Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS)

➢Intelligent Transportation Systems (ITS) combine advances in information systems, communications, sensors, advanced modelling and algorithms to improve the *performance of surface transportation*.

➢Intelligent Transportation System (ITS) applies advanced technologies of electronics, communications, computers, control, sensing and detecting in all kinds of transportation system in order to improve *safety, efficiency and service*, and *traffic situation* through transmitting real-time information.

➢These systems involve *vehicles, drivers, passengers, road operators, and managers* all interacting with each other and the environment, and linking with the complex infrastructure systems to improve the *safety and capacity of road systems.*

Congestion

➢ Increased…

> Travel time
>
> Travel cost Air
>
> pollution
>
> Accident risk

Options

➢ Construct new roads
  - Covered in geometric design
  - Not likely to happen on a large scale

➢ Reduce Traffic
  - Travel demand management
  - Alternative transportation

➢ Increase existing infrastructure capacity
  - Uses intelligent transportation systems (ITS)

Safety

Traditional driver training, infrastructure and safety improvements not enough to combat this threat.

- **Safety** is one of the principal driving forces behind the evolution, development, standardization, and implementation of ITS systems

- Wireless and wire line communication based information and electronics technologies to better manage traffic and maximize the utilization of the existing transportation infrastructure.

- It improves driving experience, safety and capacity of road systems, reduces risks in transportation, relieves traffic congestion, improves transportation efficiency and reduces pollution.

ITS-Advantages

TRAVEL

☐ Decreased travel time

☐ Relieve Traffic congestion

☐ Improved safety and security

☐ Increased reliability

☐ Decreased cost

☐ Improved trip planning

☐ Improved emergency response

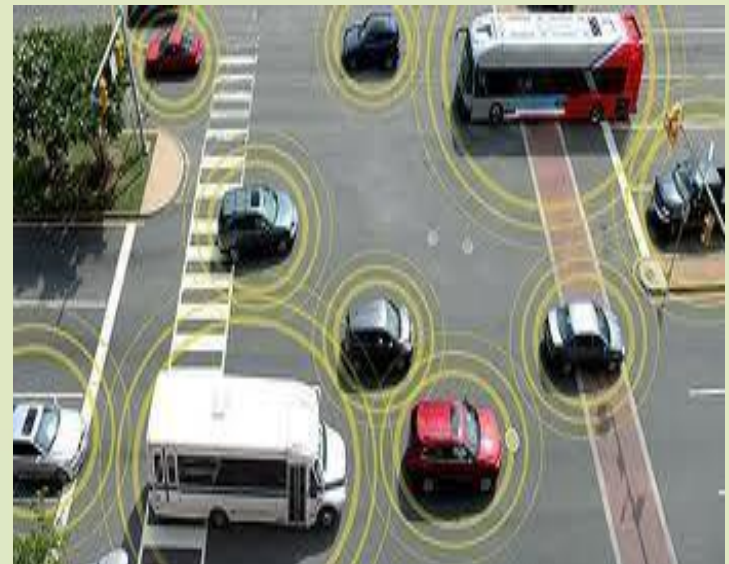**Economic**

☐ Increased productivity

☐ On-time delivery

Environmental

☐ Decreased air pollution

☐ Fuel savings

ITS Applications

- Advanced Traffic Management Systems (ATMS)

- Advanced Traveler Information Systems (ATIS)

- Commercial Vehicle Operations (CVO)

- Advanced Transportation Public Systems (APTS)

- Advanced Vehicle Control Systems (AVCS)

ITS Applications

1-Advanced Transportation Management Systems (ATMS)

☐ Detects traffic situations, transmits them to control centre via communication network, and then develops traffic control strategies by combing all kinds of traffic information

☐ Incident management, traffic light control, electronic toll collection, congestion prediction, and congestion ameliorating strategies.
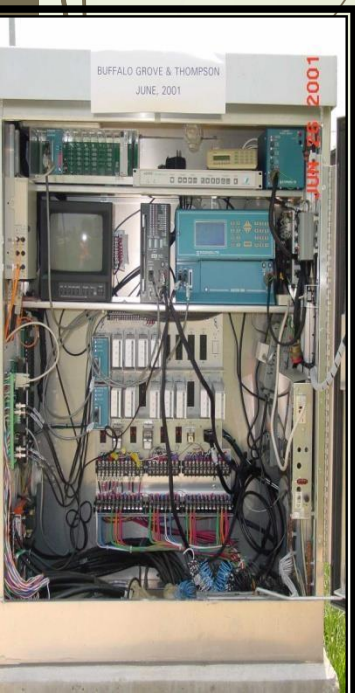
Advanced Transportation Management Systems (ATMS)

ATMS Incorporates

- **Variable Message Sign**
- **Closed Circuit TV**
- **Traffic Management Center**
- **Parking Guidance System**
- **Modernization of Existing Traffic Circles**
- **Traffic Signal Coordination**
- **Road Side Safety**

ATMS Components

❑ Traffic Signals

❑ Detectors

  ▪ Loops

  ▪ Cameras

❑ Communication Systems

❑ Traffic Signal Optimization & Synchronization

❑ Physical Infrastructure

❑ Control Cabinet

❑ Cycle length – *total time for one complete servicing of all movements in the intersection*

❑ Phase – *specific movement*

2-Advanced Traveller Information Systems (ATIS)

☐ Road users can access real-time information in the car, at home, in the office or outdoors as the reference of choosing transportation modes, travel trips and routes.

☐ The system mainly includes changeable message signs, GPS, internet connection, telephone, fax, cable television and mobile etc.
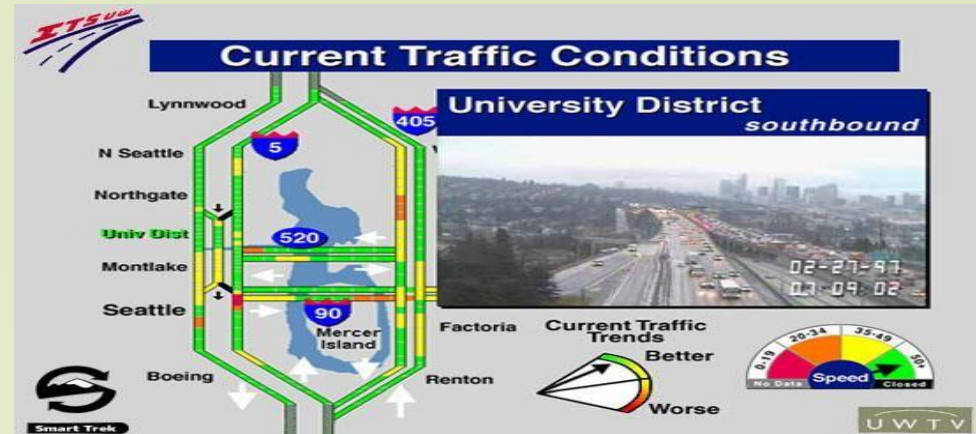
Impact of Traveller Information

➢ Provide information to road users before and during a trip (through in-vehicle technologies)

➢ Public transport users can also benefit from information provided through:

> Vehicle location systems

> Scheduling systems (e.g. online journey planners)

➢ Freight operators can use Commercial Vehicle Operations (CVO) technologies to more effectively manage their fleets

➢ The information not only lead to more efficient network flows but can also be used for strategic transportation planning purposes.

ATIS Components

Real Time Traffic information

- **Web**
- **TV/ Radio**
- **Highway advisory Radios (HARS)**
- **Cell phones**
- **Variable message signs (VMS)**

ATIS Components

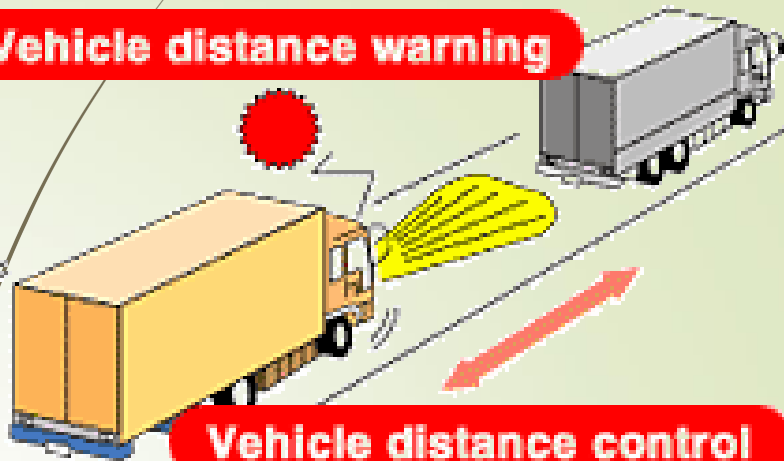## Highway Advisory Radio (HAR)

3-Advanced Vehicle Control Systems (AVCS)

Technologies that enhance driver control and vehicle safety.

☐ Anti-collision warning and control, driving assistance, automatic lateral/longitudinal control, and the long-run plans of automatic driving and automatic highway system

4-Commercial Vehicle Operations (CVO)

- CVO applies the technology of ATMS, ATIS and AVCS in commercial vehicle operation such as trucks, buses, taxis and ambulances in order to improve efficiency and safety

- Apply, pay for and receive permits, registrations, and licenses electronically

- Share of common trucking data across agencies

- Exchange information electronically with roadside enforcement personnel

- Electronic "screening" of trucks for safety or other regulatory violations
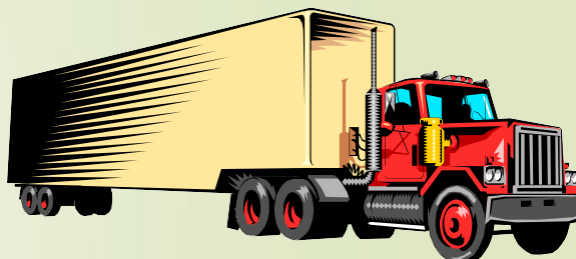
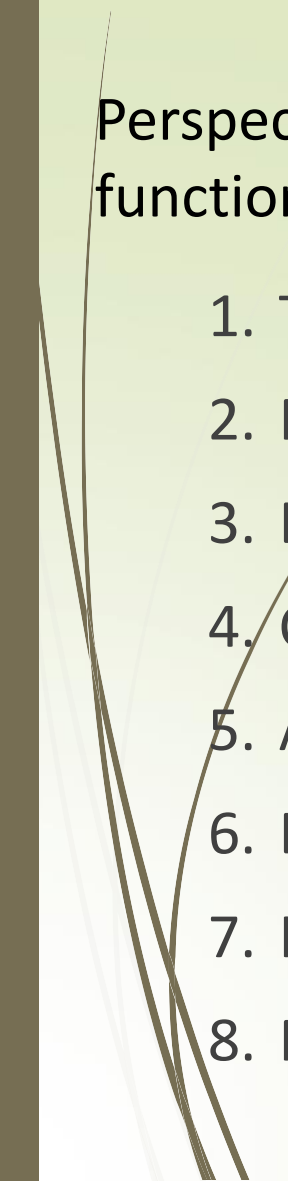# 5-Advanced Public Transportation

- Passenger information and technologies to enhance system operations, including fare collection, intramodal and intermodal transfers, scheduling, and headway control.

- Provide better transit information to users and better transit operation

ITS user services

Perspective of the organization and sharing of common technical functions
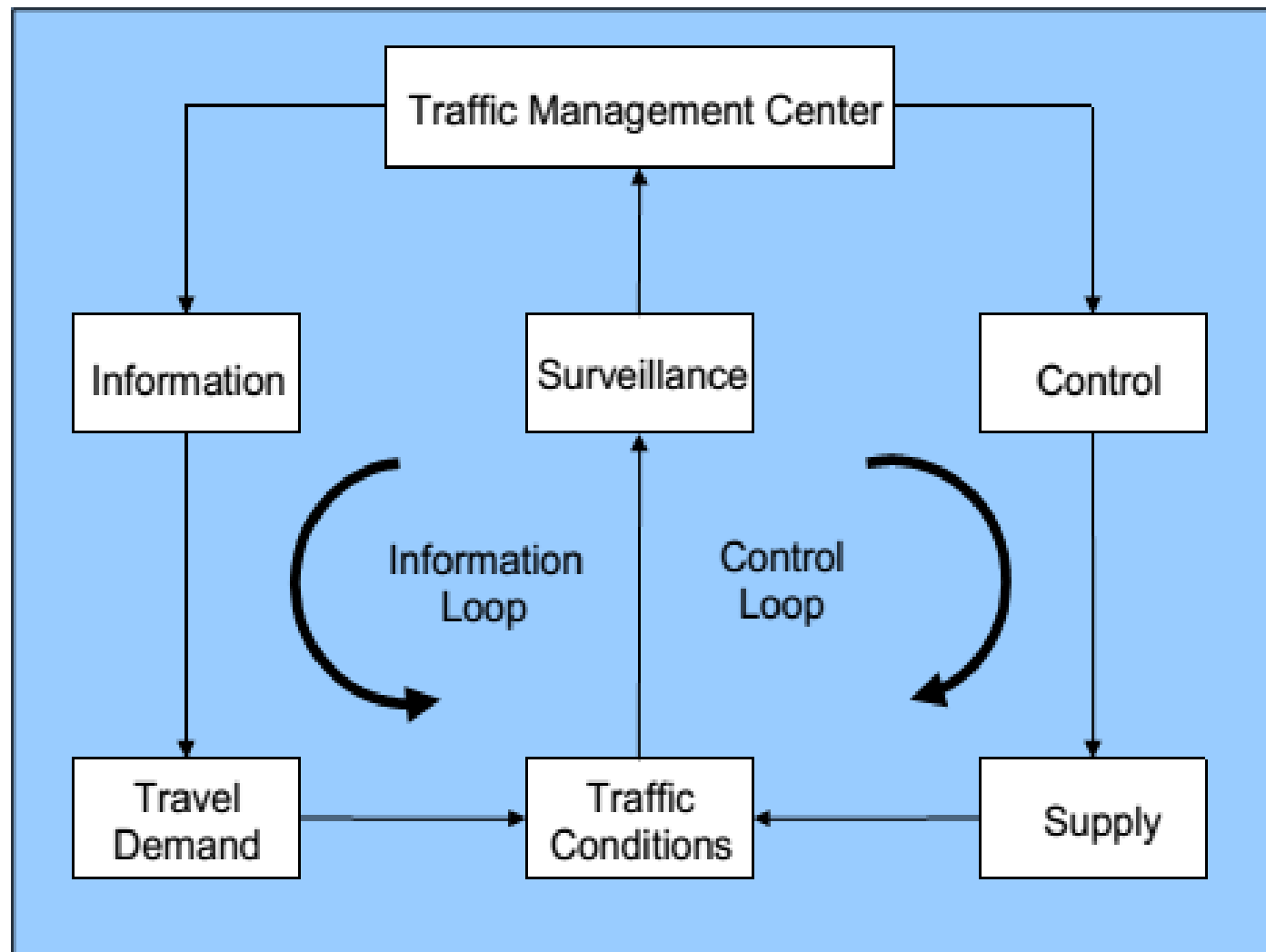
1. Travel and traffic management

2. Public transportation operations

3. Electronic payment

4. Commercial vehicle operations

5. Advance vehicle control and safety systems

6. Emergency management

7. Information management

8. Maintenance and construction management

ITS user services
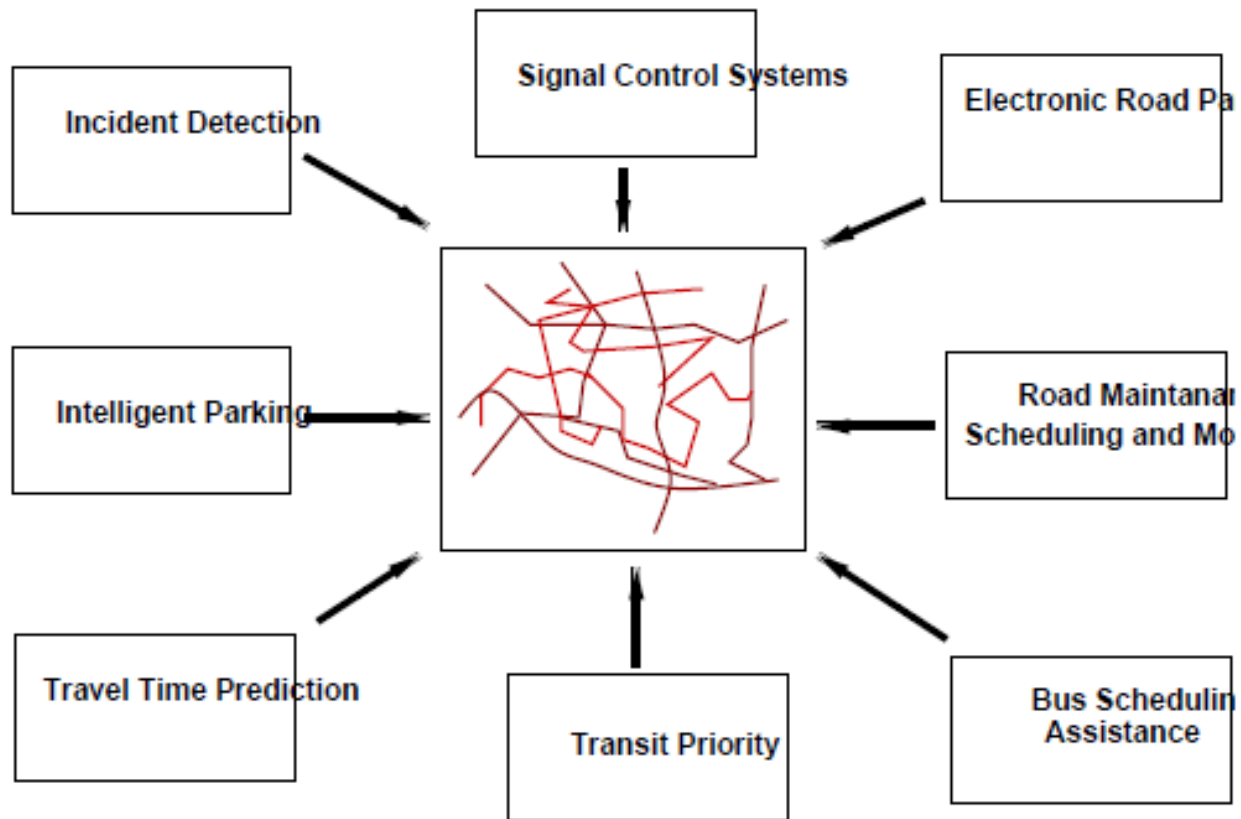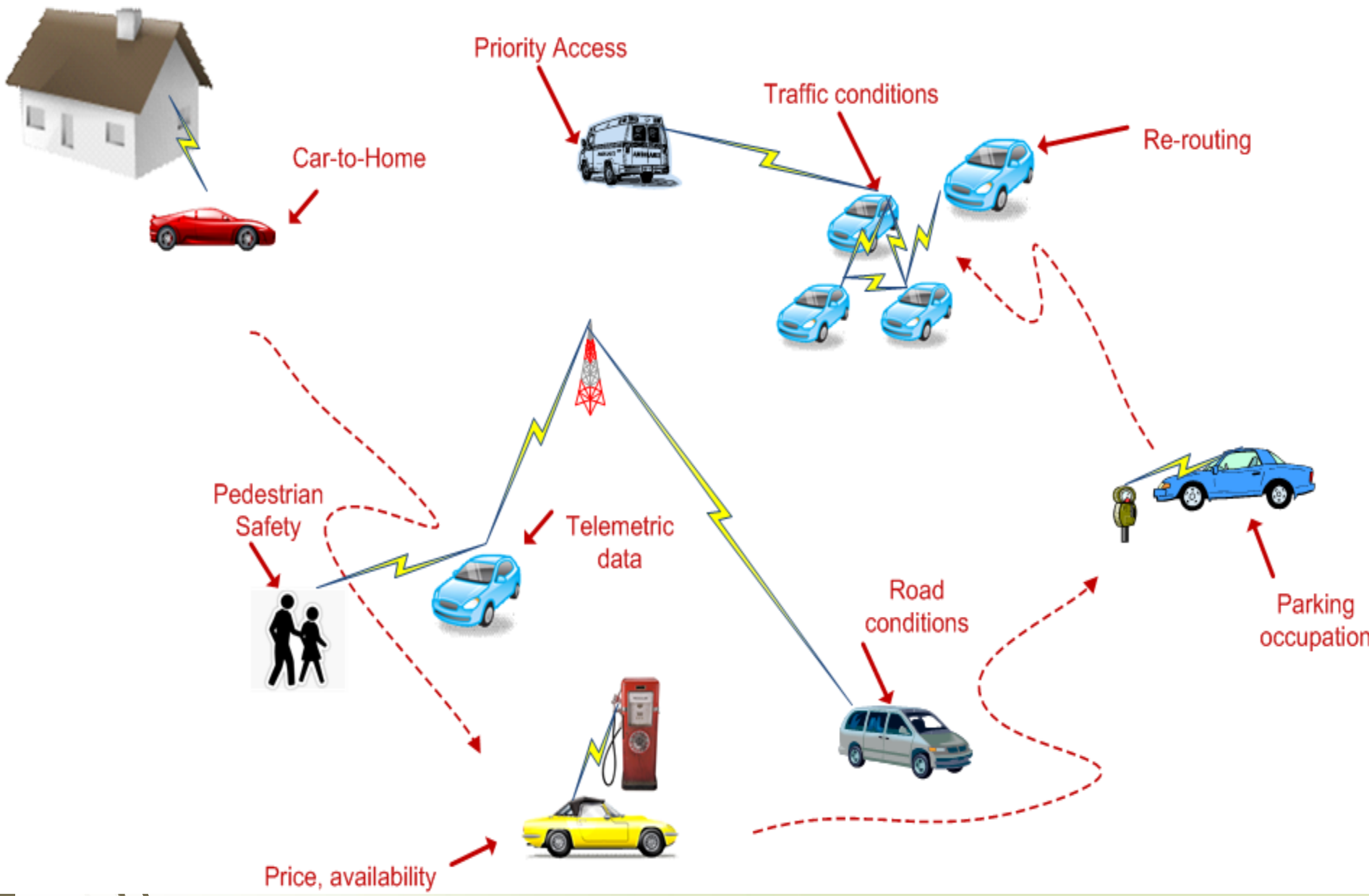
Dynamic Traffic Management

TRAFFIC

☐ The movement of the people from one place to another for work, education, shopping, recreation and social meetings.

☐ Movement of goods from farms to markets, from farms to Industries, from Industries to markets and from markets to homes and other places.

MANAGEMENT

Consists of Five Principles

☐ Planning

☐ Organizing

☐ Leading

☐ Staffing

☐ Controlling

TRAFFIC MANAGEMENT

Application of these five principles to the traffic systems to get

 Max: Efficiency

 Min: Congestions

 Min: Delays etc.

TRAFFIC MANAGEMENT & ADVANCED TECHNOLOGY

☐ The adjustment of the Transportation System to new technology is a constant challenge.

☐ Advanced technology for information collection, data processing, decision support and automation has created major changes in the ways people work and play.

ADVANCED TECHNOLOGY

☐ By employing new computer-based technologies, we can greatly expand our capabilities.

However, Research has discovered that available advanced technologies are substantially underutilized because

1) Difficult to learn

2) Present usability problems

3) People are as yet unwilling to trust them

DISPLAY AND COMMUNICATION TECHNOLOGY

 New display and communication technologies, within vehicles and as part of the infrastructure, provide increased opportunities for controlling and influencing traffic.

 Infrastructure-based displays, including Variable Message Signs (VMS), Highway Advisory Radio (HAR), provide drivers with warnings of incidents and congestions ahead.

TRAFFIC MANAGEMENT

INPUTS

☐ Traffic and Roadway Sensors

☐ Cellular Phone

☐ Visual CCTV Sensors

☐ Voice Communication Systems

☐ Data Base Services

OUTPUTS

- Intersection Control Devices

- Variable Message Signs

- Traffic Bulletin Board

- Highway Advisory Radio

SUPPORT SYSTEM DESCRIPTIONS

Adaptive Control System (ATCS)

➤ ATCS is a new concept which is used with the real time information to synchronize the traffic signals according to the traffic scenario

➤ ATCS will optimize current traffic flow. It will receive roadway sensor data and use it to control Traffic Signal Timing

➤ System gets the input from the sensor embedded In road and synchronize the group of signal accordingly.

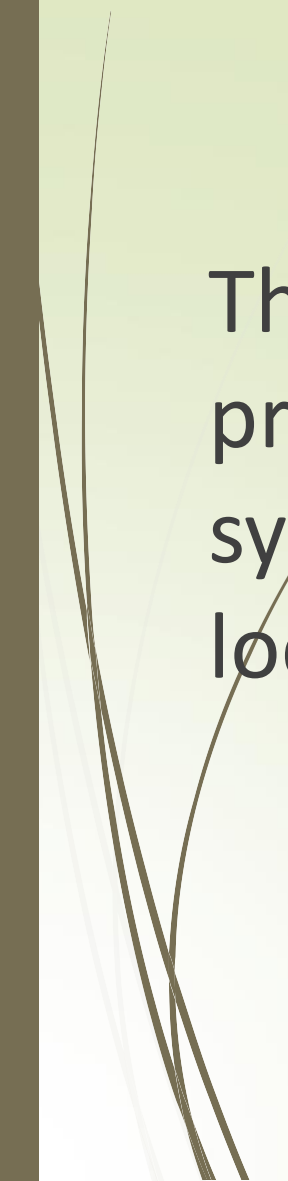➤ A key feature will be its ability to integrate control across streets and freeway traffic.

PREDICTIVE TRAFFIC MODELING SYSTEM (PTMS)

☐ It will use current data, historical data and weather forecasts to predict traffic flow for a few minutes into the future (5-30 min).

☐ PTMS predictions will allow preemptive actions to be taken well before an actual traffic problem arises.

INCIDENT DETECTION AND LOCATION SYSTEM (IDLS)

The IDLS will detect and verify the presence of incidents on the roadway system and determine the exact location of an incident.

INCIDENT RESPONSE AND ADVISORY SYSTEM (IRAS)

IRAS will assist in determining the appropriate response to an incident.

- Informing the motorists of a slight delay
- Re-routing some traffic

- Closing a major freeway and re- routing all traffic

INFORMATION DISSEMINATION SYSTEM (IDS)

- It will interface with data services supplied to the mass media, the traffic channel and bulletin board services.

- It will be capable of posting messages on Variable Message Signs (VMS) and creating voice broadcast via Highway Advisory Radio (HAR).

TRAFFIC MANAGEMENT TRAINING SYSTEM (TMTS)

☐ TMTS provides training operators to TMC

☐ Training exercises in routine traffic management, incident management and special event management

☐ To maintain operators skills needed in Critical situations like extreme weather conditions

TRAFFIC DATA MANAGEMENT SYSTEM (TDMS)

☐ It will serve as ATMS information hub.

☐ It will accept all roadway sensor data and perform validity checks of such data

SMART CAR

➢First basic concept in any ITS

Implementation is SMART CAR

➢The car is equipped with all the new electronic devices. It helps the user to use service efficiently. Some of the features of SMART CAR are:

▪ GPS and on-board communications

▪ Anti-collision sensors

SMART CAR

- A smart car must be able to sense, analyse, predict and react to the road environment, which is the key feature of smart cars.

- The car works with a central component that monitors the roadway and the driver.

- It also evaluates the potential safety benefits. It addresses navigation, obstacle avoidance and platooning problems.

- Smart cars present promising potentials to assist drivers in improving their situational awareness and reducing errors.

- The smart car will adopt active measures such as stopping the car in case that the driver is unable to act properly or applying passive protection to reduce possible harm in abrupt accidents, for example, popping up airbags.