



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2021/2022 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: TUESDAY 26TH APRIL 2022 TIME: 8.00 – 10.00 AM

INSTRUCTIONS:

1. This paper contains **TWO** sections
2. Answer **ALL** questions in **section I** and **any two** from section **II**
3. Marks for each question are indicated in the parenthesis.
4. Relevant design charts are provided
5. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 6 Printed Pages. Please Turn Over.

SECTION I- ANSWER ALL QUESTIONS (30 MARKS)

1. (a) Differentiate between conventional layered flexible pavements and full depth asphalt pavements **(3 marks)**
 (b) Explain the concept "performance is the heart of the pavement design process" **(4 marks)**
2. (a) Given the following data calculate the surface deflection of a pavement under the centre of the tyre using Burmister's theory. The Burmister chart is presented in figure 1 **(6 marks)**

Tyre pressure	= 10kg/cm ²
Radius of contact	=15cm
Pavement thickness	=45cm
Modulus of paving materials	=5000kg/cm ²
Modulus of sub-grade material	= 100kg/cm

(b) Explain the following terms as related to pavement design: Equivalence factor and Equivalent standard axle **(4 marks)**

3. (a) Given the traffic loading presented in the table below calculate: the average daily number of standard axles in the base year and the cumulative number of standard axles assuming a 6% growth in traffic and a 15-year design period. **(4 marks)**

Axle load	10-30	30-50	50-70	70-90	90-110	110-130	130-150
No. of axles	80	100	80	60	50	30	20

(b) Using the results obtained in section a, design the pavement using the Road Note 29 design method assuming subgrade CBR of 4% **(6 marks)**.

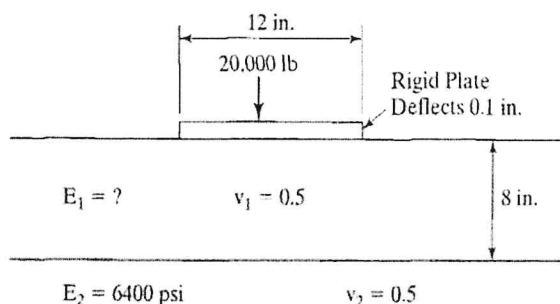
(c) Mention any three types of joints found in concrete pavements stating their function. **(3 marks)**

SECTION II – ANSWER ANY TWO QUESTIONS 40 MARKS

4. (a) Differentiate the load carrying mechanism of flexible and rigid pavements. Use appropriate sketches if need be **(8 marks)**

- (b) There are three main factors that affect the stability of road pavements. Describe them **(8 marks)**
- (c) What are the main functions of a drainage system in pavement design. **(4 marks)**
5. (a) A pavement should be designed to meet a certain minimum number of requirements. State three and explain them briefly. **(6marks)**
- (b) (a)The soil sample from a proposed road site gave the following data
 Soil passing sieve no. 200 = 60%
 Liquid limit = 45%
 Plasticity index = 20%
 The estimated volume comprising buses and trucks is 400 per day which will be using the road when it is commissioned. Determine the pavement thickness using the group index design method. **(10 Marks)**
- (c) State and briefly explain any four factors considered in the AASTHO design guide **(4 marks)**

6. (a) A total load of 20,000 lb (89 kN) is applied on the surface of a two-layer system through a rigid plate 12 in. (305 mm) in diameter, as shown below. Layer 1 has a thickness of 8 in. (203mm) and layer 2 has an elastic modulus of 6400 psi (44 .2 MPa). Both layers are incompressible with a Poisson ratio of 0.5. If the deflection of the plate is 0.1 in. (2 .54mm), determine the elastic modulus of layer 1 **(6 marks)**



- (b) Layered theory approach to analysis of flexible pavements is the approach widely used. Describe the main working principle of this approach. **(6 marks)**
- (c) In the design of flexible pavements what are the main design objectives. Mention and briefly describe any four **(8 marks)**

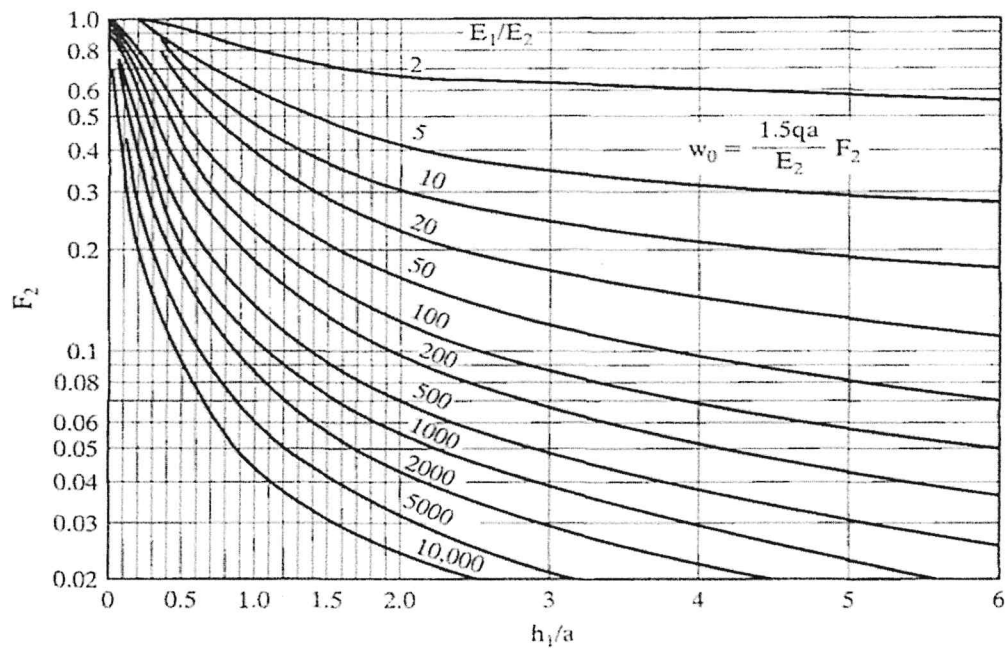


Figure 1: Burmister chart

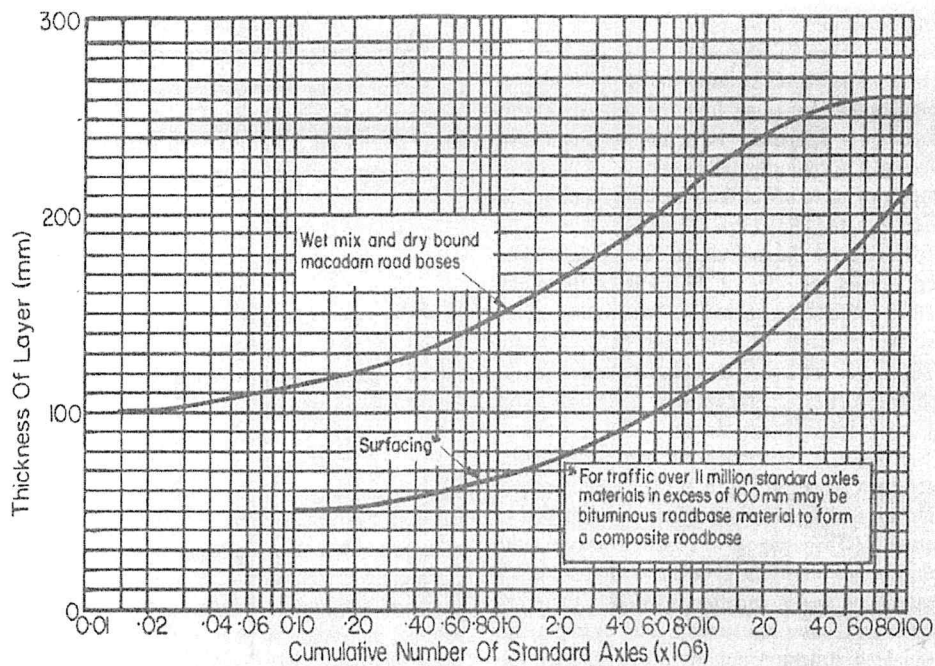


Fig. 6.29 Design chart for surfacing and base thickness for wet-mix and dry-bound macadam bases (RN 29). [Source: reference (8)]

Figure 2: RN 29 Design chart 1

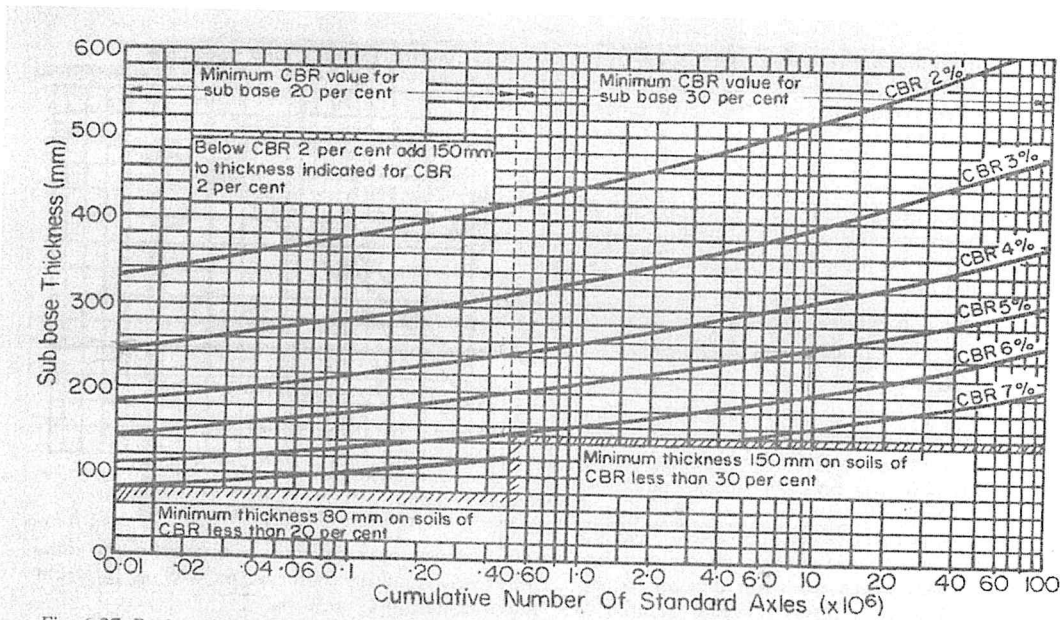


Fig. 6.27 Design chart for sub-base thickness (RN 29).
[Source: reference (8)]

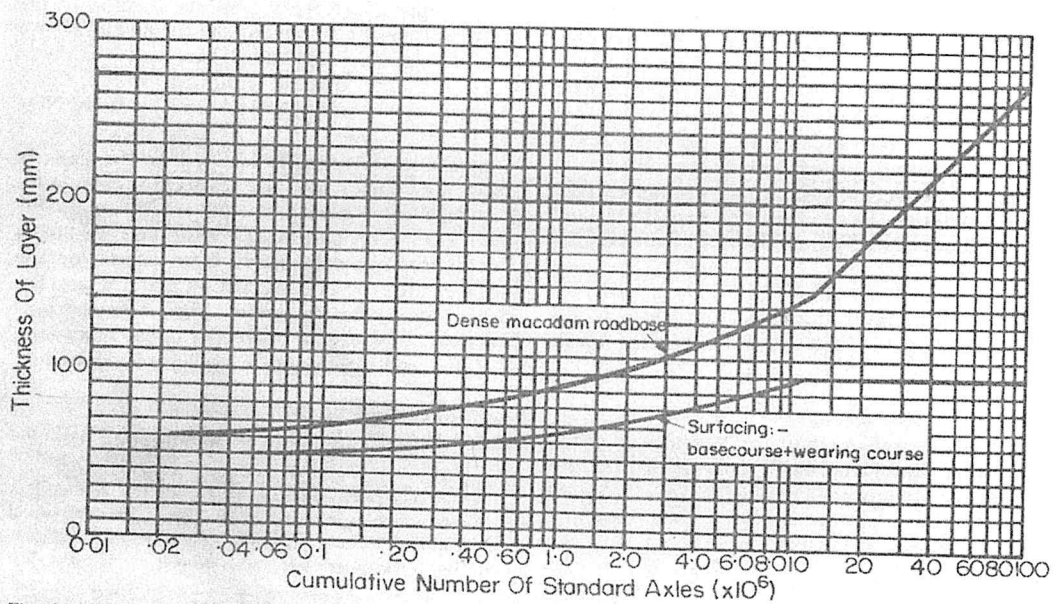


Fig. 6.28 Design chart for surfacing and base thickness for dense macadam bases (RN 29).
[Source: reference (8)]

Figure 3: RN 29 Design chart 2

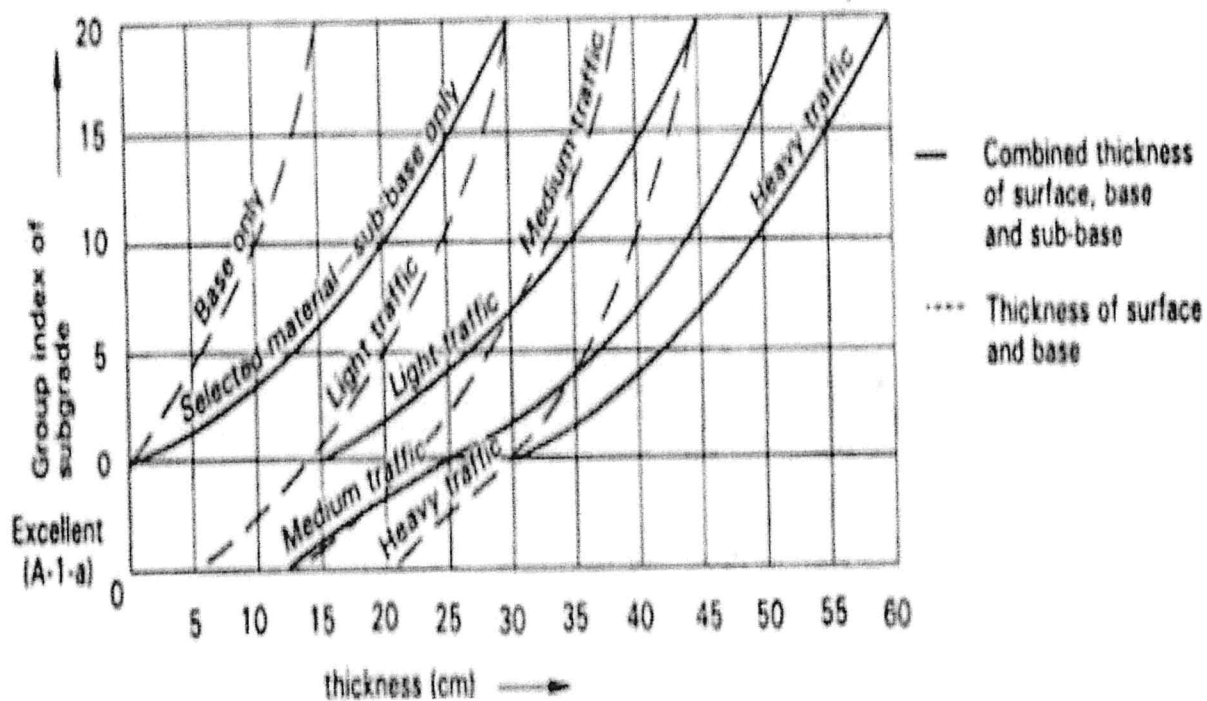


Figure 4: GI chart