



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of BUILDING & Civil engineering

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN CIVIL ENGINEERING DCE 2301 : TRANSPORTATION ENGINEERING I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of five questions.

Attempt Question ONE and any OTHER TWO questions.

Do not write on the question paper.

QUESTION ONE (20 Marks) (Compulsory)

The following data to a field study:

(i) Alignment soil consisting of black cotton soil of average 1.2 m thickness overlying decomposed phonolite, the C.B.R. of black cotton soil ranging between 2% and 5% and that of phonolite 15-30%.

(ii) The traffic count and axle load surveys show that the initial daily number of commercial

Vehicles and equivalent factors are as follows:

Buses – 202 E.F. – 1

Medium goods vehicles – 400 E.F. – 2
Heavy goods vehicles – 390 E.F. -8

(iii) The design period is 20 years and the annual growth rate is 5%.

(iv) Stone suitable for asphalt concrete, dense bitumen macadam and lean concrete is abundant. The stone can be used as graded crushed stone (GCS) for sub-base.

Design a flexible pavement using Standard pavement structures Type 12, 13 and 14 and Table 1, 2 & 3 below. (20 Marks)

QUESTION TWO (20 Marks)

(a) With the aid of a sketch, describe the Roman road construction. (10 Marks)

(b) In regard to planning of transportation systems, explain FOUR purposes of soil and materials surveys. (8 Marks)

(c) Outline TWO purposes of reconnaissance survey. (2 Marks)

QUESTION THREE (20 Marks)

(a) Identify and explain THREE factors considered in selection of width of a road. (9 Marks)

(b) With aid of a sketch, outline the procedure for setting out horizontal curves. (11 Marks)

QUESTION FOUR (20 Marks)

(a) Briefly explain THREE aspects of location survey. (6 Marks)

(b) In regards to highway alignment, identify and explain SIX obligatory points. (9 Marks)

(c) State FIVE requirements of highway alignment. (5 Marks)

TABLE 1: SUBGRADE CLASSES

CLASS	S1	S2	S3	S4	S5	S6
CBR (%)	2-5	5-10	7-13	10-18	15-30	>30

TABLE 2: TRAFFIC CLASSIFICATION - 1

CLASS	CUMULATIVE NUMBER OF STANDARD AXLES
T1	25 – 60 million
T2	10 – 25 million
T3	3 – 10 million
T4	1 – 3 million
T5	0.25 – 1 million

TABLE 4: TRAFFIC CLASSIFICATION- 2

CLASS	ESA/Day in 1 Year
T1	2,500 – 6,000
T2	1,000 – 2,500
T3	300 – 1,000
T4	100 -300
T5	25 - 100

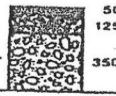
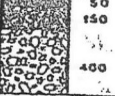
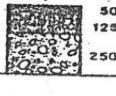
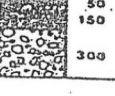
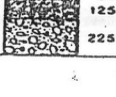
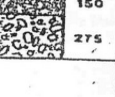
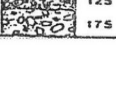
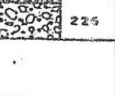
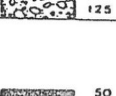
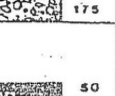
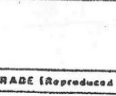
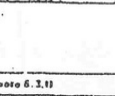
ROAD DESIGN MANUAL **PART 111 : MATERIALS AND PAVEMENT DESIGN FOR NEW ROADS**

CHAPTER 9 : STANDARD PAVEMENT STRUCTURES

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STANDARD PAVEMENT STRUCTURE TYPE 12

BASE : Dense bitumen macadam
SUBBASE: Graded crushed stone (Base quality)

	T5	T4	T3	T2	T1
S1		UNSUITABLE TECHNICALLY AND ECONOMICALLY. USE IMPROVED SUBGRADE		 50 125 350	 50 150 400
S2				 50 125 250	 50 150 300
S3				 50 125 225	 50 150 275
S4				 50 125 175	 50 150 225
S5				 50 125 125	 50 150 175
S6				 50 125 100	 50 150 125

SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10 ⁶
S1	2 - 5	T1	25 - 60
S2	5 - 10	T2	10 - 25
S3	7 - 13	T3	3 - 10
S4	10 - 18	T4	1 - 3
S5	15 - 30	T5	0-25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table 6.1.1)									
Native Subgrade Class		S1		S2		S3		S4	
Improved	Material	S2	S3	S4	S3	S4	S4	S5	
Subgrade	Thickness (mm)	400	350	425	275	325	450	300	200
Subgrade	Thickness (mm)	150	150	150	150	150	150	150	150
New Class		S2	S2	S3	S2	S3	S4	S4	S4, S5

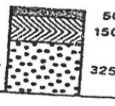
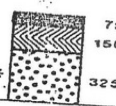
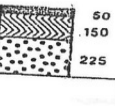
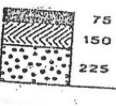
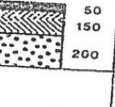
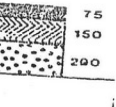
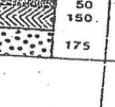
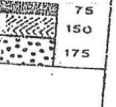
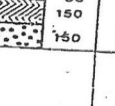
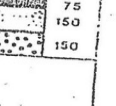
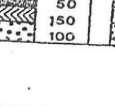
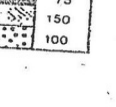
ROAD DESIGN MANUAL
PART 111 : MATERIALS AND PAVEMENT DESIGN FOR NEW ROAD
 CHAPTER 9 : STANDARD PAVEMENT STRUCTURES

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STANDARD PAVEMENT STRUCTURE TYPE 1B

BASE : Lean concrete

SUBBASE : Cement or lime improved material (Base quality)

	T5	T4	T3	T2	T1
S1				 50 150 325	 75 150 325
S2		*TECHNICALLY UNSUITABLE. USE IMPROVED SUBGRADE TO S4 STANDARD		 50 150 225	 75 150 225
S3				 50 150 200	 75 150 200
S4				 50 150 175	 75 150 175
S5				 50 150 150	 75 150 150
S6				 50 150 100	 75 150 100

ECONOMICALLY
UNJUSTIFIED

SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10 ⁶
S1	2 - 5	T1	25 - 60
S2	5 - 10	T2	10 - 25
S3	7 - 13	T3	3 - 10
S4	10 - 18	T4	1 - 3
S5	15 - 30	T5	0.25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table J 11)									
Native Subgrade Class		S1		S2		S3		S4	
Improved Material	Subgrade	S2	S3	S4	S3	S4	S4	S5	
Thickness (mm)		400	350	325	275	325	450	300	200
New Class		S2	S2	S3	S2	S3	S4	S3	S4

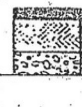
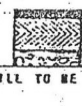
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CHAPTER 9 : STANDARD PAVEMENT STRUCTURES

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STANDARD PAVEMENT STRUCTURE TYPE 1A

BASE : Lean concrete
 SUBBASE : Graded crushed stone

	T5	T4	T3	T2	T1
S1		TECHNICALLY UNSUITABLE. USE IMPROVED SUBGRADE			
S2					
S3					
S4		ECONOMICALLY UNJUSTIFIED			
S5					
S6					

SUITABILITY STILL TO BE ASCERTAINED

SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10 ³
S1	2 - 5	T1	25 - 60
S2	5 - 10	T2	10 - 25
S3	7 - 13	T3	3 - 10
S4	10 - 18	T4	1 - 3
S5	15 - 30	T5	0.25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table 5.11)											
Native Subgrade Class											
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
Improved Material	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Subgrade Thickness (mm)	400	350	425	275	325	450	200	280	350	300	350
New Class	S2	S2	S2	S2	S3	S4	S3	S3	S4	S4	S5