

DHANALAKSHMI SRINIVASAN
COLLEGE OF ENGINEERING AND TECHNOLOGY, MAMALLAPURAM
DEPARTMENT OF CIVIL ENGINEERING -QUESTION BANK

CE6006 TRAFFIC ENGINEERING AND MANAGEMENT

UNIT I INTRODUCTION

1. Define - Traffic Engineering

Traffic Engineering is that branch of engineering which deals with the improvement of traffic performance of road networks and terminals. This is achieved by systematic traffic studies, scientific analysis and engineering applications.

2. What is the scope of traffic engineering?

The basic objective of traffic engineering is to achieve efficient free and rapid flow of traffic, with the least number of traffic accidents. Factual studies of traffic operations provide the foundation for developing methods for improvement in general and for solving specific problems.

3. What are the various vehicular characteristics affecting the road design?

The various vehicular characteristics affecting the road design may be classified as static and dynamic characteristic of vehicles.

4. State the static and dynamic characteristics of vehicle.

Static characteristics of the vehicles affecting the road design are the dimensions, weight and maximum turning angle.

Dynamic characteristics of vehicles affecting road design are speed, acceleration and braking characteristics and some aspects of vehicle body design.

5. What are the factors which affect the characteristics of road users?

The various factors which affect road user characteristics are classified as follows:

- a) Physical characteristics
- b) Mental characteristics
- c) Psychological characteristics
- d) Environmental characteristics

6. What are the psychological human factors governing road user behaviour?

The various psychological human factors governing road user behaviour are:

- a) Perception
- b) Intellection
- c) Emotion
- d) Volition

7. What are the various resistances to the motion of a vehicle?

The various resistances to the motion of a vehicle are:

- a) Rolling resistance
- b) Air resistance
- c) Grade resistance
- d) Inertia forces during acceleration and deceleration

8. What are the various traffic studies?

The various traffic studies generally carried out are:

- a) Traffic volume study
- b) Speed and delay study
- c) Origin and destination (O&D) study
- d) Traffic flow characteristics
- e) Traffic capacity study
- f) Parking study
- g) Accident studies

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9.What is off tracking?

The difference in distance between the curved wheel paths of a particular set of front and rear wheels (i.e., either the set of front and rear wheels on the outer side of horizontal curve or the set on the inner side) is called off-tracking or the mechanical widening for a vehicle.

Off tracking = $l^2 / 2R$ (where 'l' is the wheel base in meters and 'R' is the radius of the curved path in metres)

10.In a braking test, vehicle travelling at a speed of 80 km/hr was stopped by applying brakes fully and the skid marks were 7.8 m. Determine the average skid resistance of the pavement surface.

Initial speed, $u = 80/3.6 = 22.22$ m/s

Braking distance, $L = 7.8$ m = $u^2/2gf$

Average skid, $f = (22.22)^2 / (2 \times 9.8 \times 7.8) = 493.72/152.88 = 3.22$

Average skid, $f = 3.22$

PART –B

1. What are the various vehicle characteristics which affect the road design and traffic performance
2. Define rolling and air resistance. Explain it briefly
3. A passenger car weighing 2 tonnes is required to accelerate at a rate of 3 m/sec² in the first year from a speed of 11 K.P.H. the Gradient is +1 percent and the road have a black topped surface. The frontal projection area of the car is 2.0m². The car tyres have radius of 0.33 m. The rear axle gear ratio is 3.82 : 1 and the first gear ratio is 2.78 : 1. Calculate the engine horsepower needed and the speed of the engine. Make suitable assumptions

List out the various road user characteristics with Indian Road Congress (IRC)

4. What are the different types of resistance that is offered by the vehicle when it is in motion? Explain
5. List out the various urban transport problems in India.

UNIT II TRAFFIC SURVEYS AND ANALYSIS

1. What are the methods of volume counting?

The different methods of volume counting are:

- a) Manual methods
- b) Combination of manual and mechanical methods
- c) Automatic devices
- d) Moving observer method
- e) Photographic method

2. Define - Traffic Volume and Density

Volume, also known as flow, is the number of vehicles passing a specified point during a stated period of time. It is usually expressed in vehicles per hour.

Density, also known as concentration, is the number of vehicles present in a stated length of road at an instant. It is usually expressed in vehicles per kilometre length of road per lane.

3. Differentiate basic from possible highway capacity.

Basic capacity Possible capacity

The maximum number of passenger cars that can pass a point on a lane or a roadway during one hour under the most nearly ideal roadway and traffic conditions which can possibly be attained.

The maximum number of vehicles that can pass a given point on a lane or roadway during one hour, under prevailing roadway and traffic conditions.

4. What is meant by PCU?

When the traffic is composed of a number of types of vehicles, it is the normal practice to convert the flow into equivalent Passenger Car Unit (PCU), by using certain equivalency factors. The flow is then expressed as PCUs per hour or PCUs per day.

5. Define - Spot Speed

Spot speed is defined as the instantaneous speed of a vehicle at a specified location.

6. What are meant by 85th, 50th and 15th percentile speeds?

85th percentile speed is the speed below which 85% of all the vehicle travel, and is used for determining the speed limits for traffic regulation.

50th percentile speed or the median speed, is the speed at which there are many vehicles going faster as there are going slower.

15th percentile speed is the speed below which 15% of all the vehicles travel.

7. What is 98th percentile speed? State its significance.

The 98th percentile speed is the speed below which, 98% of all the vehicle travel.

Significance: 98th percentile speed is used as a design speed in geometric design.

8. What are the methods of conducting origin destination survey?

The following are the methods for conducting origin destination survey:

- a) Home interview survey
- b) Road-side interview

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- c) Post-card questionnaire survey
- d) Registration number plate survey
- e) Tags on vehicles

9. List out any two uses of origin and destination survey.

The following are the uses of origin and destination survey:

- a) To determine the amount of by-passable traffic that enters a town, and thus establish the need for a bypass
- b) To develop trip generation and trip distribution models in transport planning process
- c) To determine the extent to which the present highway system is adequate and to plan for new facilities

10. What is meant by the term desire line diagram?

Desire line diagram is a pictorial representation in which, the trips between any pair of zones are represented by a straight line connecting the centroids of the two zones and having a band width drawn to a suitable scale to represent the actual volume count.

PART –B

1. List out the various methods of carrying out speed and delay study
2. List out the various methods of conducting moving observer method of journey speed studies.
 - i. Define the term Traffic Volume. (6)
 - ii. What are the objects of carrying out traffic volume studies? (7)
3. List out the advantages and disadvantages of manual method of volume count survey
4. Summarize the different methods of collecting Origin Destination (OD) studies with its significance

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UNIT III TRAFFIC CONTROL

1. What are the various types of traffic signs?

Traffic signs give timely warning of hazardous situations when they are not self - evident.

The various types of traffic signs are:

- a) Prohibitory signs
- b) Mandatory signs
- c) Information signs, further sub-divided into:
 - i) Indication signs
 - ii) Advanced direction signs and direction signs
 - iii) Place and route identification signs

2. What are mandatory signs?

Mandatory signs are part of regulatory signs and are intended to convey definite positive instructions when it is desired that motorists take some positive action.

3. What are warning signs?

Warning signs are used when it is deemed necessary to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street. Warning signs are of great help in ensuring safety of traffic.

4. What are informatory signs?

Informatory signs are intended to guide the motorist along streets and highways, to inform him of interesting routes, to direct him to cities, villages or other important destinations, to identify rivers and streams, parks, forests and historical sites, and generally give him information as well as help him along his way in the most simple, direct manner possible.

5. What are the main traffic control aids?

The various traffic control aids are:

- a) Roadway delineators
- b) Safety barriers
- c) Speed breakers
- d) Barricades
- e) Railings
- f) Traffic signs

6. What are the different methods by which street light arrangement can be done?

The different methods by which street lighting arrangements can be done are:

- a) Single - sided
- b) Staggered
- c) Central
- d) Opposite
- e) Combination of (c) and (b) or (c) and (d)

7. Draw the GIVE WAY sign as per Indian Road Congress (IRC) with its relevance.

GIVE WAY is a mandatory sign. The GIVE WAY sign as per IRC is a downward pointing equilateral triangle having a red border and a white background. The side of equilateral triangle is 900 mm long in the standard sized sign and 600 mm long in the smaller sized sign. It shall be used in combination with a definition plate carrying the message GIVE WAY.

8. What are the different types of road markings available?

The two types of road markings are:

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- a) Carriage markings
- b) Object markings

9. Write the formula to calculate optimum cycle time.

$$C_0 = (1.5 L + 5) / (1 - Y)$$

where, C_0 = Optimum cycle time (s)

L = Total lost time per cycle (s)

$Y = y_1 + y_2 + \dots + y_n$ { $y_1 + y_2 + \dots + y_n$ are the maximum ratios of flow to saturation flow for phases 1, 2,... n (i.e. q / s , where q is the flow and s is the saturation flow)}.

10. Write any two advantages of vehicle actuated signals.

The advantages of vehicle actuated signals are:

- a) They are flexible and are able to adjust to changing traffic conditions automatically
- b) Delay is held to a minimum and maximum capacity is achieved

PART –B

1. What is an intersection? Explain in detail, the two broad classifications of intersections
2. (a) List out the advantages of traffic signals. (4)
(b) What is meant by saturation flow? (4)
(c) State the need for signal co-ordination(5)
3. Explain the various types of traffic signals and their functions. How are the signal timings decided?
4. A fixed type 2 – phase signal is to be provided at an intersection having a North – South and an East – West road, where only straight ahead traffic is permitted. The design hour flows from the various arms and the saturation flows for these arms are given in the following table. Design the traffic signal with timing diagram and phase diagram. Assume relevant data

Details of flow	North	South	East	West
Design hour flow (PCU/hour)	810	380	770	950
Saturation flow (PCU/hour)	2500	1900	2800	3100

5. Explain in detail, the channelization of intersection and its purposes with neat sketches

UNIT IV GEOMETRIC DESIGN OF INTERSECTION

1. Define – Intersection

An intersection is defined as the general area where two or more highways join or cross, within which are included the roadway and roadside facilities for traffic movements in that area.

2. What are the various types of conflicts at intersections?

The various types of conflicts at an intersection are:

- a) Crossing conflicts
- b) Merging conflicts
- c) Diverging conflicts

3. What is an at-grade intersection?

An intersection where all roadways join or cross at the same level is known as an at-grade intersection.

4. What are channelized and unchannelized intersections?

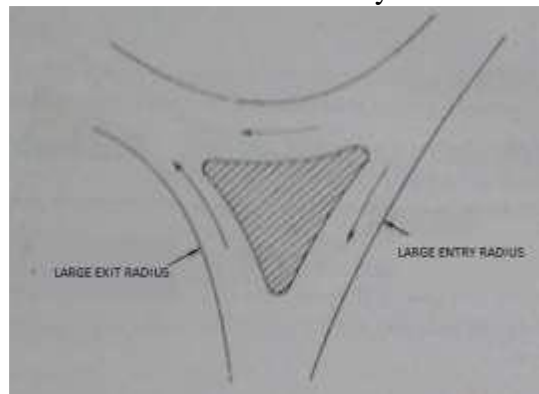
A channelized intersection is one in which traffic is directed into definite paths by islands and markings.

An unchannelized intersection is the one without islands for directing traffic into definite paths.

5. With a neat sketch, write any one Channelizing island as per IRC standard with its function.

One of the important functions of channelized island is the control of speed. To reduce the speed of traffic entering the intersection and increase the speed of traffic leaving the intersection, bending or funnelling by suitable channelization techniques is resorted to.

The above figure shows the control of radius of entry and exit for control of speed.



6. What are the advantages of channelized intersections?

The following advantages of channelized intersections:

- a) Separation of conflicts
- b) Control of angle of conflict
- c) Control of speed
- d) Protection of traffic for vehicles leaving or crossing the main traffic stream
- e) Protection of pedestrians
- f) Elimination of excessive intersectional areas
- g) Blockage of prohibited areas
- h) Location of traffic control devices

7. What are the advantages of rotary intersections?

The advantages of rotary intersections are:

- a) An orderly and regimented traffic flow is provided by rotary one - way movement

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- b) All traffic proceeds simultaneously and continuously at fairly uniform, low speed
- c) All turns can be made with ease, although little extra travel distance is required for all movements expect left turns
- d) For moderate traffic, rotaries are self governing and need no control by police or traffic signals

8. What are the types of grade - separated intersections?

The two types of grade - separated intersections are:

- a) Grade - separated intersections without interchange
- b) Grade - separated intersections with interchange

9. What are the factors on which the choice between an At Grade Intersection and a Grade Separated Intersection depend upon?

The factors on which the choice between an At Grade Intersection and a Grade Separated Intersection depend upon are traffic, economy, safety, aesthetics, delay, etc

10. How are interchanges classified?

The interchanges are classified as:

- a) Three leg interchange
 - i) T interchange
 - ii) Y interchange
 - iii) A partial rotary interchange
- b) Four leg interchange
 - i) Diamond interchange
 - ii) Half clover leaf interchange
 - iii) Clover leaf interchange
 - iv) Rotary interchange
 - v) Directional interchange
- c) Multi-leg interchange
 - i) Rotary interchange

PART-B

1. Write briefly the different factors causing accidents
2. Write in detail about the skid resistance value and methods of measurement skid resistance
3. Write in detail about Noise Pollution, causes, abatement measures.
4. Explain the factors affecting street lightening
5. Write in detail about air Pollution, causes, and abatement measures

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1. What are the traffic management measures?

Some of the well-known traffic management measures are:

- a) Restrictions on turning movements
- b) One - way streets
- c) Tidal - flow operations
- d) Exclusive bus lanes
- e) Closing side streets

2. What is Transportation System Management (TSM)?

Transportation System Management (TSM) is a package of short term measures to make the most productive and cost - effective use of existing transportation facilities, services and modes.

3. List out the various types of Travel Demand Management (TDM) techniques.

The following are some of the techniques of Travel Demand Management (TDM):

- a) Car pooling and other ride-sharing programmes
- b) Peripheral parking schemes
- c) Road pricing
- d) Entry fee
- e) Priority for buses in traffic.
- f) Restriction on entry of trucks during day time

4. What is period of forecasting?

Since the traffic forecasting is needed for transport plans, the design period selected for transport plans should be sufficient for traffic forecasting. In general, transport plans are for a period of about 5 to 10 years in detail and an additional five years in less detail. In U.K., it is customary to forecast traffic for a design period of 15 years when dealing with rural roads. In India, National Highways are designed for 15 years after completion of work.

5. What is Aggregate and Disaggregate Models in Traffic Forecasting?

Aggregate models deal with the estimation of travel of a group of travellers.

Disaggregate models deal with the smallest decision making unit, the individual traveller.

6. What is the purpose of one - way streets?

One-way streets provide the most immediate and the least expensive method of controlling the traffic conditions in a busy area. In combination with other methods such as banned turning movements, installation of signals and restrictions on loading and waiting, the one-way street system is able to achieve great improvement in traffic congested areas.

7. What are the disadvantages of one - way streets?

The disadvantages of one - way streets are:

- a) Although the journey times and delays are reduced, the actual distances to be covered by drivers increases
- b) Where buses operate on the streets, the stops will have to be relocated and in many instances the passengers will have to walk extra distances
- c) In the initial stages of introduction of one-way streets, confusion is likely to be created amongst motorists and pedestrians

8. Write any two advantages of closing side streets.

The advantages of closing side streets are:

- a) Since interference from the traffic from side streets is eliminated, the speed increases, journey time reduces and accidents reduces
- b) The side - streets which are closed can be utilised for parking of vehicles, if there is an acute shortage of parking space in the area

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9. What is meant by traffic regulations?

The traffic regulations should cover all aspects of control of vehicles, driver and all other road users. The regulations should be rational. Traffic regulations and laws give legal coverage for strict enforcement.

Traffic regulations and laws cover the following four phases:

- a) Driver controls
- b) Vehicle controls
- c) Flow regulations
- d) General controls

10. Define - Traffic Calming

Traffic calming consists of physical design and other measures for the intention of reducing the motor vehicle speed as well as to improve the safety of pedestrians and cyclists.

Traffic calming includes the engineering measures such as:

- a) Narrowing traffic lanes
- b) Speed bumps
- c) Speed humps
- d) Speed cushions
- e) Speed tables

PART-B

1. Write short notes on few of the traffic management measures:

- a) Tidal flow operation (4)
- b) Exclusive bus lane (4)
- c) Restriction on turning movement (5)

2. Write briefly on the following:

- a) Locations where parking is prohibited(4)
- b) Peripheral parking schemes(4)
- c) Traffic calming(5)

3. Write a brief notes on:

- 1. Vehicle licensing (4)
- 2. Tidal Flow(4)
- 3. Define briefly the strategies adopted to avoid right turning at intersections

4. Discuss in detail the various methods of traffic regulatory measures in traffic management

5. Explain in detail about

- i. Traffic System Management (TSM) (7)
- ii. Traffic enforcement and education (6)