R.C.Patel College Of Engineering & Polytechnic, Shirpur

Department of Civil Engineering

Course Title- Highway Engineering **Course Code -** 313323

Programme Name -Civil Engineering **Semester-**Third

Unit	Title	COs	Learning hours	R Level	U Level	A Level	Total Marks
III	Traffic Engineering	CO4	06	02	04	04	10

Unit 4. Traffic Engineering

4.1 Traffic volume study (TVS):

Definition → Traffic volume study (TVS) is the process of counting and analyzing the number of vehicles passing through a road, intersection, or highway during a specific period of time.

In simple words,
It is a study used to know how much traffic is using a road.

Purpose of Traffic volume Study (TVS)

1) To know traffic flow
- Determines the number of vehicles using a road.

2) For road planning and design.
- Helps engineers decide the width and number of lanes required.

3) To reduce traffic congestion
- Identifies busy roads and peak traffic hours.

4) For traffic control.
- Helps in planning traffic signals, signs and road markings.

5) For future road development.
- Estimates future traffic growth and road improvement needs.

6) To improve road safety.
- Helps identify accident-prone and overcrowded locations.

Methods of Traffic volume study →

1) Manual Counting Method:
- People stand at the survey location and count vehicles.
- vehicles are classified as cars, buses, trucks, motorcycles etc.
- Counting is recorded on survey sheets.

Example, In table formate.

Sr No	Vehicles Category/ Directions	Left turning		straight going		Right turning		Grand total
		Enumeration	Total	Enumeration	Total	Enumeration	Total	
1.	Cars, jeep, Van 3 wheelers							
2	Buses							
4.	Scooters & motorcycle							
5	Bicycles							

2) Automatic Counting Method.

Electronic devices are installed on the road to count vehicles automatically.

Types of Automatic Counters.

a) Pneumatic Tube Counters:
- A rubber tube is placed across the road.
- When a vehicle passes over it, the device records the count.

b) Inductive loop detector.
- A wire loop is embedded in the pavement.
- detects vehicles through changes in magnetic fields.

c) video camera method.
- cameras record traffic movement.
- software counts and classifies vehicles.

Advantages:

1) More accurate
2) Can collect data for long periods.

Disadvantages:

1) Higher installation cost.
2) Requires equipment maintenance.

Types of Traffic volume Counts →

1) Classified traffic volume count:
- Counts different types of vehicle separately.

2) Turning movement count:
- Records vehicles turning left, Right, or moving straight at intersections

3) Continuous Count
- Traffic is counted continuously for several days or months.

4) Short-Term Count.
- Traffic is counted for a few hours or a day.

4.2 Passenger Car Unit (PCU)

Definition → Passenger Car Unit (PCU) is a unit used to convert different types of vehicles into an equivalent number of passenger cars.

Since, roads carry different vehicles such as cars, buses, trucks, motorcycles and auto-rickwas, PCU helps express all traffic in terms of passenger cars for easy analysis.

Factors Affecting PCU →

1. Vehicle Size:
- Larger vehicles occupy more road space.
- Therefore, buses and trucks have higher PCU values than cars.

2. Vehicle Speed:
- Slow-moving vehicles obstruct traffic more than fast moving vehicles.
- Lower speed generally increases PCU value.

3. Traffic composition:
- The proportion of different vehicle types affects PCU.

- mixed traffic conditions can change PCU values.

4) Road Width :

- Wider roads allow easier overtaking and smoother movement.
- Therefore, PCU values may increases on wider roads.

5) Traffic volume :

- During heavy traffic, vehicle interaction increases.
- This may change the PCU value of vehicle different.

6) Road surface condition.

- Poor road conditions reduce vehicle speed and increase interference.
- Hence, PCU value may increase.

7) Terrain and Gradient

- on hilly roads, heavy vehicles move slowly and affect traffic more.
- Therefore, their PCU valuer become higher.

Suggested PCU value for urban roads →

Sr No.	Vehicles class	PCU values of vehicle classes at		
		Urban roads mid block section	Signalized intersection	Kerb parking (parallel & angle)
1	Car	1.0	1.0	1.0
2	Bus & truck	2.2	2.8	3.4
3	Auto rickshaw	0.5	0.4	0.4
4	Two wheeler automobile	0.4	0.3	0.2
5	Pedal cycle	0.7	0.4	0.1
6	Bullock cart	4.6	3.2	1.2
7	Hand cart	4.6	3.2	0.3

Traffic density

Traffic density is the number of vehicles present on a road section at a particular time.

$$\text{Density} = \frac{\text{Number of vehicles}}{\text{Length of Road}} \quad \text{veh/km}.$$

Traffic capacity

- Traffic capacity is the ability of a roadway to accommodate traffic volume.
- Traffic capacity is the maximum number of vehicles that can pass a point on a road or lane in one hour under given conditions.

unit = vehicles per hour.

Basic capacity

The maximum number of vehicles that can pass a point on a lane in one hour under ideal conditions.

Ideal conditions: 1) straight and level road
2) Good weather
3) No intersections.
4) Skilled drivers.

Possible capacity

The maximum number of vehicles that can pass under existing road and traffic conditions, regardless of driver comfort.

characteristics:
- Vehicles move very close together.
- Little freedom for overtaking.
- High risk of congestion.

Practical capacity

The maximum number of vehicles that can pass safely and comfortably without causing excessive delays.

Characteristics: - comfortable driving conditions.
- Reasonable speed maintained.
- Most commonly used for road design.

Speed Studies

Speed study is the measurement of vehicle speeds on a road to understand traffic behaviour and road performance.

objectives → 1) Determine average speed.
2) To use in accident studies.
3) To decide the speed trends.
4) To use in planning traffic control and in traffic regulations.

Types of Speed studies.

1) Spot speed study:
- Measures vehicle speed at a specific location.

Uses → - speed limit determination.
- Accident Analysis.
- Traffic control.

2) Speed and delay study:
The speed and delay studies give the running speed, overall speed, fluctuations in speeds and the delay between two stations of a road spaced far apart.

There are various methods of coring out speed and delay study.
i) Floating car or riding check method.
ii) License plate or vehicle number method.
iii) Interview technique
iv) Elevated observations
v) Photographic technique.

4.3 Traffic control devices

Traffic control devices are tools used on roads to guide, warn, and control road users. They help in maintaining safety, reducing accidents, and ensuring smooth traffic flow.

Requirements of traffic control devices:

i) Attention
ii) Meaning
iii) Time for response and respect of road users.

Types of traffic control devices:

a) Signs
b) Signals
c) Marking
d) Island

Road Signs

i) Regulatory signs
ii) Warning Signs
iii) Informatory signs

i) Regulatory Signs

These signs tell road users what they must or must not do.

Types of Regulatory Signs

i) Stop and Give-way signs.
ii) Prohibitory signs
iii) No parking and No Stopping signs
iv) Speed limit and vehicle control signs.
v) Restriction End Sign.
vi) Compulsory direction control and other signs.

2. Warning Signs

Warning signs are traffic signs that alert road users about possible dangers or unusal conditions ahead on the road. They help drivers reduce speed and drive carefully.

Characteristics

i) usually triangular in shape
ii) Have a red border with a white or yellow background.
iii) Display a black symbol indicating the hazard.

The Warning signs are to be located at sufficient distance in advance of the hazard warned against, this distances are 120, 90, 60 & 40 m resply. on National/ state highway, MDR, ODR & VR on urban roads this distance is 50 m.

3. Informatory Signs

- Informatory signs are traffic signs that provide useful information and guidance to road users. They help drivers find facilities, services, & directions during their journey.

Characteristics

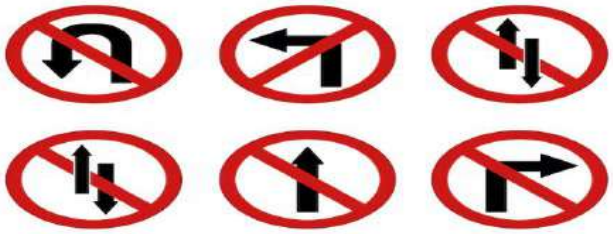
i) Usually rectangular or square in shape.
ii) Mostly blue, green, or white in color.
iii) Easy to read and understand.

- Direction and place identification signs
- facility information signs.
- other useful information signs.
- Parking signs.
- Flood Gauge.

1. REGULATORY SIGNS :

i) Stop and Give way signs

ii) Prohibitory signs



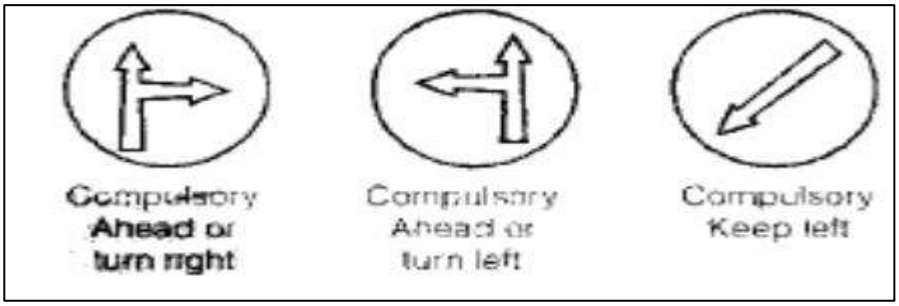
iii) No parking and No stopping signs

iv) Speed limit signs

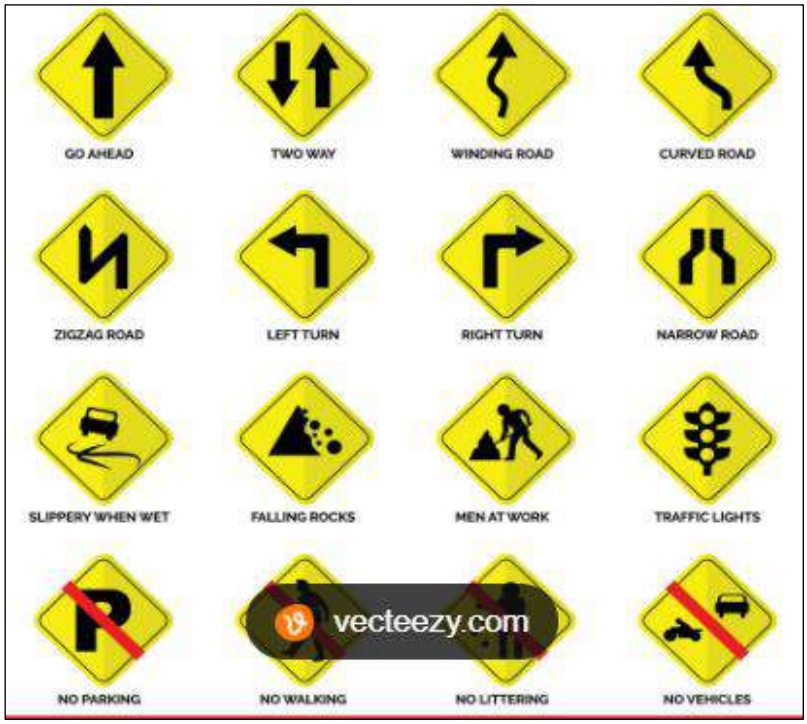
Speed Limits for vans:

Type of Van	Built-up Area*	Single Carriageway	Dual Carriageway	Motorway
Van	30	50	60	70
Car-derived Van	30	60	70	70
Van & Trailer	30	50	60	60

v) Compulsory direction control Signs



2. WARNING SIGNS :



1. INFORMATORY SIGNS :

Road Marking :

Road marking refers to lines, symbols, words and other markings painted or placed on a road surface to regulate, warn or guide traffic.

Types of Marking

The various types of markings may be classified as,

a) Pavement Markings
b) Kerb markings
c) object Markings
d) Reflector unit markings
e) Road delineators.

a) Pavement markings :

- Pavement or carriage way markings may generally be of white paint.
- Yellow colour markings are used to indicate parking restrictions and for continuous centre line and barrier line markings.

Some of the common types of pavement markings given below

i) Centre lines
ii) Lane line
iii) No passing zone markings.
iv) Turn Markings
v) Stop lines
vi) Cross walk lines
vii) Approach to obstructions
viii) Parking space limit
ix) Border of carriageway edges of road which have no kerb.
x) Route direction arrow.
xi) Parking space limit on roads.
xii) Bust stops.

b) Kerb markings:

- Kerb marking is the marking painted on the edge of a road to indicate parking restrictions and provide guidance to road users.
- colours are in Red, white and black colour.

c) Object marking:

Object marking is a marking provided on objects located on or near the roadway to make them clearly visible to drivers and help prevent accidents.

d) Reflector unit marking

Reflector unit markings are reflective devices placed along roads, medians, barriers and curves to improve visibility at night or during poor weather conditions.

e) Road Delineators:

Road delineators are reflective devices installed along the edges, curves, bridges & highways to guide drivers and show the correct path of the road, especially at night or during poor visibility.

Traffic signals:

Traffic signals are devices used to control the movement of vehicles, cyclists, and pedestrians at intersections and crossings.

Types of Traffic signals.

1) Traffic control signals:

Traffic control signals having 3 coloured light which having different specification or role.

- Red light means stop
- Green light mean Go
- Yellow light mean clearance time for the vehicles which enter the intersection area by the end of green time, to clear off.

a) Fixed time signal

- Fixed time signals are set to repeat regularly a cycle of red, yellow & green lights.
- It is simplest type of automatic traffic signals which are electrically operated.

b) Traffic actuated signals

Traffic actuated signals are those in which the timings of the phase and cycle are changed according to traffic demand.

c) Manually operated signal

The earlier practice hasbeen to control the traffic by means of traffic police by showing stop signs alternately at the cross roads so that one of the traffic streams may be allowed to move while the cross traffic is stopped.

Traffic Island

A Traffic island is a raised or marked area on a road that helps control and guide the movement of vehicles and pedestri-ans. It separates different traffic streams and improve road safety.

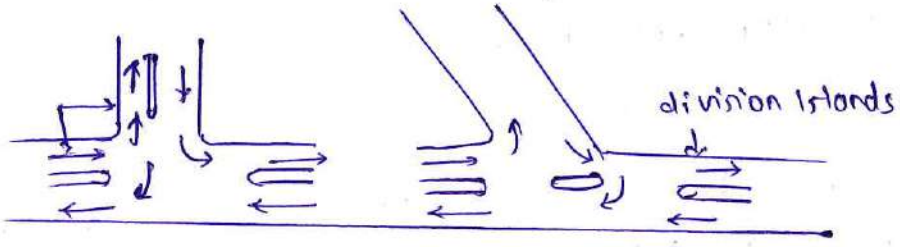
functions

1) Guides vehicles in the correct direction.
2) separates traffic moving a different directions.
3) Reduces the chances of accidents.
4) Provides a safe waiting area for pedestrians crossing the road.
5) Helps in smooth traffic flow at intersections and roundabouts.

Types of traffic Islands

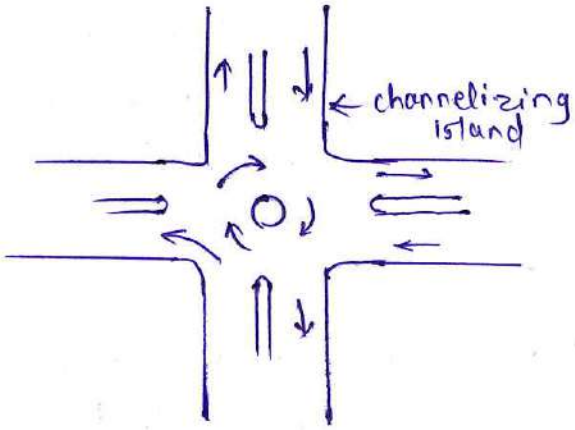
i) Division Island.

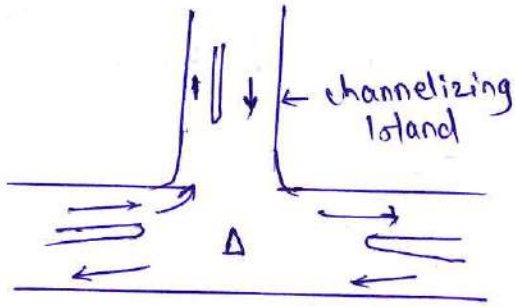
- separates traffic moving in opposite directions
- commonly found on highways and wide roads.



ii) channelizing Islands

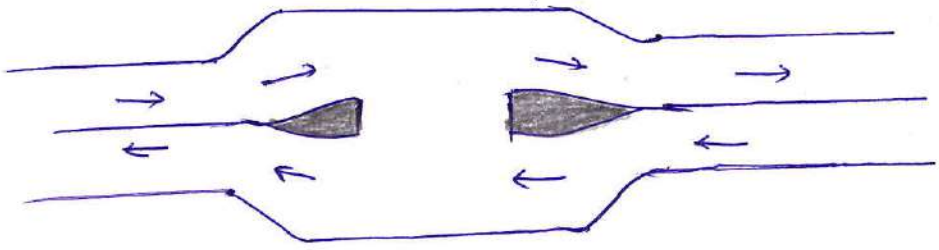
- Directs vehicles into proper lanes at interrections.
- Reduces confusion among drivers.





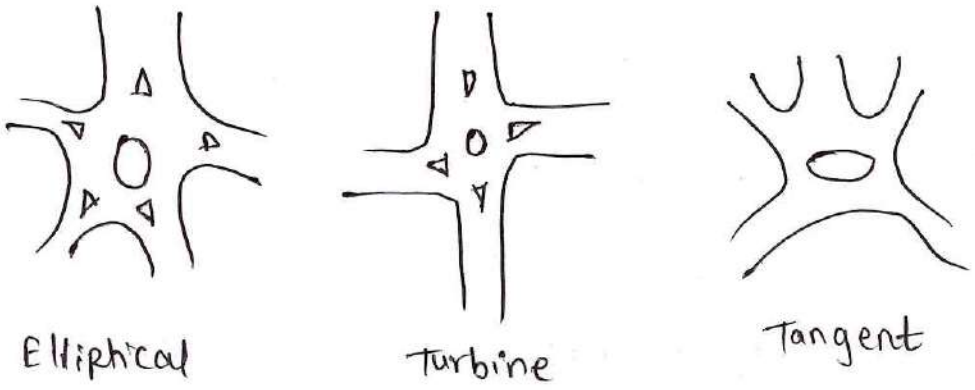
iii) Pedestrian loading Islands

- Provides a safe place for pedestrians to stand while crossing a wide road.
- Usually located in the center of the road.



iv) Rotary Island

- located at the center of a roundabout.
- forces vehicles to move around it in one direction.



Elliptical Turbine Tangent

4.4 Road Intersections:

Defination

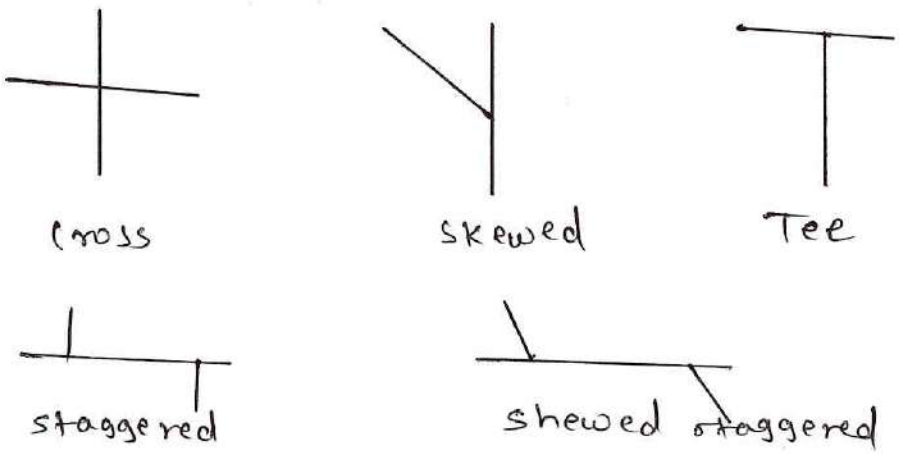
An interchange is a road junction where two or more roads cross at different levels using bridges or flyovers. It allows vehicles to move without stopping, reducing traffic congestion and accidents.

Type of Intersections

I) Intersection at grade.
II) Grade separated intersection.

I) Intersection of grade

An at grade intersection is an intersection where all roads meet at the same time.



Cross Skewed Tee

Staggered Shewed staggered

1) Vehicles cross each other on the same road level.
2) Traffic is controlled by signs, signals or traffic police.

Example → T intersection, Y-intersection.

Advantages → - Low construction cost.
- Easy to build and maintain.

II) Grade separated Intersection

A grade separated intersection is an intersection where roads cross at different levels using bridges, flyovers, or underpasses.

1) Vehicles moves without crossing each other at the same level.
2) Provides continuous traffic flow.
3) Suitable for highways and busy roads.

Ex. Cloverleaf Interchange
- Diamond Interchange
- Trumpet Interchange
- Flyovers and Underpass.

Advantages → - Reduces accidents.
- Minimizes traffic delays.
- Increases road capacity.

Disadvantages → - High construction cost
- Requires more land and planning.

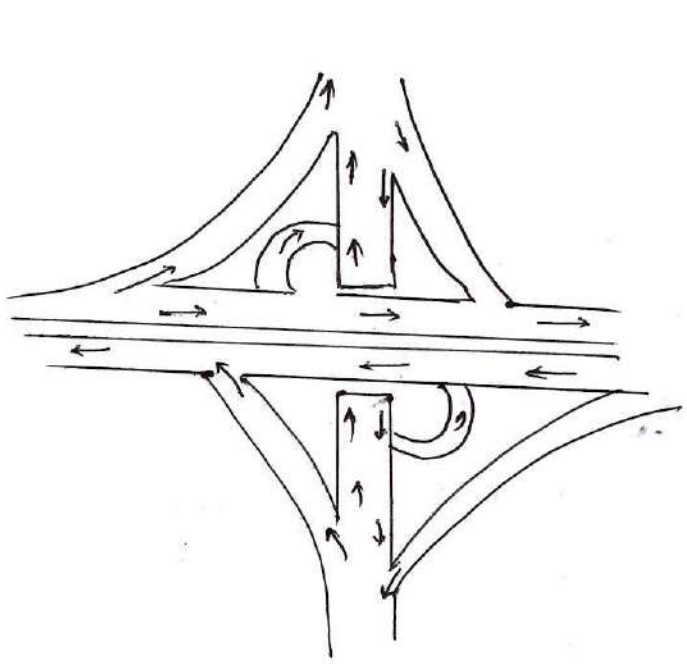
1. Cover leaf Interchange

A coverleaf interchange is a road junction with four loop shaped ramps that resemble the leaves of a clover.

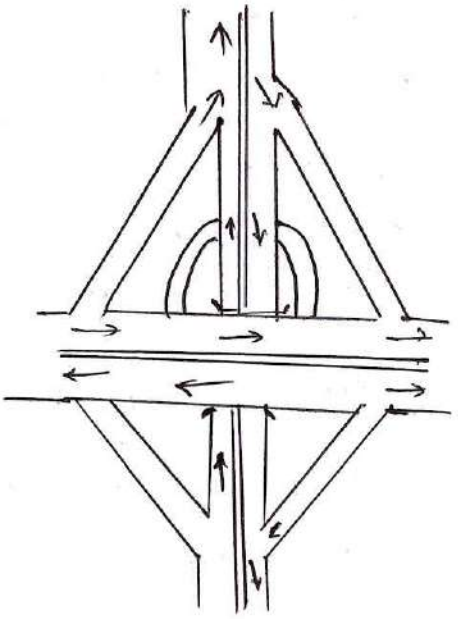
Features → 1) Allows vehicles to turn in all directions without traffic signals.

2) Uses loop ramps for right turns.

3) Commonly used where two highways intersect.



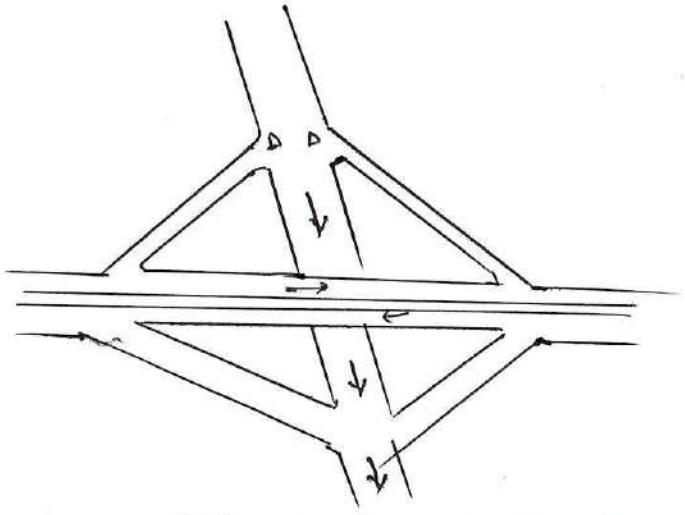
a) Partial clover leaf



b) Full Cloverleaf

2) Diamond Interchange

It is formed when a highway crosses another road, with four simple ramps connecting the roads.



Diamond Interchange

1) Diamond shaped arrangement of ramps.

2) Suitable for highways crossing local roads.

3) Requires less land than a cloverleaf interchange.

4) Economical to construct.

3) Trumpet Interchange

A trumpet interchange is used where one road ends and joins another road. Its shape looks similar to a musical trumpet.

1) Contains one loop ramp.
2) Commonly used at the end of expressways or highways.
3) Allows smooth merging of traffic

Accident studies →

The problem of accident is very acute in highway transportation due to complex flow patterns of vehicular traffic prerence of mixed traffic & pedestrians.

Causes of Accidents →

four basic elements in a traffic accidents:

i) Road users: a) Drivers
b) Pedestrians
c) Passengers

ii) Vehicles: a) Vehicle defects

iii) Road & its condition: a) Road condition
b) Road design

iv) Environmental factors - traffic, weather etc.
a) weather
b) Animals

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