



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

TCV 4323: HIGHWAY GEOMETRIC DESIGN

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MARCH 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 (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY) 20 Marks

- a) The Kenya road design manual outlines the procedure of designing intersections.
Briefly describe the four main steps taken to carry out the design. (4 marks)
- b) A 2-lane 7.3m wide single carriageway road has a curve radius of 600m. The minimum sight stopping distance required is 160m. Calculate the required distance to be kept clear of obstructions in metres. (3 marks)
- c) What is an acceleration lane? Acceleration lanes are determined by two factors: mention them. (3 marks)
- d) With the aid of a sketch, describe a deceleration lane (4 marks)
- e) Sketch the layout of typical roundabout showing all the necessary design requirements. (6 Marks)



TUM is ISO 9001:2015 Certified

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 marks)

- a) List **SEVEN** points that should be considered in the general layout of a roundabout (7 marks)
- b) Explain the factors affecting highway alignment design (9 marks)
- c) Calculate the *desired* and *absolute* minimum crest curve lengths for a dual carriageway highway with a design speed of 100km/hr where the algebraic change in gradient is 7% (from +3% (uphill) to -4% (downhill)). (4 marks)

QUESTION THREE (20 Marks)

- a) Discuss briefly **THREE** methods for draining water from a highway (6 marks)
- b) Define “Design speed” and explain how its choice affects the design of the geometric design elements. (5 marks)
- c) A vertical crest curve on a single carriageway road with a design speed of 85 km/hr is to be built in order to join an ascending grade of 4% with a descending grade of 2.5%. The motorist’s eye height is assumed to be 1.05m while the object height is assumed to be 0.26m.
 - i. Calculate the minimum curve length required in order to satisfy the requirements of minimum sight stopping distance
 - ii. Recalculate the minimum curve length with the object height assumed to be zero.(9 marks)

QUESTION FOUR (20 Marks)

- a) Explain the **THREE** basic ways of resolving crossing conflict at intersections (3 marks)
- b) With the aid of a sketch of Channelization of traffic through a four-legged intersection explain the term “channelization” and state its purposes (7 marks)
- c) What is “superelevation”? (2 marks)



- d) i. What is the minimum radius of curvature allowable for a roadway with a 100 km/h design speed, assuming that the maximum allowable super elevation rate is 0.12?
- ii) What is the actual maximum super elevation rate allowable under AASHTO recommended standards for a 100 km/h design speed, if the value of μ is the maximum allowed by AASHTO for this speed? Round the answer down to the nearest whole percent. (Refer to Tables 1.2 & 1.3) (8 marks)

QUESTION FIVE (20 Marks)

A vertical crest curve on a single carriageway road with a design speed of 85 km/hr is to be built in order to join an ascending grade of 4% with a descending grade of 2.5%. The motorist's eye height is assumed to be 1.05m while the object height is assumed to be 0.26m.

- i. Calculate the minimum curve length required in order to satisfy the requirements of minimum sight stopping distance
- ii. Recalculate the minimum curve length with the object height assumed to be zero. (10 marks)

Stopping sight distances for different design speeds

Stopping sight distance (m)	Design speed (km/hr)					
	120	100	85	70	60	50
Desirable minimum	295	215	160	120	90	70
Absolute minimum	215	160	120	90	70	50

- iii. Using the same basic data as above but with the following straight line gradients:

$$p = +0.02$$

$$q = -0.02$$

Calculate the required curve length assuming a motorist's eye height of 1.05 m and an object height of 0.26m. (10 marks)

Table 1.2:



Values of side friction recommended by AASHTO

Design speed, km/h	Maximum side friction factor
30	0.17
40	0.17
50	0.16
60	0.15
70	0.14
80	0.14
90	0.13
100	0.12
110	0.11
120	0.09

Source: From *A Policy on Geometric Design of Highways and Streets*.
Copyright 1994 by the American Association of State Highway and
Transportation Officials, Washington, DC. Used by permission.

Table 1.3:
Recommended minimum radius of curvature

Design speed, km/h	Manimum curve raidus, m
30	35
40	60
50	100
60	150
70	215
80	280
90	375
100	490
110	635
120	870

Source: From *A Policy on Geometric Design of Highways and Streets*.
Copyright 1994 by the American Association of State Highway and
Transportation Officials, Washington, DC. Used by permission.

