

TRAFFIC ENGINEERING

Open Elective

PRESENTED BY
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SYLLABUS - MODULE 3

Module -3:

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.

CO-PO AND CO-PSO MAPPING

Course Outcomes		Blooms Level	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the human factors and vehicular factors in traffic engineering design.	L2, L3	1	2	2	1	-	-	1	-	-	-	-	-	1	-	-	-	-
CO2	Conduct different types of traffic surveys and analysis of collected data using statistical concepts.	L2, L3	2	2	1	-	-	-	1	1	-	-	-	-	1	-	-	-	-
CO3	Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.	L4	3, 4	2	2	1	-	-	1	-	-	-	-	-	1	-	-	-	-
CO4	Understand the basic knowledge of Intelligent Transportation System.	L2, L3	4, 5	2	2	1	-	-	1	1	-	-	-	-	1	-	-	-	-

Intersections

An intersection (junction) is an at-grade junction where two or more highway converge, diverge, meet or cross.

Principles to be considered for good road design

- **Number of intersection should be kept minimum**
- **Layout should be such that hazardous movements of drivers can be eliminated**
- **Good visibility**
- **Number of conflict points should be minimized**
- **Adequate waiting space should be available for vehicles at junctions**

Levels of intersection control

- **Passive control** : there is no explicit control on the driver.
 - ✓ No control
 - ✓ Traffic signs
 - ✓ Traffic signs plus marking
- **Semi control**: some amount of control on the driver is there from the traffic agency.
 - ✓ Channelization:
 - ✓ Traffic rotaries
- **Active control**: means the movement of the traffic is fully controlled by the traffic agency and the drivers cannot simply maneuver the intersection according to his choice.
 - ✓ Traffic signals
 - ✓ Grade separated intersections

At grade and grade separated Intersections

Classification of Intersections

Depending upon the crossing conflicts the intersections are classified as follows (i) At Grade Intersection and (ii) Grade Separated Intersection.

At Grade Intersections

It is a bridge that eliminates crossing conflicts at intersections by separation of roadways in space. It is at the same level.

Grade separated intersection are otherwise known as Interchanges. Grade separated intersections can be flyovers / underpasses or subways/interchanges.

At grade and grade separated Intersections

Advantages of Grade separated over at grade intersections:

- Grade separated intersections cause less hazard and delay than at grade intersections.
- Route transfer at grade separations is accommodated by smooth interchange facilities consisting of ramps.
- It eliminates all grade crossing conflicts and accommodates other intersecting maneuvers by merging, diverging and weaving at low relative speed.
- When relative speed is low, the average motorist will accept a smaller time gap space between successive vehicles to complete his move. This condition increases roadway capacity.

VMS road signs

- Variable message signs (VMS) is an electronic traffic sign often used on roadways to give travellers information about special events.
- The information comes from a variety of traffic monitoring and surveillance systems.
- It is expected that by providing real-time information on special events on the oncoming road, VMS can improve motorists' route selection, reduce travel time, mitigate the severity and duration of incidents and improve the performance of the transportation network.
- Such signs warn of traffic congestion, accidents, incidents, roadwork zones, or speed limits on a specific highway segment.

VMS road signs

- In urban areas, VMS are used within parking guidance and information systems to guide drivers to available car parking spaces.
- They may also ask vehicles to take alternative routes, limit travel speed, warn of duration and location of the incidents or just inform of the traffic conditions.
- The content of the sign will change, dependent on the situation. One should pay particular attention to these signs and messages.
- In recent years, some newer LED variable message signs have the ability to display colored text and graphics.

VMS road signs



Information regarding speed limit



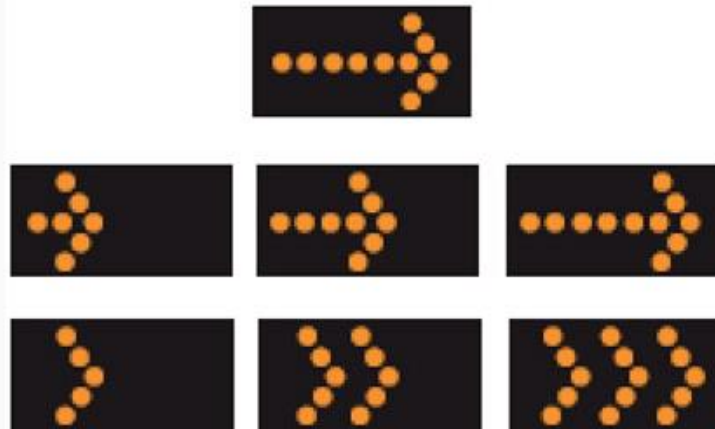
New road layout ahead



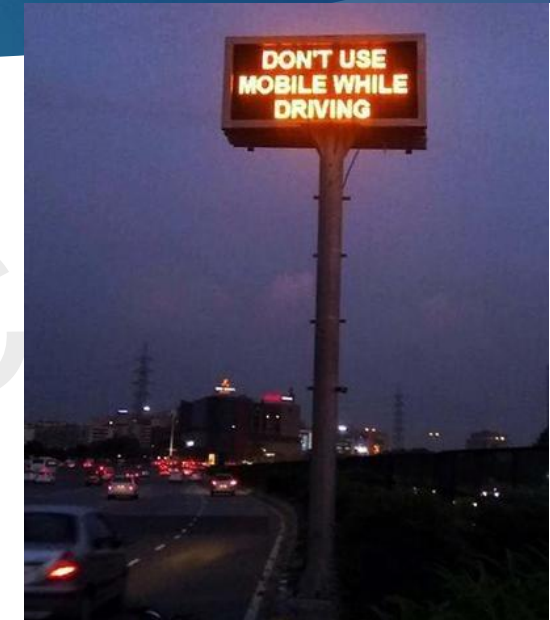
mobile VMS (displaying text message)



mobile VMS (displaying chevrons)



Arrow formats for mobile VMS



Truck-mounted VMS's (also called Portable Changeable Message Signs or PCMS) are sometimes dispatched by highway agencies to warn traffic of incidents such as accidents in areas where permanent VMses aren't available or near enough as a preventive measure for reducing secondary accidents.

At grade intersections



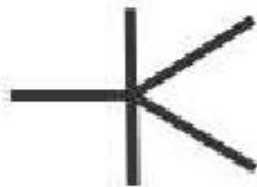
T-Junction



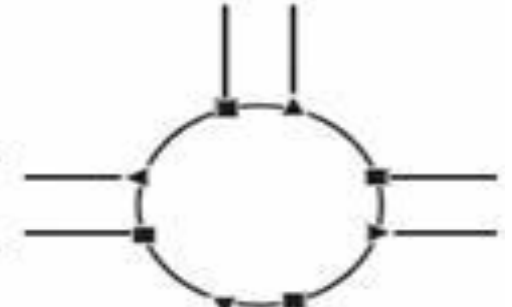
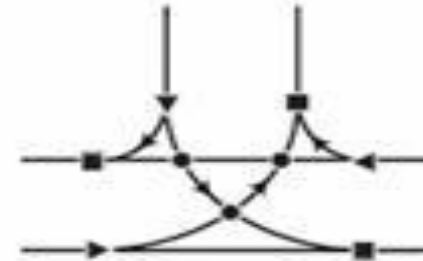
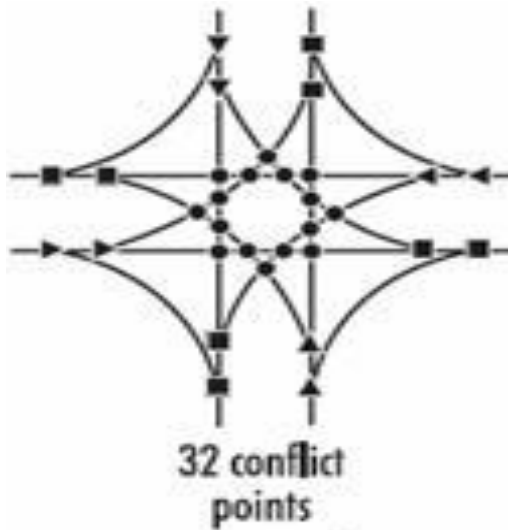
Y-Junction



4 ways
Intersection



Multileg
Intersection



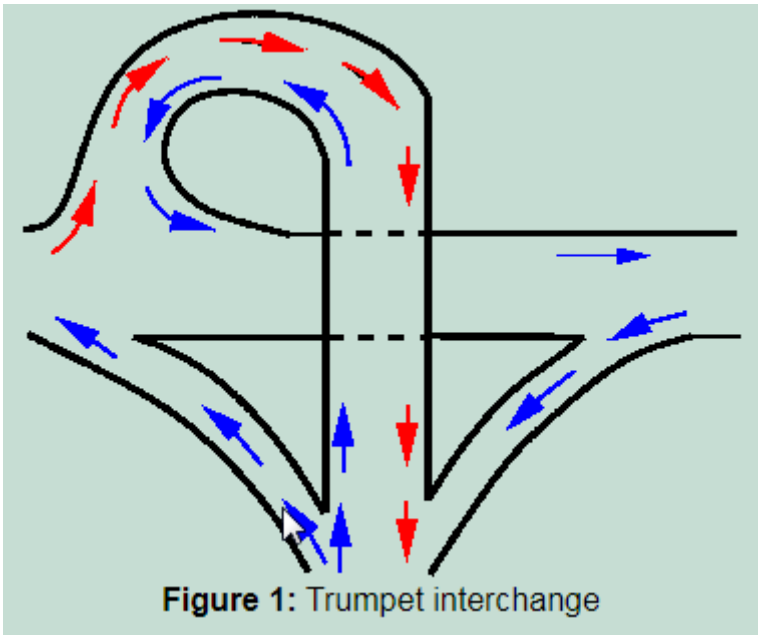
▲ : Diverging ■ : Merging ● : Crossing

Grade separated intersections



Interchanges

Interchange is a system where traffic between two or more roadways flows at different levels in the grade separated junctions.



Trumpet interchange is a three leg interchange. If one of the legs of the interchange meets a highway at some angle but does not cross it, then the interchange is called trumpet interchange.



<https://www.youtube.com/watch?v=a2MPKn3orfM>

<https://www.youtube.com/watch?v=7th7FvbYQ8s>

Interchanges

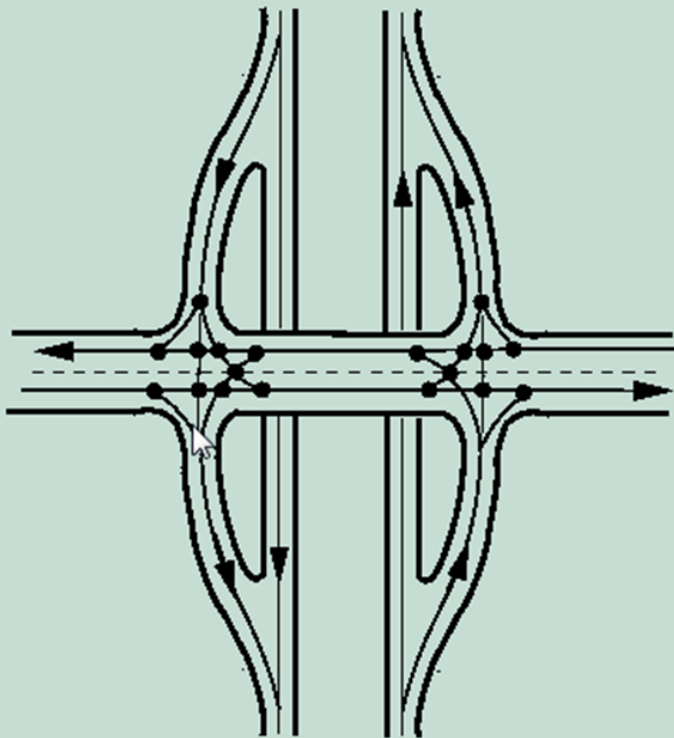


Figure 1: Diamond interchange

Diamond interchange: Diamond interchange is a popular form of four-leg interchange found in the urban locations where major and minor roads crosses.



<https://www.youtube.com/watch?v=TRtprRT2xfg>
<https://www.youtube.com/watch?v=Zd5AatLWvcg>

Interchanges

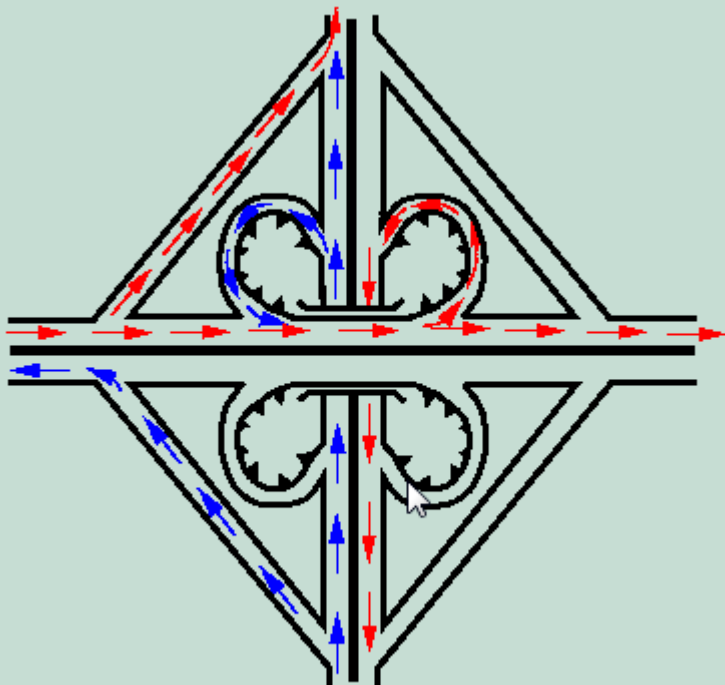


Figure 2: Cloverleaf interchange

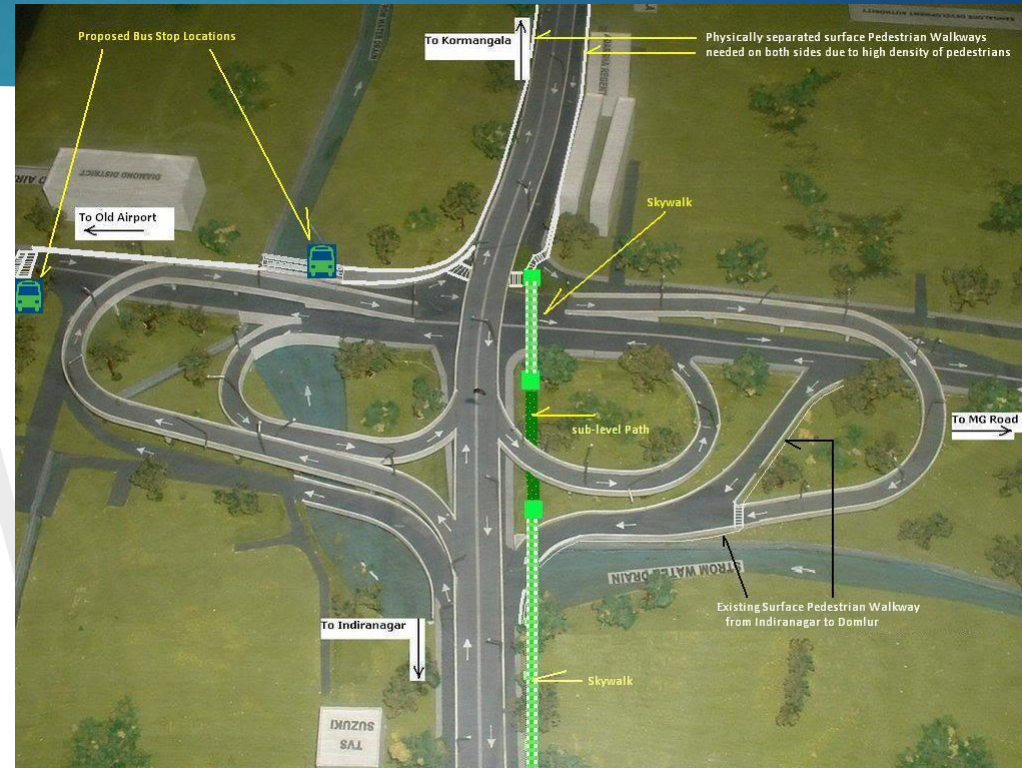
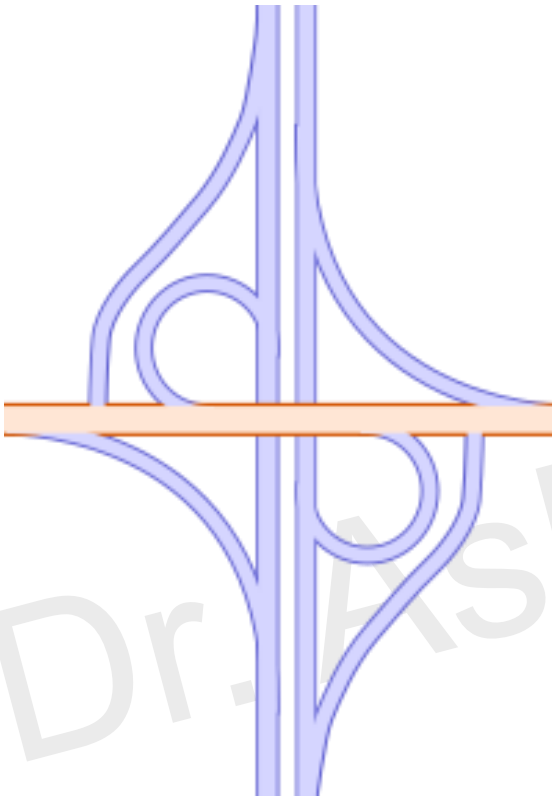
Clover leaf interchange: It is a four leg interchange used when two highways of high volume and speed intersect each other with considerable turning movements. The main advantage of cloverleaf intersection is that it provides complete separation of traffic. In addition, high speed at intersections can be achieved. However, the disadvantage is that large area of land is required. Therefore, cloverleaf interchanges are provided mainly in rural areas.



Chennai Bypass and Indian National Highway 4, Maduravoyal Grade Separator

<https://www.youtube.com/watch?v=OGDeKFdD5xE>

Interchanges

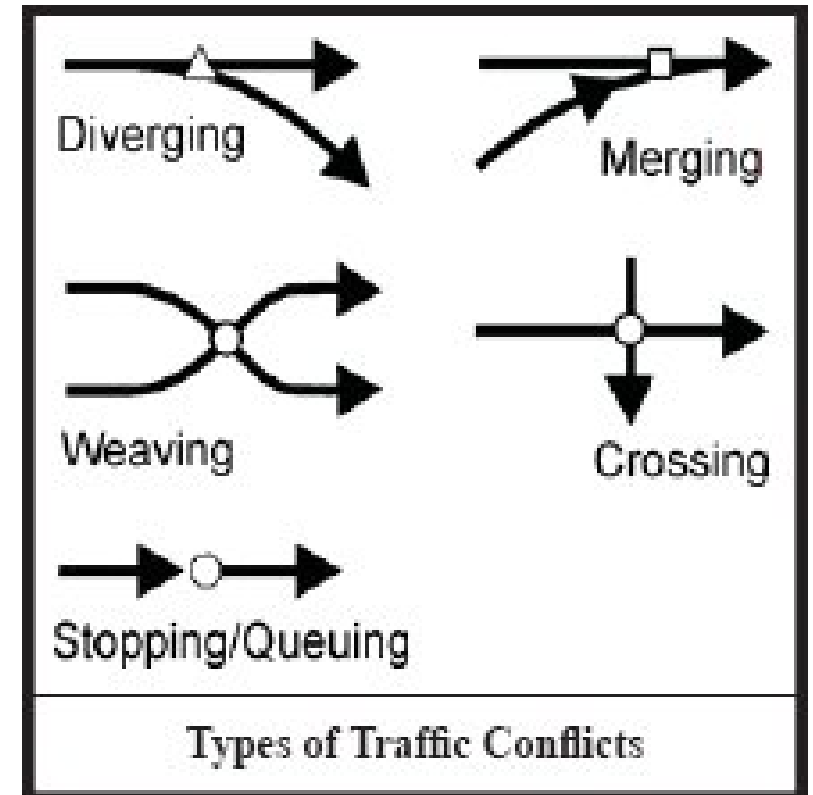


https://www.youtube.com/watch?v=DWANYmw_aGg

Channelization

Channelization - It is the separation or regulation of conflicting traffic movements into definite paths of travel by traffic islands or pavement marking to facilitate the safe and orderly movements of both vehicles and pedestrians.

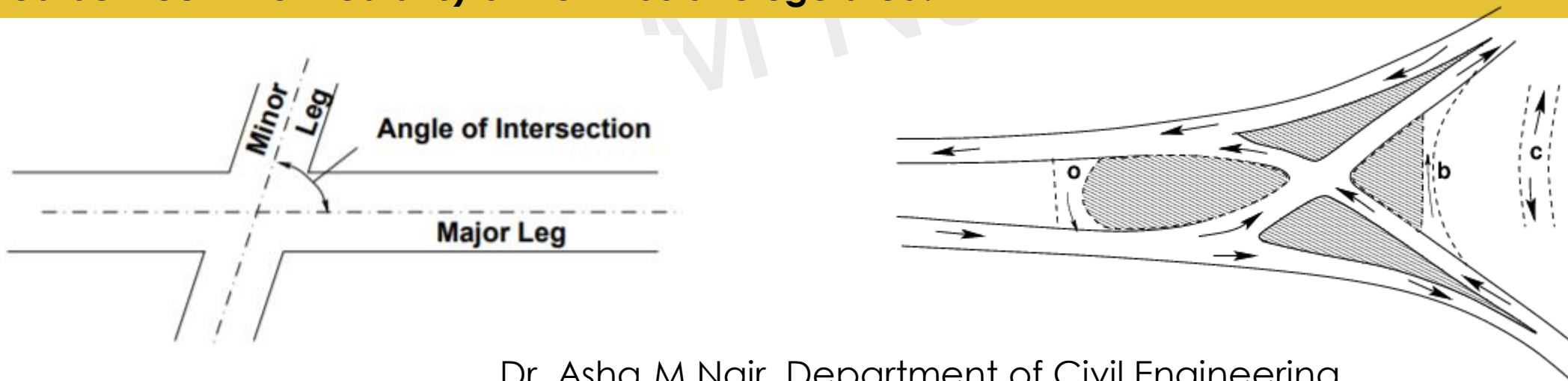
Conflict - It is defined as the demand for the same highway space by two or more users of the highway. Conflicts are classified into mainly three types: (a) Crossing conflicts (b) Diverging conflicts (c) Merging conflicts



Channelization

Angle of Intersection - The angle of intersection is that formed by the centerlines of the intersecting streets. Where the angle of intersection departs significantly (more than approximately 20°) from right angles, the intersection is referred to as a skewed intersection.

Refuge Areas - The area which is used to give refuge to the pedestrians crossing a street (the open area between two medians) is known as a refuge area.



Channelization

Objectives:

- 1. Separation of maneuver areas:** The drivers should be presented with only one decision at a time to reduce confusion and the influence of operations caused due to the overlapping of maneuver areas.
- 2. Reduce excessively large paved areas:** The spread of the paved area can be considerably reduced by the construction of raised islands and medians where these are considered safe and necessary.
- 3. Control of maneuver angle:** The intensity of accidents can be reduced to a large extent by providing small angles for merging, diverging and weaving (at low relative speeds) and approximately right angles for crossing (at high relative speeds). The maneuver angle can be easily controlled by constructing islands of appropriate shapes and sizes.

Channelization

Objectives:

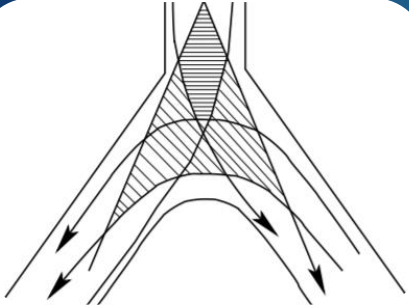
4. **Favor predominant turning movements:** Channelization is also directed for giving preference to turning movements at an intersection where the proportion of such traffic is high.
5. **Control of speed:** Channelization is also used for supporting stop or speed regulations by removing differentials in speed for merging, diverging, weaving and crossing by using the bending and funneling techniques.
6. **Protection and storage of turning and crossing vehicles:** To shadow slow or stopped vehicles from other traffic flows.
7. **Blockage of prohibited movements:** Proper Channelization also helps maintain traffic regulations by making prohibited movements impossible or inconvenient.

Channelization

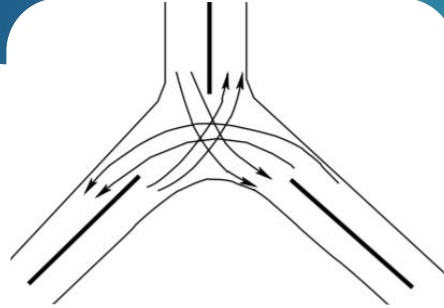
Objectives:

8. **Provide space for traffic control devices:** To provide space for traffic control devices when the ideal location for the same is within the intersection area.
9. **Segregation of non-homogeneous flows:** Channelization provides separate channels for turning and through, fast and slow, and opposite direction traffic.
10. **Protection of pedestrians and reduction of crossing distances between refuges:** Non-traversable and wide medians provide a refuge for pedestrians crossing a street.

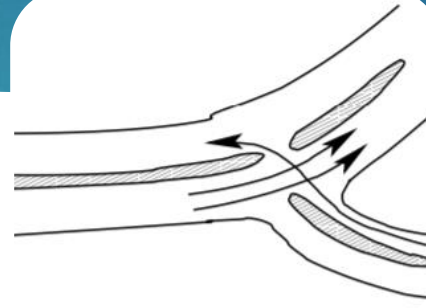
Design principles of a channelized intersection



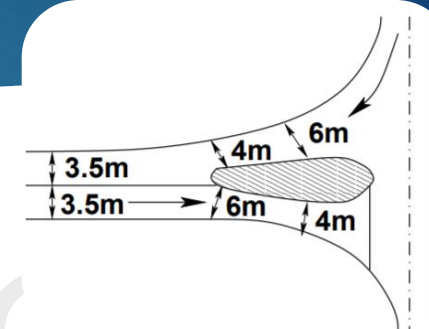
1. Reduction of the Area of Conflict



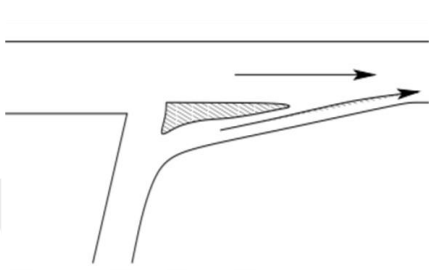
2. Merging traffic streams at small angles



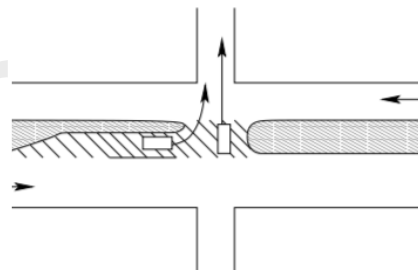
3. Reduction of speed of incoming traffic by bending its path.



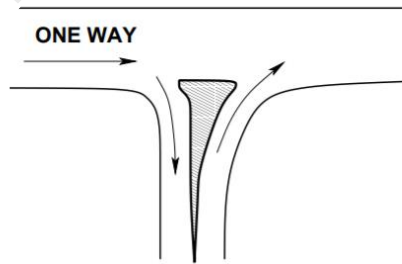
4. Reduction of speed by funneling



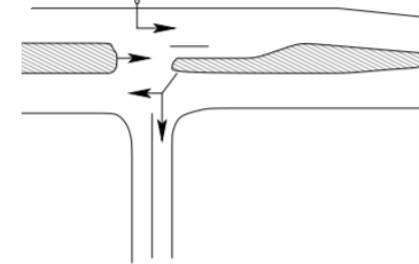
5. Protection for turning vehicles/crossing conflicting streams



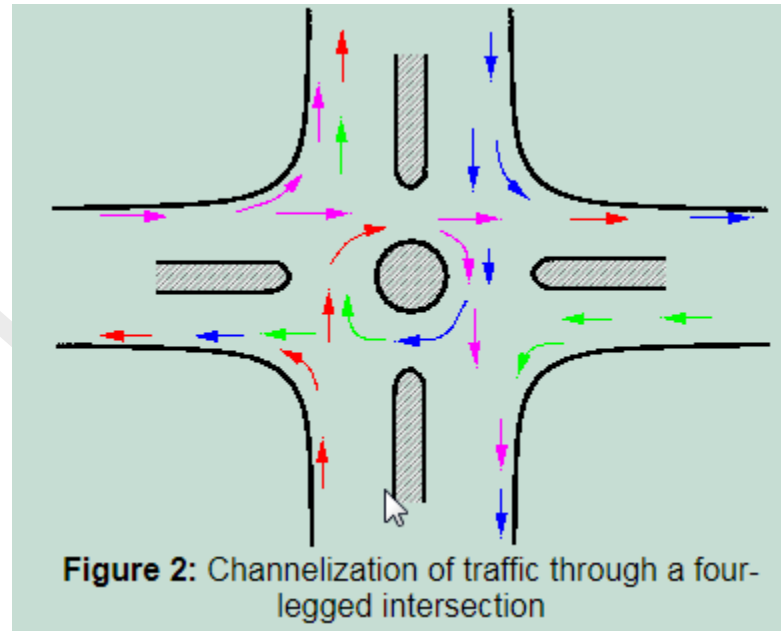
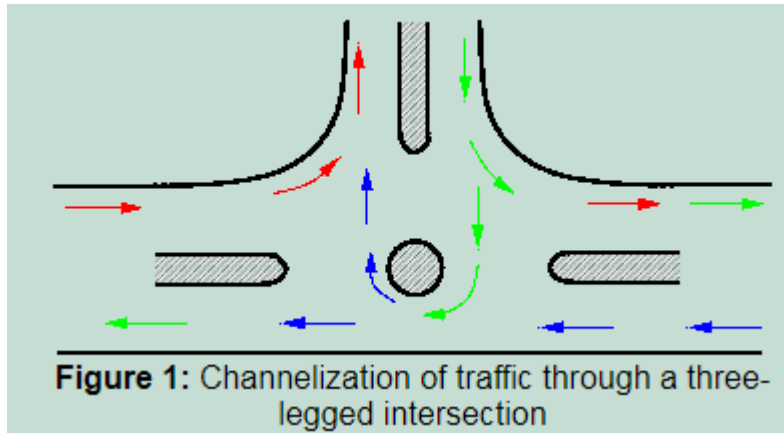
6. Discourage prohibited turns by island placement and shape



7. Providing locations for traffic control devices



Design principles of a channelized intersection



THANK YOU FOR YOUR PATIENCE!!!!

Open for Questions !!!

For any queries and discussions contact me at:

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