6e

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITRY MAIN EXAMINATIONS 2023/2024 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 443

COURSE TITLE: PAVEMENT DESIGN

DATE: 11TH DCEMBER 2023 **TIME: 8 A.M- 10 A.M**

INSTRUCTIONS:

1. This paper contains **FOUR** sections
2. Answer questions ONE and **any other two**
3. Marks for each question are indicated in the parenthesis.
4. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

Question 1: (30 marks) COMPULSORY

(a) Outline any four differences between flexible and rigid pavements. **(4 marks)**

(b) The Figure Q1 below shows a set of dual tyres, each having contact radius of 115(4.52in) mm and contact pressure of 483 kPa (70psi). The center-to-center spacing of the dual is 343 mm(13.5in). Layer 1 has thickness of 152 mm(6in) and elastic modulus of 690 MPa (100,000psi). layer 2 has elastic modulus of 69 MPa (10,00psi). Determine the vertical deflection at point A, which is on the interface beneath the center of one loaded area. **(5 marks)**

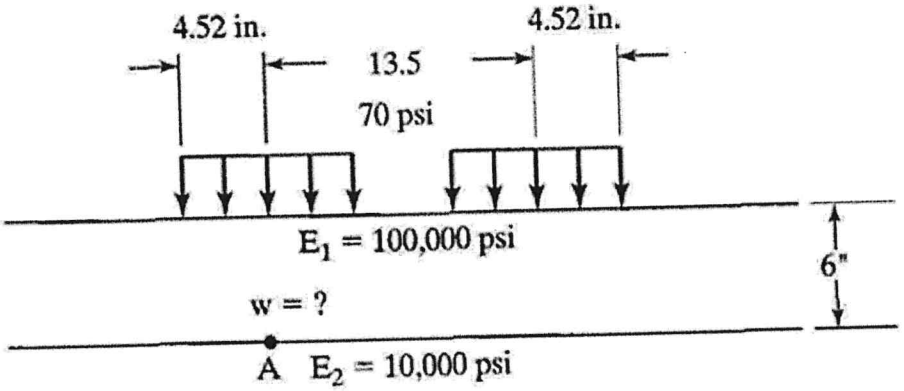


Figure Q1

(c) Outline any five key components of pavement performance evaluation for flexible pavement design under the AASHTO guidelines. **(5 marks)**

(d) From the data given in the table below determine was collected from axle load surveys to design a flexible pavement. The pavement is to have a 20-year design period and assuming a traffic growth rate of 5%. The volume given is for both directions.

Axle load=LS	**Number of passages**
89	600
80	100
71	100
27	200
18	200

(i) Determine the cumulative standard axles for the design lane assuming the worst case scenario of lane distribution. **(4 marks)**

(ii) Using the results obtained in part i and the subgrade CBR of 4%, design the flexible pavement based on the Road note 29 design method. **(3 marks)**

(e) There are three main factors that affect the stability of road pavements. Describe them. **(6 marks)**

(f) Mention any three types of joints found in concrete pavements stating their function. **(3 marks)**

Question 2: 20 marks

(a) What is a pavement **(1 mark)**

(b) Outline the three main types of concrete pavements. The description should cover the main differences between the three and one advantage of each type. **(9 marks)**

(c) You have been appointed by the county Government of Kakamega as a roads engineer. One of your first tasks is to design a flexible pavement linking two market centres. Outline the step by step procedure you will follow to come up with the design. Any important formula for this exercise should be included. **(10 marks)**

Question 3: (20 marks)

(a) Mention and briefly describe any four design objectives in the design of flexible pavements **(8 marks)**

(b) Define the analytical approach to pavement design and describe the procedural steps used in this design approach. **(6 marks)**

(c) Describe any three advantages of the analytical approach to pavement design. **(3 marks)**

(d) How does temperature affect pavement performance and design. **(3 marks)**

Question 4: 20 marks

(a) State and briefly describe any two limitations of the one-layer theory. **(2 marks)**

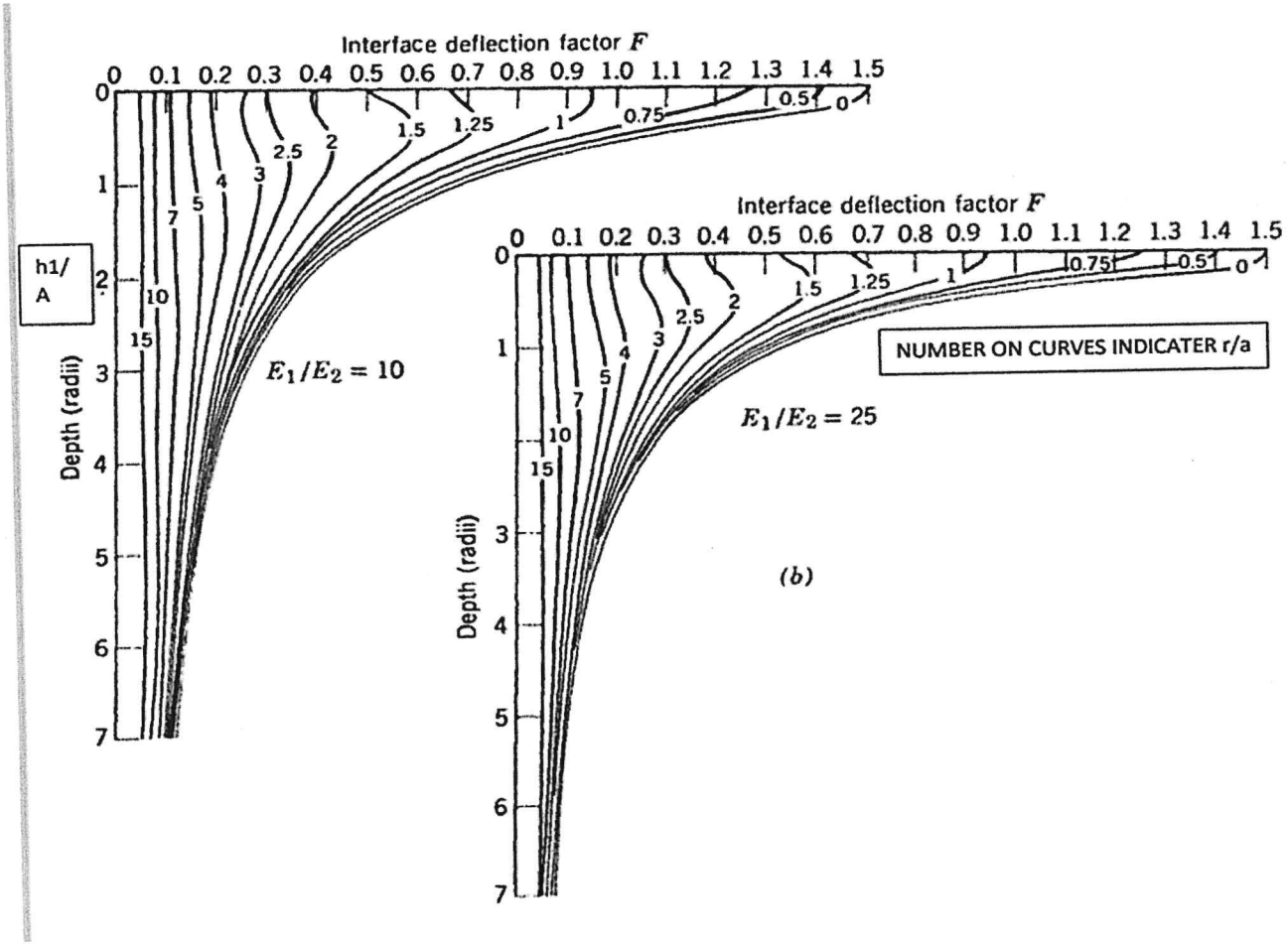
(b) In the AASHTO design method for rigid pavements. The design of pavement thickness is based on a number of factors. Mention any four and clearly describe how they contribute to pavement thickness determination **(8 marks)**

(c) You have been tasked with design of a flexible pavement and you opt for road note 29 design method. Outline the steps you would follow to come up with the design. **(5 marks)**

(d) Differentiate between the functional and structural performance of pavements giving examples in each case. **(2 marks)**

(e) The Kenya Road Design Manual outlines the process of designing unpaved roads(gravel). Name and describe the steps to determine the thickness. **(3 marks).**

Charts



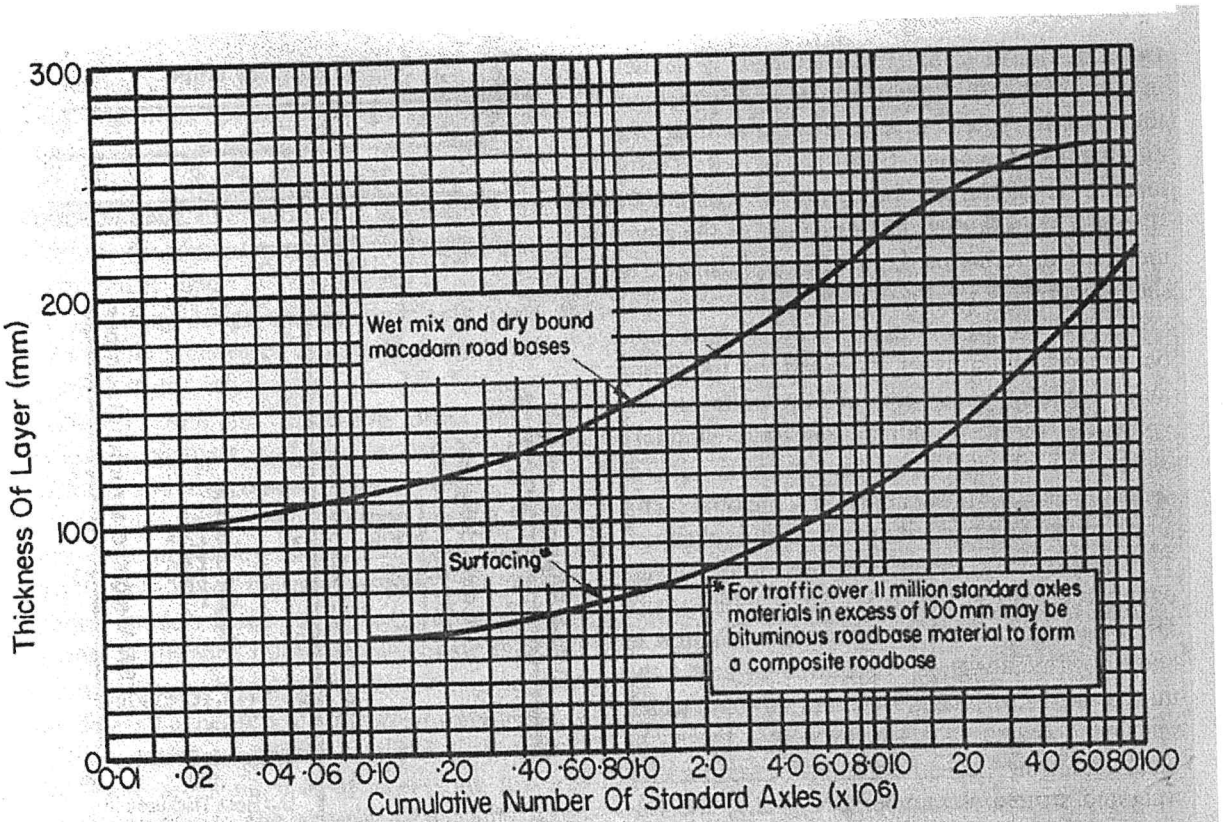


Fig. 6.29 Design chart for surfacing and base thickness for wet-mix and dry-bound macadam bases (RN 29). [Source: reference (8)]

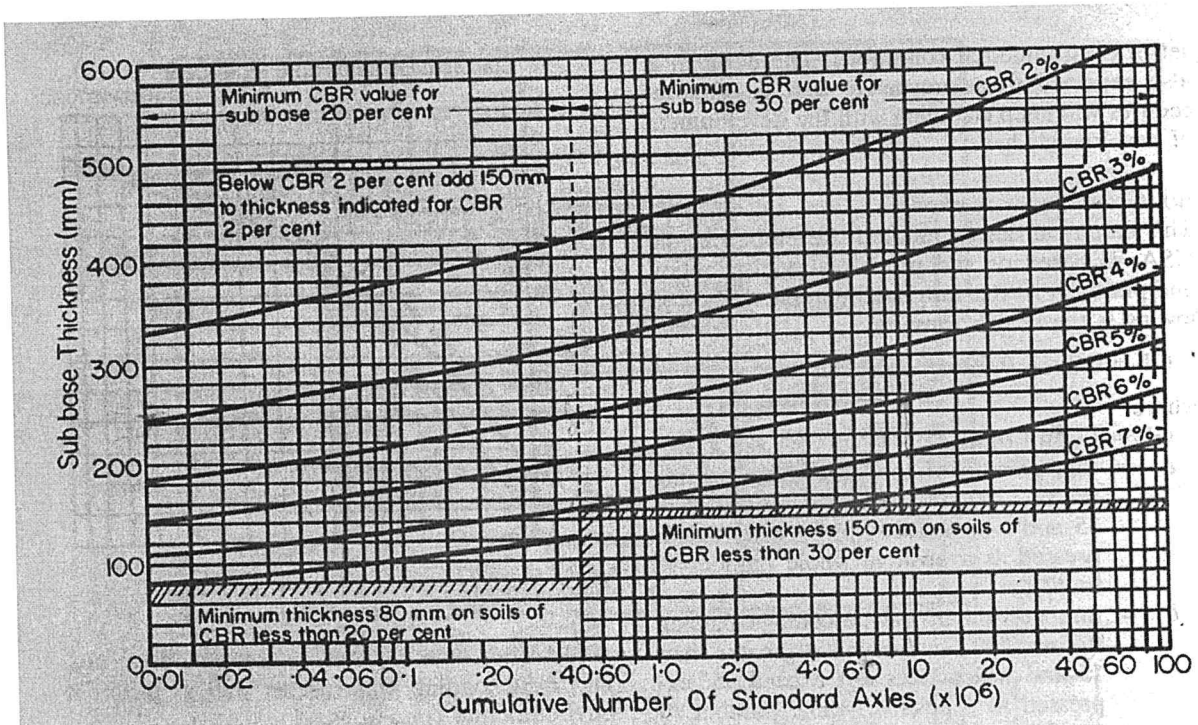


Fig. 6.27 Design chart for sub-base thickness (RN 29).
[Source: reference (8)]

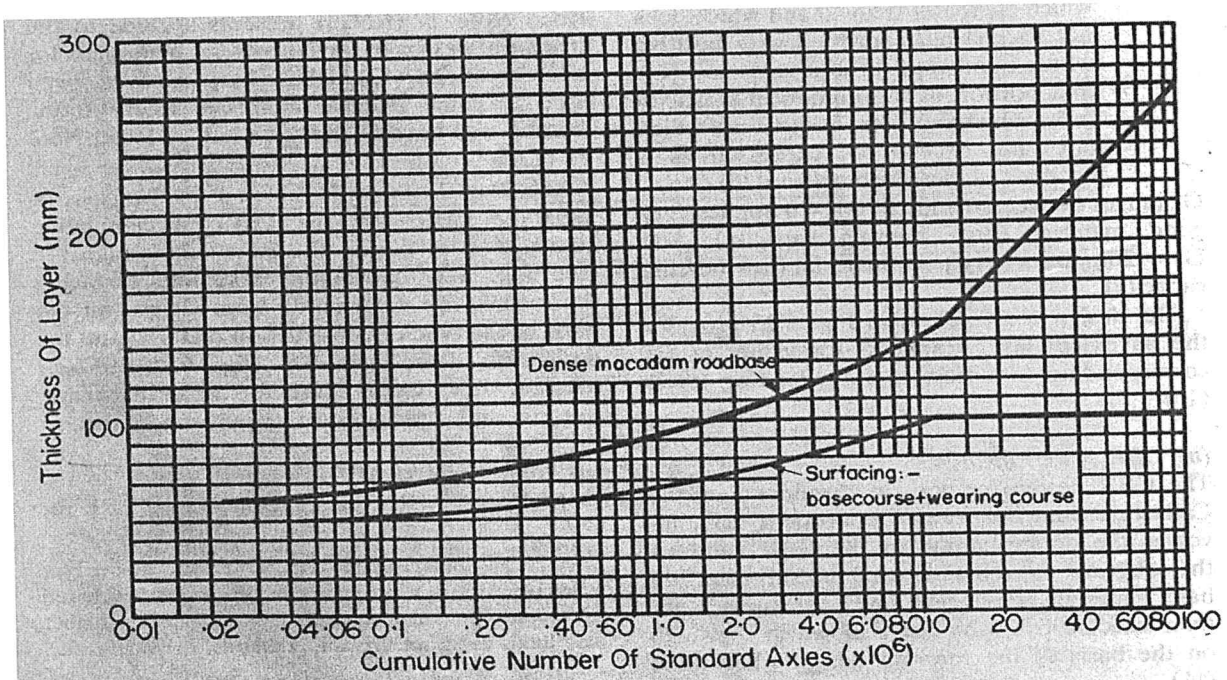


Fig. 6.28 Design chart for surfacing and base thickness for dense macadam bases (RN 29).
[Source: reference (8)]