Course Code: CE 455
Course Title: Traffic Engineering and Management

Lecture 2: Traffic management concepts

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Outline

- Scope of traffic management measures,
- Restrictions to turning movements,
- One way streets,
- Tidal flow operations,
- Traffic segregation,
- Traffic calming,
- Exclusive bus lanes,
- Introduction to ITS

Scope of traffic management measures

Traffic management is a key branch within logistics. It concerns the planning, control and purchasing of transport services needed to physically move vehicles (for example aircraft, road vehicles, rolling stock and watercraft) and freight.

Traffic management is implemented by people working with different job titles in different branches:

- Within freight and cargo logistics: **traffic manager**, assessment of hazardous and awkward materials, carrier choice and fees, demurrage, documentation, expediting, freight consolidation, insurance, reconsignment and tracking
- Within air traffic management: air traffic controller
- Within rail traffic management: rail traffic controller, train dispatcher or signalman
- Within road traffic management: traffic controller

Traffic Control Management is the design, auditing and implementation of traffic control plans at worksites and civil infrastructure projects. Traffic Management can include: flagging, lane closures, detours, full freeway closures, pedestrian access, traffic plans, and sidewalk closures.[1]

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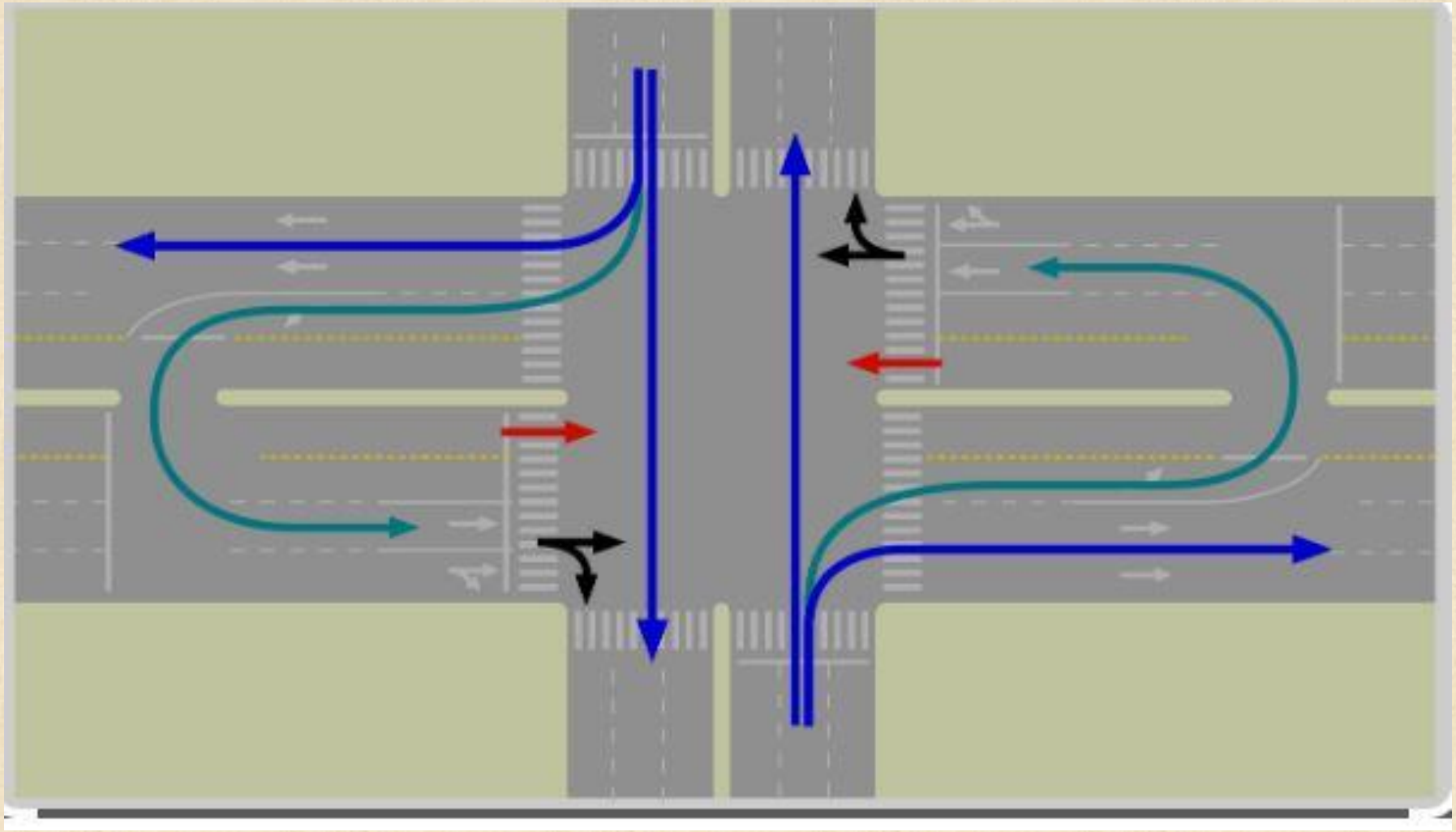
Traffic management objectives (continued)

- Enhanced access
- Better access for particular group of road users
- Pedestrians
- Bicyclists
- Freight vehicles
- Road safety
- These objectives may potentially be in conflict of each other, so priorities may have to be determined.

Restrictions to turning movements

- Right turns consume an especially large amount of space and signal time, while queued left turns are especially problematic for transit operations in the right lane.
- Prohibiting turns where they present issues, and shifting turn volume to the intersections where they can be best accommodated—with signal phases and turn lanes—can improve transit performance, general traffic performance, and walking and bicycling safety at the same time.

Restrictions to turning movements



Restrictions to turning movements

1. Narrowing lanes

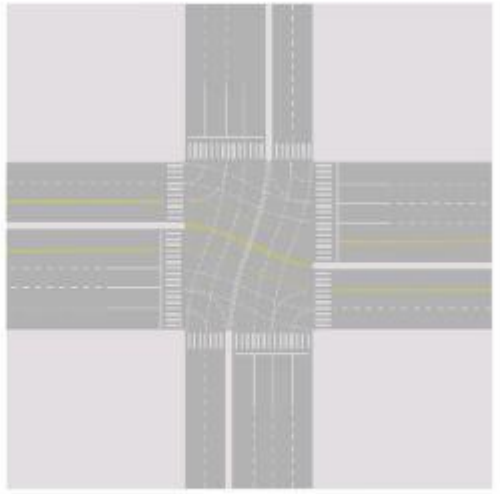


Fig. 24.28 Exchanging width between entrance and exit sections where turning volumes are high enough to allow the change to improve capacity meaningfully. *Elebeta.*

Fig. 24.29 Cape Town, South Africa's standard four-phase intersection with a cross-traffic-turn waiting area using the narrowed width of the opposite way. *Bruce Sutherland.*

Fig. 24.30 Lanes as narrow as 2.4 meters are an effective way to improve intersection capacity, as in this intersection in Montgomery County, Maryland, USA. *Google Earth.*

Restrictions to turning movements

2. Eliminating Intersections

Fig. 24.31 Prior to Quito's Ecovía line, mixed-traffic vehicles were allowed to cross through this intersection as well as negotiate cross-traffic and curbside turns. To give priority to public transport, crossing straight and cross-traffic turn movements have been blocked. *Lloyd Wright.*

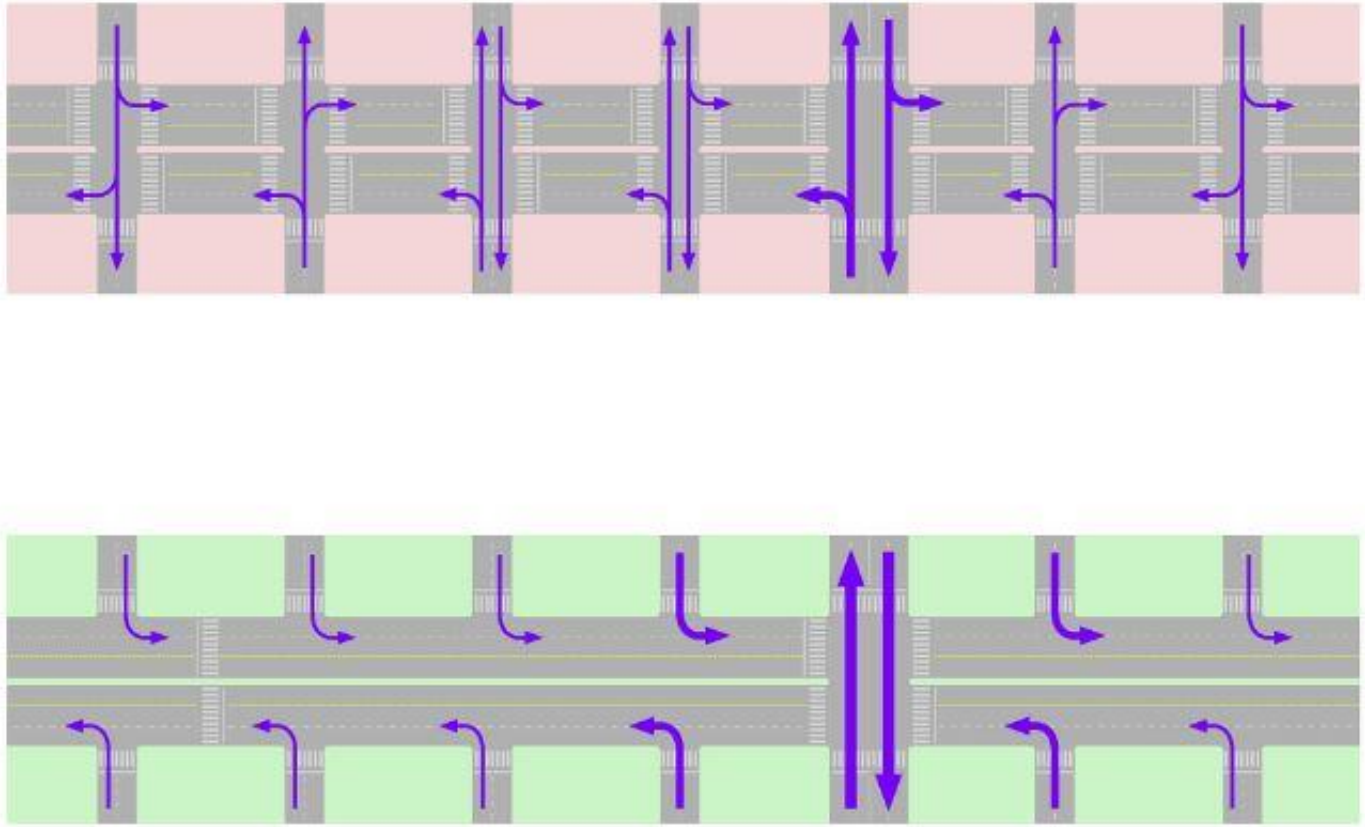


Fig. 24.32 Closing intersections reduces accessibility, and may lead to harder to handle intersections. With no stations, BRT vehicles can benefit from signal coordination. *Elebeta.*

Restrictions to turning movements

3. Shortening and Eliminating Phases

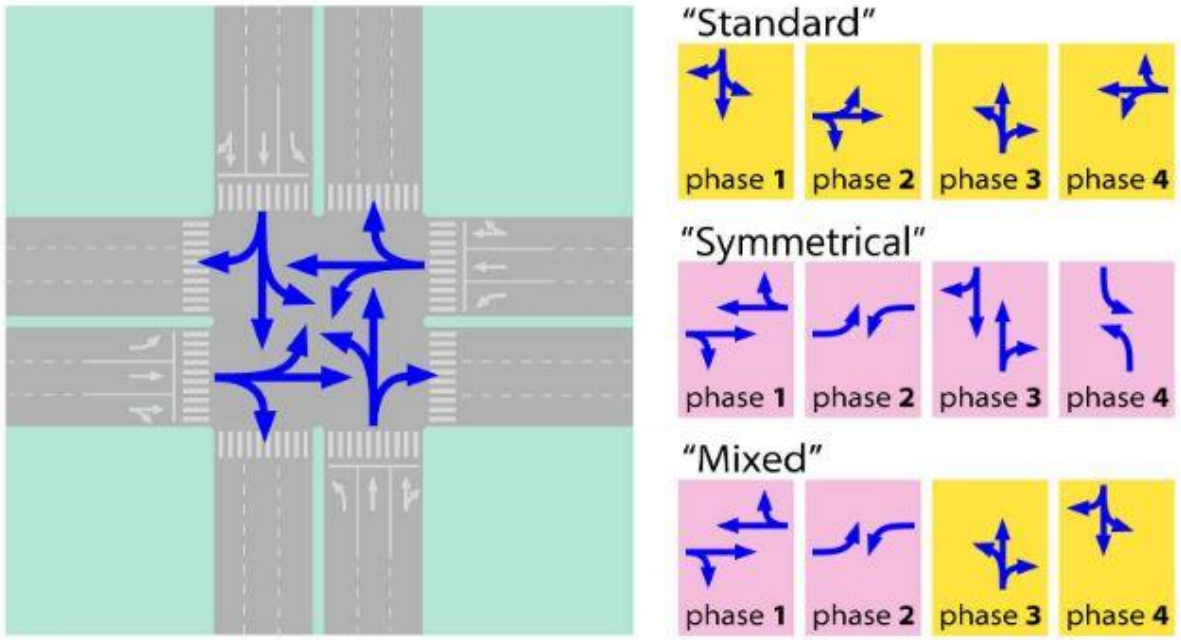
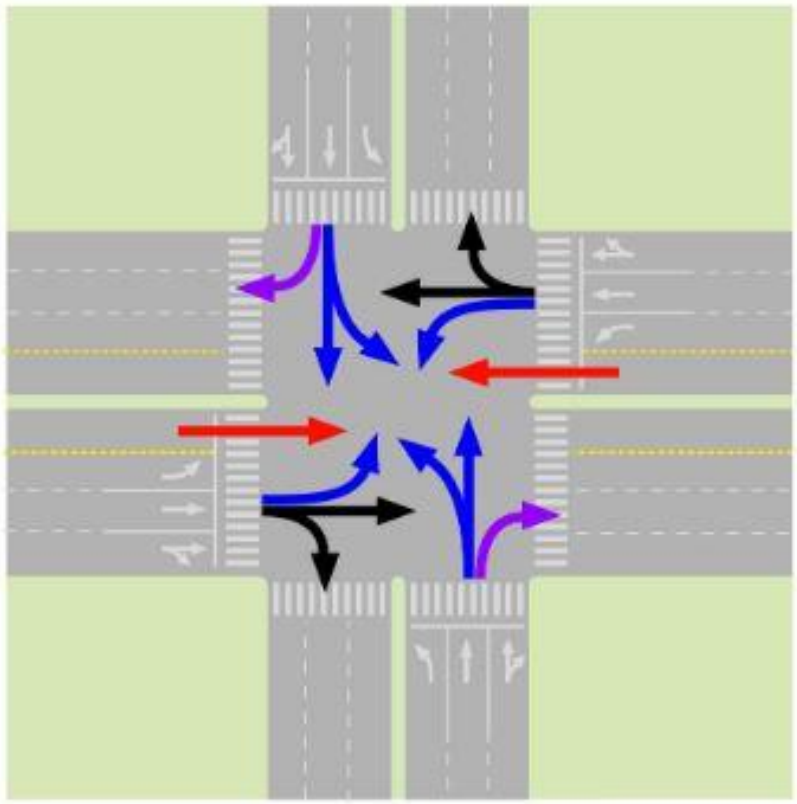


Fig. 24.34 Possible movements and signal phases at a typical four-leg intersection. *ITDP.*

Fig. 24.35 Along Quito's Central Norte corridor, vehicles in mixed traffic are given a phase to perform left turns. Image *Lloyd Wright.*

Restrictions to turning movements

3. Shortening and Eliminating Phases



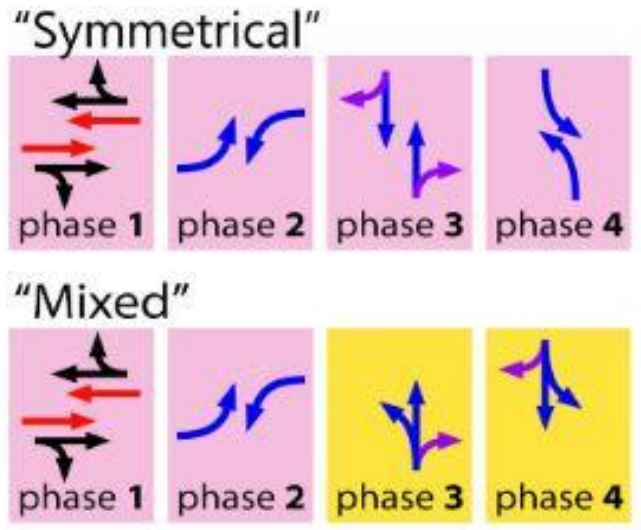


Fig. 24.36 With the insertion of BRT (red) in a four-stage signal, the cross-traffic turn from the same direction needs to have its own phase. *Elebeta*.

Restrictions to turning movements

3. Creating Two-Phase Intersections

Fig. 24.48 Traffic is diverted past this TransOeste station in Rio de Janeiro before it is allowed to perform U-turns away from the station. *Google Earth.*

Fig. 24.49 Dongpu BRT station in Guangzhou (see layout at Figure 24.45) provides at-grade station access at both ends, combined with mixed-traffic U-turns. *Karl Fjellstrom.*

One way streets

- A one way street only allows vehicles to move in one direction down the road.
- ‘No-entry’ signs are used to prevent vehicles travelling the wrong way along the road, and sometimes road junctions are redesigned to make it difficult to turn against the flow of traffic.
- For traffic travelling in the correct direction, arrow signs are used to show it is a one way street

One way streets

One way streets

Advantages

- Can prevent vehicles using the road as a short cut / rat run
- Can create more road space for car and cycle parking
- Can help traffic to move more freely

Effectiveness

If a road is currently a narrow **two way** street where motor vehicles need to slow down to pass each other, changing the road to a **one way** street will increase vehicle speeds. Vehicle drivers may also be tempted to drive faster because they do not expect any oncoming vehicles.

If motor vehicles speeds increase, this will reduce how safe the road is.

One way streets

Disadvantages

- Likely to increase vehicle speeds
- Motor vehicles and emergency vehicles may need to travel greater distance to get to their destination

One way streets

Restrictions

- Only usually used on local residential roads, where an alternative major route is available

Tidal flow operations

One of the familiar characteristics of traffic flow on any street leading to the city centre is the imbalance in directional distribution of traffic during the peak hours. For example, the moving peak results in a heavy flow toward the city centre, whereas the evening peak brings in heavy flow away from the city centre. In either case, the street space provided for the opposing traffic will be found to be in excess. This phenomenon is termed as 'tidal flow'.

One method of dealing with this problem is to allot more than half the lanes for one direction during the peak hours. This system is known as 'tidal flow operations'.

There are two methods for tidal flow operations :

1. To apportion a greater number of lanes in a multilane street to the in bound traffic during the morning peak and similarly a great number of lanes to the out bound traffic during the evening peak.

2. If two separate streets parallel to each other and close to each other are available, the wider street can be set apart heavier traffic both during morning peak and the evening peak. In this case, two streets will operate as one way streets.

Tidal flow operations

Birmingham's A38(M) features Tidal Flow

The A38(M) Aston Expressway in Birmingham is the most famous example, being a single carriageway motorway without physical barrier down the centre of the road for much of its length: instead overhead signals show which lanes are open and closed, with one lane always closed to separate traffic heading in opposite directions.

Traffic segregation

Traffic segregation

Where transport is used in a workplace, it is important that vehicles and pedestrians are kept apart whenever possible. To allow people and vehicles to move safely, the best approach is to separate vehicles from pedestrians entirely. This is called 'segregation'.

Pedestrians (and cyclists) are vulnerable where vehicles are being used. As well as segregating people from moving vehicles, you also need to keep them away from the area that a vehicle moves through when it is working, eg the area that a body of an excavator moves through.

The most effective way of protecting pedestrians is to provide separate routes away from vehicles, where possible.

Dealing with traffic segregation problems

- ✓ Footbridges and subways
- ✓ Barriers
- ✓ Bollards:
- ✓ Separate access/doors
- ✓ Kerbed footways
- ✓ Crossing points
- ✓ Coloured surfacing
- ✓ Signage and markings
- ✓ Oneway system

Photo Jackie Stevens

prevent pedestrians from walking straight onto roads. Where pedestrians and vehicle routes cross, you should provide appropriate crossing points for people to use, with safe working areas where pedestrians can see and be seen. Lighting may be necessary.

Traffic Calming

- Traffic calming is a term that has emerged in Europe to describe a full range of methods to slow cars, but not necessarily ban them, as they move through commercial and residential neighborhoods.
- The benefit for pedestrians and bicyclists is that cars now drive at speeds that are safer and more compatible to walking and bicycling.
- There is, in fact, a kind of equilibrium among all of the uses of a street, so no one mode can dominate at the expense of another.

Traffic Calming

Traffic Calming

11.4 Traffic-Calming Devices

Traffic calming has many potential applications, especially in residential neighborhoods and small commercial centers. Traffic-calming devices can be grouped within the following general categories:

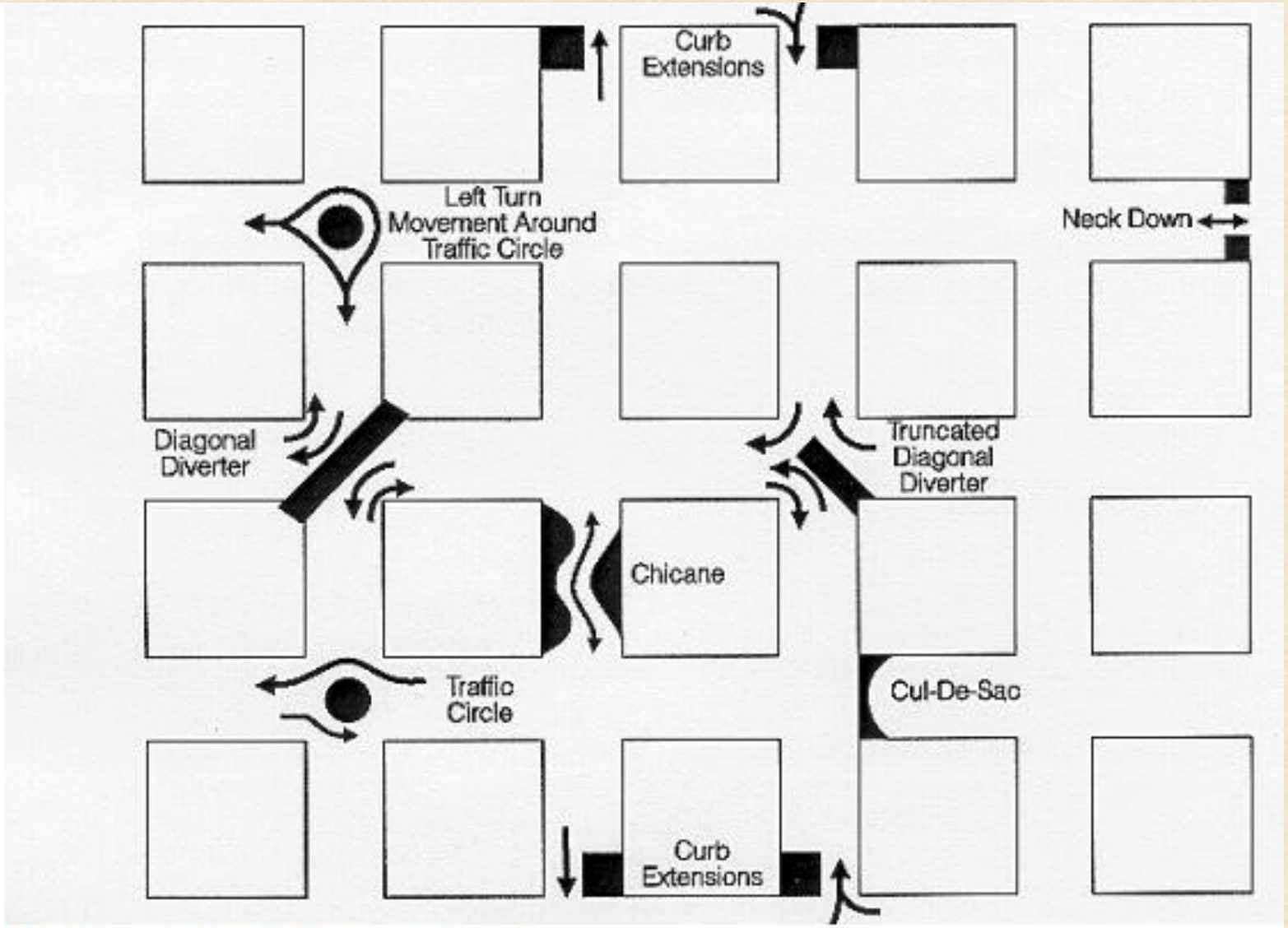
- Bumps, humps, and other raised pavement areas.
- Reducing street area where motor traffic is given priority.
- Street closures.
- Traffic diversion.
- Surface texture and visual devices.
- Parking treatments.

Traffic Calming

A 7-foot radius allows for a slow and safe turn. As the radius increases, so does the speed of the vehicle.

Diagonal road closures/diverters limit vehicular access, but allow emergency vehicles to enter through removable bollards.

Traffic Calming



Example of an integrated traffic-calming plan.

Exclusive bus lanes

Exclusive bus lane (EBL) is one of the most common transit prioritization strategies implemented to improve transit speed. However, one major drawback of implementing EBLs is the associated reduction in road capacity left for other road users.

Introduction to ITS

Intelligent transportation system is the application of sensing, analysis, control and communications technologies to ground transportation in order to improve safety, mobility and efficiency. Intelligent transportation system includes a wide range of applications that process and share information to ease congestion, improve traffic management, minimize environmental impact and increase the benefits of transportation to commercial users and the public in general.

Advantages of Intelligent Transportation System

- Reduction in stops and delays at intersections.
- Speed control & improvement.
- Travel time improvement.
- Capacity management.
- Incident management.

How Intelligent Transportation System Works?

1. ITS combining technologies

Fig. 1: ITS combining technologies

How Intelligent Transportation System Works?

2. ITS Enabling Technologies

Data Acquisition

Fig.2: CCTV camera as part of intelligent transportation system

Data Processing

Fig.3: Automatic incident detection (AID) pedestrian on the highway

How Intelligent Transportation System Works?

Data Communications

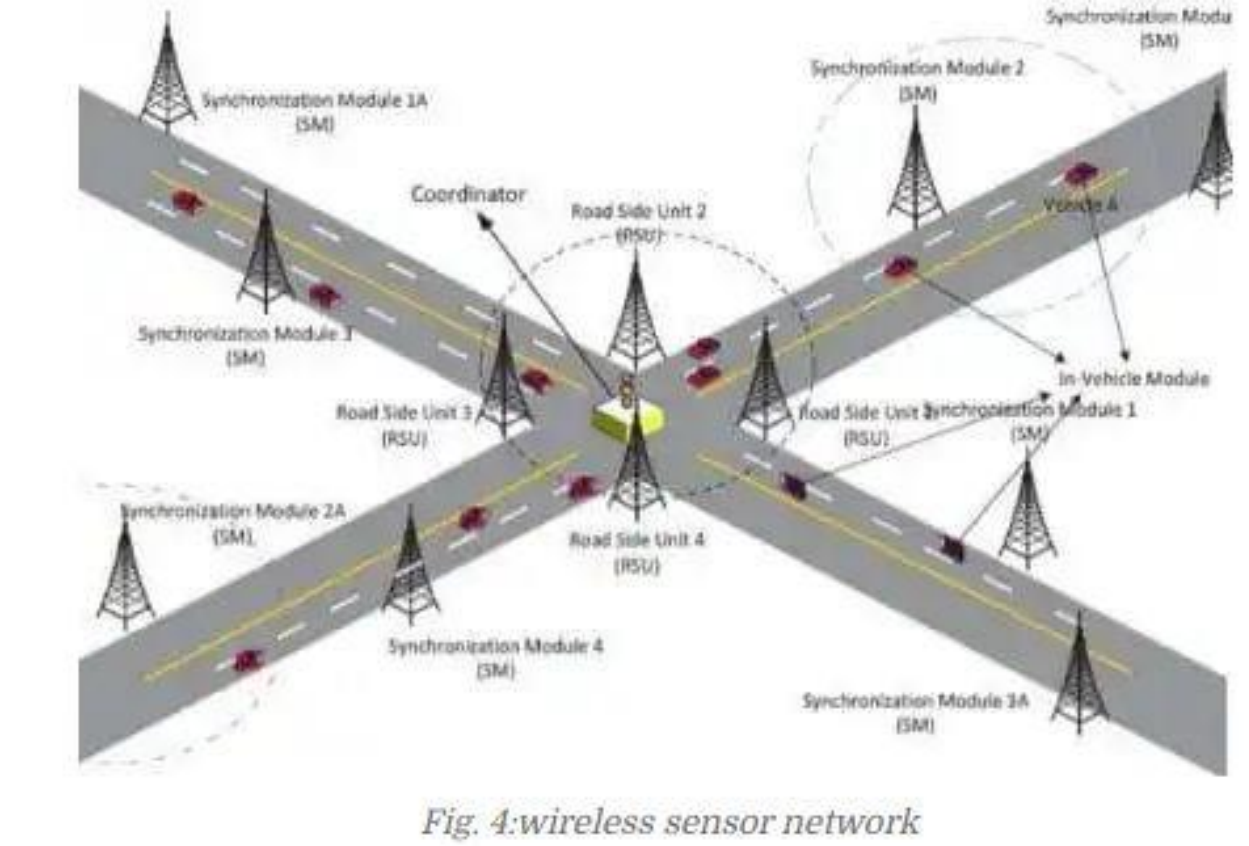


Fig. 4:wireless sensor network

Data Distribution

Information Utilization

Fig. 5:Adaptive cruise control

Intelligent Transportation System User Services

Intelligent transportation user services are provided in Table 1. **Table 1 Intelligent transportation services**

Title	Services
Traveler Information	Pre-trip Information, on-trip driver information, on-trip public transport information, personal information services, and route guidance and navigation
Traffic Management	Transportation planning support, traffic control, incident management, demand management, traffic regulations, infrastructure maintenance management.

Vehicle Systems	longitudinal collision avoidance, lateral collision avoidance, safety readiness, pre-crash restraint deployment.
Commercial Vehicles	Commercial vehicle pre-clearance, vehicle administrative processes, automated road side safety inspection, commercial vehicle on-board safety monitoring, commercial vehicle fleet management
Public Transport	Public transport management, demand responsive transport management, shared transport management.
Emergency Management	Emergency notification and personal security, emergency vehicle management, hazardous materials and incident notification
Electronic Payment (EP) Safety	Electronic financial transactions, public travel security, safety improvement for vulnerable road users, intelligent junctions.

Fig.7: Global positioning system (GPS)

Fig.8: Advanced traveler information

Fig. 9: in vehicle transit information system

3. System Architecture

Framework for planning, defining, and integrating intelligent transportation systems.

Benefits of Architecture

- Reduces time and resources required to integrate the technologies to local needs.
- Helps identify agencies and jurisdictions & seeks their participation.