



University Of Technology
Building and Construction Eng. Dept.
Final Exam – First Attempt – 2010/2011



Branch : Highways & Bridges Eng.
Subject : Principles of Highways & Bridges
Eng.

Class: 1st
Time : 3 Hours

Examiner : Dr. Karim Al-Helo
& Asst. Lect. Mundher Ali

Date : 18 / 6 / 2011

Note: Attempt Four of the following questions

Q1:

- a) Define the following terms: (10 marks)
(Collector Roads, Rural Areas, Volume of traffic, Capacity, Right-of-way)
- b) Draw the section of flexible pavement showing all the layers. (5 marks)
- c) Calculate the maximum safe speed on the minor road (SB) so that the distance x & y can be taken 8^m & 14^m , when the design speed on the major road (SA) is (50 km/hr).
Assume the level road $g = 0$, $a = 2.1 \text{ m/sec}^2$, $t = 2.2 \text{ sec}$. (10 marks)

Q2:

- a) There are seven types of loads affecting on bridges, state these types of loads and explain one of them. (9 marks)
- b) Draw the following interchanges:
(Trumpet, Diamond and Full-Cloverleaf). (6 marks)
- c) A drivers traveling at an average speed (60 km/hr.) when he saw an object. Assuming that the perception time is (2 sec.) and the acceleration rate is (6 m/sec^2), calculate:
1- The S.S.D on a level road ($g = 0\%$)
2- The S.S.D on a level road (4%) uphill road. (10 marks)

Q3:

- a) State bridges components. (6 marks)
- b) State the basic principles for selection of highway elements. (6 marks)
- c) A (+4%) grade intersection with a (-3%) grade on a rural highway. The design speed is (70 km/hr.) and perception reaction time (2.5 sec). The acceleration rate is (2 m/sec^2). (13 marks)
Determine the minimum length of the vertical curve required to join these two grades, and then find the passing sight distance on the curve.

Q4:

- a) Draw 4-legs intersection showing clearly the location and number of crossing, diverge and merge points. (6 marks)
- b) State the factors affecting on geometric design of highways. (9 marks)
- c) Two tangent of a rural highway have be connected with a simple circular curve of (R=180m), if the minimum superelevation allowed is (0.1).
What will be the maximum driving speed on the curve and what will be the minimum safe stopping distance? (10 marks)
Assume $f = 0.12$, $a = 3 \text{ m/sec}^2$, $g = 0$ and perception reaction time 2.5sec

Q5:

- a) The relationship between volume (Q) and density (D) on a given highway was found to be: $Q = 75.6 D - 0.87 D^2$ (1)
While the relationship between volume (Q) and speed (V) on the same highway was found to be: $Q = 43.1 V - 0.68 V^2$ (2)
What is the expected relationship between speed (V) and density (D) on this highway? (Assume linear relationship) (8 marks)
- b) Calculate the total width of the pavement on horizontal curve, given the following information:
Design speed = 80 km/hr pavement width = 6.6 m
Long wheel base = 6.4 m Superelevation = 8 %
Friction factor = 0.12 (7 marks)
- c) Draw at reasonable scale a typical cross-section of two lanes - two direction road constructed by cut at one side and fill at other side, showing all elements for this type of roads. (10 marks)

GOOD LUCK