

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

Course Title: **Transportation Engineering –II: Highway Design & Railways**

Course Code: CE 451

Time: 3 Hours

Full Marks: 150

There are two sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

There are FOUR questions. Answer any THREE

1. (a) Elaborately explain different type of distresses in rigid and flexible pavement. Also discuss the causes of these distresses and relevant remedial measures. (20)
 (c) Explain "Pavement Serviceability Concept". (5)

2. (a) Establish a relationship between degree of curvature and versine of a curve. (7)
 (b) Write a short note on ballast cushion. (10)
 (c) Why generally the followings are favored (8)
 i) Broken Stone ii) Geo-textile.

3. (a) Discuss the classification of fixed signals. (15)
 (b) Write a short note on Marshalling yard. (5)
 (c) Briefly differentiate cant-deficiency and cant excess. (5)

4. (a) Draw a typical doweled expansion joint. (5)
 (b) Design a minimum thickness of flexible pavement (i.e. thickness of different layers) for the following traffic condition: (20)

Daily Count	Axle load(kips)
3000 (Single Axle)	8
1000 (Single Axle)	15
150(Single Axle)	32
100 (Tandem Axle)	48

Given:

Sub grade soil CBR value is 5

Design life is 12 years

Traffic growth rate is 5% per annum

Reliability is 90%

Overall standard deviation is 0.45

Design serviceability loss is 2.0

Available material:

- Hot mix asphalt surface concrete ($a_1=0.44$)
- Crushed stone base course ($a_2=0.14$, $m_2=0.4$ & $E_2= 30$ ksi)
- Crushed stone sub base ($a_3=0.11$, $m_3=0.9$ & $E_3= 14.5$ ksi)

Note: Use attached Figure. 1.

SECTION B

There are FOUR questions. Answer any THREE

5. (a) Describe different stress inducing factors of rigid pavement. Also explain the problems arise from these factors and suggest how these problems can be handle. (10)
 (b) Show the classification of different types of asphalt. Write a short note on "Cutback asphalt". (6+3)
 (c) What are the objectives of asphaltic concrete mix design? (6)
6. (a) Write down the functional classification of railway station. (15)
 (b) Differentiate between Station and Yard. (5)
 (c) Briefly list the important requirements of ballast. (5)
7. (a) Compare the rigid and flexible pavement systems from various criteria. (8)
 (b) Discuss the outcomes of AASHO road test. (7)
 (c) For the following data, design and draw the distributed reinforcement and tie bars for a rigid pavement: (10)

Thickness of the rigid pavement= 9 inch
 Lane width= 11 ft, two lane
 Spacing of the transverse joint=42 ft
 Allowable stress of steel =20000 psi
 Compressive strength of concrete= 3650 psi, $f = 1.5$

8. (a) Show a simplified flow chart of the recovery and refining of petroleum asphalts. What are the laboratory tests of bituminous materials, used in road construction? (5+3)
 (b) An asphalt concrete surface course mixture is being designed by Marshall Method for heavy traffic. Test results for different asphalt contents are given in the following table: (17)

Asphalt content (%)	Unit wt. of specimens, (pcf)	Marshall stability (lbs)	Marshall flow value	V _a (%)	VMA (%)
4.5	150.32	1732	9.0	4.40	15.30
5.0	151.63	1785	10.0	3.10	14.90
5.5	152.88	1808	12.0	1.45	14.45
6.0	152.56	1652	15.0	0.90	15.19
6.5	151.63	1426	19.0	0.82	16.30

The maximum size of the aggregate is 1.0 inch for which the minimum VMA% should be 12% as per Marshall design criteria. Compaction, no. of blows in each end of specimen is 50. Determine the optimum asphalt content. Is the mix satisfactory? Check from the design criteria table. If not, what adjustments may be suggested? To plot data use graph paper.

Note: Use attached Table.