Kandungan Bitumen

iii. Graph of Void In Total Mix (VTM) versus Bitumen Content
Graf Lompang Dalam Keseluruhan Campuran lawan Kandungan Bitumen

iv. Graph of Void In Aggregate Filled Bitumen (VFB) versus Bitumen Content
Graf Lompang Dalam Aggregat Terisi Bitumen lawan Kandungan Bitumen

Note: Please use attachment B3.2 to plot all of the graphs above.
Nota: Sila gunakan Lampiran B3.2 untuk membina semua graf diatas.

[10 marks]
[*10 markah*]

CLO2
C5

(c) Every Optimum Bitumen Content that obtained from Marshall Design Mix Procedure must be cross checked with the Public Work Department Specifications to make sure it was suitable to be used in Malaysia. Evaluate the Marshall parameter obtain from the graph plotted in **Q3(b)** based on the standards that required by the Public Work Department for Asphaltic Concrete refer to the **Table 3.2** in terms of the following parameters:

Setiap Kandungan Bitumen Optima yang diperolehi daripada Prosedur Ujikaji Marshall perlu disemak kembali dengan piawaian Jabatan Kerja Raya (JKR), untuk memastikan ianya sesuai digunakan di Malaysia. ***Jadual 3.2*** *menunjukkan piawaian yang ditetapkan oleh JKR untuk campuran konkrit asfal yang ingin digunakan di Malaysia. Berdasarkan* ***Jadual 3.2*** *dan Graf yang telah diplot dalam* ***Q3(b),*** *Nilaikan Kandungan Bitumen Optima yang telah diperolehi sebelum ini untuk digunakan di Malaysia berdasarkan parameter-parameter berikut:*

i. Stability / *Kestabilan*
ii. Flow / *Aliran*
iii. Stiffness / *Kejelikitan*
iv. Voids In Total Mix (VTM)
Lompang Dalam Campuran
v. Voids In Aggregate Filled With Bitumen (VFB)
Lompang Dalam Aggregat Yang Terisi Dengan Bitumen

Table 3.2 Test and Analysis Parameters (JKR, 2008)
Jadual 3.2 Parameter Ujian dan Analisis (JKR, 2008)

Parameter	Wearing Course	Binder Course
Stability	>800 kg	>800 kg
Flow	2.0-4.0 mm	2.0-4.0 mm
Stiffness	>200kg/mm	>200kg/mm
Voids In Total Mix (VTM)	3.0-5.0%	3.0-7.0%
Voids In Aggregate Filled With Bitumen (VFB)	70-80%	65-75%

[10 marks]
[*10 markah*]

QUESTION 4
SOALAN 4

CLO2
C2

(a) Identify **FIVE (5)** purposes of traffic management.
Kenalpasti ***LIMA (5)*** *tujuan pengurusan lalulintas.*

[5 marks]
[*5 markah*]

CLO2
C3

(b) Interperate **THREE (3)** traffic management techniques below:
Tafsirkan ***TIGA (3)*** *teknik pengurusan trafik berikut:*

i. Physical management of road system
Pengurusan fizikal sistem jalan raya

ii. Management of information to road user
Pengurusan maklumat kepada pengguna jalan raya

iii. Management of payment for traffic facilities
Pengurusan pembayaran bagi kemudahan lalulintas

[10 marks]
[*10 markah*]

CLO2
C5

(c) Compare **TWO (2)** types of highway maintenance in Malaysia with **THREE (3)** examples for each types.
Bandingkan ***DUA (2)*** *jenis penyenggaraan jalan di Malaysia beserta* ***TIGA (3)*** *contoh bagi setiap jenis.*

[10 marks]
[*10 markah*]

SOALAN TAMAT

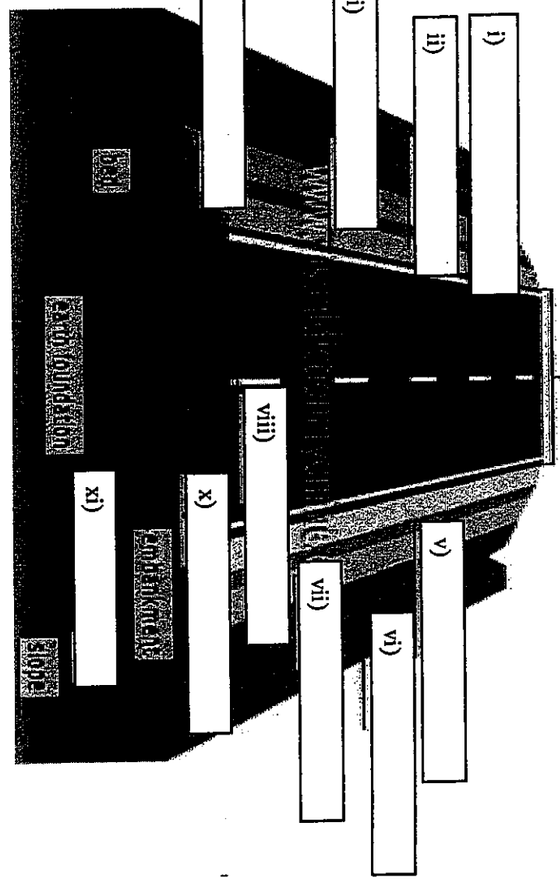


Figure B1 : Section the road pavement construction

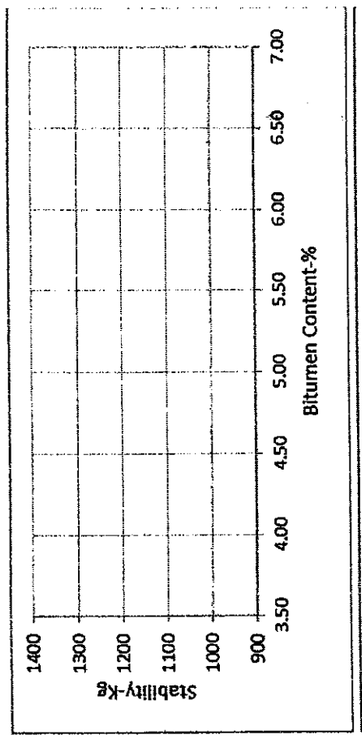
Rajah B1 : Bahagian pembinaan permukaan turapan

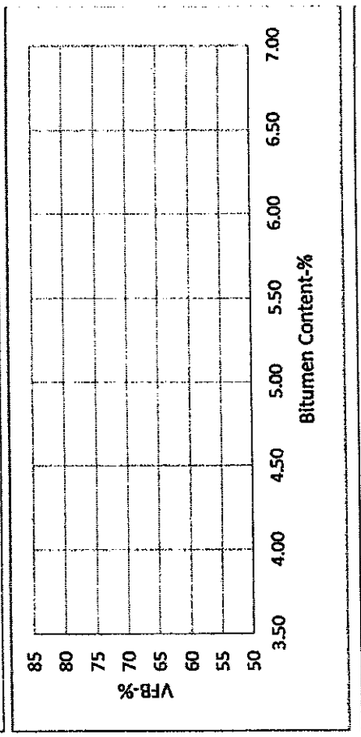
MARSHALL TEST RESULT

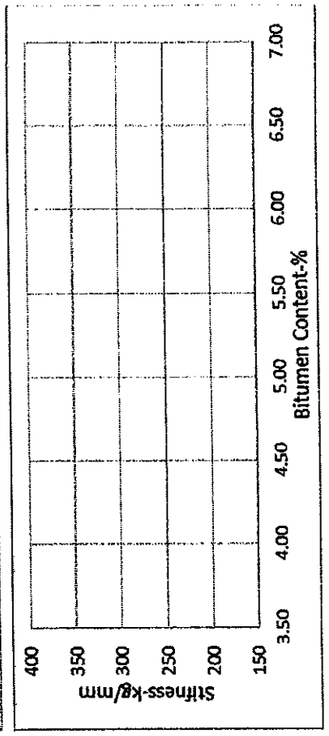
TYPE OF MIX: ASPHALTIC CONCRETE WEARING COARSE (ACW20)

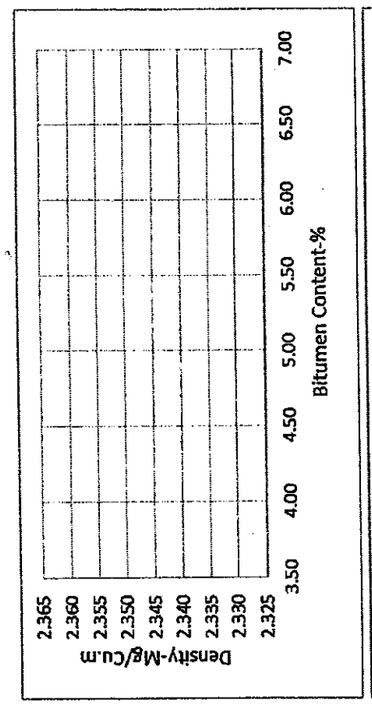
Table 3.1 Marshall Test Result For An ACW20 Samples At Various Content Of Bitumen

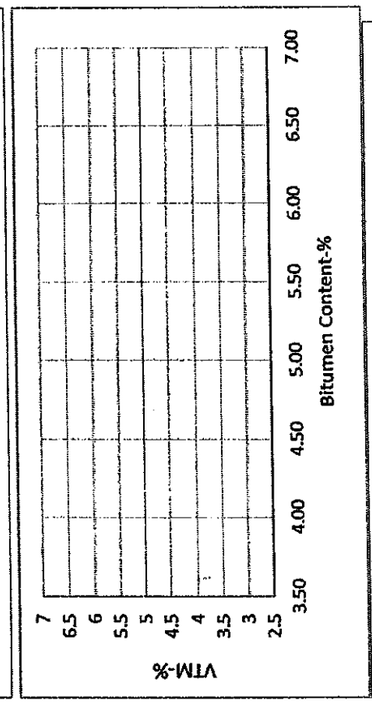
% Bitumen	% Bitumen	Weight (gm)			Bulk Volume	Specific Gravity		Volume-% Total			Voids-%			Stability (kg)			Flow (mm)	Stiffness
		Sat. Surface Dry	In Air	In Water		Bulk Density	Max. Theory	Bitumen	Aggregate	Voids	Aggregate	Filled Bitumen	Total Mix	Correction Factor	Measured	Corrected		
	4.50	1202.0	1194.3	686.9	515.1	2.319								1.00	1161	1161	3.27	
		1196.4	1193.7	685.9	510.5	2.338								1.00	1100	1100	3.17	
		1196.7	1191.7	685.8	510.9	2.333								1.00	1150	1150	3.33	
Average						**2.330**	**2.490**	**10.2**	**83.2**	**6.6**	**16.8**	**60.6**	**6.4**			**1137**	**3.26**	**349.1**
	5.00	1197.9	1194.7	690.7	507.2	2.355								1.04	1191	1239	3.70	
		1195.8	1192.7	690.2	505.6	2.359								1.04	1163	1210	3.71	
		1200.5	1197.1	692.4	508.1	2.356								1.04	1151	1197	3.83	
Average						**2.357**	**2.480**	**11.4**	**83.6**	**5.0**	**16.4**	**69.8**	**5.0**			**1215**	**3.75**	**324.3**
	5.50	1202.8	1199.9	695.2	507.6	2.364								1.04	1321	1374	4.30	
		1180.3	1176.4	682.7	497.6	2.364								1.04	1298	1350	4.29	
		1178.6	1174.8	681.2	497.4	2.362								1.09	1239	1351	3.93	
Average						**2.363**	**2.461**	**12.6**	**83.4**	**4.0**	**16.6**	**76.0**	**4.0**			**1358**	**4.17**	**325.4**
	6.00	1185.0	1182.3	685.8	499.2	2.368								1.04	1163	1210	4.63	
		1196.0	1191.5	690.6	505.4	2.358								1.04	1135	1180	4.72	
		1188.8	1184.0	685.6	503.2	2.353								1.04	1111	1155	4.69	
Average						**2.360**	**2.443**	**13.7**	**82.8**	**3.4**	**17.2**	**80.0**	**3.4**			**1182**	**4.68**	**252.5**
	6.50	1172.7	1168.2	675.9	496.8	2.351								1.04	870	905	5.31	
		1185.6	1180.8	685.6	500.0	2.362								1.04	870	905	5.48	
		1178.9	1172.4	679.6	499.3	2.348								1.04	919	956	5.69	
Average						**2.354**	**2.426**	**14.9**	**82.2**	**3.0**	**17.8**	**83.3**	**3.0**			**922**	**5.49**	**167.8**

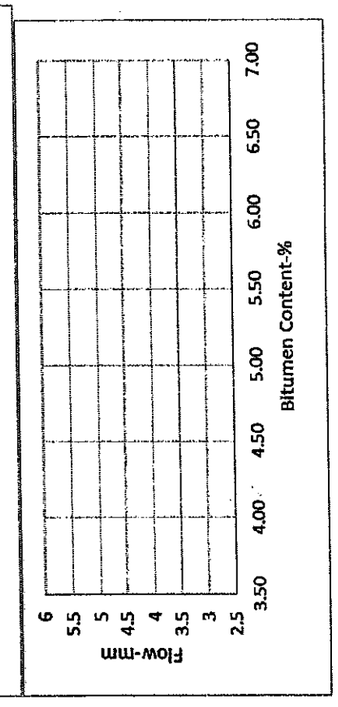












Appendix

V_0 = $ADT \times 0.5 \times 365\ P_c/100$

V_c = $\frac{V_0[(1+r)^x-1]}{r}$

ESA = e x V_C

V_f = $V_1(1+r)^x$

c = I x R x T

C = c x 10

T_A = $a_1D_1+a_2D_2+...+a_nD_n$

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	1.00	0.97	0.94	0.90
7.0m	0.88	0.86	0.83	0.79
6.0m	0.81	0.78	0.76	0.73
5.0m	0.72	0.70	0.67	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 Mechanically Stabilized crushed aggregate	Unconfined Compressive strength(7 days) 30-40 kg/cm2	0.45
		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 3.7 Standard & Construction Layer Thickness

Type of layer		Standardard thickness	One layer lift
Wearing course		4-5 cm	4-5 cm
Binder course		5-10 cm	5-10 cm
Base Course	Bituminous	5-20 cm	5-15 cm
	Wet mix	10-20 cm	10-15 cm
	Cement treated	10-20 cm	10-20 cm
Subbase Course	Granular	10-30 cm	10-20 cm
	Cement treated	15-20 cm	10-20 cm

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

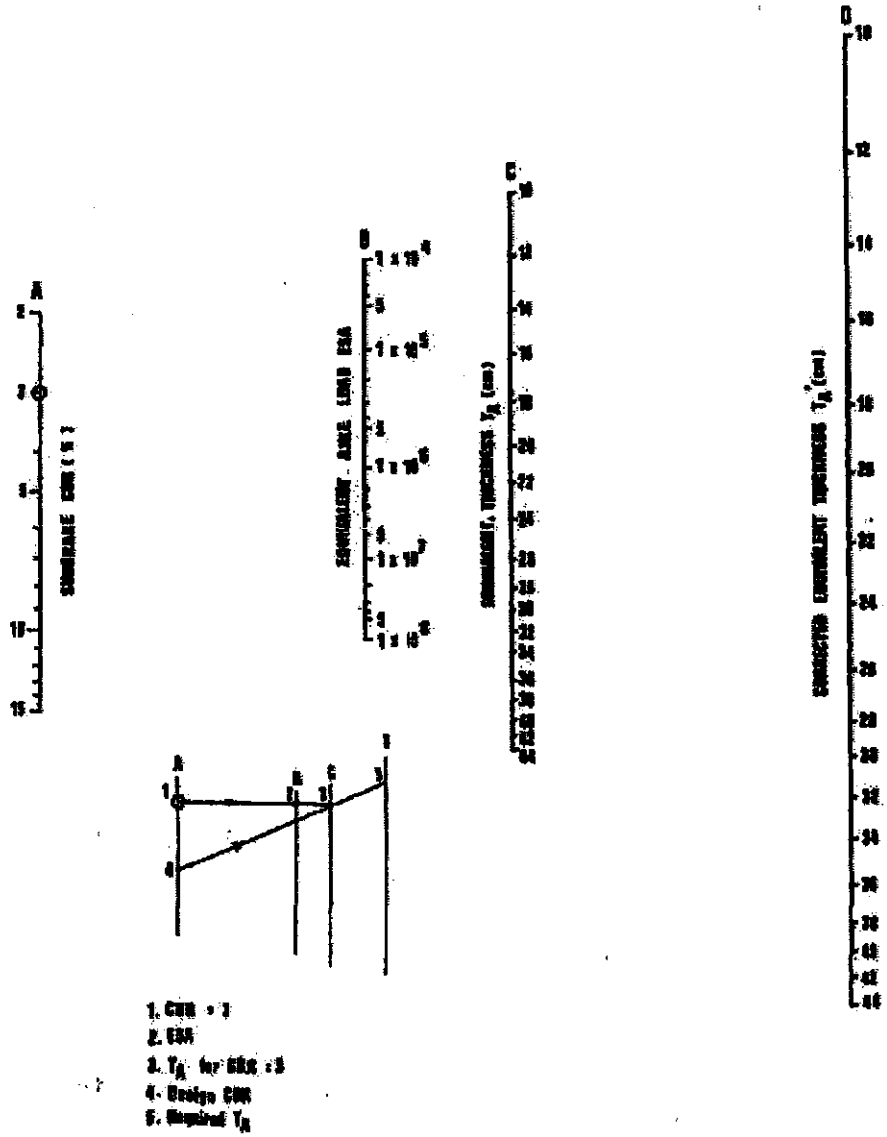


Figure 1: Thickness Design Nomograph