SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

Siddharth Nagar, Narayanavanam Road, Puttur – 517583

SOLVED QUESTION BANK (DESCRIPTIVE)

UNIT–I

ROAD ACCIDENTS – CAUSES & PREVENTION

1a) Briefly explain about road accidents and how traffic engineer plays role in prevention of road accident?

Road Accidents & Traffic Engineering:-

- A traffic collision, also called a motor vehicle collision, car accident, or car crash, occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree, pole or building.
- These collisions often result in injury, disability, death, and property damage as well as financial costs to both society and the individuals involved.
- The spectacular increase in the number of motor vehicles on the road has created major social problems like loss of lives, appalling human miseries and serious economic loss through road accidents.
- Road transport is the most dangerous situation where people deal on a daily basis, but casualty figures from such incidents attract less media attention than other, less frequent types of tragedy.
- Number of factors contribute to the risk of collisions, including vehicle design, speed of operation, road design, weather, road environment, driving skills, impairment due to alcohol or drugs, and behavior, notably aggressive driving, distracted driving, speeding and street racing.
- The traffic engineer is concerned about many features of the highway which affect the safety of the vehicle and the other road users.
- The analysis of the accident statistics provides clues to many factors that lead to the accident and to improvement that may be desired. Based on the statistics the traffic engineer must devise ways to reduce the accidents through better planning, design construction, maintenance and traffic operation.
- The traffic engineer is also concerned about the regulation and management of traffic to ensure safer travel. Accident data supply valuable information to control regulates and manage the traffic more efficiently.

1.b) Explain about the engineering uses in collection of accident data?

1. In determining the adequacy, size, shape and legibility of traffic signs.
2. In determining the justification for traffic control devices, such as traffic signals.
3. In determining speed zonings and speed control.
4. In planning traffic regulation measures such as prohibition of on street parking, one way street and prohibited turnings.
5. In designing safe and efficient street lighting, designing or re-designing intersections, providing channelizing islands, central verges, refuge islands etc.,
6. In planning safety measures for traffic during construction
7. In providing adequate sight distance, improving horizontal and vertical alignments

8. In understanding the deficiency of the pavement surfaces, super-elevations and camber and also devising various ways and means of improving them.

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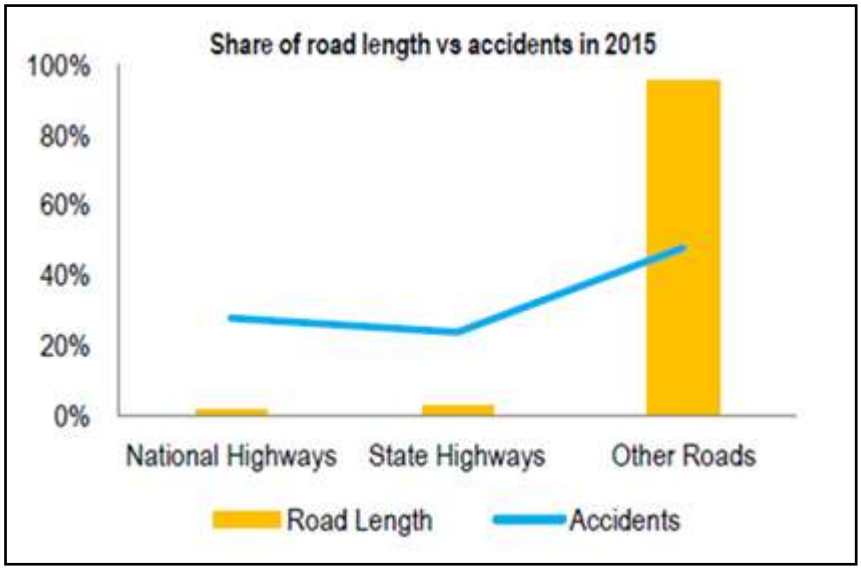
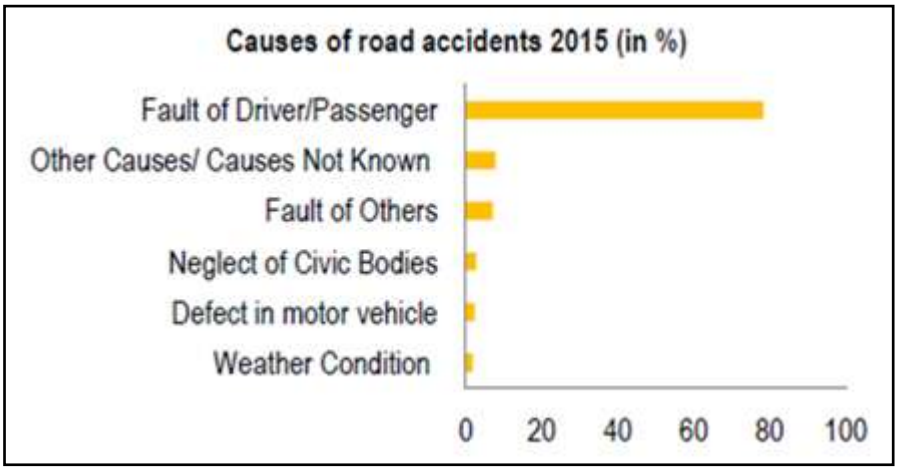
2) Give a detailed discussion about accident situation in India with past accident data.

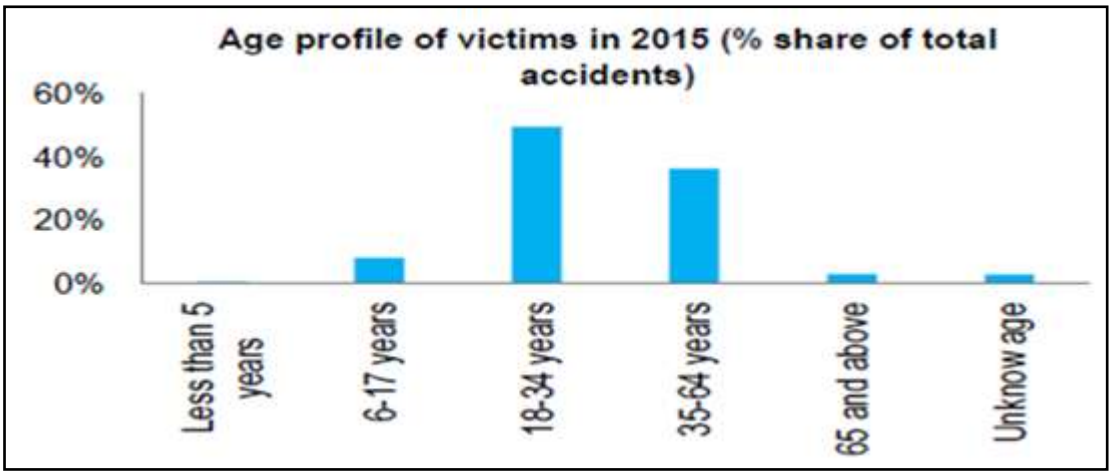
- The accident situation is more serious in India because of the rapid growth of motor vehicle in the past few years.
- This is due to the inadequacy of many of our roads and streets to cope up with this traffic and the mixed traffic conditions prevailing on the roads in India which makes the matters much worse.
- In 2019, India reported a total of 449,002 road accidents of which 151,113 were fatal and 451,361 had injuries – says the recently released government Road Accident in India 2019 report.
- However, in percentage terms there was a decline in all three though a marginal one — there were 3.86% fewer accidents in 2019.





- Road length in India has increased from about 4 lakhs kilometers in the 1950s to about 55 lakh kilometers in 2015; majority of this growth has been in rural roads and roads constructed by the Public Works Department (PWD). The Rural roads account for about 61%, and PWD roads for 20% of the total road length.
- In comparison, urban roads have a 9% share in the road network. The growth in rural roads may be attributed to schemes such as the Pradhan Mantri Gram Sadak Yojana, which was launched in 2000 and aimed to improve road connectivity in rural areas.

- National Highways constitute 2%, and State Highways 3% of the total road length. Project Roads, account for 7% of the total road length, and include roads built by various state departments such as forest, irrigation, electricity, public sector undertakings such as Steel Authority of India, and the Border Roads Organization.
- Since 2000, while road network in the country has grown by 39%, the number of registered vehicles has grown by about 158%. While growth in road network will be limited (due to physical constraints), a constant increase in the number of vehicles on roads may lead to congestion and road fatalities.



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3) How results are interpreted on road accidents in various countries. List the fatality rates from different countries?

- International comparison of road accident data is of great value but to be meaningful it should be based on agreed definitions of accidents, fatalities and injuries.
- Another difficulty in interpreting the results is the wide variation that exists in different countries as regards economic condition, education and literacy, climate types of vehicles, traffic conditions, legal measures in force, population density, degree of urbanization and value of vehicle kilometer to which the statics are usually related. Caution is therefore needed in drawing conclusions from such comparisons.
- Smeed and jeffcoate have presented the accident figures from 68 countries (India being one of them), for the period of 1960-67 and have fitted a relation between the number of motor vehicles (N) per population (P) and the number of deaths (D) per vehicle population. The relation is of the form:

$$(D/N) = 0.00003(N/P)^{-2/3}$$

- Through this formula has its limitations, it provides a tolerably good procedure for estimating the number of road fatalities in a given country where the population and number of vehicles are known. It will be seen that as the values of (N/P) increases the value of (D/N) decreases.
- A further modification of the above relationship has been recently suggested by Jacobs and Hutchinson for developing countries and is as follows:

$$(D/N) = 0.0007\ (N/P)^{-2/5}$$

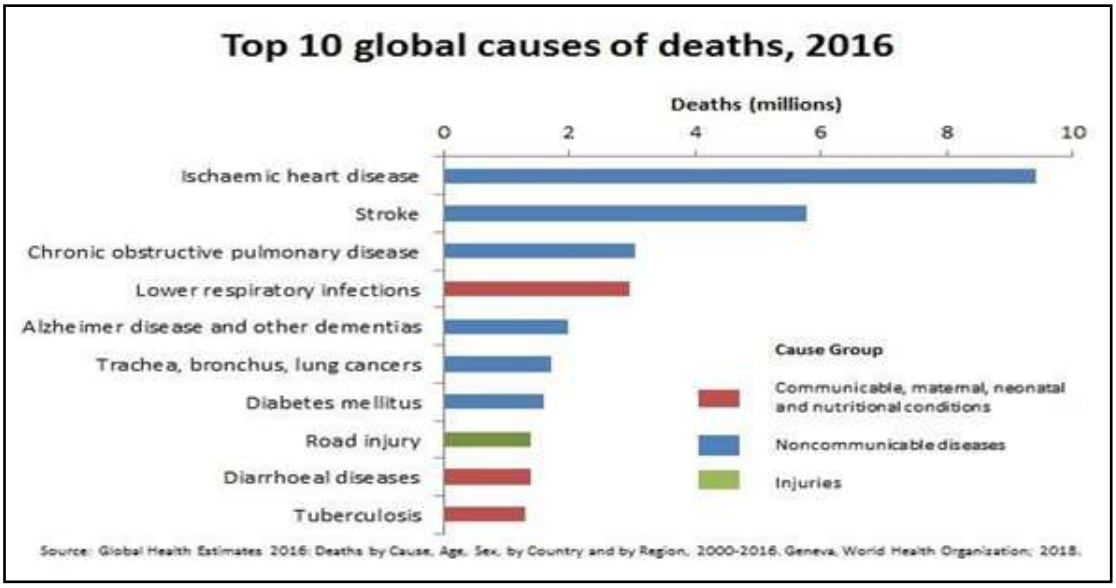
- A comparison of select indicators published in World Road Statistics, 2018 of International Road Federation has been undertaken with the objective of positioning India viz-a-viz other countries in terms of road accidents and corresponding number person killed, injured and rates per lakh people.

S.No	*Country*	*Fatality Rate (Death per 10,000 vehicles)*	*S.No*	*Country*	*Fatality Rate (Death per 10,000 vehicles)*
1	Nigeria	160.0	2	Tanzania	150.8
3	Ghana	111.8	4	Zambia	84.8
5	Liberia	53.7	6	Mauritius	36.2
7	Ecuador	20.7	8	China	26.2
9	India	25.2	10	Russian Federation	14.7
11	Indonesia	12.6			
12	Iran	6.1	13	Malaysia	5.6
14	Portugal	4.4	15.	Brazil	4.1
16	Austria	2.9	17	USA	2.1
18	Japan	1.7	19	Norway	1.2

Personal vehicle ownership and official road traffic fatality rates per 100 population (Source : W.H.O., 2015)

Country	MTW + light 4-wheelers per 100 persons	Official fatality rate per 100,000 population
India	9*	12
Australia	71	5.1
Canada	61	6
Chile	45	12
Greece	60	7.8
Hungary	32	6
Japan	69	4.5
Portugal	56	6
Sweden	56	2.7
United Kingdom	54	2.8

* Vehicle ownership rate adjusted for number of actual vehicles on road. See text.



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4) Analyze the various road geometric design elements and how they are related to cause Road accidents.

a) Terrain/Topography

The classification of the terrain is done by means of cross slope of the country, i.e., slope approximately perpendicular to the center line of the highway location. To characterize variations in topography, engineers separate it into four classifications according to terrain as listed.

b) Speed

Speed is defined as the distance covered per unit time. Since speed of every vehicle is impossible to track on a roadway; therefore, in practice, average speed is based on the sampling of vehicles over a period of time on a particular section of road. Speed is one of the most important factors considered by travelers in selecting alternative routes.

c) Horizontal Alignment

The horizontal alignment is the route of the highway, defined as a series of horizontal tangents and curves. Horizontal curve is the curve in plan to change the direction of the center line of the highway. The geometries of horizontal alignment are based on an appropriate relationship between design speed and curvature and on their joint relationship with super elevation and side friction.

d) Vertical Alignment

Vertical alignment is the longitudinal section of a roadway to provide easy and safe change of gradient. It is defined as a series of gradients and vertical curves. Gradient is the rate of rise or fall with respect to the horizontal along the length of a road expressed as a percentage or as 5 a ratio or in degrees

e) Cross Section

Cross section is defined as the number of lanes and lane width including cross fall, shoulder, sidewalk, earth slope and drainage features in the transverse direction of the roadway. The cross section shows the total formation of the road.

f) Super elevation

Super elevation is tilting or banking the roadway to counteract the centripetal force developed as the vehicle moves around the horizontal curve. When a vehicle moves in circular path, it undergoes a centripetal acceleration that acts towards the centre of curvature. This acceleration is

sustained by a component of the vehicle's weight related to the roadway superelevation, by the side friction developed between the vehicle's tires and or the pavement surface.

g) Sight Distance

Sight distance is the distance along the road surface at which a driver has visibility of object at a specified height above the carriageway. This is the adequate length along the highway in the different situations to permit drivers enough time and distance to control their vehicles so as to avoid unforeseen accidents.

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5) Discuss your answer about the following elements in view of causing road accidents.

a)The vehicle b)Weather c)Speed

a) The vehicle:

i) Braking system:

Brakes are needed to bring the vehicles to a stop whenever a driver comprehends immediate danger. A good braking system should achieve the objective without resulting in the drivers loss of directional control of the vehicles.

ii) Vehicle lightning system:

The lighting system of the vehicle consists of headlights, side lamp, parking lights, rear light, direction indicator and stop lamps. An efficient and reliable system of lighting the vehicle is desirable for averting accident.

iii)Vehicle body and its features:

In the design of motor vehicle for safe driving, an aspect which has been receiving increasing attention is the features and dimension of the vehicle body. The seat of the driver should be comfortable and adjustable to give him a clear view all around and to secure easy access to all controls.

iv)Tyres:

Tyres are an important aspect of vehicle design from the point of view of safety. The performance of tyres relative to puncture, blowout, vulnerability to damage to sharp objects, while braking. Skidding is a phenomenon which is governed by the interaction of the tyre, brakes, road surface, speed and wetness of the road surface.

b) Weather:

i) Weather & its Effects on Accidents: - The most significant result relates to rain. Rainfall has a positive (direct effect) and a negative (indirect effect) on the number of injury accidents both on main roads and motorways.

They act through visibility impairments, precipitation, high winds, and temperature extremes to affect driver capabilities, vehicle performance, pavement friction, roadway infrastructure, crash risk, traffic flow, and agency productivity. Weather-related crashes are defined as those crashes that occur in adverse weather (i.e., rain, sleet, snow, fog, severe crosswinds, or blowing snow/sand/debris) or on slick pavement (i.e., wet pavement, snowy/slushy pavement, or icy pavement).

On average, nearly 5,000 people are killed and over 418,000 people are injured in weather-related crashes each year. The vast majority of most weather-related crashes happen on wet pavement and during rainfall: 70% on wet pavement and 46% during rainfall. A much smaller percentage of weather-related crashes occur during winter conditions: 18% during snow or sleet, 13% occur

on icy pavement and 16% of weather-related crashes take place on snowy or slushy pavement. Only 3% happen in the presence of fog.

c) Speed: The following are the factors are responsible for this:

- The distance needed to bring a vehicle to a stop increase as the speed increases
- The minimum safe separation distances between vehicles increases with speed, and as many drivers do not maintain these distance the risk of accident increases at greater speeds.
- With higher speeds, the distance travelled during the driver's reaction time increases.
- The skid resistance of wet roads decreases as the speed increases.
- When vehicles are approaching at fast speed, the judgment of the pedestrian can be less reliable.

6a) Come out with brief explanation about parking and its influence on road accidents.

i) Parking & Its Influence on Accident: -

Due to a lack of parking facilities in a society, vehicle owners park on a footpath lining the roads. Pedestrians have to then resort to walking on the sides of the road, which is an obstruction to free-flowing traffic. This overflow of pedestrians onto the streets causes traffic jams.

ii) Parking vehicles is the major contributors to accident:

- Parking and un-parking maneuvers can cause accidents to pedestrian, cyclist or to others motorist.
- Opening of car doors on parking can suddenly causes a cyclist or a motorist to be involved in an accident.
- Pedestrian can appear from between parked vehicles or tin front of a parked vehicles, unnoticed by a speeding vehicle.
- Parking generally reduces the street space and increases the congestion, thereby indirectly causing accidents.
- There is no doubt that a suitable policy of regulating on street parking will have a salutary effect on the accident satiation.

6.b) Explain about the enforcement uses in collection of accident data?

- Legislation by itself cannot achieve its objective unless it's enforced rigidly.
- The laws are flouted by many motorist and other road users, and unless cases of such offences are detected and other offenders brought to book, matters cannot improved.
- The enforcement is in the hand of police department in co-operation with the magistrates or special traffic courts. The police force should be adequately strengthened to deal with detection.
- The work of police is rendered easy in certain cases of detection offences, such as exceeding the speed limit, by mechanical aids.
- Radar speed measuring instrument can record the speed instantaneously form an inconspicuous position by the roadside. Breath analyzers can detect the drunken driver. Police patrols in vehicles equipped with wireless are of great help.

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7) Identify the various measures to be taken into account to prevent the accident caused by

a)Two wheeler driver **b) Pedestrian**

a) Two wheeler driver

Motor Cycle & Scooter Rider:- A scooter or motor scooter is a low-speed motorcycle with a step-through frame and a platform for the rider's feet.. Scooters are popular for personal transportation partly due to being more affordable, easier to operate, and more convenient to park and store than a car. Licensing requirements for scooters are easier and cheaper than for cars in most parts of the world, and insurance is usually cheaper. The term motor scooter is sometimes used to avoid confusion with kick scooter, but can then be confused with motorized scooters, another distinct kind of scooter.

Other regulatory measures aimed at safety of motor cycle and scooter riders are:

- Compulsory provision of rear view mirrors
- Compulsory provision for screen to cover the rear wheel o that loose garments do not get entangled in the spokes of the wheels.
- Restricting the number of riders to the driver and one pillion riders.
- Prohibition a rider with a learner license to carry pillion riders
- Compulsory provision of a proper foot rest for the pillion rider.
- Restricting the speed of vehicles to a lower value when the rider is not wearing a crash Hemet.

b) Pedestrian

Pedestrian Safety:- A pedestrian can be defined as a vulnerable road user that is at risk when it comes to roads. Thus the safety of such being is essential. The pedestrian safety and protection norms are aimed to do so. It will ensure that the new cars meet a minimum requirement of safety for the pedestrians.

There are many factors that can lead to a pedestrian getting involved in an accident. Most of the times, the driver is at fault. Few of the moments when the driver is at fault are:

1. **Distracted Driving:** Driver is busy talking to someone on the phone, or maybe even talking to the passenger. Or could be texting, eating or drinking. This all can lead to the driver not noticing the pedestrian who has the right to way and can lead to an accident.
2. **Speeding:** It is not just a violation of traffic laws but also a threat to the pedestrian on the roads. The result can be life-threatening injuries to the person or can even lead to death.
3. **Intoxicated driving:** There have been cases when the driver was not in his complete senses while driving and the pedestrians were at the major loss end. Thus alcohol consumption is not only a violation of traffic rules but another threat to the pedestrians.
4. **Poor reaction time:** Many a time, drivers are able to see the pedestrian but are not able to react accordingly due to poor reaction timing. This leads to devastating results.
5. **Reverse parking or Backing up:** Drivers are usually not able to see who is behind the car, especially kids who are not visible. This usually happens at the parking lots.

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8) Apply your knowledge as a graduate and how you suggest various measures to be considered in view of controlling the Road Accidents.

The probability of accidents can be reduced by controlling the following indiscipline:

1. **UNTRAINED DRIVING**

   New drivers should complete a basic rider course or advanced tuition at race tracks. It can be cheaper than you fear. Safety gear doesn't just help prevent injury in a crash, but can make riding more comfortable, put you in better control of your vehicle and help you be seen by other drivers.

2. **OVERSPEEDING**

   SPEED is the single biggest factor contributing to road deaths in India. Excess and inappropriate

speed is responsible for a high proportion of the mortality and morbidity that result from road crashes.

3. **BUZZED DRIVING**
   The sobering reality of drunk driving is that it is obviously a dangerous behavior, yet too often drivers get behind the wheel with alcohol in their bloodstream, impairing judgment and slowing reaction time. Drink and driving is a deadly combination on the road.
4. **TAILGATING**
   This is probably one of the greatest offences. Some drivers are extremely impatient, some people do it without thinking, just following traffic they get a bit close, but then they back off as you accelerate way. Some drivers tailgate deliberately though and these are the ones that are the most dangerous.
5. **DISTRACTED DRIVING**
   As the slogan says, hang up and drive. And whatever you do, don't text. In many states, it is now illegal to drive and operate a hand-held phone, but in all states, it is a bad idea.
6. **TRAFFIC VOILATIONS**
   Look both ways and be sure no one is trying to speed through a yellow light. Exercise caution when passing semis. Be especially careful when driving next to an 18-wheeler. If you cannot see the truck's side mirrors, the truck driver cannot see you.
7. **RASH & NEGLIGENCE**
   Beware of blind spots. Also, when at an intersection making a right-hand turn, look both directions at least twice before proceeding. Vehicles can appear almost out of nowhere very quickly, so exercise caution when pulling into a busy intersection.
8. **OVERTAKING**
   Overtaking is an invitation to accident. In residential areas where the speed limit is already low, go even lower, at least 5 mph below the official speed limit. This will give you time to stop when a little ghost or X-Men character darts out into the street unexpectedly.
9. **NO LANE DRIVING**
   Drive in your lane. Sometimes when you have to drive out of an alley or underground parking lot you can't see whether pedestrians are ready to step out in front of you. Drive at a crawl and wait until you're absolutely certain it's safe for you to proceed.
10. **UNROADWORTHY VEHICLES**
    When your vehicle is in good shape you can have peace of mind knowing that you're less likely to have any breakdowns. Make sure your vehicle has proper insurance coverage and vehicular documents. Be mindful for petrol/diesel, oil, water, seat belt, brakes and air pressure.

9a) Give the detailed notes on cost of road accidents.

- The study of cost of road accidents found that average socio-economic cost of every death due to a road accident. According to official statistics 151,417 persons were killed and 469,418 injured in road traffic crashes in India in 2018. However, this is probably an underestimate for injuries, as not all injuries are reported to the police.
- With the fast growth of traffic in the road accident rate in India is increasing at an alarming rate. The road accident cause huge economic loss to injured victims, expenses incurred in medical treatment, administrative cost of police, insurance companies and accident claims bributants, and damage to vehicles and property.

- Apart from these tangible components intangible cost such as pain, grief and suffering are also caused. An accurate understanding of the monetary cost of accident of various types helps transportation planners and economists to account for this component of road user cost while undertaking an economic appraisal of the highway schemes, in view of the urgent data gap in the country on accident cost, the CRRI (Central Road Research Institute) took up a limited investigation into this subject as a part of the road user cost study.
- The number of cars and Motorized Two-Wheelers (MTW) registered in 2016 was 30.2 and 168.9 million respectively. The official registration data over-represent the number of vehicles in actual operation because vehicles that go off the road due to age or other reasons are not removed from the records. The actual number of personal vehicles on the road is estimated to be 50%-60% of those mentioned in the records.

9.b) Apply your knowledge to suggest the preventive measures for road accidents by cyclist.

The ideal solution for preventing cycle accidents is to provide separate cycle tracks. The design criteria and guidelines for the provision of separate cycle tracks are given elsewhere.

It is desirable that cycle traffic be governed by rules intended to promote safety. Some of the common rules adopted by many city authorities are:

1. Not more than two cycles shall remain abreast except at separate cycle tracks.
2. Cyclists should not use foot-ways.
3. Cyclists should compulsorily use separate cycle tracks wherever they are provided.
4. Cyclists should not allow themselves to be towed by any other vehicle.
5. Double-riding shall not be allowed.
6. Where no separate cycle tracks are provided, the cyclists shall keep to the extreme left of the carriageway.
7. All cycles should be provided with good brakes, night lamps and red reflector at the rear.

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10) Bring out the various legislation and education measures to be adopted in prevention of road accidents.

❖ **Various Legislative measures that in prevention of road accident:**

A variety of legislative measures are possible and different countries have adopted different measures. Some of them are listed below:

1. To stipulate age limits for drivers.
2. To introduce penalties of fine, imprisonment, disqualification or endorsements on licenses for careless driving.
3. To enable police to check the drivers for their drunkenness and to impose suitable penalties.
4. To prescribe maximum hours of work for drivers of commercial vehicles and buses to prevent them from fatigue.
5. To prescribe uniform road signs throughout the country and provide for penalties for the non-observance of the same.
6. To lay down rules for pedestrians when crossing streets and to impose penalties for their non-observance.
7. To prescribe rules for cyclists.
8. To prescribe rules for motor cycle and scooter riders.
9. To prescribe rules for the maximum size and weight (axle loads) of vehicles.
10. To prescribe minimum standards for the design of vehicles.

11. To prescribe minimum standards for the inspection and maintenance of vehicles.

❖ **Education**

- Road safety education occupies an important place in the prevention of accidents. School children who are particularly liable to accidents, can be easily imparted the necessary training in the school about the rules of the road and related safety aspects.
- Since the attitudes and personality of the children are in their formative stage, a lasting impression can be left in their minds about their precautions. The society can reap the benefits when the children grow up and can expect them to be law-abiding citizens in observing the traffic laws.
- Training of professional drivers of commercial vehicles and buses and personnel of the armed forces can be of great value. Refresher courses for drivers can serve to educate them on the needs of traffic safety and how to use their motor vehicles in a safe and efficient manner.
- In the U.S.A., high-school driver education is an integral part of the curriculum for students approaching the legal driving age. Under this programme, the potential drivers at a young age are imparted necessary instructions to learn fundamental driving skills and to achieve desirable traffic safety pattern.

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SOLVED QUESTION BANK (DESCRIPTIVE)

UNIT – II

REGULATIONS OF TRAFFIC & PARKING

1.a) What are the needs for traffic regulation?

a) Needs for Traffic regulation

1. Safe operation of traffic enforcement of these regulations.
2. Safe and efficient movement of traffic and pedestrian with out at same time infringing unduly upon the individual rights of road user.
3. The regulations should be respect by road user and not be disregarded.
4. They should be flexible with the changing conditions and time.

1.b) List out the various Traffic Laws as per Indian Motor Vehicle Act.

b) Various Traffic Laws as per Indian motor vehicle Act.

In India, the motor vehicle acts 1988 provide the basics for regulating vehicles, drivers, other road users and traffic. It contains the following chapters:

1. Preliminary.
2. Licensing of drivers.
3. Registration of motor vehicles.
4. Control of transport vehicles.
5. Control of traffic.
6. Liability without fault in certain cases
7. Insurance of motor vehicles.
8. Motor vehicles temporarily leaving, visiting India.

2.a) Give the discussion about the regulation of speed at night.

Regulation of speed at night:

- Speed limits at nights are generally lower than during day time.
- This is obviously necessitated by greater risk hazards during night.
- In U.S.A. the Uniform Vehicle Code recommends a speed limit of 55 MPH in rural locations during night time, as against 60 MPH during day time.

2.b) Discuss about the various speed limits in rural and urban areas.

Various speed limits in rural and urban areas:

Speed limits in rural areas:

- The speed limits normally imposed are 80,100,110KMPH.
- The uniform vehicle code recommends a speed limit of 60KMPH
- *In* U.K, certain rural sections of motorways used to have an upper speed limit 70 M.P.H., till recently when the energy crisis forced the Government to reduce this.
- Single carriageway rural roads in U.K. operate on speed limits of 50 M.P.*H.* or 60 M.P.H.

Speed limits in urban areas:

Different categories of road and streets	Speed limits in kmph	
	Group I	Group II
	Light and medium vehicles	Heavy vehicles
Major roads mostly in open and thinly built up areas	50	40
Roads with moderate built up areas	40	30
Congested roads in built up areas	30	20

3.a) What are the various enforcement methods and instruments used for detection of speed violators?

a) Various enforcement methods and instruments used for detection of speed violators

(i) The ultimate benefit of regulatory measures, to the community depends the extent to which these laws are enforced and observed.

(ii) The nature and type of penalties nonobservance also has an effect on the degree of observance of the rules, Enforcement involves considerable deployment of police and administrative personnel and, by its very nature, is costly.

(iii) If the resources are limited, it may he necessary to evaluate the cost of enforcement a developing country like India, where a good proportion of the road users are not educated, enforcement measures should be given a high priority.

- Goals and objectives: The major goals and objectives of traffic enforcement are :
  (i) To achieve safe and efficient movement of traffic and prevent accidents
  (ii) To prevent violations of traffic laws.
  (iii) To take persuasive action to prevent road users from violating traffic laws.
  (iv) To punish those who violate traffic laws.
- Machinery for enforcement
  (i) The machinery for enforcement usually consists of police, courts or traffic deal with minor authorities.
  (ii) In some countries, the police or traffic authorities deal with minor offences and impose penalties directly.
  (iii) The courts are usually called upon to with more serious traffic offences.

3.b) Explain about speed zoning and criteria considered to determine speed zoning

b) Speed zoning and criteria considered to determine them.

Speed zoning :

Regular motorway users will all have experience of restricted speed zones, usually for road works, in which limits are enforced with average speed cameras.

Criteria considered in determining speed zoning:

(a) Space controls

(i) Restrictions on loading and unloading of commercial vehicles.
(ii) Exclusive parking spaces for taxis.
(iii) Reservation of curb space for bus stop.
(iv)Restriction on parking near intersections
(v) Limitations on curb parking and designation of parking places along the curb.

(b) Time Controls

(i)Peak hour parking prohibitions

(ii) Parking control by fees.

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4) Explain the various aspects which are indicated in regulation of vehicles

The regulation of vehicles broadly covers the aspects below

(i) Vehicle registration
(ii) Construction and equipment of vehicles.
(iii) Size, weight and loads of vehicles
(iv) Lighting of vehicles.
(v) Inspection of vehicles.
(vi) Control of transport vehicles.
(vii) Insurance.

- *Vehicle Registration:*
  Registration is a basic requirement and the data accumulated provides guidance to administrators, planners, traffic police, economists and traffic Engineers on total number of vehicles in use, their different types and use taxation, name of the owner and license plate number registered in different States bear different license plate numbers, and the identity of the State can be established by the alphabets preceding the number.
- *Construction and equipment of vehicles:*
  It is essential that the motor vehicles be constructed and equipped in such a manner as to promote safe and efficient traffic. For this purpose, the regulations usually cover the following aspect:
  (i) The width, height, length and overhang of vehicles and trailers
  (ii) The diameter, width and condition of tires of vehicles and trailers
  (iii) Seating arrangements in public service vehicles and the protection of passengers against weather.
  (iv) The use of safety glass
  (v) Signaling appliances, lamps and reflectors
  (vi) Speed governors
  (vii) Noise caused by the vehicles
  (viii)The use of trailers with motor vehicles
- *Insurance:*
  Most of the countries have laws requiring the vehicles to be insured against third party risks. The insurance is intended to cover liability in respect of death or injury to persons or damage to any property of a third party arising out of the use of the vehicle. In India, the Motor Vehicles Act contains suitable provisions in this respect.
- *Control of Transport Vehicles:*
  The State Governments have an empowered to frame rules to govern the use of commercial transport vehicles. These rules are intended to grant permit for the plying of goods vehicles on specified routes and regions, having due regard to
  (i) The advantages offered by the development of road transport;
  (ii) The desirability of co-coordinating road and rail transport;
  (iii) The desirability of preventing the deterioration of the road system; and
  (iv) The desirability of preventing uneconomic competition among motor vehicles.

5) Develop your answers for the following elements in view of regulation concerning the driver.

i) Licensing of the driver

ii) Requirements of physical fitness

iii) Disqualification and endorsement of licenses

Regulations Concerning the Driver

Regulations concerning the driver cover the following aspects

(i) Licensing of the driver
(ii) Requirements of physical fitness
(iii) Age of drivers
(iv) Disqualification and endorsement of licenses

- Licensing of the Driver:

Driving of a motor vehicle without the driver having a valid driving license is on offence. The driving license legally confers upon the driver the privilege to drive the vehicle. The license is usually granted after the driver passes a test of competence.

- Physical Fitness

The following diseases and disabilities are deemed to absolutely disqualify a person from obtaining a license

(i) Epilepsy
(ii) Inadequate perception
(iii) Night blindness.
(iv) Deafness preventing the hearing of ordinary sound signals.
(v) Inability readily to distinguish red and green colors.

- Age of Drivers:

In India, the minimum age to drive a motor vehicle is 18 years and the minimum age to drive a transport vehicle is 20 years.

- Disqualification and endorsement of License

Habitual drinking and dangerous driving render a driver to be disqualified 1 from holding a driving license. In India, the Regional Transport Authority and I the courts have the power to disqualify. Similarly, such authorities have powers to endorse upon the driving license and particulars of the disqualification.

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6) Explain about the various rules adopted in concern to traffic for cyclist and pedestrians

- **Cycles:** The following rules promote safety of cycle traffic.

  Wear a helmet

  Though it seems like the kind of rule your mum would set for you during school, riding your bike without a helmet is not strictly against the rules, but doing so is frankly reckless and stupid.

  Signal

  You are required to signal as if you are a car when cycling – use your arms to indicate which way you are turning and do so with enough time that the car behind you slows down.

  Ride on the left

  When you use cycling means you must drive on the left-hand side of the road, pass right and ride in the same direction as traffic. You will be fined if you are found to be cycling up the wrong way of a one-way street; you are going to get a hefty fine.

No phones or earphones

As is the practice with driving – and walking on busy streets – keep off your phone. It is a recipe for disaster when there are so many people around you at all times. It is also important to cycle without listening to anything with earphones, as it means you have your wits about you and your senses are focused on your surroundings.

Use night-lights

Though your goal won't always be to cycle at night, given how early the sun goes down during the winter months, this is not always avoidable.

Do not carry passengers

Unless the bike is specifically designed for it, you should not have more than one person on it at a time. This is one of the rules on the finable-list.

No drunk driving

Cycling drunk is completely against the rules of cycling. Though there is no technical limit, and your driver's license is not affected by the offence.

- **Rules for Pedestrian Traffic**

The following are some of the simple safety rules which the pedestrians should observe:

- ✓ Prepare a safe walking route in advance
- ✓ Use sidewalks if they are available
- ✓ Walk facing the traffic if a sidewalk isn't available
- ✓ Obey all signs and signals
- ✓ Only cross streets at designated areas
- ✓ Stay on well-lit paths at night
- ✓ Wear bright colors during the day and reflective tape at night
- ✓ Watch for cars that are turning or backing up
- ✓ Avoid drugs and alcohol if you plan to go walking
- ✓ Do not assume other drivers see you or will stop when they should. Walk defensively.

7.a) What are the various ill-effects of parking in detail.

- *Congestion*

  One of the serious ill-effects of parking is the loss of street space and the attendant traffic congestion. The capacity of the streets is reduced, the journey speed drops down and the journey time and delay increase. The operational cost of vehicles is thereby increased, causing serious economic loss to the community.

- *Accidents*

  The maneuvers associated with parking and un parking are known to cause road accidents. Care less opening of the doors of parked vehicles. Moving out of a parked position and bringing a car to the parking location from the mainstream of traffic are some of the common causes of parking accidents.

- *Obstruction to fire-fighting operations*

  Parked cars obstruct the movement of fire-fighting vehicles and greatly Obstruct their operations. They block access to hydrants and access to buildings.

- *Environment*

  Parked vehicles degrade the environment of the town centre. Stopping and starting of vehicles result in noise and fumes. Cars parked into every little available space reduce the visual aesthetics

and “buildings seem to rise from a plinth of cars"

7.b) Briefly explain about zoning and parking space requirement of IRC standards

- While on-street parking and its regulation will be an important aspect of the overall parking policy of a town.
- For future development of land-use and building activity adequately takes care of parking needs is to promulgate(publicize) zoning ordinances whereby all new or remodeled buildings will be required to have within their cartilage a prescribed parking space.
- The advantages of zoning and land-use controls for safe and efficient traffic have been well recognized.

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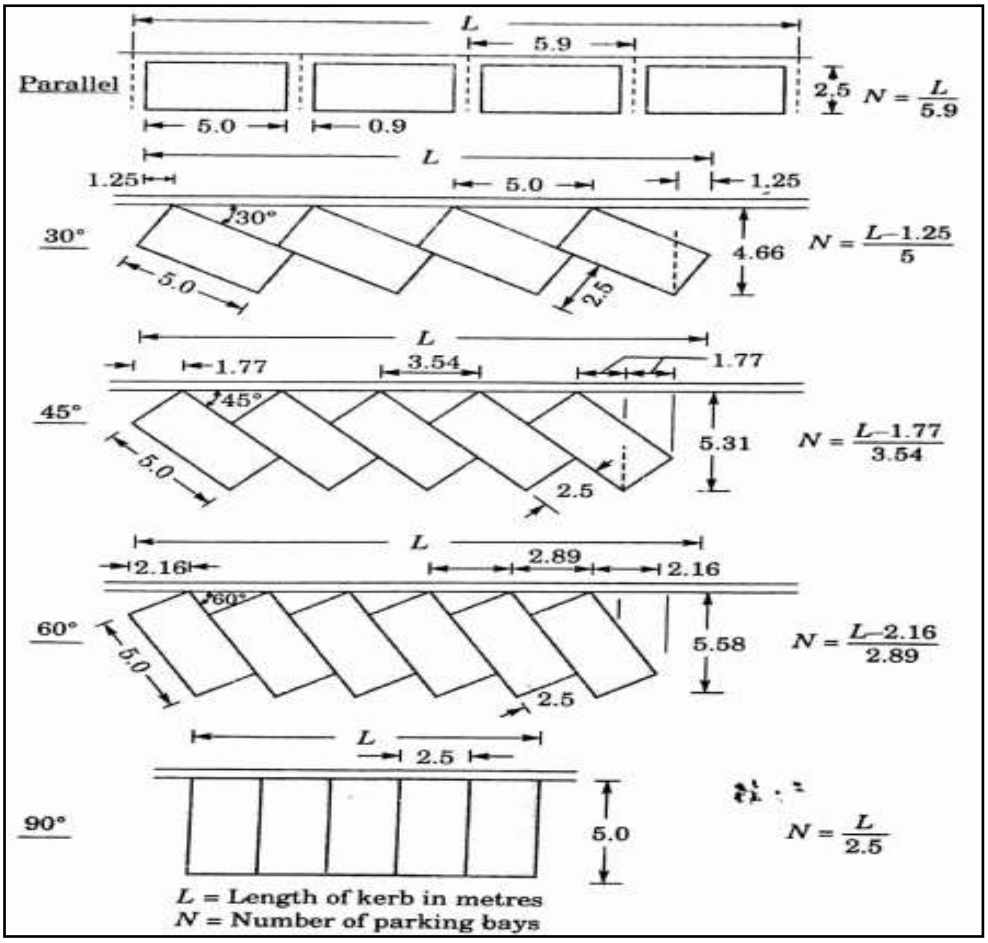
8) Identify various common methods in design of on-street parking with sketches.

Common methods of on-street parking are listed below:

(i) Parallel parking (ii) 30° angle parking (iii) 45° angle parking

(iv) 60° angle parking (v) Right angle parking.

Layouts and dimensions for on-street parking stalls



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9) Briefly explain the various traffic regulatory measures that should be considered for On-street Parking.

- Prohibited parking
  (i) Near intersections.
  (ii) Narrow streets
  (iii) Pedestrian crossings.
  (iv) Structures.
  Structures such as bridges, tunnels and underpasses generally have a roadways width less than the highway and for this reason it is desirable to prohibit parking on them.
  (v) Entrance driveways.
  Vehicles should be prohibited from parking in front of entrance driveways leading to houses and buildings.
- Free parking for limited period :
  Under the scheme, free parking is allowed in designated stalls for a limited period. The enforcement is done by traffic police or wardens. The conditions which favors the adoption of this scheme are the availability of sufficient parking spaces.
- Parking meters:
  Under the parking meter scheme a controlled zone is established within which, during specified days and hours, parking may only take place at a metered parking bay.

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10) Give a brief discussion about different types of Off-street parking facilities.

- The types of off-street facilities commonly considered are
  (i) Surface car parks
  (ii) Multi-storey car parks
  (iii) Roof parks
  (iv) Mechanical car parks
  (v) Underground car parks.
- Surface car parks:
  Surface car parks, properly located and developed on a piece of vacant land or surrounding an office complex or super market, are very popular with the motorists.
- Multi-storey car parks:
  Surface parks consume too much of the precious land in the city. One of the alternatives when land is mostly is to provide multi-storey car parks; such facilities have become common and popular in many cities.
- Roof parks:
  A very popular method of solving the parking problems adopted in many cities is to park the vehicles on roof tops. Access ramps or-mechanical lifts provide the necessary access to the roofs.
- Mechanical car parks
  Mechanical car parks provide for lifting of the cars from floor to floor by means of a lift and transfer of cars to and from the parking stall by means of wheeling.
- Underground car parks
  The great advantage of underground car parks is the least intrusion they cause to the aesthetics of a place. These parks can be built in the basement of any multi storied building or below **open spaces.**

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SOLVED QUESTION BANK (DESCRIPTIVE)

UNIT –III

ROAD MARKINGS

1. What are the functions of road markings & List out all 14 various types of road markings?

Road markings are used as a means of controlling and guiding traffic. They are highly important on roads and intersections as they promote road safety and bring about smooth and harmonious flow of traffic along guided paths of travel they also serve to supplement the messages conveyed by road signals and signs. In some cases, they are used alone to convey certain regulation, information or warning that cannot otherwise be effectively made known to the road users.

Despite certain limitations inherent in them, such as obliteration by snow, poor visibility when wet and the need for frequent renewals when painted on surfaces exposed to traffic, road markings have a useful role to play in traffic engineering. One advantage with road markings is that they convey the required information to the driver without distracting his attention from the carriageway.

Types of Road Markings

Road markings are basically of two types: carriageway markings and object markings. As the name implies, the former type of markings are those that are applied to the carriageway itself.

The latter type covers markings on objects such as abutment, piers, kerbs, traffic islands, culvert headwalls, etc.

Carriageway markings are of the following categories :

1. Centre line.
2. Traffic lane lines.
3. No-overtaking zone markings.
4. Pavement edge lines.
5. Carriageway width reduction transition markings.
6. Obstruction approach markings.
7. Stop lines
8. Pedestrian crossings.
9. Cyclist crossings.
10. Route direction arrows etc.
11. Word messages.
12. Markings at approaches to intersections.
13. Parking space limits.
14. Bus stops

2. a) Explain briefly about commonly used Materials and Colours in road markings.

The material commonly used for pavement, curb and object markings is paint. Ordinary paints for road markings are covered by Indian Standards IS : 164–1981 (First Revision Reaffirmed in 1986) (Ref. 7). Those paints do not have a good degree of brightness and hence fail to catch instantaneously the drivers eyes. They also have short life. The better alternative is hot applied thermoplastic paints, which are now-a-days specified for roads (Ref. 8). Improved night visibility is obtained by the use of minute glass beads incorporated in the markings to produce a "retro-reflective" surface.

Other materials that may also be used include pre-fabricated sheet materials, glue-down plastic stripes, metal and plastic inserts, and road studs.

The commonly used colours for road markings are white and yellow. The useage of these colours in India is summarized in Table

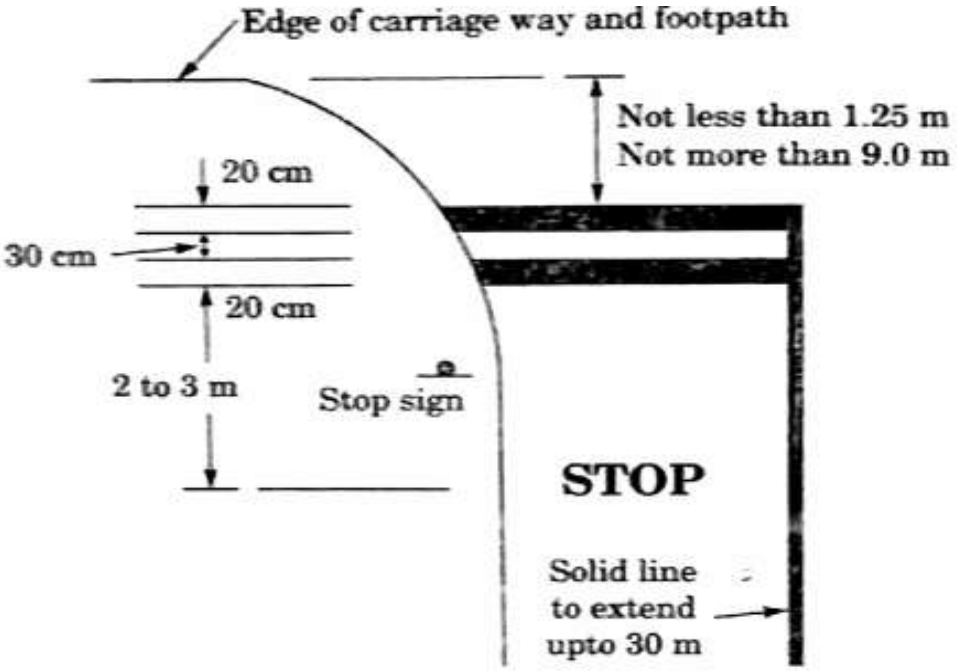
colour	Uses
White	All carriageway markings except those

	intended for parking restrictions
Yellow	(i) Markings intended for parking restrictions. (ii) Continuous centre and barrier line markings.
Alternate bands of white and black.	Kerb and object markings.

b). Briefly explain about stop lines with neat sketch.

Stop lines are solid white lines provided transversely to the carriageway and used to indicate the point behind which vehicles are required to stop in compliance with a STOP sign, traffic signal or traffic police. The width of the stop line as per current Indian Practice (Ref. 4) is :

Urban and sub-urban roads : 20 cm. Rural roads : 30 cm.



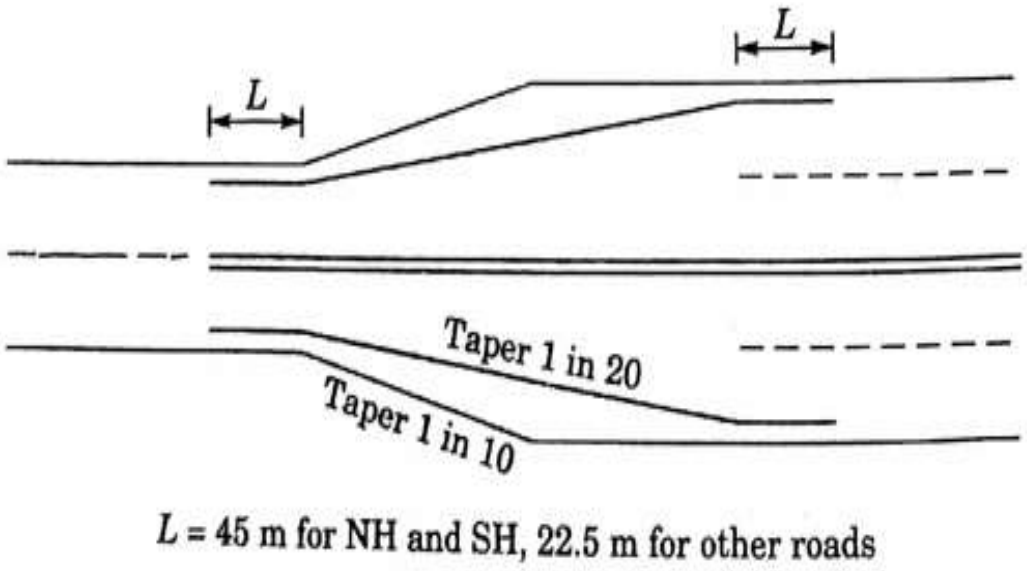
Stop lines are ordinarily located not less than 2 m and not more than 3 m in advance and parallel to the nearest boundary of the pedestrian crossing marking. Where there is no pedestrian crossing, the stop line is placed not less than 1.25 m and not more than 9 m from the nearest carriageway edge of the intersecting road.

Fig. below gives details of a stop line

3. Explain briefly about the following terms with neat sketches:

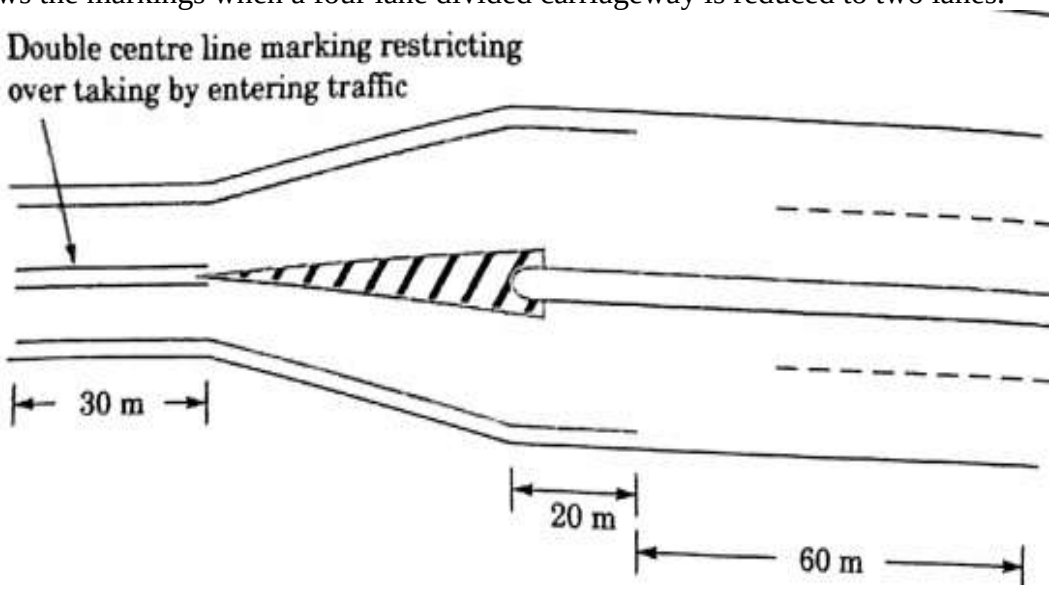
a) Carriageway width reduction transition markings.

Reduction in the carriageway width is made known by a combination of carriageway markings and road signs. A typical design for carriageway marking showing reduction from 4 lanes to 2 lanes as per current Indian practice (Ref. 4) is given in Fig. below



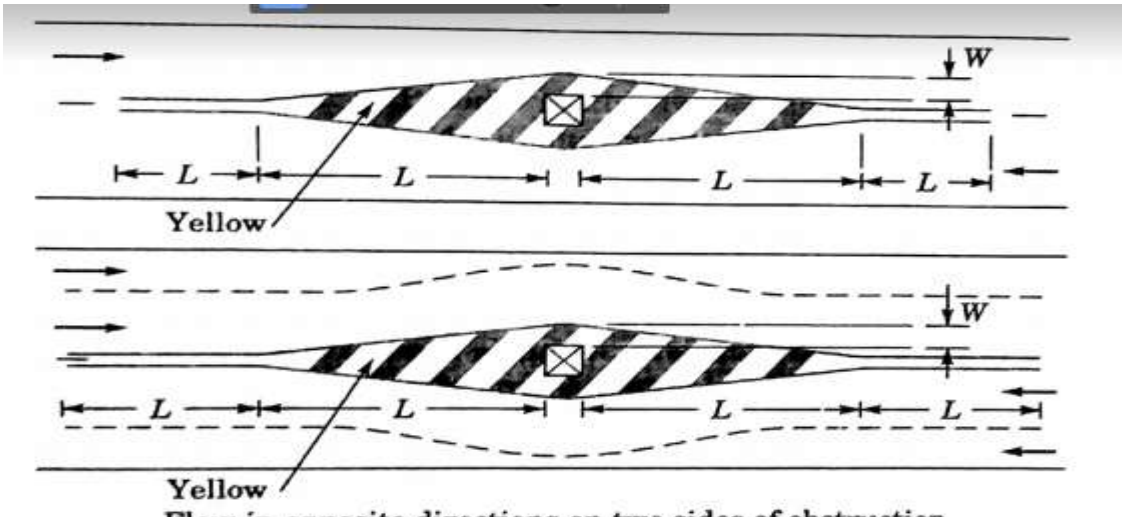
L = 45 m for NH and SH, 22.5 m for other roads

Fig. below shows the markings when a four lane divided carriageway is reduced to two lanes.

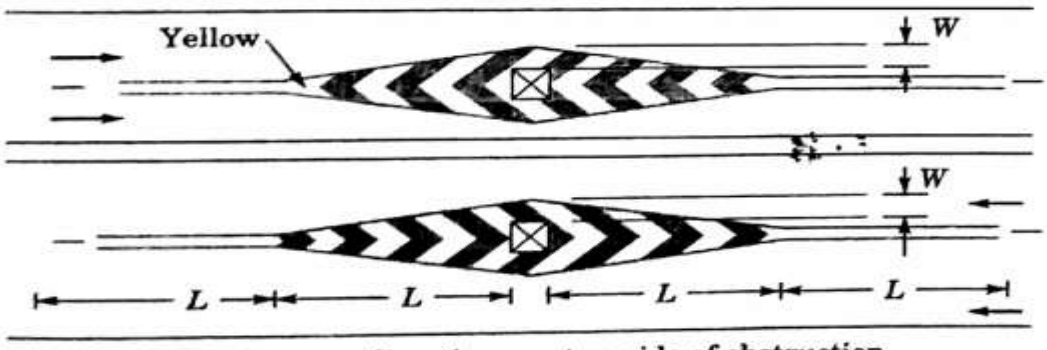


b) Obstruction approach markings.

Obstruction approach markings are necessary to guide traffic on the approach to fixed obstructions within the carriageway. The markings must be designed to guide the traffic away from the obstruction. Typical markings for median strip approach and approach to an obstruction on a four lane road as per current Indian practice are given in Fig.

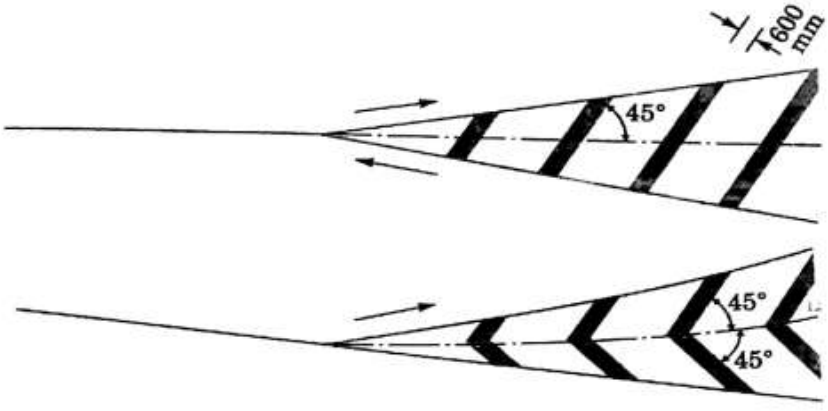


Flow in opposite directions on two sides of obstruction



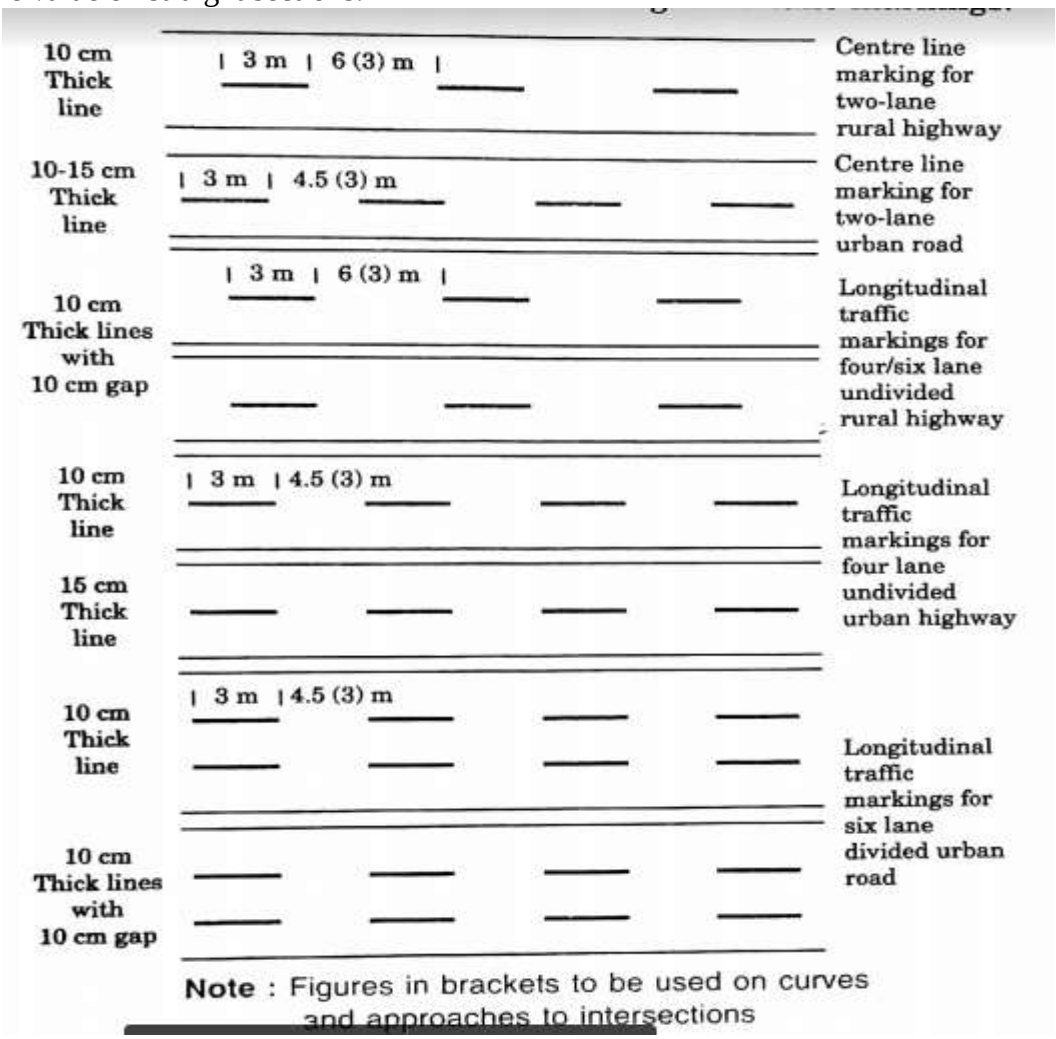
Flow in same directions on two side of obstruction

For speeds more than 60, L = 0.63 x S x W
For speeds 60 or less, L = W S^2 /150
S = 85th percentile speed in kmph
W = Offset distance in *M*
Minimum length of L = 30 m in urban areas
L = 60 m in rural areas Typical diagonal and chevron markings as per British Practice near channelizing islands are given in Fig.



4a) Explain the concept of centre lines with neat sketch.
A centre line marking is provided to demarcate the centre of a *c*arriageway and to separate traffic in opposite directions.
The pattern of centre line markings depends upon whether the road is in an urban section or rural section. On rural sections, the segments and gaps are double in length than for an urban location.

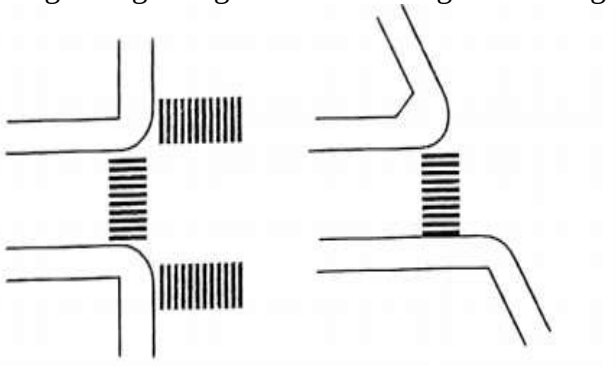
The length of gap is shorter near approaches to intersection and on curves than on straight reaches. The gap is half the value on straight sections.



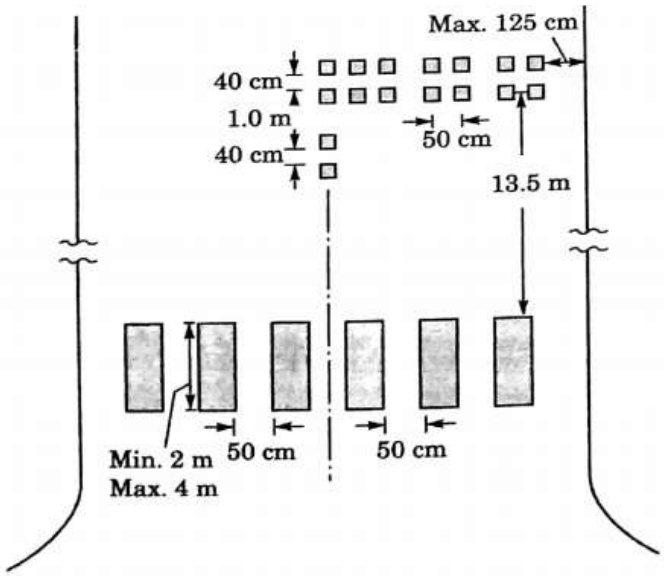
b) What is meant by pedestrian crossings and explain with neat sketch

Pedestrian crossings are very important for pedestrian safety as they guide and pedestrian in the proper paths. They are marked at all intersections where there substantial conflict between vehicle and pedestrian movements in addition they may also be provided at non-intersectional locations, where there is Concentrated pedestrian movement. The location of the pedestrian crossings should be selected properly to ensure adequate visibility, sufficient space on the footway for the pedestrian to wait and freedom from obstructions. As per current Indian requirements (Ref. 4) the minimum width of pedestrian crossing should be 2 m and the maximum width should be 4 m. At mid-block locations, it may be advantageous to install flashing signal in combination with pedestrian crossing markings.

The location of pedestrian crossings at right-angled and acute angled crossings is indicated in Fig,



The current Indian design for pedestrian crossings at a non signalized intersection is given in Fig.



5. Develop your answer about the following elements in view of road markings

i) Pavement edge lines

Pavement edge lines are used to indicate the edges of carriageways which have no kerbs. They serve as a visual guidance for the drivers, indicating to them the limits upto which the driver can safely venture. They especially are useful during adverse weather and poor visibility. Where the paved shoulder is of a lesser structural strength than the main pavement, the edge lines are used to promote travel on the main pavement itself. Edge lines are in the form of a single continuous line placed about 15 cm from the edge. The width of the line is 15–20 cm.

ii) Traffic lane lines

The division of the carriageway into separate lanes for traffic travelling in the same direction on either side of the centre-line or median strip helps to promote travel in proper lanes and curb the meandering tendency of the drivers, thus promoting safety and ensuring maximum capacity.

Traffic lane lines are broken lines which permit lane changing with caution.

iii) No overtaking zone markings

No overtaking zone markings are provided on summit curves, horizontal curves and elsewhere in two and three lane highways where overtaking and passing manoeuvres must be prohibited because of non-availability of safe overtaking sight distances or other hazardous conditions.

The marking for a "n*o* overtaking" zone consists of a combination of line with centre line. The combination line consists of a double line the left hand element of which shall be a solid barrier line. The right hand element will be either a normal broken centre line or solid barrier line governing the traffic from the opposite direction. Where a solid barrier line is to the right of the broken line the, overtaking restriction shall apply only to the opposing traffic. If both the lines are solid lines, no overtaking is permitted in both the directions marking the use of marking is illustrated in Fig.