

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:3154008****Date:20-12-2023****Subject Name: Highway and Traffic Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1**
- (a) Define: NH, Expressway, Arterial **03**
- (b) Draw a typical sketch of C/S of NH two-lane highway with flexible pavement in embankment. Show all the components. **04**
- (c) Determine OSD on 2 lane one-way and 2 lane two-way highway for the design speed of 80 kmph. Take acceleration of overtaking vehicle = 1.6 kmph/sec. **07**

- Q.2**
- (a) Define: Camber, Super elevation, OSD. **03**
- (b) Derive the expression to determine the super elevation of pavement on horizontal curve. **04**
- (c) Determine the maximum allowable speed on horizontal curve of 240 m radius of 2 lane highway. What would be Total widening on curve, and set back distance for the calculated maximum allowable speed on the same curve? Take wheelbase = 6 m, $f = 0.36$. **07**

OR

- (c) What would be SSD on a single lane two-way road for 100 kmph speed, for (i) up and (ii) down gradient, of 1 in 25. Take $f=0.35$. **07**

- Q.3**
- (a) Define: Flakiness Index, CBR, Flash point of bitumen. **03**
- (b) Explain with sketch “Impact Test” for the aggregates. **04**
- (c) An ascending gradient of 1 in 20 meets a descending gradient of 1 in 30. Determine the length of summit curve to provide ISD for a design speed of 70 kmph. Assume $f = 0.36$. **07**

OR

- Q.3**
- (a) Compare bitumen with tar. **03**
- (b) Briefly discuss with sketch “Softening Point test” of bitumen. **04**
- (c) A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate. **07**

Mean Settlement values (mm)	0	0.25	0.5	0.75	1.05	1.2	1.5	1.7
Load Values (kg)	0	430	840	1150	1400	1580	1660	1720

- Q.4** (a) Briefly describe: ESWL, EWLF, Rutting. **03**

- (b) Describe with sketches step wise procedure of preparing Bituminous Concrete mix in a hot-mix plant. **04**
- (c) Design a suitable bituminous pavement section for a four-lane divided carriageway. The traffic in the year of completion of construction is 3800 commercial vehicles per day in both directions with average vehicle damage factor of 5.2. Assume growth factor 6% per annum, design life 20 years. CBR of soil below 500 mm of subgrade is 3% and CBR of 500 mm of the subgrade from borrow pit is 18%. Use given graph and plate of IRC 37-2012. Also, determine resilient modulus of (i) compacted subgrade, and (ii) granular layer. **07**

OR

- Q.4 (a)** Draw a detailed sketch showing all layers and joints of Cement Concrete Pavement. **03**
- (b) Discuss with sketches any two types of failures in rigid pavements. Suggest remedial measures for them. **04**
- (c) Calculate the (i) edge load stresses using modified equation of Teller and Sutherland, (ii) corner load stress using modified equation of Kelley, using following data for the CC pavement. **07**
 Take wheel load = 5100 kg, $E_c = 3 \times 10^5 \text{ kg/cm}^2$, Pavement thickness = 18 cm, $\mu = 0.15$, Modulus of subgrade reaction $k = 6 \text{ kg/cm}^3$, Radius of contact area = 15 cm.

- Q.5 (a)** Define: ADT, PCU, Time headway. **03**
- (b) Describe with sketch any one method of measuring TMS on mid-block section of highway. **04**
- (c) From the following data of spot-speed study, draw graphs for frequency (%) –vs- Speed range and Cumulative frequency (%) - vs-Speed. Determine TMS, SMS, Speed for traffic regulation. **07**

Speed range (kmph)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
No. of vehicles	7	15	26	32	39	29	21	12	4

OR

- Q.5 (a)** What are the applications of “ITS” in road transportation? **03**
- (b) Describe with sketch “Collision Diagram” in road accidents. **04**
- (c) Explain “Speed-flow-density” relationship with ideal graphs. Derive the Greenshield’s model to find the maximum flow on a road section. **07**

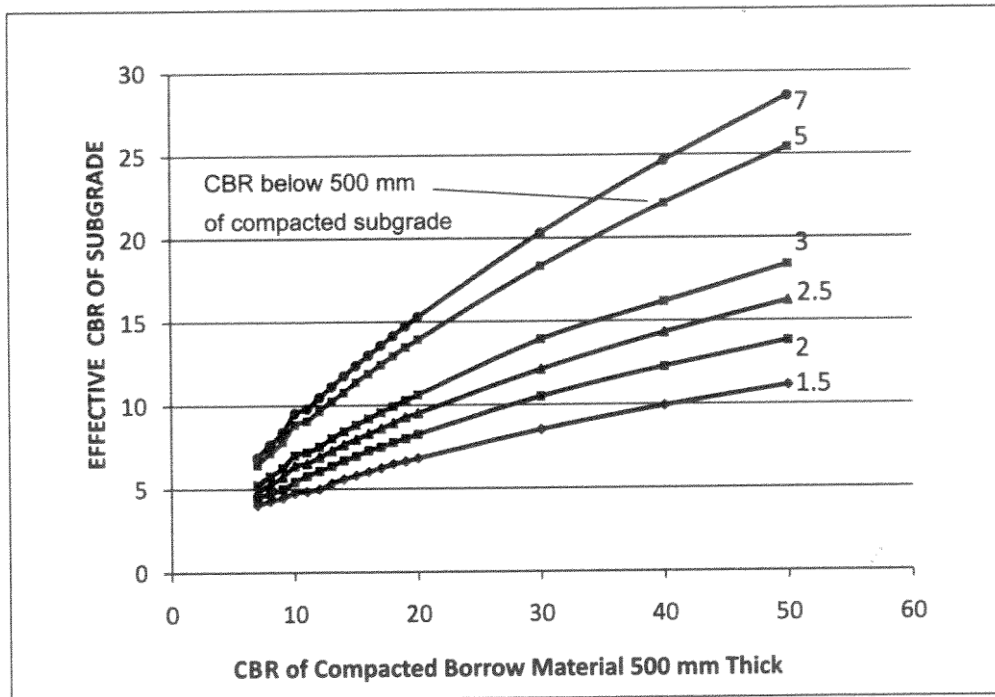


Fig. 5.1 Effective CBR of Subgrade

IRC:37-2012

