2707/205
BUILDING CONSTRUCTION II,
CIVIL CONSTRUCTION AND
TRANSPORT ENGINEERING I
June/July 2017
Time: 3 hours

15 AUG 2017



#### THE KENYA NATIONAL EXAMINATIONS COUNCIL

## DIPLOMA IN CIVIL ENGINEERING MODULE II

BUILDING CONSTRUCTION II, CIVIL CONSTRUCTION AND TRANSPORT ENGINEERING I

3 hours

#### INSTRUCTIONS TO CANDIDATES

You should have the following for this examination: Answer booklet; Scientific calculator.

This paper consists of EIGHT questions in THREE sections; A, B and C.
Answer FIVE questions choosing TWO questions from section A, TWO questions from section B and
ONE question from section C.
All questions carry equal marks.

Maximum marks for each part of a question are indicated. Candidates should answer the questions in English.

This paper consists of 8 printed pages.

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

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#### SECTION A: BUILDING CONSTRUCTION II

Answer any TWO questions from this section.

1. Explain five requirements for the construction of upper floors. (10 marks) (a) Explain the term "centering" as used in reinforced concrete upper floors. (b) (i) (ii) Describe self-centering concrete floors. (4 marks) With aid of a sketch, describe a hollow concrete beam floor. (6 marks) (c) State six functional requirements of a roof. (6 marks) (i) Describe the following timber roof members: Appearante (1) ridge; (II) common rafter. (ii) With the aid of a sketch, describe the following types of roofs: (I) closed couple roof; (II) collar roof. (9 marks) With the aid of sketches, describe the following types of tiles: (i) standard plain tile; half round ridge tile. (5 marks) ·(ii) 3. (a) Describe a slate as a roofing material. (6 marks) Sketch each of the following timber connectors: (b) (i) toothed plate timber connector; galvanised steel gang nail connector. (4 marks) (ii) (c) State four disadvantages of flat roofs. (4 marks) - Bud warne Describe the following types of roofs: (d) protito (i) purlin roof; (ii) trussed roof construction. (6 marks) TOUSSEN MA 2707/205 June/July 2017

### SECTION B: CIVIL ENGINEERING CONSTRUCTION

Answer any TWO questions from this section.



| A.   | (a)  | <ul> <li>State five limit states which if exceeded<br/>walls.</li> </ul>              | I may result in failure of retaining                                     |
|------|------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
|      |      | (ii) With aid of a sketch, explain the failure downward acting weight and an overture | ming moment on a retaining wall.                                         |
|      |      | _ (le tro)                                                                            | d ou desposed loads (6 marks)                                            |
|      | (b)  | State four functions of foundations.                                                  | creek sinking or a winding (4 marks) reduce costs of stemed store number |
|      | (c)  | Outline five situations where pile foundations                                        | may be preferred. (5 marks)                                              |
| 0    | (d)  | State five advantages of a tunnel.                                                    | afron (Outes (5 marks)                                                   |
| \$.  | (a)  | Describe the following water front structures:                                        | t actures contar compensation                                            |
|      |      | (i) seawall;-                                                                         |                                                                          |
|      |      | (ii) breakwaters; -                                                                   | Frenor.                                                                  |
|      |      | (iii) dolphin                                                                         | To rechard (9 marks)                                                     |
|      | 75.5 |                                                                                       |                                                                          |
|      | (b)  | (i) List four functions of a railway sleeper                                          |                                                                          |
|      |      | (ii) With aid of a sketch, describe a railway                                         | chair. (7 marks)                                                         |
|      | (c)  | Use sketches to illustrate the following method                                       | is of basement construction:                                             |
|      |      | (i) retaining wall and raft;                                                          |                                                                          |
|      |      | (ii) piled basement.                                                                  | (4 marks)                                                                |
| N.6. | (a)  | Explain each of the following:                                                        |                                                                          |
|      |      | (i) objective of a well development;                                                  |                                                                          |
|      |      | (ii) the completion of a sanitary well.                                               | (6 marks)                                                                |
|      | (b)  | Outline how each of the following factors influ                                       | sences the choice of a dam type:                                         |
|      |      | (i) topography of the site;                                                           |                                                                          |
|      |      | (ii) availability of construction materials.                                          | (6 marks)                                                                |
|      | (c)  | With aid of a sketch, describe a hooded type si                                       | iphon spillway. (6 marks)                                                |
|      | (d)  | Describe a chute block as an auxillary device i                                       | in a stilling basin (2 marks)                                            |

#### SECTION C: TRANSPORT ENGINEERING I

Answer ONE question from this section.

(a) State two advantages of road transport over other transport systems.

(2 marks)

(b) Outline three sources of funding for the planning and execution of transport systems.

- Gotannest - Marks (6 marks)

(c) Differentiate between vertical alignment and horizontal alignment in road construction.

(2 marks)

(d) Explain three factors that might influence the design of a transport system,

- Avoid the space - Myre of venicles (6 marks)

- (e) Describe the following classifications of roads in Kenya:
  - (i) class A: high ways
  - (ii) class B; panged to high any
  - (iii) class C; torately one from our one one of
  - (iv) class D. gops up an orga (4 marks)
- 8. (a) Outline the design steps followed when using road note 29 Manual. (5 marks)
  - (b) Design a flexible pavement using the Kenyan design manual for the following conditions:
    - (i) Subgrade:

Alignment soil - black cotton soil for 1 m depth overlaying decomposed phenolite.

- (ii) CBR:
  - (I) black cotton soil 2% to 5%;
  - (II) phenolite (decomposed) 10% 20%.
- (iii) Traffic:

Initial daily number of commercial vehicles and their equivalent factors:

- (I) Buses 300 equivalent factor 1;
- (II) Medium goods 280 equivalent factor 2;
- (III) Heavy goods 295 equivalent factor 10.

1 5 AUS 2017

Design period: (iv)

20 years with a constant annual growth rate of 4%.

Road Construction Materials: (v)

Field investigations and laboratory tests show that:

- there is stone suitable for asphalt concrete; dense bituminous, macadam and lean concrete is abundant; (II)
- the stone may also be used as graded crushed stone sub base. (III)

Use charts type 13, 14 and 15 attached.

(15 marks)



146 . .

## ROAD DESIGN MANUAL

PART 111 : MATERIALS AND PAVEMENT DESIGN FOR NEW ROADS

CHAPTER 9 : STANDARD PAVEMENT STRUCTURES

## STANDARD PAVEMENT STRUCTURE TYPE!

BASE | Lean concrete

Cement or lime improved material

|           | T 5 | T4           | Т3 | T2               | T 1                 |
|-----------|-----|--------------|----|------------------|---------------------|
| S1        |     |              |    | 300              | 7:1<br>20:6<br>30:6 |
| S2        |     |              |    | 50<br>200<br>250 | 7÷<br>2ng<br>2ng    |
| <b>S3</b> |     | ECONOMICALLY |    | 50<br>200<br>226 | 76<br>200<br>226    |
| \$4       |     | UN LUSTIFIFD |    | 50<br>200<br>175 | 25<br>200<br>175    |
| \$5       |     |              |    | 50<br>200<br>150 | 76<br>206           |
| S6        |     |              |    | 50 200           | 7 n                 |

|       | GRADE   | TRAFFIC |            |  |  |  |  |  |
|-------|---------|---------|------------|--|--|--|--|--|
| CLASS | 作事件 (%) | CLASS   | ESA × 10 E |  |  |  |  |  |
| 51    | 2 - 5   | T1      | 25 - 80    |  |  |  |  |  |
| 52    | 5 - 10  | T2      | 10 - 25    |  |  |  |  |  |
| 53    | 7 - 13  | 13      | 3 - 10     |  |  |  |  |  |
| SA    | 0 - 18  | TE      | 1 - 3      |  |  |  |  |  |
| 58    | 15 - 30 | 1.5     | 0-25 - 1   |  |  |  |  |  |
| 5.6   | > 30    |         |            |  |  |  |  |  |

|                   | IMPORED        | Bur | 284 | .01 | Rep | indu | and I |     | Tobi | e 9.3 | 11. |      |     |
|-------------------|----------------|-----|-----|-----|-----|------|-------|-----|------|-------|-----|------|-----|
| Ratins Sub        | grade Class    | 膿   |     |     | 1   |      |       |     | 52   |       |     | 10   |     |
| Improved Material |                | 52  | - 1 | 3   |     | 44   |       | 33  | A    | 4     | 24  | 110  | 1   |
| lishgrade         | Thickness (mm) | 400 | 354 | 423 | 275 | 326  | 451   | 189 | 281  | 358   | 349 | 15 ( | 44. |
| aw Class          | 2              | 12  | 8   | 20  | DI. | 23   | m     | 43. | m    | Ш     |     |      | E,  |

# ROAD DESIGN MANUAL PART 111 - MATERIALS AND PAVEMENT DESIGN FOR NEW ROADS

CHAPTER 9 | STANDARD PAVEMENT STRUCTURES

Parque Books

## STANDARD PAVEMENT STRUCTURE TYPE 14

BASE : Lean concrete

SUBBASE: Cement or time improved material (Base quality)

|     | T 5 | T4           | Т3 | T2                      | T1                       |
|-----|-----|--------------|----|-------------------------|--------------------------|
| S1  |     |              |    | 50<br>150<br>325        | #840 #8<br>1800<br>370   |
| \$2 |     |              |    | 50<br>150<br>150<br>225 | 75<br>150<br>225         |
| S3  |     | ECONOMICALLY |    | 50<br>150<br>200        | 72<br>194<br>204         |
| \$4 |     | UNJUSTIFIED  |    | 160                     | 76<br>160<br>275 276     |
| S 5 |     |              |    | 50<br>150<br>150        | 70<br>(50<br>(50<br>(50) |
| S6  |     |              |    | 311 1                   | er is                    |

| SUB   | BABE    | TH    | AFFIC      |
|-------|---------|-------|------------|
| CLASS | CBR(%)  | CLASS | ESA : 10 6 |
| 51    | 2 - 5   | 11    | 25 - 60    |
| 52    | 5 - 10  | 12    | 10 - 25    |
| 53    | 7 - 13  | 13    | 3 - 10     |
| 54    | 10 - 18 | T4    | 1 - 3      |
| 5.5   | 15 - 38 | T 5   | 0-25 - 1   |
| 5.0   | > 30    |       |            |

|                   | IMROVED           | 208   | EHA | HE. | RAP | 0.00 | red 1 | - 10 70 | 144   | 46.7 | 11  |     |       |
|-------------------|-------------------|-------|-----|-----|-----|------|-------|---------|-------|------|-----|-----|-------|
| Watter Sub        | prode Class       |       |     | - 1 | 1   |      |       |         | 41    |      |     | 11  |       |
| Improved Material |                   | 12 53 |     |     | 44  |      | 83 54 |         | 84 55 |      |     |     |       |
| Subgrede          | Thickorns<br>[mm] | 400   | 150 | 425 | 275 | 326  | 464   | 300     | 288   | 118  | 140 | ten | \$6.0 |
| New Class         |                   |       | ш   | 11  | 17  | 23   | m     | 80      | 20    | 0.9  | 44  | 2.4 | 13    |

2707/205 June/July 2017

1 5 AUG 2017

Turn over

## ROAD DESIGN MANUAL

PART 111 : MATERIALS AND PAVEMENT DESIGN FOR NEW ROADS

CHAPTER 9 : STANDARD PAVEMENT STRUCTURES

Page - T

#### STANDARD PAVEMENT STRUCTURE TYPE

SASE : Lean concrete SUBBASE: Graded crushed stone

|           | T 5 | T4            | T3 | T2                                     | T1                                            |
|-----------|-----|---------------|----|----------------------------------------|-----------------------------------------------|
| \$1       |     |               |    | 200<br>200<br>200<br>200<br>350<br>350 | 200<br>300000 and                             |
| S2        |     |               |    | 20 0<br>20 0<br>20 0<br>25 0<br>25 0   | 210                                           |
| <b>S3</b> |     | ECONOMICALLY  |    | 50<br>200<br>000<br>000<br>1<br>223    | 200<br>200<br>200<br>200<br>200<br>200<br>200 |
| \$4       |     | UN 16ST (FIED |    | 500<br>200<br>5108 176                 | 74<br>2000 200<br>5150 5 175                  |
| \$5       |     |               |    | 200<br>200<br>01.00 b. 150             | 70<br>200<br>200<br>200<br>150                |
| S6        |     |               |    | 50                                     | 7.5<br>200                                    |

|   | SUR   | GRADE   | 17    | AFFIC      |
|---|-------|---------|-------|------------|
| i | CLASS | CHR (%) | CLASS | ESA 1 10 1 |
| ۰ | \$1   | 2 - 5   | TI    | 25 - 60    |
| • | 8.2   | 5 - 10  | 12    | 10 - 25    |
| 8 | 8.3   | 1 - 11  | 13    | 3 - 10     |
| п | 54    | 10 - 18 | 74    | 1 - 3      |
| 8 | 55    | 16 - 30 | 15    | 0-25 - 1   |
| 8 | \$8   | > 10    |       |            |

|             | IMPROVED            | EHI   | ERA | DE  | ***  | em ele | 144.3 | trans | Tebb | 19.3 | OI.  |      |     |
|-------------|---------------------|-------|-----|-----|------|--------|-------|-------|------|------|------|------|-----|
| Marine Sate | grade Clean         | 4,    | -1  | - 1 |      |        |       |       | 52   |      |      | 54   |     |
| imarayed    | Material            | 12 11 |     |     | 54   |        | 53    | 24    |      | 64   | - 55 |      |     |
| Satputa     | flaightease<br>(mm) | 405   | 158 | 628 | 7715 | 325    | 40,0  | 201   | 288  | 310  | m    | 16.0 | 351 |
| Knie Cine   |                     | 52    | 173 | 11  | 11   | 8.8    | 面     | n     | 51   | 84   | 81   | 3.0  | N'a |

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