

Name: _____ Index No. _____

2307/306

CIVIL ENGINEERING CONSTRUCTION
AND DRAWING

Oct./ Nov. 2014

Time: 3 hours

Candidate's Signature: _____

Date: _____



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN CIVIL ENGINEERING

CIVIL ENGINEERING CONSTRUCTION AND DRAWING

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.

Sign and write the date of the examination in the spaces provided above.

You should have the following for this examination:

Drawing instruments;

Drawing paper size A2.

This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.

Answer **FIVE** questions choosing **FOUR** questions from section **A** and **ONE** question from section **B**.

Questions in section **A** carry **15** marks each while those in section **B** carry **40** marks.

Maximum marks for each part of a question are as shown.

Candidates should answer the questions in English.

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A		15	
		15	
		15	
		15	
B		40	
TOTAL SCORE		100	

This paper consists of 16 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: CIVIL ENGINEERING CONSTRUCTION

Answer any FOUR questions from this section.

1. (a) State **three** methods that can be used to avoid excessive differential settlement of a foundation. (3 marks)
- (b) Using a sketch explain the following methods of ground water control:
 - (i) well point method of dewatering;
 - (ii) pumping from sump. (10 marks)
- (c) State **two** precautions to be considered before any form of underpinning work commences. (2 marks)
2. (a) Using sketches, explain the following modes of failure of retaining walls:
 - (i) overturning;
 - (ii) bearing on the ground. (6 marks)
- (b) (i) List **three** factors affecting the design of caisson. (1½ marks)
- (ii) With the aid of a sketch, describe the sand island method of sinking caissons. (5 marks)
- (c) State **five** uses of cofferdams. (2½ marks)
3. (a) Design a flexible road pavement as per road note 29, given the following data.

DATA:
 Design life is 25 years
 Initial daily number of commercial vehicle, in each direction is 75
 Subgrade conditions is sandy clay
 Liquid limit is 80%
 Plastic limit is 60%
 Water table is approximately 1 m below formation level

NB: Use the charts provided on pages 6, 7 and 8. (9 marks)
- (b) (i) State **five** functional requirements of a bridge. (2½ marks)
- (ii) With the aid of a sketch, describe the construction of a flush causeway. (3½ marks)

4. (a) (i) State **three** factors that determine the selection of the type of a dam. (3 marks)
- (ii) Sketch and label the following types of a spillway:
- (I) ogee;
- (II) syphon spillway. (4 marks)
- (b) Describe each of the following in geometric design of railways:
- (i) ruling gradient;
- (ii) momentum gradient. (5 marks)
- (c) State **three** purposes of ventilation in tunnels. (3 marks)
5. (a) (i) Define the following terms as applied to sewage and sewerage treatment:
- (I) biochemical oxygen demand (BOO);
- (II) incineration.
- (ii) State **three** purposes of chlorination to sewage and its affluents. (6 marks)
- (b) (i) State **three** factors which influence the choice of sewage treatment method. (3 marks)
- (ii) List **two** types of oxidation ponds. (2 marks)
- (c) Explain the following process of waste treatment:
- (i) anaerobic process;
- (ii) facultative process. (4 marks)
6. (a) Briefly explain the following operations carried out at a water treatment plant:
- (i) filtration;
- (ii) disinfection;
- (iii) sedimentation with coagulants. (6 marks)
- (b) With the aid of a labelled sketch, explain the construction of a cess pool. (6 marks)
- (c) State **three** functions of primary sedimentation tank in waste management. (3 marks)

SECTION B: CIVIL ENGINEERING DRAWING

Answer any ONE question from this section.

7. (a) To a scale of 1:25 draw a vertical cross-section of a flexible pavement given the following data.

DATA

Width of carriage way = 7400 mm
 440 mm thick sub - base of lean concrete in 100 mm compacted layers
 90 mm thick compacted dense macadam road base - cambered
 45 mm compacted bitumen macadam base course to 1:40 (slope camber)
 20 mm thick rolled asphalt wearing course to BS 594 to 1:40 camber
 concrete hunching to the kerb
 310 x 110 x 915 p.c. channel
 1700 mm wide shoulders on both sides
 75 mm compacted hardcore to the shoulders
 600 x 600 x 50 p.c.c paving slabs to the shoulders laid to 1:50 slope
 half round lean concrete to edging

Assume any other relevant information.

(25 marks)

- (b) To a scale of 1:25 draw a vertical section through a gravity retaining wall given the following data:

DATA

top width of wall - 300 mm
 height of wall above top base - 4000 mm
 width of wall at base - 1500 mm
 total length of base slab - 4000 mm
 key to the toe of base slab - 200 mm wide by 300 mm deep
 thickness of base slab - 225 mm
 height of soil above top of the slab at toe - 800 mm
 height of soil above top of the slab at the heel - 4000 mm
 toe projection from the base of wall - 1000 mm

(15 marks)

8. (a) Asymmetrical railway turn-out has deflection of 30° from the straight. The turn-out is set out of circular curves such that the radius of the curve to the centre of the inside rail of the turn-out is 6200 mm and the rail gauge is 1200 mm.

To a scale of 1:75 mm draw the turn-out showing the following details:

- (i) gauge;
- (ii) check rails of 900 mm long;
- (iii) hinges;
- (iv) frogs;
- (v) switches and their principles of operation;
- (vi) switch rails.

Assume any other relevant information.

(25 marks)

- (b) Draw to a scale 1:10 a concrete road gulley inlet using the following information:

Basic trap bottom of 1200 mm diameter

Overall depth of the gulley trap is 1750 mm

Depth of the main catch basin upto the outlet is 1200 mm

Horizontal outlet of 250 mm diameter

Wall thickness of the catch basin as 100 mm

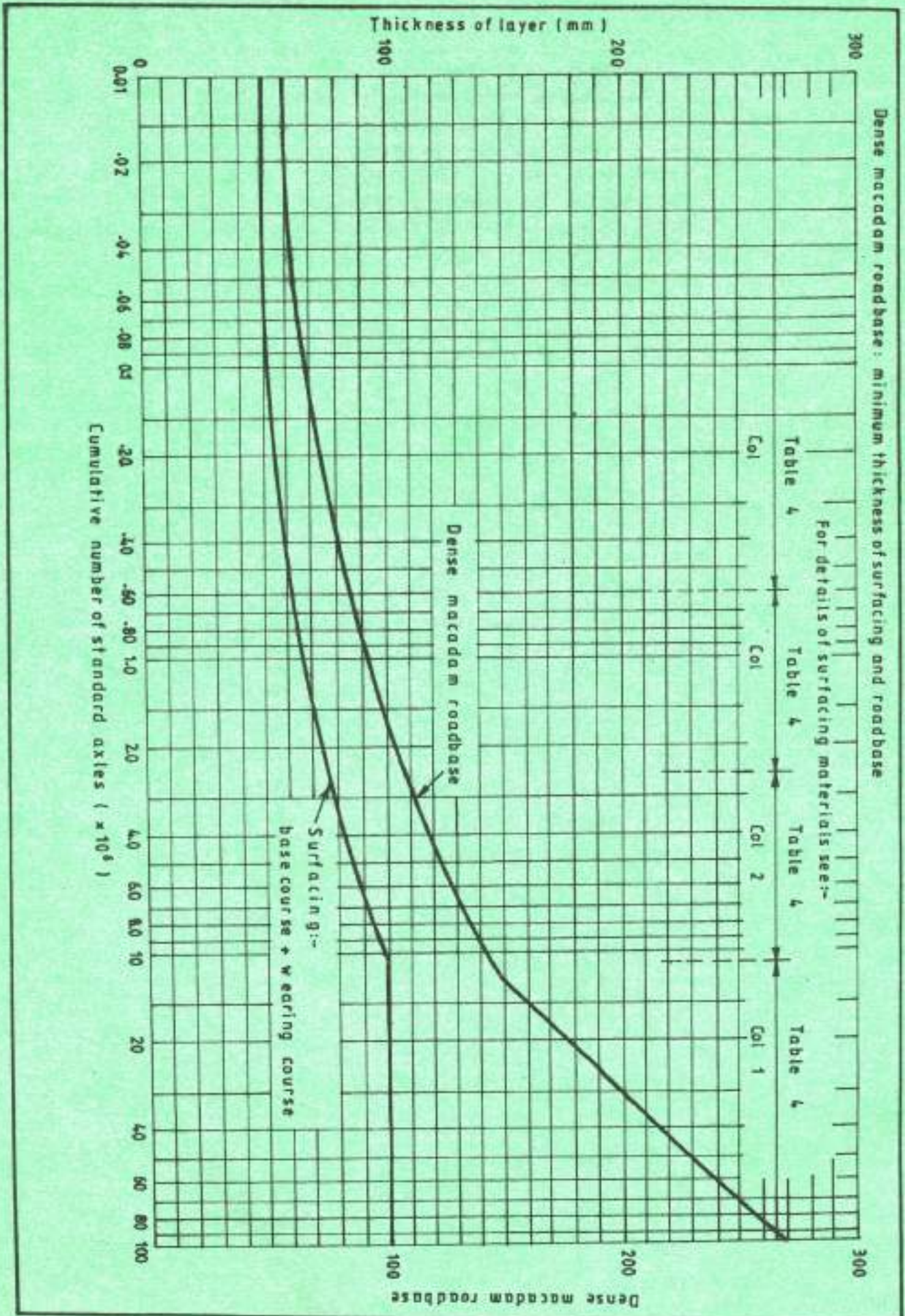
The wall on the outer slope at 1:2 (H:V)

Starting at a depth of 1450 mm from the bottom of basin to 125 mm below the grating

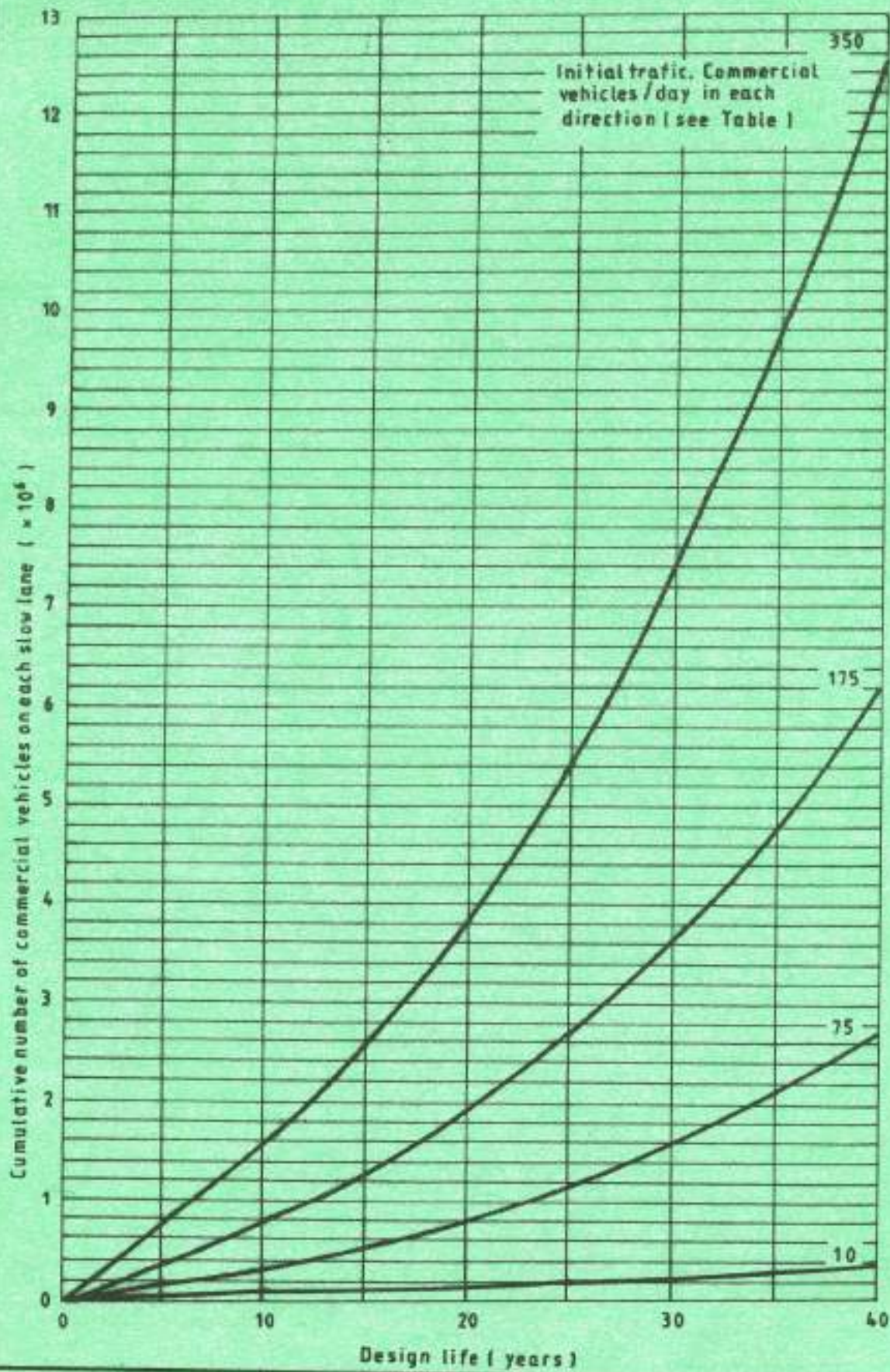
Cast iron grating is 750 x 750 mm with 50 mm thick grates and 25 mm openings

Assume any other relevant information.

(15 marks)



Roads in residential and associated developments: relation between cumulative number of commercial vehicles carried by each slow lane and design life



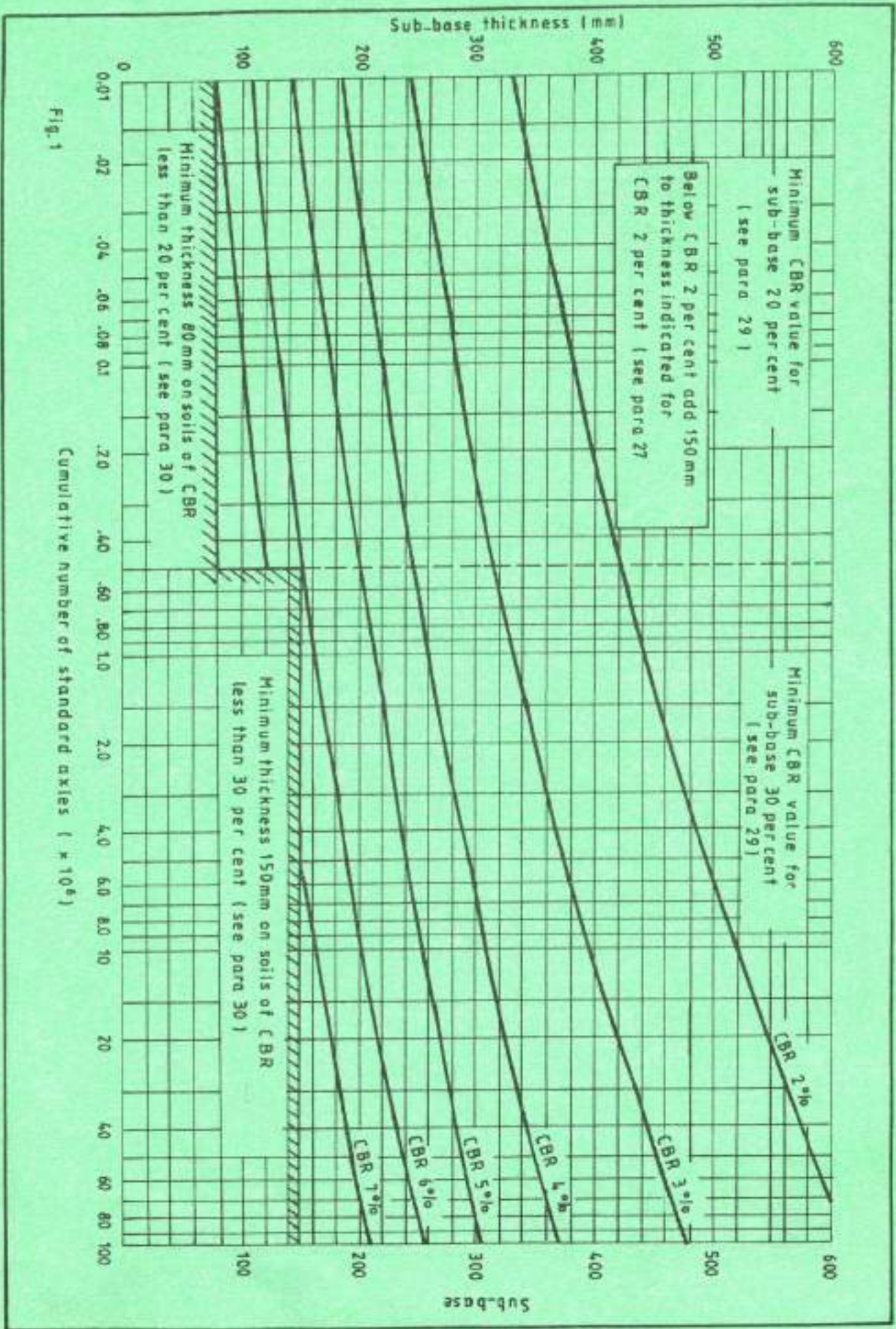


Fig. 1

Cumulative number of standard axes ($\times 10^6$)