

DARBHANGA COLLEGE OF ENGINEERING, DARBHANGA

Mabbi, P.O.- Lal Sahpur

Bihar-846005



COURSE FILE

OF

TRANSPORTATION ENGINEERING-I

(PCC-CE307)

Faculty Name:

MR. ADITYA KUMAR

ASSISTANT PROFESSOR

DEPARTMENT OF CIVIL ENGINEERING

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Vision of the Department

To produce quality civil engineers to pursue higher studies in core areas of civil engineering who are also competent to serve the national and multi-national industries and our society at large.

Mission of the Department

1. To produce competent and technologically capable professionals through good teaching-learning ambience as well as by collaborating with relevant industries.
2. To motivate graduates towards innovation and research in the field of civil engineering.
3. To provide quality education in undergraduate levels with strong emphasis professional's ethics and social commitment.

Civil Engineering Program Educational Objectives

After 4 to 5 years of graduation a B.Tech(CE) graduate would be able to

- Plan, design, construct, maintain, analyze, advance, and manage civil engineering projects of moderate complexity
- Pursue professional licensure and certifications
- Engage in life-long learning and pursue advanced level studies
- Demonstrate leadership skills through career advancement and active participation in the civil engineering profession and in the community

Civil Engineering Programme Outcomes

Students who complete the B.Tech degree in CE will be able to:

1. **Engineering Knowledge:** Apply to knowledge of Mathematics, Science and Engineering in five broad areas of Civil engineering namely Structures, Water resources, Geotechnical, Transportation and Environmental Engineering for solution of complex problems in the Civil Engineering.
2. **Problem Analysis:** Use first principle of Mathematics and Civil Engineering concepts to design and conduct experiments as well as to analyze and interpret data to analyze the complex Civil Engineering problems.
3. **Design/Development of Solutions:** to design a system, component or process to meet desired needs with respect to societal needs of public within realistic constraints.
4. **Conduct Investigations:** Use research based knowledge and research methods to identify, formulate and solve engineering problems.
5. **Modern Tool Usage:** create, select or apply appropriate engineering techniques, skills and modern engineering tools like Software necessary for Civil Engineering practice.
6. **Society and Engineer:** to understand the role and responsibility of a professional Civil Engineering in the social, health, safety and cultural issues.
7. **Environment and Sustainability:** to understand the impact of engineering solutions in a global, economic, environmental and societal context.
8. **Ethics:** to understand the professional ethics and humanitarian ethics as pertaining to norms of Civil Engineering practice.
9. **Individual and Team Work:** to function effectively as an individual and applying the principle of “UNITY IN DIVERSITY” with a spirit of teamwork.
10. **Communication:** to communicate effectively (i.e Simple, Clear and Complete) by design and drawing including use of relevant codes, writing effective technical reports and make oral or written presentation as per the need of project.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of Civil Engineering and project management principles and apply them to manage/complete within the stipulated period and funds.
12. **Life-long Learning:** Recognition the need for and develop competencies necessary for life-long learning so as to offer enhanced knowledge and skill in globally changing and challenging project.

Course Description

Transportation Engineering -I introduces us to the role of engineers in planning, designing and managing the transportation system and infrastructure. The students shall be exposed to various aspects of the transportation system such as planning and design. These aspects represent integral components of transportation infrastructure. The importance of road design as per IRC can be better understood by the students and the factors that shall be accounted for while designing the transportation system. The course comprises both theoretical components and the application of theoretical knowledge into design practice.

Course Objectives

To provide basic knowledge in transportation so that students can understand and be able to solve transportation related problems and design for highway mode of transportation with focus on highway users' characteristics, geometric and pavement design and maintenance, traffic engineering, and transportation planning.

Course Outcomes

PCC-CE307.1 Plan highway networks.

PCC-CE307.2 Design highway geometrics.

PCC-CE307.3 Design Intersections and prepare traffic management plans.

PCC-CE307.4 Design flexible and rigid pavements.

PCC-CE307.5 Understand the principles of construction and maintenance of highways.

CO	Description (Student able to)
C01	Understand the importance & characteristics of road transport, Highway planning and development, engineering survey for highway location and its alignment.
C02	Develop understanding about to solve traffic problems such as pedestrian flow, signalized and unsignalized intersections.
C03	Understand the importance & characteristics of road transport for geometric design of various roads with proper alignment.
C04	Design of Flexible pavement and rigid pavement design by IRC and AASHTO method
C05	Recognize the knowledge of highway materials & construction with Different type of materials for highway construction, there properties, test related to find the quality of the materials

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	Engineering knowledge	Problem analysis	Design/development of solutions	Investigation	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communications	Project management and finance	Life-long learning
CO1	2	3	1				2			2		2
CO2	2	3	3	3	3	2		1		1		2
CO3	1	2	3	1		1	1					
CO4	1		3	3		2	2	2	2	2	2	1
CO5		1	2	2			2					

B. Tech. V Semester (Civil)
PCC-CE307 Transportation Engineering -I

UNIT-I

Introduction: Importance of transportation, Different modes of transportation. Characteristic of road transport, importance of roads in India, Scope of Highway Engineering, Classification of roads and road patterns, recently launched highway projects in India.

UNIT-II

Traffic Engineering: Traffic Characteristic, Traffic Operation, Elements of Design of Intersections.

UNIT-III

Highway Geometric Design: Introduction, Highway cross-section elements, sight distance, Design of Horizontal Alignment, Design of Vertical alignment, IRC Specifications.

UNIT-IV

Highway Materials: Sub-grade soil, Stone aggregate, Binding material (Bitumen emulsion tar and cut back), modification binders, use of Geo-textiles and Geo-grids, MORT specs, superpave

UNIT-V

Design of Highway Pavements: Function and desirable characteristics of pavements, pavements course, Pavements types, comparison of rigid and flexible pavement, pavement components, IRC and AASHTO methods.

UNIT-VI

Highway construction: WBM, WMM, BM, BMM, PC, AC, Mastic Asphalt , BSG, PM, Seal Coat , BSD, Prime coat, Track coat, Highway maintenance and pavement Evaluation highway drainage.

Books:

TEXT BOOK1: Highway Engineering by Khanna, S.K. and Justo, S.E.G., Nemchand Bros. ,Roorkee.

TEXT BOOK 2: Principle and design of pavements by Kadiyali, L. R., Khanna Publishers, New Delhi.

REFERENCE BOOK 1: Highway Engineering by Wright, P.H., John Wiley and sons, New York

REFERENCE BOOK 2: An Introduction to Transportation Engineering and planning by Morlok, E.R., McGraw Hill, Kagakusha international student Education.

REFERENCE BOOK 3: Introduction to Transportation Engineering by Hay. W.W., John Wiley and sons, New York.

GATE SYLLABUS

Transportation engineering -I

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

TIME TABLE

Darbhanga College of Engineering

5th Semester w.e.f:

DAY	Dept.	09:00-11:00	11:00-01:00	01:00-02:00	02:00-03:00
MONDAY	EEE	CS	PS-I	LUNCH	V. PE Lab
	CE	EE-1	MOM		V. HE LAB
	CSE	REMIDAL CLASSES	DBMS		MOOC
	ME	HT	F M/C		
TUESDAY	EEE	V. CS Lab	ADC		InterShip
	CE	H & WRE	HE		V. Geo Tech Lab
	CSE	AI	DBMS		REMIDAL CLASSES
	ME	MP	V. REMIDAL LAB		
WEDNESDAY	EEE	PE	CS		V. PS-I Lab
	CE	ADCS	MOM		V. TRE LAB
	CSE	SWE	AI		V. DBMS Lab
	ME	HT	EIKT		
THURSDAY	CE	REMIDAL CLASSES	PS-I		V. CS Lab
	CSE	GEO TECH-1	TRE		V. EE-1 LAB
	CSE	V. DBMS Lab	SWE		Seminar
	ME	KOM	V. REMIDAL LAB		
FRIDAY	EEE	V. PE Lab	PE	V. ADC Lab	
	CE	COI	ADCS	GEO TECH-I	
	CSE	PS	FLAT	InterShip	
	ME	MP	F M/C		
SATURDAY	EEE	InterShip	ADC	REMIDAL CLASSES	
	CE	EE-1	TRE	V. H & WRE LAB	
	CSE	PS	FLAT	MC 501	
	ME	KOM	V. REMIDAL LAB		

EEE (5th Sem)			ME (5th Sem)		
SN	Subject	Faculty	SN	Subject	Faculty
1	PS-I	Mr. Tabish Shama	1	HT	Mr. Madhav Ram
2	CS	Mr. Sanjay Kumar	2	F M/C	Mr. Prabhakar Kumar
3	PE	Mr. Abhishek Sharma	3	MP	Mr. Rajat Gupta
4	ADC	Dr. Ravi Ranjan	4	KOM	Mr. Prashant Kr. Singh
5	InterShip	All Faculty	5	EIKT	Mr. Prashant Kr. Singh
6	MOOC	All Faculty	6	MOOC	Mr. Vikash Kumar

CE (5th Sem)			CSE (5th Sem)		
SN	Subject	Faculty	SN	Subject	Faculty
1	MOM	Mr. Ravi Ranjan Kumar	1	DBMS	Mr. Adhish Kumar
2	HE	Mr. Loknath Kumar	2	SWE	Mr. Sunil Kumar Sahu
3	ADCS	Mr. S. S. Choudhary	3	AI	Mr. Dhirendra Kumar
4	Geo Tech-I	Mr. Ahsan Rabbani	4	FLAT	Mr. Ajit Kumar Gupta
5	H & WRE	Mr. Prashant Kumar	5	PS	Anand Kamal
6	EE-1	Mr. Jitendra Kumar	6	MOOC	Mr. Sunil Kumar Sahu
7	TE	Mr. Aditya Kumar	7	InterShip	Mr. Anand Kamal
8	COI	Mr. Loknath Kumar	8	MOOC	Mr. Anand Kamal
9	InterShip	All Faculty			

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HOD (EEE)

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HOD (ME)

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HOD (CE)

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HOD (CSE)

15/07/2020 15/07/2020 15/07/2020

HOD (EEE) HOD (ME) HOD (CE)

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Routine Incharge Routine Incharge Routine Incharge

LIST OF THE STUDENT

S.No.	Name of Student	Roll No.
1	Saurav Kumar Suman	18-C-59
2	Raju Kumar Mishra	18-C-74
3	Aryan Kumar	18-C-02
4	Md. Istaba	18-C-04
5	Kumar Shubhendu Shubham	18-C-13
6	Kanhaiya Kumar	18-C-20
7	Satish Kumar	18-C-15
8	Sagar Kumar	18-C-12
9	Pradeep Kumar	18-C-08
10	Nivedita Kumari	18-C-09
11	Suraj Kumar	18-C-26
12	Kunal Kumar	18-C-05
13	Ankit Chandra	18-C-23
14	Ashutosh Anand	18-C-39
15	Rahul Kumar	18-C-40
16	Kaushal Kumar	18-C-37
17	Md Naimuddin	18-C-27
18	Kartik Kumar	18-C-36
19	Nikita Raj	18-C-43
20	Bandana Kumari	18-C-34
21	Ganesh Kr. Sah	18-C-41
22	Robins Kumar	18-C-46
23	Rahul Dutta	18-C-51
24	Manish Kumar	18-C-47
25	Raja Kumar	18-C-50
26	Bipin Kumar	18-C-44
27	Mohit Kumar	18-C-52
28	Md. Shahadat	18-C-56
29	Bharat Pandit	18-C-55
30	Kumar Purendra Shekhar	18-C-53
31	Rahul Kumar Das	18-C-57
32	Shubham Kumar	18-C-58
33	Karanjeet Kumar	18-C-75
34	Anand Kumar	18-C-62

35	Kamaljee Mandal	18-C-68
36	Rishav Kumar	18-C-67
37	Rajiv Ranjan	18-C-63
38	Md. Abdul Kalam	18-C-70
39	Siddharth Raj	18-C-79
40	Gajendra Kr. Sharma	18-C-60
41	Sahil Raj	18-C-61
42	Ram Kumar Suman	18-C-65
43	Prahlad Kumar	18-C-69
44	Rishav Krishna	18-C-72
45	Mayank Vishwabandhu	18-C-81
46	Prince Kumar	18-C-71
47	Dhirendra Kumar Verma	18-C-73
48	Ankit Kumar	18-C-66
49	Aashish Kr. Choudhary	18-C-80
50	Satya Prakash	19LEC
51	Anjali Sahani	19LEC08
52	Manoj Kumar	19LEC02
53	Rima Kumari	19LEC01
54	Sanyukta Kumari	19LEC
55	Om Prakash Singh	19LEC06
56	Himanshu Ranjan	19LEC03.
57	Avinash Kumar	19LEC04
58	Prince Raj	19LEC05
59	Anshu	19LEC10
60	Manzar Imam	19LEC11

Institute/College Name:	Darbhanga College of Engineering.
Program Name:	B.Tech (CE, 5 th semester).
Course Code:	PCC-CE307
Course Name:	Transportation Engineering.
Lecture/Tutorial(per week):	4/0
Course Credits:	04
Course Co-coordinator Name:	Mr. Aditya Kumar

1. Scope ,Objective and Outcomes of Course

Scope:

Transportation Engineering -I introduces us to the role of engineers in planning, designing and managing the transportation system and infrastructure. The students shall be exposed to various aspects of the transportation system such as planning and design. These aspects represent integral components of transportation infrastructure. The importance of road design as per IRC can be better understood by the students and the factors that shall be accounted for while designing the transportation system. The course comprises both theoretical components and the application of theoretical knowledge into design practice.

Course objective:

To provide basic knowledge in transportation so that students can understand and be able to solve transportation related problems and design for highway mode of transportation with focus on highway users' characteristics, geometric and pavement design and maintenance, traffic engineering, and transportation planning.

Course Outcomes:

On successful completion of the course a student can be able to very well appreciate:

1. The need and importance of transportation with respect to Indian context.
2. The highway development and its planning.
3. The various geometric design aspects.
4. The various traffic operations, elements of traffic design and its design.
5. The highway materials used in pavement construction as per IRC standards.
6. The design of highway pavements, construction and maintenance.

2. Textbooks

TB1: Highway Engineering by Khanna, S.K. and Justo, S.E.G.,
Nemchand Bros.,Roorkee.

TB2:Principle and design of pavements by Kadiyali, L. R., Khanna Publishers, New Delhi.

3. Reference Books

1. Highway Engineering by Wright, P.H., John Wiley and sons, New York
2. An Introduction to Transportation Engineering and planning by Morlok, E.R., McGraw Hill, Katakusha international student Education.
3. Introduction to Transportation Engineering by Hay. W.W., John Wiley and sons, New York.
4. Fundamental of Transportation Engineering by Papacostas, C. S., Prentice hall of India, New Delhi.
5. Pavement analysis and Design by Huang, Y. H., Prentice Hall, Englewood Cliffs, New Jersey.

Other readings and relevant websites

S. No.	Link of journals, Magazines, websites and Research papers
1.	www.youtube.com/playlist?list=PL911998B0A90DFC88
2.	nptel.ac.in/downloads/105101087/
3.	www.courses.com/civil-engineering/2
4.	IRC 086: Geometric Design Standards for Urban Roads in Plains.
5.	<u>IRC 073: Geometric Design Standards for Rural (Non-Urban) Highways</u>
6.	<u>IRC065: Recommended practice for traffic rotaries.</u>
7.	<u>IRC SP 062: Guidelines for the Design and Construction of Cement Concrete Pavement for Low Volume Roads</u>

Course plans

<u>Lecture No.</u>	<u>Topics</u>	<u>Web Links for Videos Lecture</u>	<u>Text Books/Reference books/Reading Materials</u>	<u>Page No. of Text Books</u>
1-3	Introduction	www.youtube.com/watch?v=5zKC_aq4ypM&list=PL911998B0A90DFC88	(TB1) Introduction. Highway development and Planning.	01-07. 09-50.
	Importance of transportation, Different modes of transportation. Characteristic of road transport, importance of roads in India, Scope of Highway Engineering, Classification of roads and road patterns, recently launched highway projects in India.			
4-9	Traffic Engineering	www.youtube.com/watch?v=uCPlvu-bzDw&index=7&list=PL911998B0A90DFC88	(TB1) Traffic Engineering.	159-265.
	Traffic Characteristic, Traffic Operation, Elements of Design of Intersections.			
10-21	Highway Geometric Design	www.youtube.com/watch?v=936Rv57vzQ8&list=PL911998B0A90DFC88&index=9	(TB1) Highway Geometric Design	72-157.
	Introduction, Highway cross-section elements, sight distance, Design of Horizontal Alignment, Design of Vertical alignment, IRC Specifications.			
22-27	Highway Materials	www.youtube.com/watch?v=3oNa9Z94Hiw&index=27&list=PL911998B0A90DFC88	(TB1) Highway materials	268-328.
	Sub-grade soil, Stone aggregate, Binding material (Bitumen emulsion tar and cut back), modification binders, use of Geo-textiles and Geo-grids, MORT specs, superpave			
	Assignment-1			
27-35	Design of Highway Pavements	www.youtube.com/watch?v=uJ	(TB1) Design of	330-

		Function and desirable characteristics of pavements, pavements course, Pavements types, comparison of rigid and flexible pavement, pavement components, IRC and AASHTO methods.	ntLOgEHD4&index=36&list=PL911998B0A90DFC88	Highway Pavements.	407.
		Assignment-2			
	36-45	Highway construction	www.youtube.com/watch?v=25HZmhhO_FQ&index=41&list=PL911998B0A90DFC88	(TB1) Highway Construction.	409-460. 488-517.
		WBM, WMM, BM, BMM, PC, AC, Mastic Asphalt , BSG, PM, Seal Coat , BSD, Prime coat, Track coat, Highway maintenance and pavement Evaluation highway drainage.			

Syllabus

<u>Topics</u>	<u>No. of Lectures</u>	<u>Weightages</u>
Introduction: Importance of transportation, Different modes of transportation. Characteristic of road transport, importance of roads in India, Scope of Highway Engineering, Classification of roads and road patterns, recently launched highway projects in India.	3	6.7
Traffic Engineering : Traffic Characteristic, Traffic Operation, Elements of Design of Intersections.	6	13.3
Highway Geometric Design : Introduction, Highway cross-section elements, sight distance, Design of Horizontal Alignment, Design of Vertical alignment, IRC Specifications.	12	26.7
Highway Materials : Sub-grade soil, Stone aggregate, Binding material (Bitumen emulsion tar and cut back), modification binders, use of Geo-textiles and Geo-grids, MORT specs, superpave	6	13.3
Design of highway Pavements: Function and desirable characteristics of pavements, pavements course, Pavements types, comparison of rigid and flexible pavement, pavement components, IRC and AASHTO methods.	8	17.7

Highway construction : WBM, WMM, BM, BMM, PC, AC, Mastic Asphalt , BSG, PM, Seal Coat , BSD, Prime coat, Track coat, Highway maintenance and pavement Evaluation highway drainage.	10	22.3
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Evaluation and Examination Blue Prints:

Internal assessment is done through quiz tests, Sessional tests, assignments. Whereas, the external examination is done by the university.

The components of evaluation along with their weightage followed by the university is given below:

Component-1	Sessional test-1	20%
Component-2	Assignments, Quiz's, Test, Attendance	10%
Component-3	End Term Examination	70%
Totals		100%

Lecture Plans

<u>Lecture No.</u>	<u>Date of Lecture</u>	<u>Topics</u>	<u>Web Links for Videos Lecture</u>	<u>Text Books/Reference books/Reading Materials</u>	<u>Page No. of Text Books</u>
1-3	02/08/20 to 08/08/20	Introduction	www.youtube.com/watch?v=5zKC_aq4ypM&list=PL911998B0A90DFC88	(TB1) Introduction. Highway development and Planning. TB2	01-07. 09-50.
		Importance of transportation, Different modes of transportation. Characteristic of road transport, importance of roads in India, Scope of Highway Engineering, Classification of roads and road patterns, recently launched highway projects in India.			
4-9	09/08/20 to 23/08/20	Traffic Engineering	www.youtube.com/watch?v=uCPlvu-bzDw&index=7&list=PL911998B0A90DFC88	(TB1) Traffic Engineering. TB2	159-265.
		Traffic Characteristic, Traffic Operation, Elements of Design of Intersections.			
10-21	28/08/20 to 23/09/20	Highway Geometric Design	www.youtube.com/watch?v=936Rv57vzQ8&list=PL911998B0A90DFC88&index=9	(TB1) Highway Geometric Design RB4	72-157.
		Introduction, Highway cross-section elements, sight distance, Design of Horizontal Alignment, Design of Vertical alignment, IRC Specifications.			
22-27	28/09	Highway Materials	www.youtube.com/watch?v=3oNa9Z9	(TB1) Highway	268-328.

	/20 to 06/10 /20	Sub-grade soil, Stone aggregate, Binding material (Bitumen emulsion tar and cut back), modification binders, use of Geo-textiles and Geo-grids, MORT specs, SUPERPAVE	4Hiw&index=27&list=PL911998B0A90DFC88	materials. RB4	
		Assignment-1 MID Semester Exam			
27-35	8/10/20 to 17/10/20	Design of Highway Pavements	www.youtube.com/watch?v=uJntLOgEHD4&index=36&list=PL911998B0A90DFC88	(TB1) Design of Highway Pavements RB5	330-407.
		Function and desirable characteristics of pavements, pavements course, Pavements types, comparison of rigid and flexible pavement, pavement components, IRC and AASHTO methods.			
			Assignment-2		
36-45	2/11/20 to 10/11/20	Highway construction	www.youtube.com/watch?v=25HZmhO_FQ&index=41&list=PL911998B0A90DFC88	(TB1) Highway Constructi on. RB5	409-460. 488-517.
		WBM, WMM, BM, BMM, PC, AC, Mastic Asphalt , BSG, PM, Seal Coat , BSD, Prime coat, Track coat, Highway maintenance and pavement Evaluation highway drainage.			

ASSIGNMENT NO. 1

1. What is transportation? What are the various modes of transportation?
2. Derive the expression for finding out the stopping sight distance at level and at grades. Also explain the PIEV theory and the total reaction time of the drivers, factors on which these are dependent upon?
3. (a) Explain the methods of introducing the extra widening of pavement on horizontal curves.
(b) There is a horizontal curve of radius 400m and length of which is 200m on this highway compute the setback distances required from the centerline of the inner side of the curve so as to provide for :-
(i) stopping sight distance of 90 m;
(ii) safe overtaking sight distance of 300m, Given that the distance between the centerline of the road and inner lane is 1.9 m.
4. What is meant by grade compensation on curves? Design a valley curve at the junction of a downward gradient of 1 in 30 and a level stretch from headlight consideration. The stopping sight distance is 180m. Treating the curves as a square parabola, set out the curve.

ASSIGNMENT NO. 2

1. What are the various factors affecting the design of highway pavements? Calculate the deflection at the surface due a wheel load of 40 kN and a tyre pressure of 0.5 Mn/m^2 . The value of modulus of elasticity of the pavement and the subgrade may be assumed uniformly equal to 20 Mn/m^2 .
2. Give various grades of bitumen cutback and emulsions and their suitability.
3. What is surface dressing and explain its function.
4. What is pavement failure? Explain the various modes of failure of pavements.

ASSIGNMENT NO. 3

1. The traffic studies and axle load distribution studies carried out during project preparation indicated that there are (a) 9800 vehicles per day with rear axle loads in the range of 2500 to 3500 kg and growth rate of 6.5% p.a. and (b) 2800 heavy vehicles with rear axle loads in the range 11000 to 13000 kg and growth rate 4.0%. The road pavement is expected to be constructed in a period of 2.0 years after this study and the flexible pavement structure is to be designed for a life of 15 years. Determine value of CSA for design.
2. Explain 'Flexible and Rigid' pavements and bring out the points of difference.
3. Explain ESWL. Briefly explain the graphical method of determination of ESWL.
4. Compute the radius of relative stiffness of 25 cm thick cement concrete slab using the following data:
Modulus of elasticity of cement concrete = 3×10^5
Poisson's ratio for concrete = 0.15
Modulus of subgrade reaction, $K = 20 \text{ kg/cm}^3$
What are the steps for the thickness design of rigid pavements as per IRC guidelines?

Code : 011619

B.Tech 6th Semester Exam., 2016

TRANSPORTATION ENGINEERING—I

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
 (ii) There are **NINE** questions in this paper.
 (iii) Attempt **FIVE** questions in all.
 (iv) Question No. **1** is compulsory.

1. Choose the most suitable option (any seven) :

2×7=14

- (a) The road connecting capitals of State is known as
 (i) NH
 (ii) SH
 (iii) provincial highway
 (iv) MDR
- (b) The portion of the road surface which is used by the vehicular traffic is known as
 (i) carriageway
 (ii) shoulder
 (iii) expressway
 (iv) All of the above

UK16/675

(Turn Over)

(c) As per IRC, the camber on cement concrete road should be

(i) 1 in 45 to 60

(ii) 1 in 20 to 24

(iii) 1 in 12 to 16

(iv) 1 in 60 to 72

(d) For the relationship $u = 55 - 0.44k$, where u is the speed in kmph and k is the density in vph, what will be the maximum flow in vph?

(i) 625

(ii) 1250

(iii) 1718

(iv) 125

(e) Ratio of width of the car parking area required at kerb for 30° parking relative to 60° parking is approximately

(i) 0.7

(ii) 0.5

(iii) 0.8

(iv) 2.0

AK16/675

(3)

- (f) As per IRC, the minimum length of transition curve for a mountainous terrain road with radius of curvature 100 m and design speed of vehicle 100 kmph is
- 270 m
 - 200 m
 - 170 m
 - 100 m
- (g) In the design of highways, expansion and contraction joints should respectively be provided at
- 50 m and 32 m
 - 50 m and 10 m
 - 25 m and 10 m
 - 25 m and 32 m
- (h) The result of ring and ball softening point test on asphalt is given in terms of
- viscosity
 - time
 - temperature
 - flow

AK16/675

(Turn Over

- (i) Excessive deformation in foundation course of a flexible pavement is known as
- base course failure
 - wearing course failure
 - subgrade failure
 - pavement failure
- (j) Reinforcement in cement concrete pavement is kept
- 5 cm high from the bottom level
 - 5 cm below from the top level
 - in the centre of the slab
 - in the bottom of the slab
- (k) What is the importance of Nagpur Road Plan in highway planning of our country?
- 6
- (l) Briefly outline the main features of various road patterns commonly in use. Explain with sketches the star and grid patterns.
- 8

(5)

3. (a) Differentiate between camber and super-elevations. 4

- (b) Find the length of transition curve and extra width of pavement required on a horizontal curve of radius 300 m of a two-lane highway passing through rolling terrain for a design speed of 80 kmph. Assume all other data as per IRC recommendations. 10

4. (a) Explain PIEV theory. What are the factors on which the stopping sight distance depends? 7

- (b) On a two-way traffic road, the speed of overtaking and overtaken vehicles are 65 kmph to 40 kmph respectively. If the average acceleration of overtaking vehicle is 0.92 m/sec^2 , determine
 (i) safe overtaking sight distance and
 (ii) the minimum length of overtaking zone. 7

5. (a) Discuss spot speed, running speed, space-mean speed, time-mean speed and average speed. How are spot-speed studies carried out? 8

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(6)

- (b) A helicopter pilot recorded the travel time of five vehicles on a 3.2 km segment of a highway. Estimate the time-mean speed and space-mean speed of the vehicles : 6

Vehicle	Travel Time (sec)
1	161
2	173
3	145
4	159
5	182

6. (a) Differentiate between flexible and rigid pavements. 5

- (b) Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaard's stress equations using the following data : 9

Wheel load = 4100 kg P
 E of concrete = $3.3 \times 10^5 \text{ kg/cm}^2$
 Pavement thickness = 18 cm h
 Poisson's ratio = 0.15 μ
 Modulus of subgrade reaction
 $= 25 \text{ kg/cm}^3 K$
 Radius of contact area = 12 cm a

(Continued)

(7)

7. (a) Discuss the advantages and disadvantages of traffic rotaries. 6

- (b) Explain the following terms : 8
 ESWL; Tyre inflation pressure;
 CBR; Dowel bar

8. (a) What are the functions of prime coat, tack coat and seal coat in bituminous construction? 7

- (b) Enumerate the steps for preparation of WBM layer. Explain all steps in brief. 7

9. (a) What are the various types of failure in flexible pavement? Explain the causes. 7

- (b) Indicate how the filter material is designed for use in subsurface drainage system. 7

Code : 011619

B.Tech 6th Semester Exam., 2019

TRANSPORTATION ENGINEERING—I

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct answer of the following
(any seven) : 2×7=14

- (a) In India the modes of transportation, in the order of their importance are
 - (i) air transport, shipping, roads, railways
 - (ii) shipping, roads, railways, air transport
 - ☒ (iii) roads, railways, air transport, shipping
 - (iv) shipping, railways, roads, air transport

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(2)

(b) Length of vehicles does not affect

- (i) extra widening
- (ii) minimum radius of turning
- (iii) passing sight distance
- ☒ (iv) width of shoulders

(c) The advantage of providing super-elevation on roads is

- (i) increased volume of traffic
- (ii) reduced maintenance cost of the roads
- ☒ (iii) higher speed of vehicles
- (iv) All of the above

(d) Camber in pavements is provided by

- (i) straight line method
- (ii) parabola method
- (iii) straight at the edges and parabolic at the crown
- ☒ (iv) All of the above

(Continued)

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- (e) A camber of 1 in 30 means that for a 30 m wide road, the crown of the road will be ____ above the edge of the road.

- (i) 0.5 m (ii) 1.0 m
(iii) 2.0 m (iv) 3.0 m

- (f) The maximum rate of super-elevation (e) is given by

~~(i) $e = \frac{V^2}{225R}$~~

(ii) $e = \frac{V^2}{424R}$

(iii) $e = \frac{V^2}{540R}$

(iv) $e = \frac{V^2}{1000R}$

where V = Speed of vehicle in kmph and
 R = Radius of curvature in meters.

- (g) In CBR test, the value of CBR is calculated at

- (i) 2.5 mm penetration only
(ii) 5.0 mm penetration only
~~(iii) both 2.5 mm and 5.0 mm penetration~~
(iv) None of the above

- (h) If W is the wheel load and σ is the unit stress in tension, then the thickness of concrete pavement (t) is given by

(i) $t = \sqrt{\frac{W}{\sigma}}$

(ii) $t = \sqrt{\frac{2W}{\sigma}}$

~~(iii) $t = \sqrt{\frac{3W}{\sigma}}$~~

(iv) $t = \sqrt{\frac{4W}{\sigma}}$

- (i) The traffic volume is equal to

(i) $\frac{\text{Traffic density}}{\text{Traffic speed}}$

(ii) $\frac{\text{Traffic speed}}{\text{Traffic density}}$

(iii) Traffic density \times Traffic speed

- (iv) None of the above

- (j) The length of the side of warning signboards of road is

(i) 30 cm

~~(ii) 45 cm~~

(iii) 60 cm

(iv) 75 cm

2. (a) What are the different modes of transportation? Explain the specific function of each of them.

(b) What are the various objectives of preliminary survey for highway alignment? Enumerate the details to be collected and the various steps in the conventional method.

3. (a) Explain camber. What are the objects of camber? Discuss the factors on which the amount of camber to be provided depends.

(b) Calculate the stopping sight distance for a design speed of 100 km/hr. Take the total reaction time 2.5 second and the coefficient of friction is 0.35.

4. (a) Enumerate the various design factors controlling the vertical alignment of highways.

(b) While aligning a highway in a built-up area, it was necessary to provide a horizontal circular curve of radius 325 meter. Design the following geometric features :

(i) Superelevation

(ii) Extra widening of pavement

(iii) Length of transition curve

(Given that, Design speed = 65 kmph, Length of wheel base of largest truck = 6 m, Pavement width = 10.5 m)

5. (a) What are the objects and scope of traffic engineering? Explain briefly.

(b) A vehicle skids through a distance equal to 40 m before colliding with another parked vehicle, the weight of the vehicle is 75% of the former. After collision if both the vehicles skid through 14 m before stopping, compute the initial speed of the moving vehicle. Assume friction coefficient of 0.65.

6. (a) Explain the traffic manoeuvres and their applications.

(b) With neat sketches, show various types of traffic signals and classify them in proper group.

7. (a) Sketch typical cross-sections of a flexible pavement and a rigid pavement, and explain the functions of the various components.

(b) Explain soil stabilization and its scope in road construction.

8. (a) What is traffic volume? Why are traffic volume studies conducted?

(b) A truck travelling at 30 km/hr was stopped in 1.25 seconds after applying the breaks. Determine the average skid resistance of the road surface.

9. Write short notes on any four of the following :

(a) Shoulders

(b) Tie-bars

(c) Crushing value test

(d) Traffic volume

(e) Surface dressing

(f) Wet mix macadam