Unit – 5 Incident Mgmt

- Traffic Incident Management is the response to traffic accidents, incidents and other unplanned events that occur on the road network, often in potentially dangerous situations.
- Incident management requires
  - planning,
  - response,
  - safety at the scene of the incident and
  - recovery.
- It requires attention to three main aspects – in order of priority – safety, mobility of traffic flow and control and repair of damage.

Traffic Characteristics

A knowledge of these characteristic is necessary for proper geometric design and traffic control systems allowing for safe and smooth operations.

- *Static*: include the weight and size of vehicles.
- *Dynamic:* involve the forces that cause the motion of vehicle

Traffic Characteristics

Static Characteristics

Design vehicle: the selected representative vehicle for the geometric design and control systems

– Its **dimensions** are important for the determination of design standards for several physical components of the highway:

– lane width, shoulder width, parking bays length and width, and lengths of vertical curves.

– **Vehicle weight** is important for the determination of pavement depths and maximum grades.

Traffic Characteristics

- ***Dynamics characteristics*** of vehicles affecting road design are speed, acceleration and braking characteristics and some aspects of vehicle design. The speed and acceleration depends upon the power of the engine and the resistant to be overcome and are important in all geometric design elements.
- The deceleration and braking characteristics guide safe vehicle operation. The stability of vehicle and its safe movement of horizontal curves are affected by the width of wheel base. The riding comfort on vertical curves depends on the design of suspension system of vehicles.

Traffic Characteristics

Power of vehicle

- The power of the heaviest vehicles and their loaded weights govern the permissible and limiting values of gradient on roads. From the total hauling capacity and power required to overcome the total tractive resistance it is possible to determine the speed and acceleration of the vehicle which in turn useful in traffic regulation, planning and design.

Braking characteristics

- The deceleration and braking characteristics of vehicles depend on design and type of breaking system and its efficiency. The safety of vehicle operation, stopping distance, and the spacing between two consecutive vehicle in a traffic stream is affected by the braking capacity. Thus the highway capacity and overtaking sight distance requirements also get indirectly affected.

Types of incidents

- breakdown of vehicles
- incidents with only material damage
- those involving injured persons, death, fire, and dangerous goods; and
- investigation of guilt or crime .

Impacts

- delay,
- property damage,
- injuries and fatalities, and
- road safety for the road users

Process

Common phases of an incident are:

- **detection** - that an incident has occurred
- **verification** - that the incident has occurred, determining its location and having sufficient information to enable an appropriate response
- **response** - by dispatching appropriate services to resolve the incident
- **clearance**, or the removal of the vehicles, damaged property and victims from the incident scene, and complete reopening of any blocked lanes
- **recovery** to normal traffic flow

ITS

- An **intelligent transportation system (ITS)** is an advanced application which aims to provide innovative services relating to different modes of transport and traffic management and enable users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

Intelligent Transportation Applications

(1) Electronic Toll Collection :

Today, most toll roads are equipped with an electronic toll-collection system, like E-ZPass, that detects and processes tolls electronically.

E-ZPass uses a vehicle-mounted transponder that is activated by an antenna on a toll lane. Your account information is stored in the transponder. The antenna identifies your transponder and reads your account information. The amount of the toll is deducted and you're allowed through.

(2) Emergency vehicle notification systems :

Intelligent transportation systems particularly the FCD (*Floating Car Data*) model can also be used to provide advance warning to motorists of traffic jams, accidents and other emergency situations. This system can then provide alternative routes or recommendations to motorists so as to avoid congestion and travel delays.

(3) Cordon zones with congestion pricing :

With the intelligent transportation system, cordon zones can also be enforced where mass transportation systems are available and their use encouraged. Cordon systems make it possible to collect taxes from those entering city areas with high traffic while encouraging the use of mass transit.

Congestion pricing gantry at North Bridge Road, Singapore.

Sign indicate the boundary of the congestion charge area

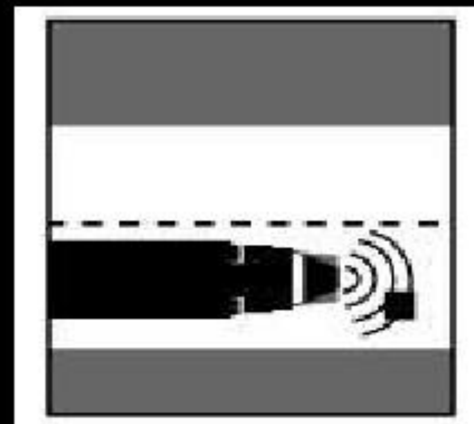
(4) Automatic Road Enforcement :

A traffic enforcement camera system, consisting of a camera and a vehicle-monitoring device, is used to detect and identify vehicles disobeying a speed limit or some other road legal requirement and automatically ticket offenders based on the license plate number. Traffic tickets are sent by mail. For Exam :-

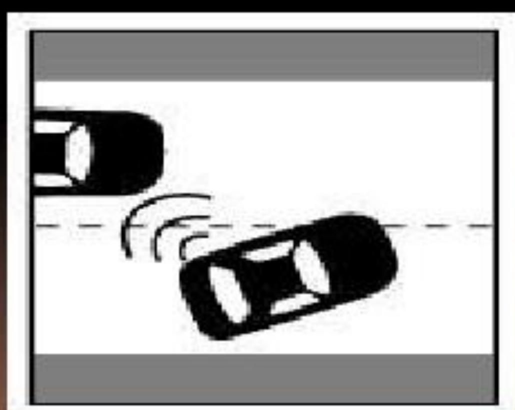
- *Speed cameras* identify speed limit.
- *Red light cameras* detect vehicles that cross a stop line.
- *Bus lane* cameras identify vehicles traveling in lanes reserved for buses.

(5) Collision Avoidance Systems :

Intersection Collision Warning

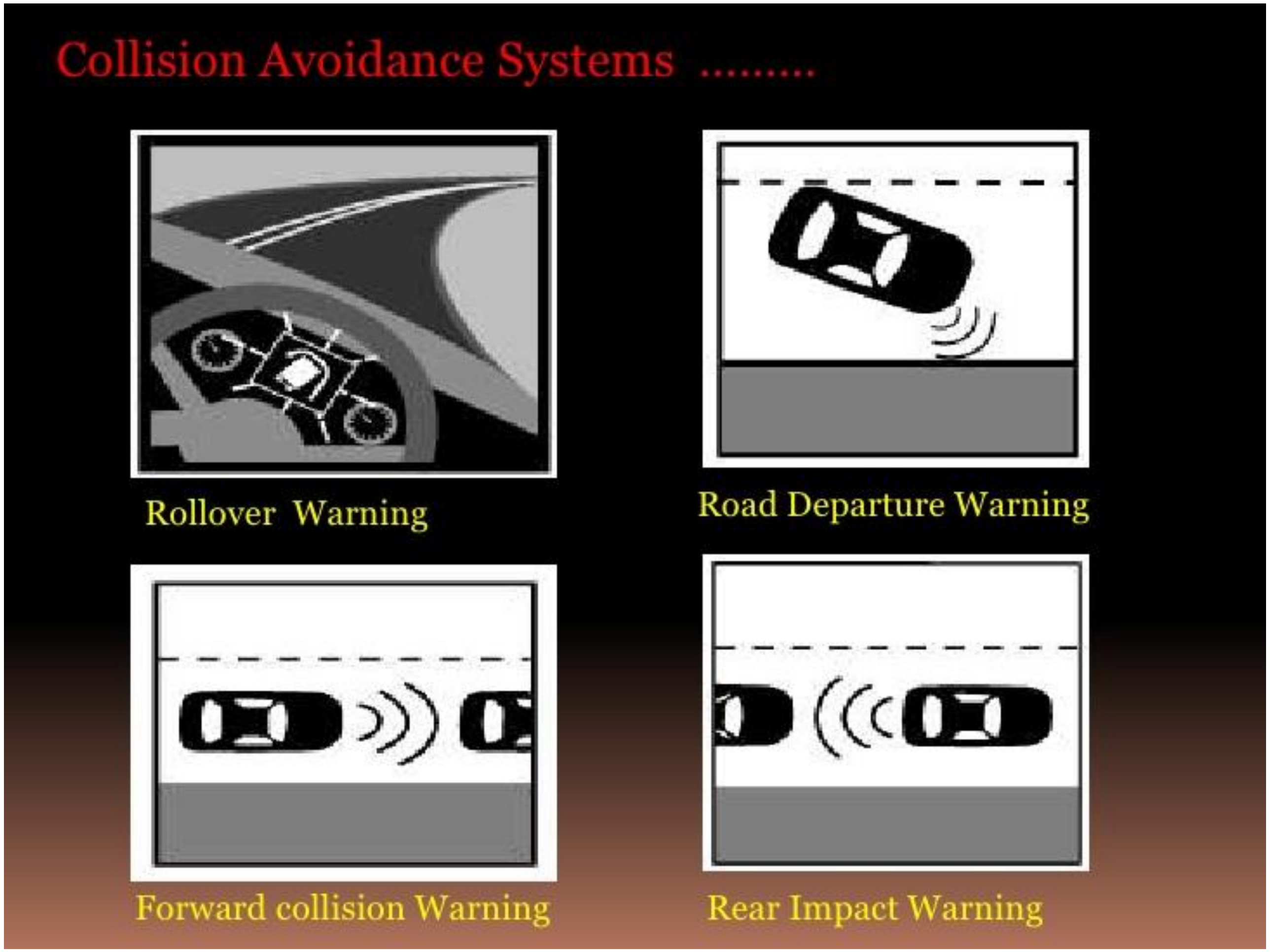


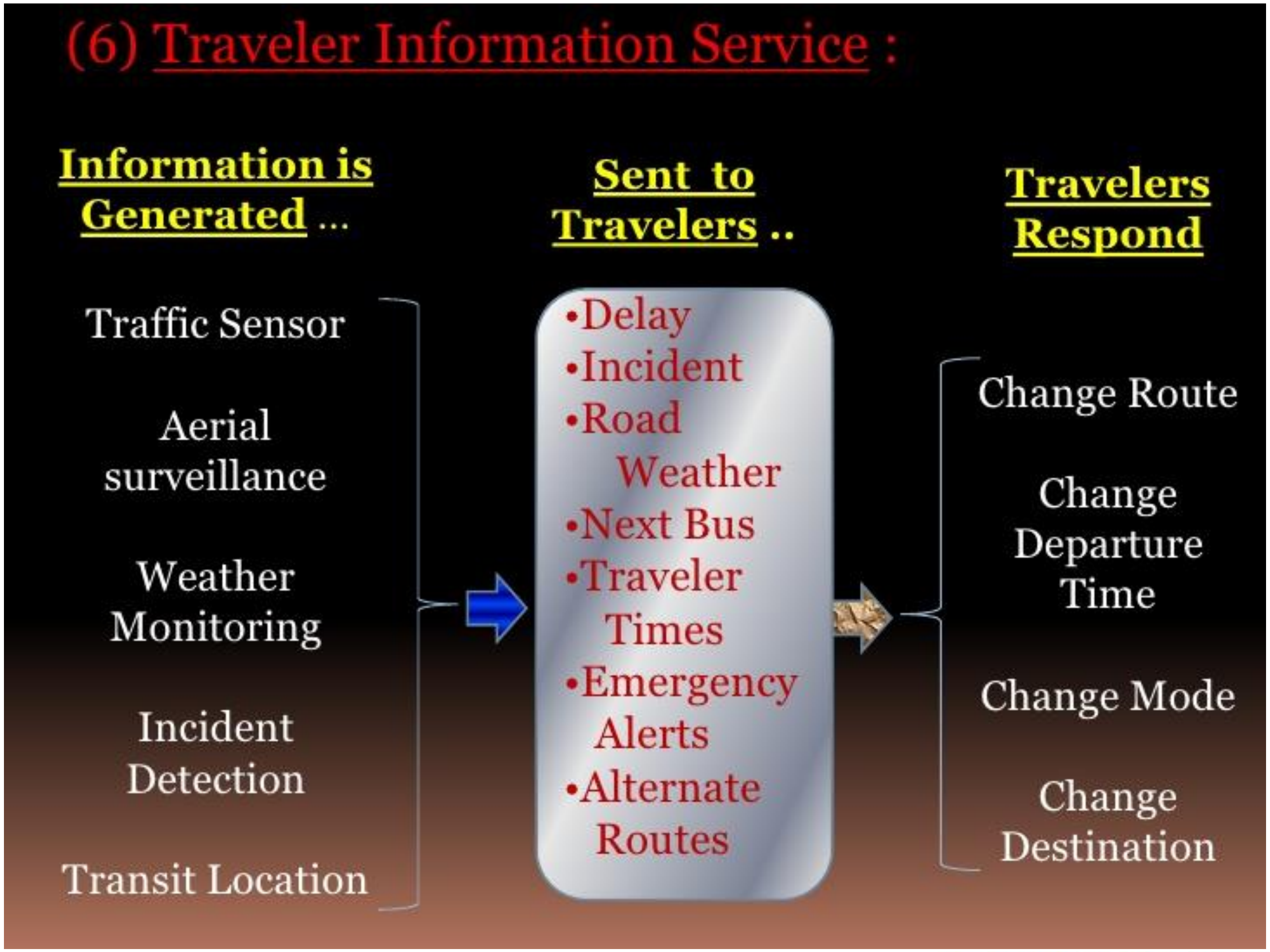
Obstacle Detection



Lane Change assistance

Lane Departure Warning


Collision Avoidance Systems ....
Rollover Warning
Road Departure Warning
Forward collision Warning
Rear Impact Warning


(6) Traveler Information Service :
Information is Generated …
Sent to Travelers ..
Travelers Respond
Traffic Sensor
Aerial surveillance
Weather Monitoring
Incident Detection
Transit Location
•Delay
•Incident
•Road Weather
•Next Bus
•Traveler Times
•Emergency Alerts
•Alternate Routes
Change Route
Change Departure Time
Change Mode
Change Destination

(7) Emergency Management Services :

Emergency Management Services are greatly enhanced by traffic control centers that continually monitor roadway conditions.

When an incident occurs, the nearest emergency service vehicle is located electronically and dispatched to the scene. Highway managers then alert other drivers of the incident through dynamic message signs. These services reduce response times, help save lives, and reduce the occurrence of secondary incidents.

Benefits of ITS :

- Time Savings
- Better emergency response times and services
- Reduced Crashes and Fatalities
- Cost Avoidance
- Increased Customer Satisfaction
- Energy and Environmental Benefits
- Decreasing of probability of congestion occurrence

Planning effective Incident Mgmt Program

- Incident Response Teams - deliver actual incident management services in the field.
- The following agencies and service providers may be part of the IRT:
- Service patrols
- Ambulance services
- Towing and recovery
- Transit
- Toxic material control
- Emergency services
- Other (Coast Guard, Railroads, etc.)

- Training: any combination of field drills; traffic operations center training; and classroom lectures, discussion, and exercises.

- CPR
- Basic First Aid
- Radio communication
- Removal of disabled vehicles ·
- Response vehicle equipment use policies and procedures ·
- Fatal or felony accident procedures

- Field Guides - Formal training programs provide the knowledge and skill base that IRT members need to perform their jobs effectively.
- ITS

- Traffic Signal Timing Adjustments
- Ramp Controls
- Response - computer and communications technologies
- Traffic Signal Pre-exemption for Emergency Vehicles
- Traffic Operations Center - serve as the hub or nerve center of ITS and traffic control systems - central point at which information about the transportation system is collected, processed, and collated.
- planning, development, implementation and operation of ITS infrastructure

- Service Patrols - effective in reducing incident detection time, as well as the overall duration of the incident.
- Post-incident debriefings - very effective for identifying areas for improvement, as well as confirming the value of practices that are working well.

National importance of survival of Transportation systems during disasters

- Transportation is often considered a **critical infrastructure** since a disruption in one of its components can have significant impact on the economic and social well being of a region of a nation.

impact of the threats and risk level of disasters on transportation systems:

- **Increased mobility -** mobility of passengers (for commuting, tourism, business and migration) and freight has increased notably around the world.
- **Infrastructure and economic interdependency**. Infrastructures are increasingly interdependent, particularly transportation and energy infrastructures, so a disruption in one will have an effect on others.

- **Centralization and concentration of distribution**. The principle of economies of scale often leads to a centralization of network structures and a concentration of economic activities.
- **Urbanization**. The emergence of large cities has led to acute concentrations of populations, a pattern significantly different than the more dispersed settlements that prevailed in rural societies.

- With the increasing reliance on distribution systems, any failure of transportation, due to intentional or non-intentional causes, can have very disruptive consequences and can compromise national security.

Natural disasters

- **Extreme weather events**. Many weather events such as storms and blizzards occur regularly and tend to have minimal impacts on transport systems with delays, partial closures or diversions.
- The 2011 Tohoku earthquake in Japan is among the five largest in recorder history. While the damage by the earthquake was significant, it is the associated tsunamis that caused the most extensive damage to Japanese transport infrastructure. Further, the earthquake had significant impacts on global supply chains as the Japanese automobile production fell by 50% in the following months, mostly because of disruptions in supply chains.

- **Sea level rise -** many cities and infrastructure are built right above the upper tidal limit. evidence underlines a rise by one meter by 2100 is certain. If the sea level rise accelerates, the one meter scenario could even be reached by 2050. sea level rise places critical transport infrastructure such as ports and airports at risk of damage and discontinuity in operations. For instance, a port terminal or an airport could not be directly impaired by sea level rise, but its access roads could be, compromising its commercial viability.

Man-made disasters

- **Accidents.** The outcome of technical failures or human errors and where modes, infrastructure or terminals can be damaged, even destroyed, which includes injuries, the loss of life and property damage.

- **Infrastructure failure.** Transportation infrastructure can fail due to a lack of (or deferred) maintenance, improper management, design flaws or handling more traffic than they are designed for. Bridges and other similar structures are particularly vulnerable.
- **Conflicts, terrorism and piracy**. Conflicts such as wars and civil unrest often result in the damaging of infrastructure with transportation commonly a voluntary or involuntary target.

- **Economic and political shocks**. They are likely to play a growing role in the future, particularly financial issues as most developed nations have accumulated a staggering amount of debt that is likely to be defaulted on.
- **Pandemics**. At the intersection of natural (biological) and anthropogenic causes (people are vectors and a virus could be mutated by anthropogenic causes), a pandemic is an event of potential profound ramifications.

Advanced ITS

Introduction

- Some new features in the ITS sector are covered in this section. The first basic concept in any ITS implementation is SMART CAR. It is the car with all modern features. The SMART CAR has to be complimented by a SMART ROAD.
- The developments in the ITS field started with the infrastructure to infrastructure communications. They formed the basis of further development of ITS. Then the I2I communications were upgraded with the vehicle to infrastructure communications. They are called V2I communications. The latest development is the vehicle to vehicle communications, i.e. V2V communications.

Smart car

As mentioned earlier the car is equipped with all the new electronic gadgets. It helps the user to use service efficiently. Some of the features of SMART CAR are:

• GPS and on-board communications

• Anti-collision sensors

A smart car must be able to sense, analyze, 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 of the potential safety benefits. It addresses navigation, obstacle avoidance and platooning problems. The car aims at expanding the time horizon for acquiring safety relevant information and improving precision, reliability and quality of driving.

There are some preventive safety technologies and in-vehicle systems, which sense the potential danger. The Adaptive Integrated Driver-vehicle Interface (AIDE) project tries to maximize the efficiency and safety of advanced driver assistance systems, while minimizing the workload and distraction imposed by in-vehicle information systems.

Almost 95% of the accidents are due to human factors and in almost three-quarters of the cases human behavior is solely to blame. Smart cars present promising potentials to assist drivers in improving their situational awareness and reducing errors. With cameras monitoring the driver’s gaze and activity, smart cars attempt to keep the driver’s attention on the road ahead. Physiological sensors can detect whether the driver is in good condition. The actuators will execute specified control on the car without the driver’s commands. 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.

Smart road

As mentioned earlier SMART CAR alone cannot operate in a system. Thus along with the SMART CAR, the infrastructure should also be improved. The infrastructure also should be well prepared for taking care of smart car. The road equipment will communicate with the vehicle and provide real time assistance to the user. Provision of Smart road along with Smart car will complete the Smart features of any facility. It may be possible that the highway forms a high density platoon of vehicles moving bumper to bumper and this platoon will move at a speed of 70 kmph or so. That road will be equipped with some sensors may be along the pavements and the decisions are left to the central unit. The road itself will show some messages which can be easily read.

Infrastructure to Infrastructure Communications

This type of communication is a initial stage in formation of present ITS system. Communication takes place between infrastructures. Evolution of I2I services led to more advanced vehicle

communications. They are the easy means of communications. But handling them on a large is an area of concern.

Vehicle to infrastructure communications

These involve advanced vehicle to infrastructure interface. The communication takes place between a vehicular device and a infrastructure equipment. It is an improvement over I2I services. Large communication is possible with this type of communication. Some examples of V2I communication are:

- Blind merge warning