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Intelligent Transportation Systems for all Engineers and City Planners



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FDA, Inc.

Intelligent Transportation Systems for Civil Engineers and City Planners

3 PDH course

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Provider: DiscountPDH.com

COURSE DESCRIPTION

This course introduces Intelligent Transportation Systems (ITS) and their role in improving the safety, efficiency, and reliability of transportation infrastructure in the United States. The course presents the fundamental components of ITS, including traffic monitoring, communications, control systems, and traveler information. Emphasis is placed on practical applications that are relevant to civil engineers involved in planning, design, construction, operations, and maintenance of transportation facilities.

The course is written for a broad engineering audience and explains how ITS technologies are integrated into highways, arterial roadways, bridges, work zones, and traffic management centers.

LEARNING OBJECTIVES

After completing this course, the participant will be able to:

- Define Intelligent Transportation Systems and their purpose
 - Identify the major components of ITS infrastructure
 - Understand how ITS improves traffic operations and safety
 - Recognize common ITS field devices and their functions
 - Describe how data is collected, transmitted, and used in transportation systems
 - Understand the role of civil engineers in ITS deployment
 - Identify the benefits and cost effectiveness of ITS solutions
 - Recognize emerging trends in smart transportation
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1. INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) integrate traditional transportation infrastructure with advanced technologies to improve mobility, safety, and system performance.

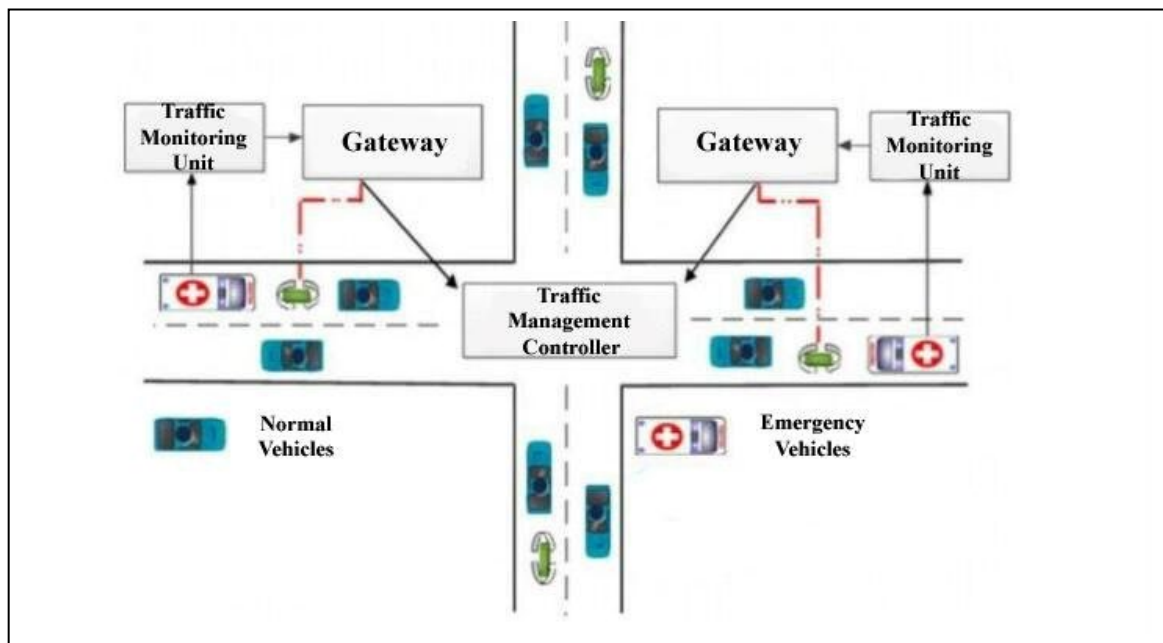
ITS combines:

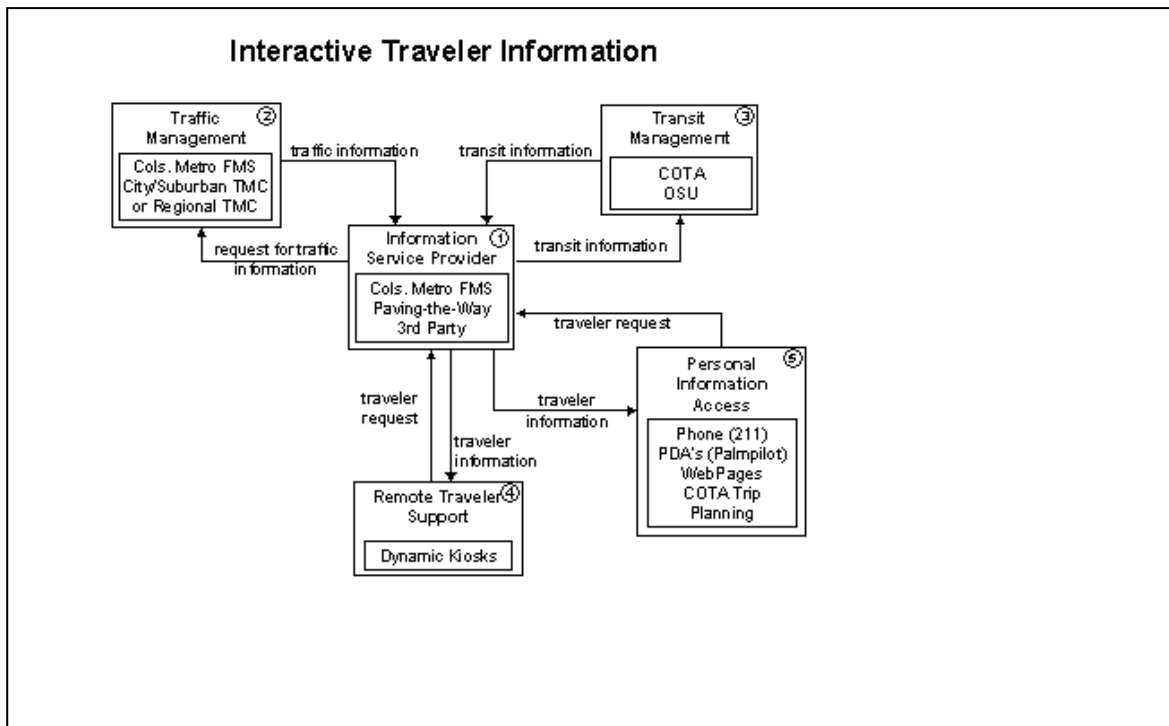
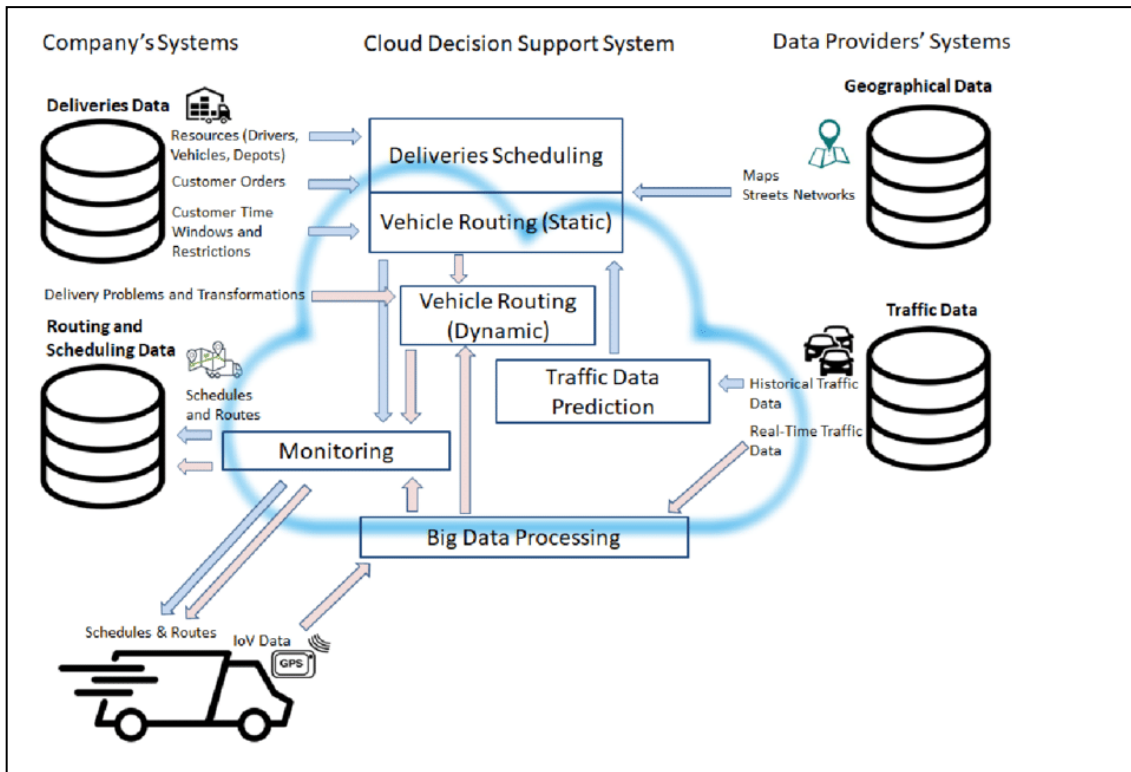
- Field devices
- Communications networks

- Data processing systems
- Control strategies

to create a transportation network that can monitor conditions in real time and respond dynamically.

[Figure 1 – Basic ITS system architecture showing field devices, communications, traffic management center, and users]





[Figure 1 – Basic ITS system architecture showing field devices, communications, traffic management center, and users]

2. EVOLUTION OF TRANSPORTATION INFRASTRUCTURE

Transportation systems have evolved from:

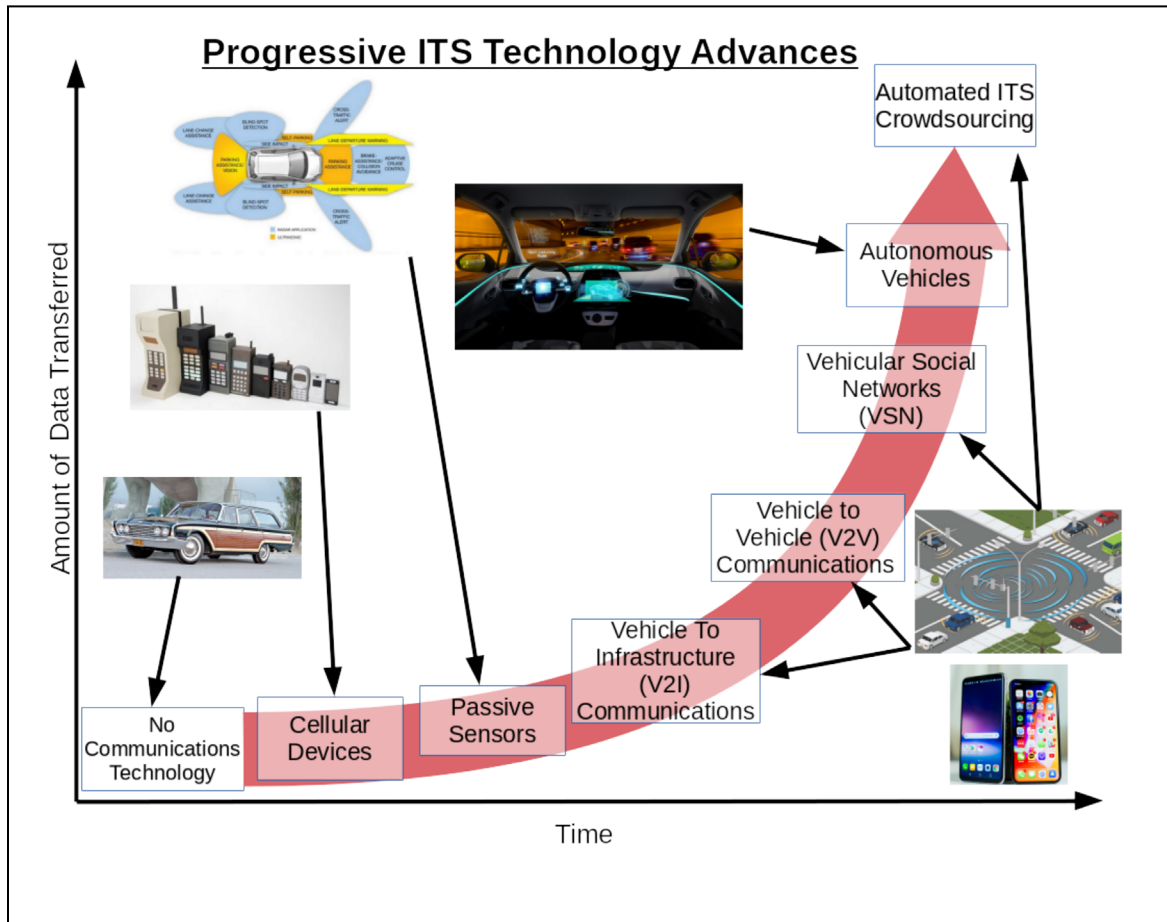
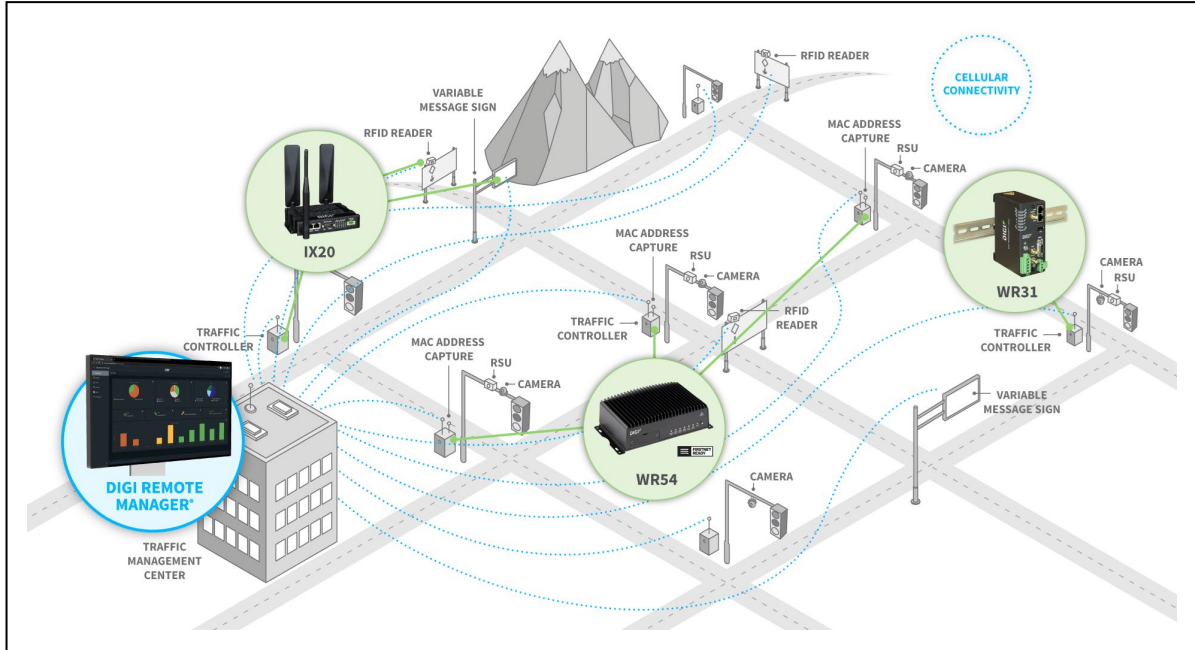
- Static roadways
to
- Signalized networks
to
- Digitally connected corridors

Traditional infrastructure was designed for capacity.

Modern infrastructure is designed for **performance and real-time management**.

[Figure 2 – Evolution from conventional roadway to smart transportation corridor]





3. PURPOSE AND GOALS OF ITS

The primary goals of ITS include:

- Improved safety
 - Reduced congestion
 - Better travel time reliability
 - Faster incident response
 - Improved environmental performance
 - Enhanced traveler information
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4. MAJOR COMPONENTS OF ITS

ITS consists of four main elements:

1. Sensing and Detection

Devices that collect data from the field.

2. Communications

Systems that transmit data.

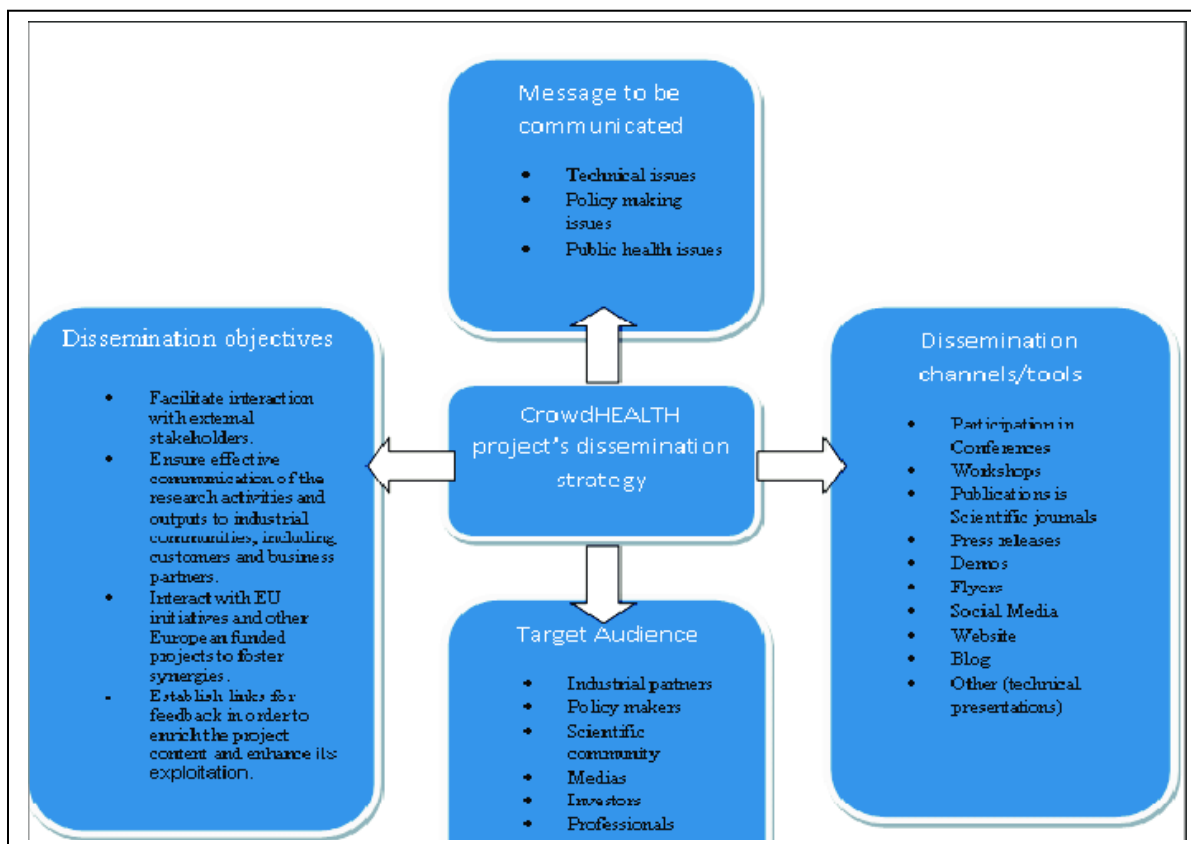
3. Processing and Control

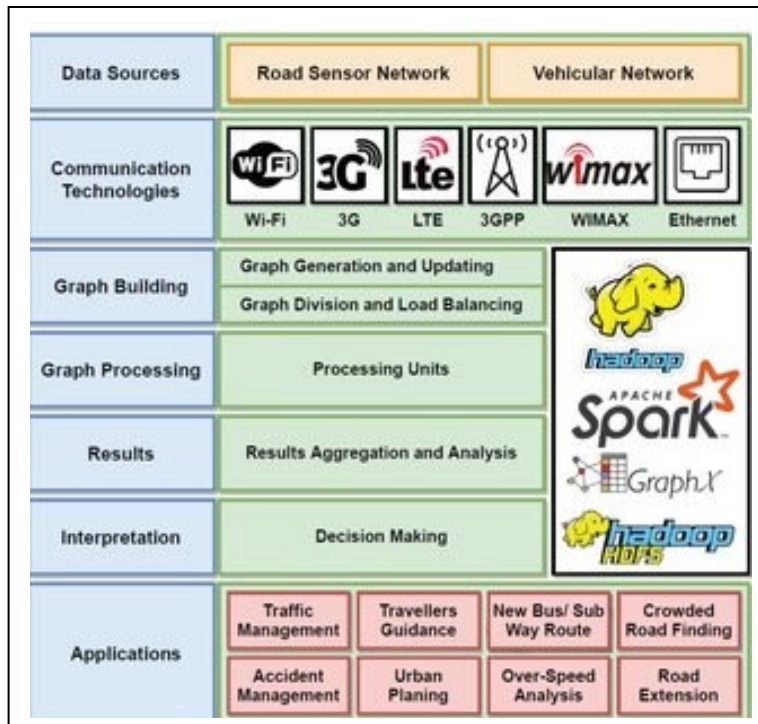
Centers where decisions are made.

4. Information Dissemination

Providing real-time information to users.

[Figure 3 – Four major components of ITS]





5. TRAFFIC MONITORING AND DETECTION SYSTEMS

Common traffic detection technologies include:

- Inductive loop detectors
- Video detection
- Radar and microwave sensors
- Bluetooth/Wi-Fi tracking
- Automatic vehicle identification

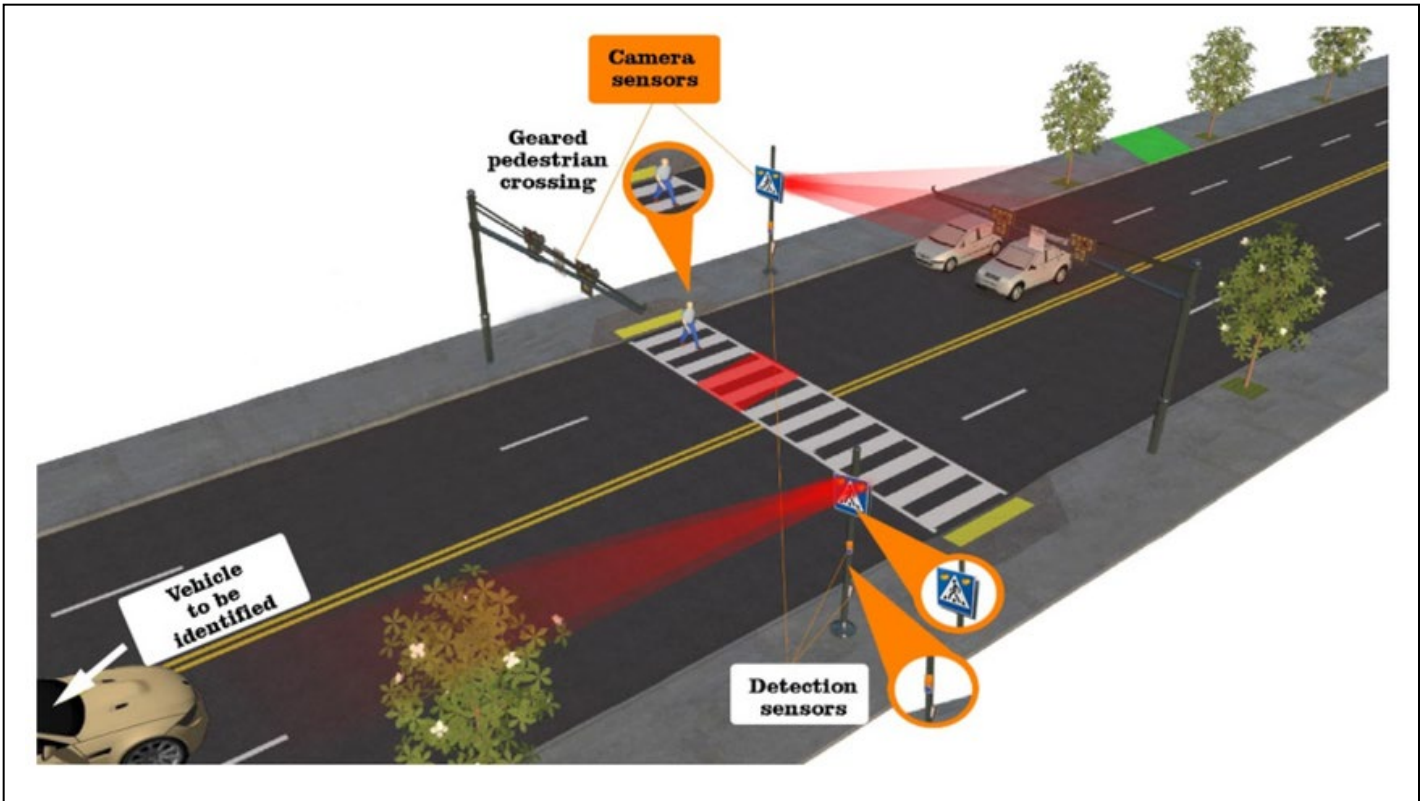
These systems provide:

- Traffic volume
- Speed
- Occupancy

- Travel time

[Figure 4 – Typical roadway traffic detection layout]





6. TRANSPORTATION COMMUNICATIONS SYSTEMS

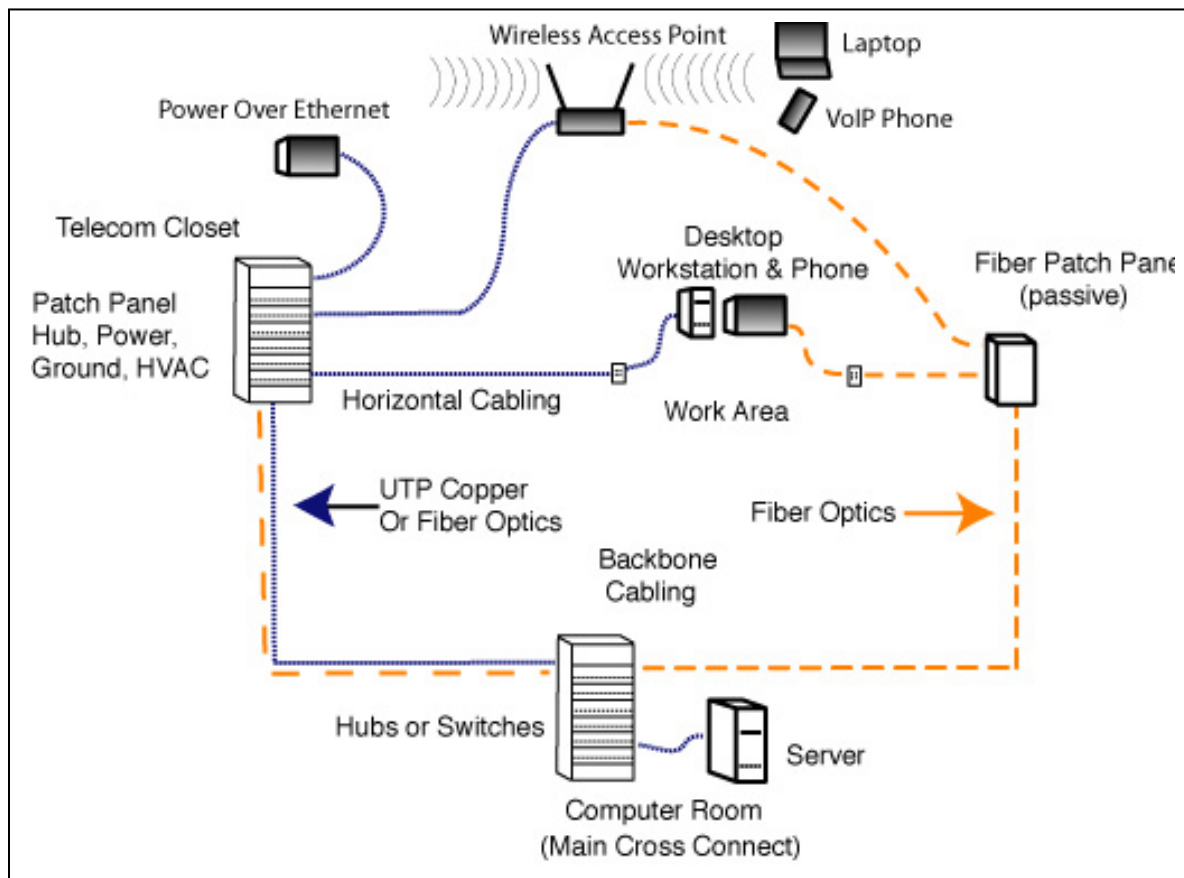
ITS relies on communications such as:

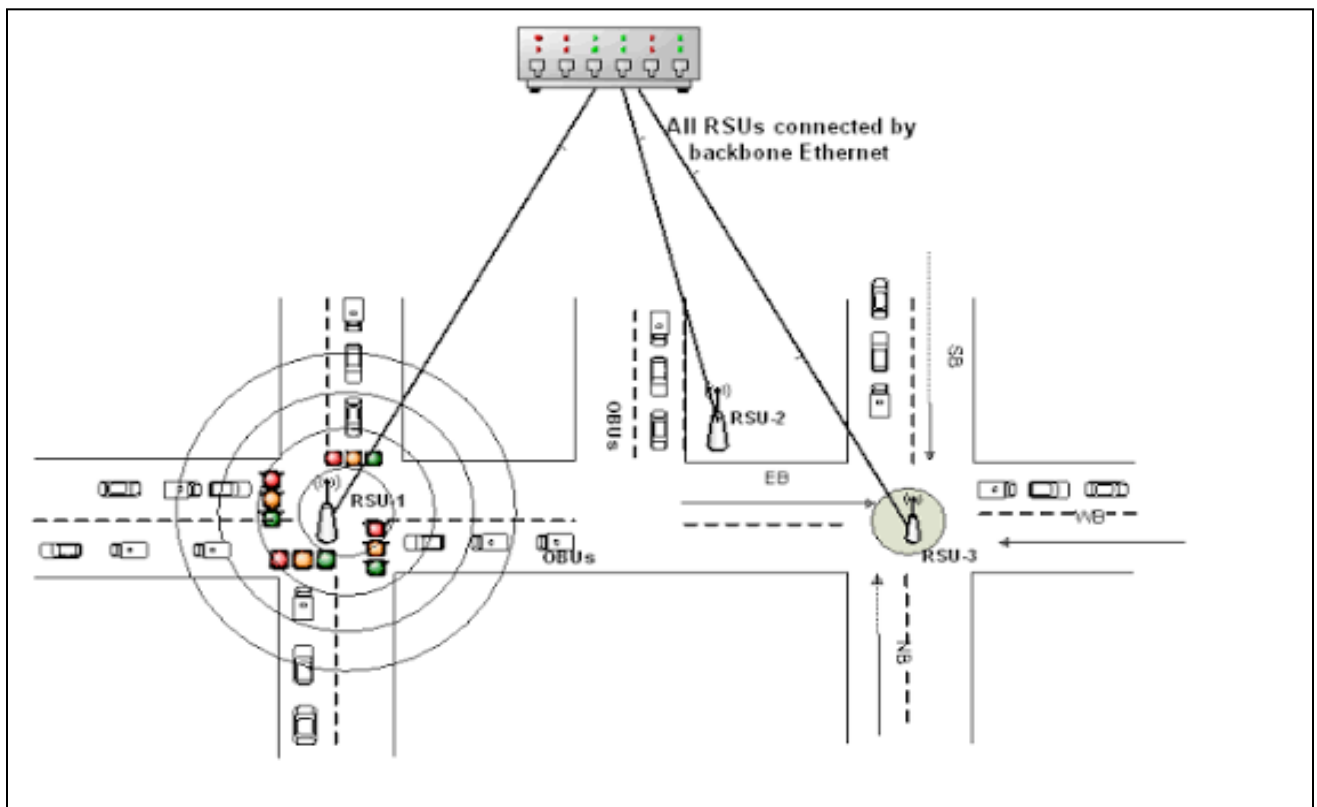
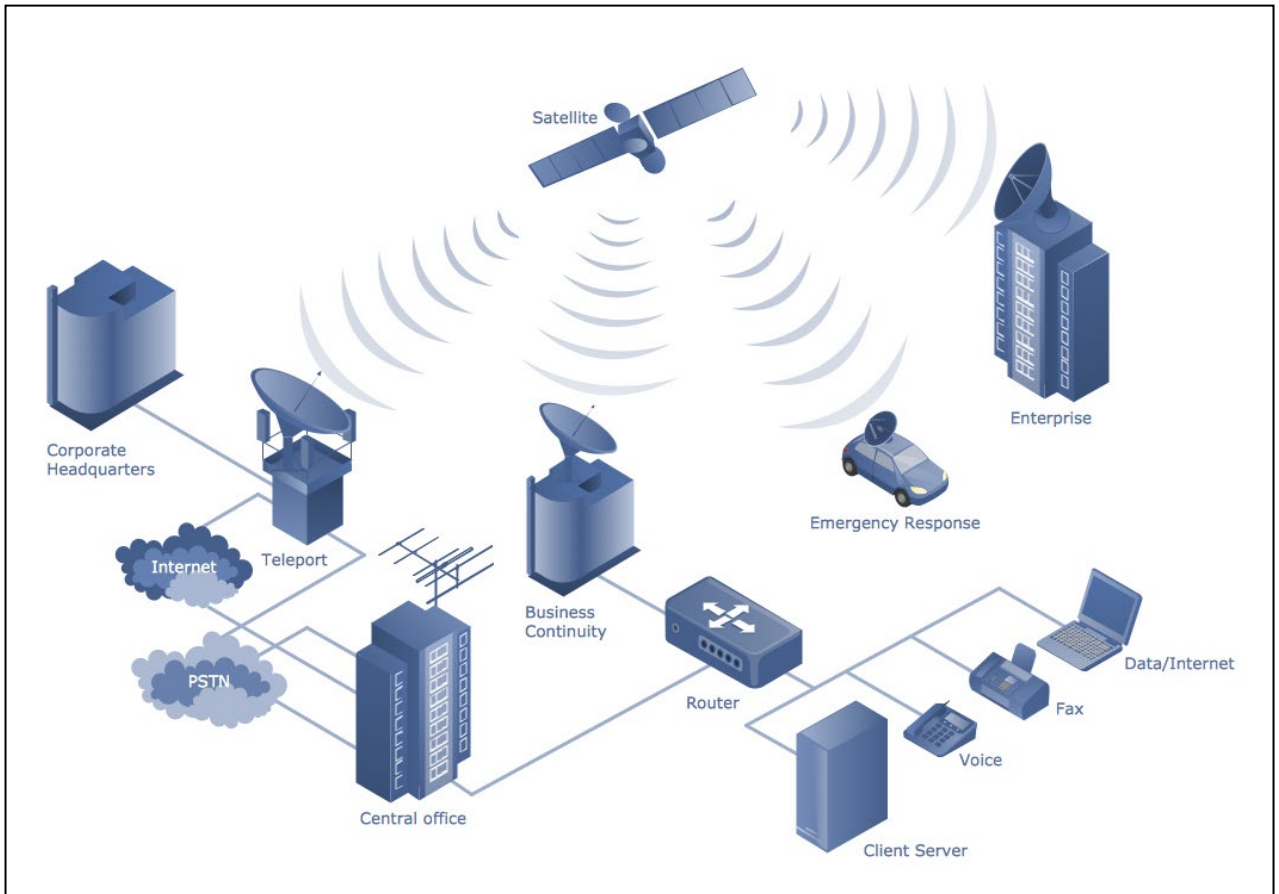
- Fiber optic networks
- Wireless communications
- Cellular networks

These systems connect:

- Field devices
- Control centers
- Emergency services
- Travelers

[Figure 5 – Transportation communications network concept]





7. TRAFFIC MANAGEMENT CENTERS (TMC)

A Traffic Management Center is the operational hub of an ITS system.

Functions include:

- Monitoring traffic conditions
- Controlling field devices
- Managing incidents
- Coordinating emergency response
- Disseminating traveler information

[Figure 6 – Traffic Management Center operations concept]





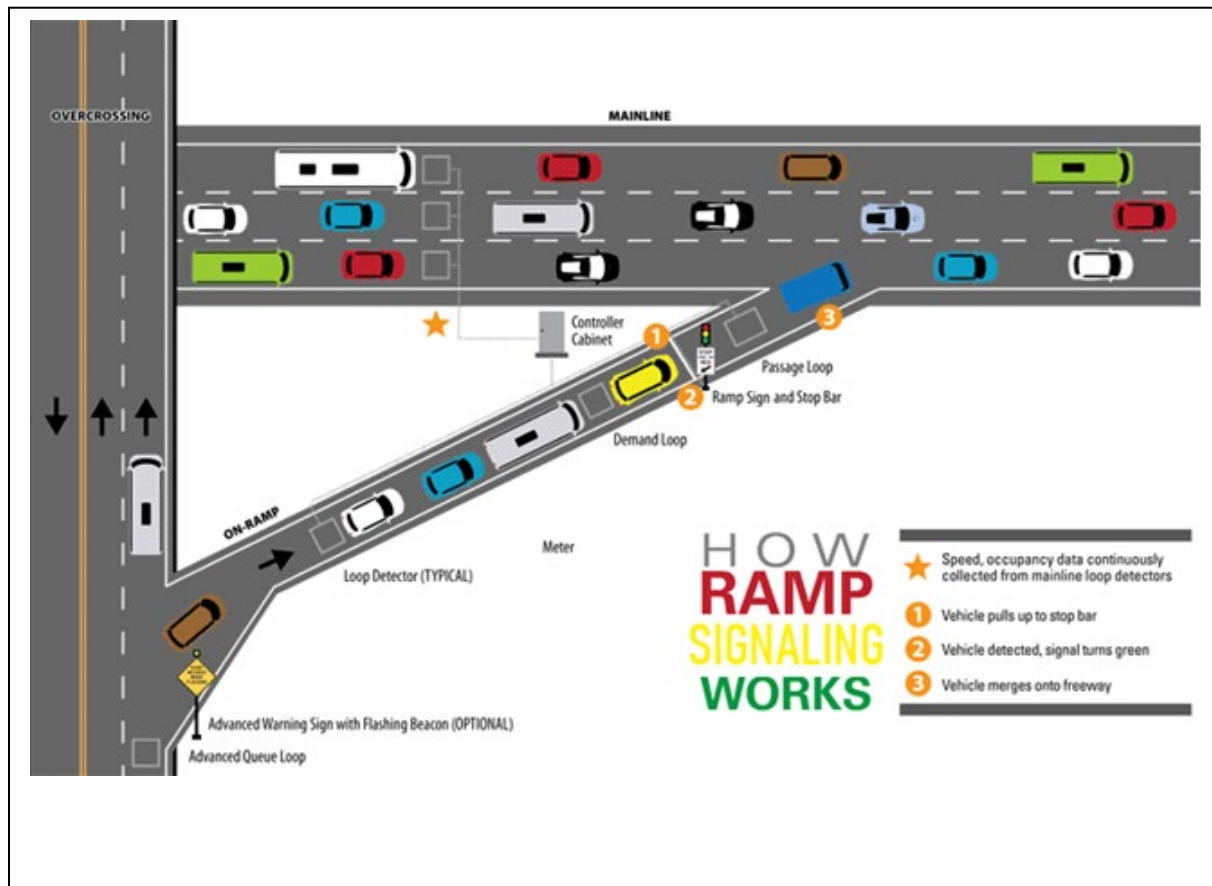
8. FREEWAY MANAGEMENT SYSTEMS

Freeway ITS applications include:

- Ramp metering
- Dynamic message signs
- Lane control signals
- Speed management systems

These systems improve:

- Traffic flow
- Safety
- Travel time reliability
- [Figure 7 – Freeway management system layout]

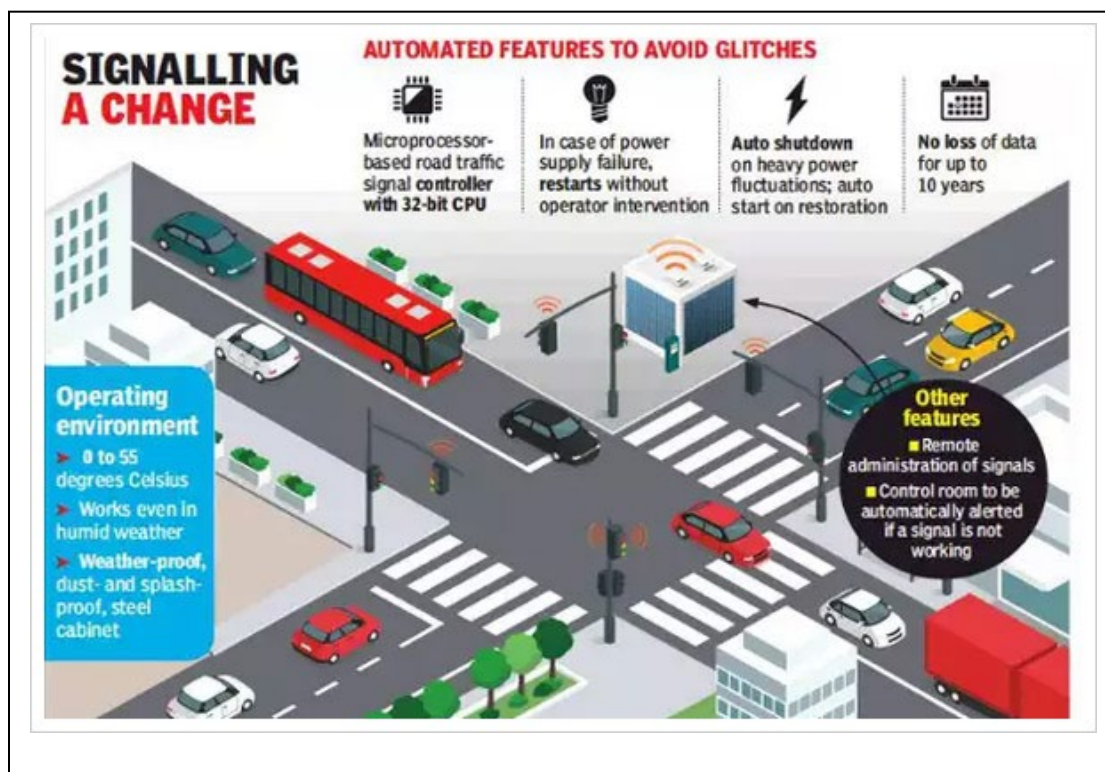


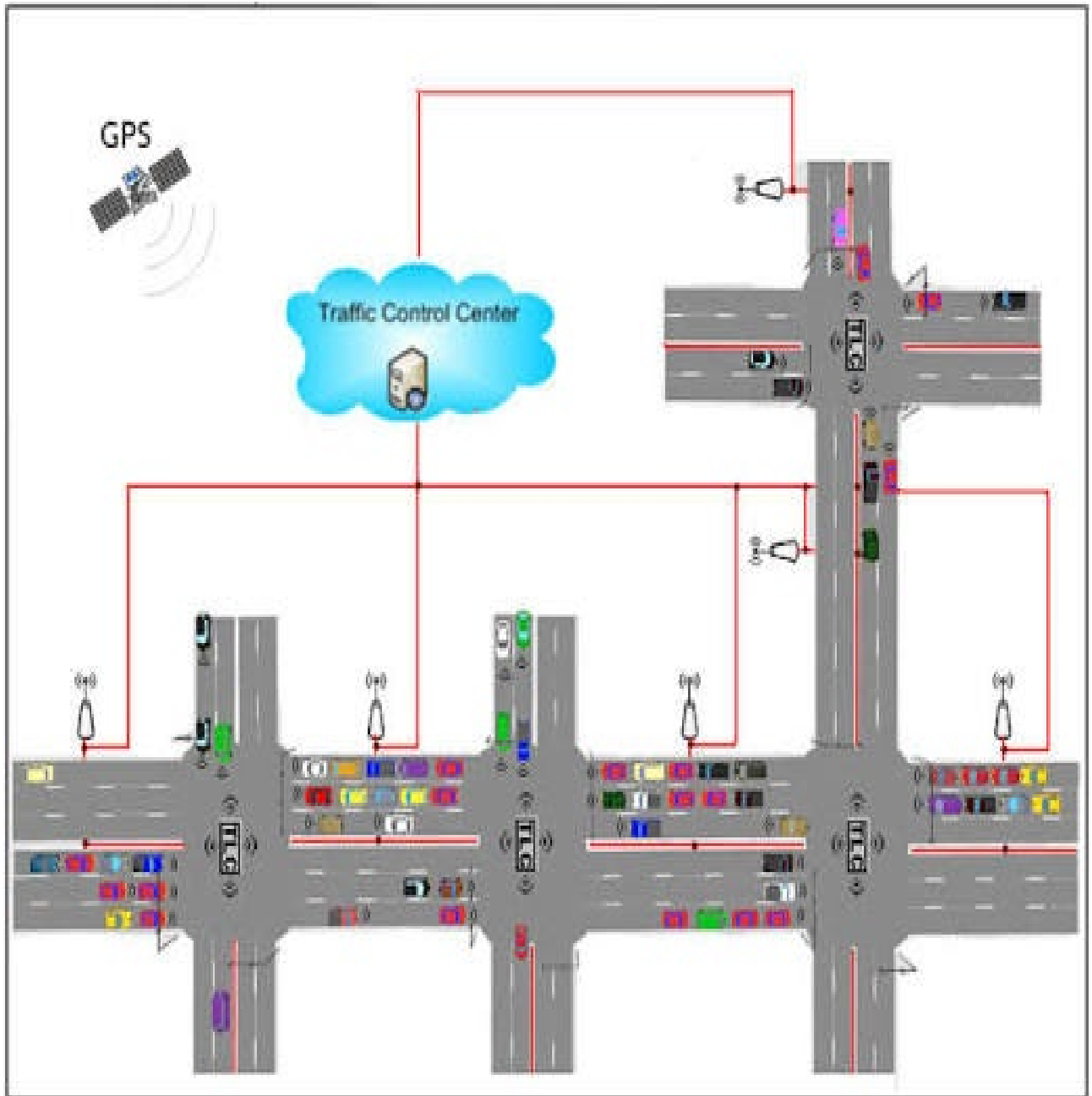
9. ARTERIAL MANAGEMENT SYSTEMS

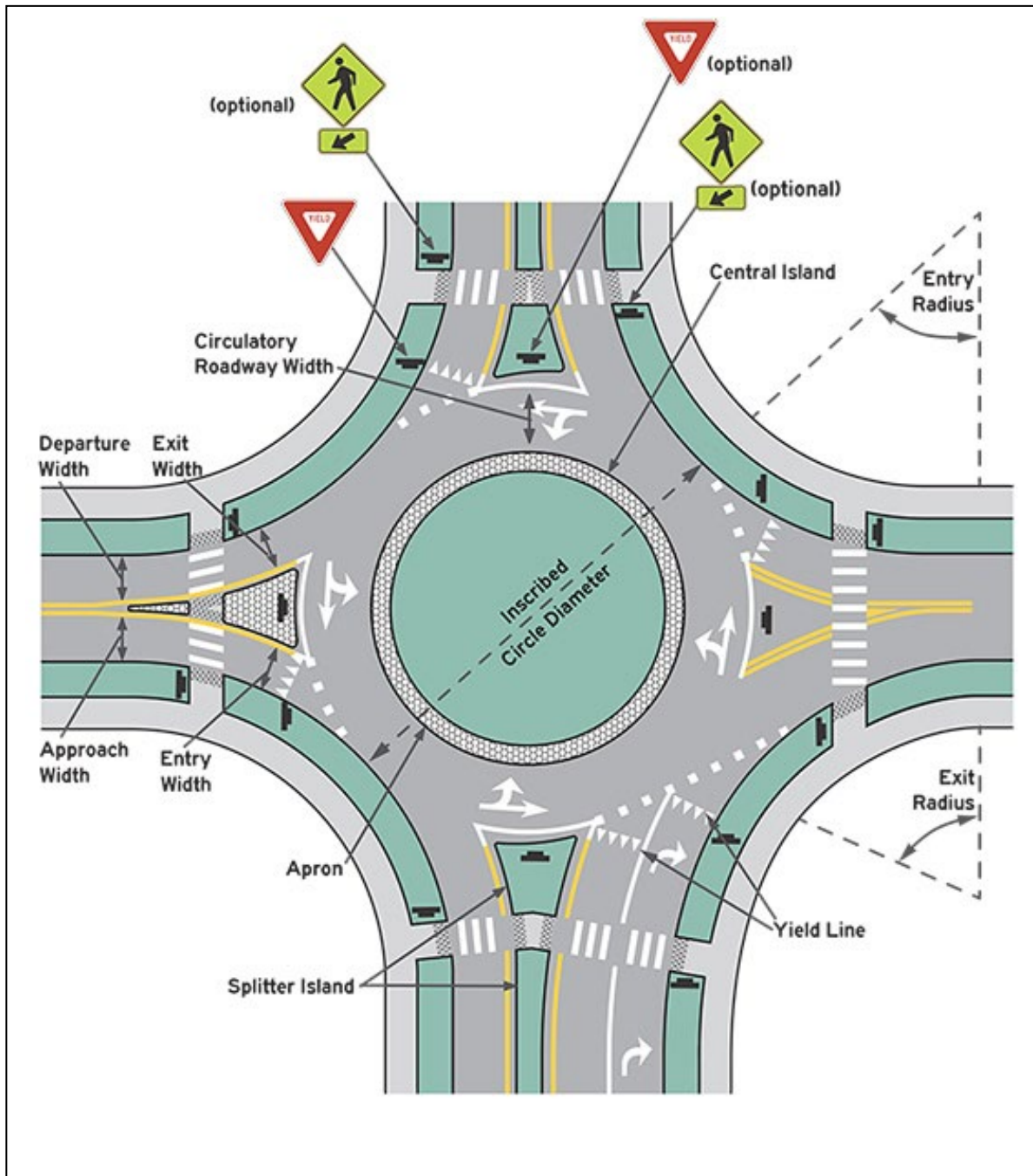
Arterial ITS strategies include:

- Adaptive signal control
- Transit signal priority
- Corridor coordination

[Figure 8 – Smart signaled intersection system]





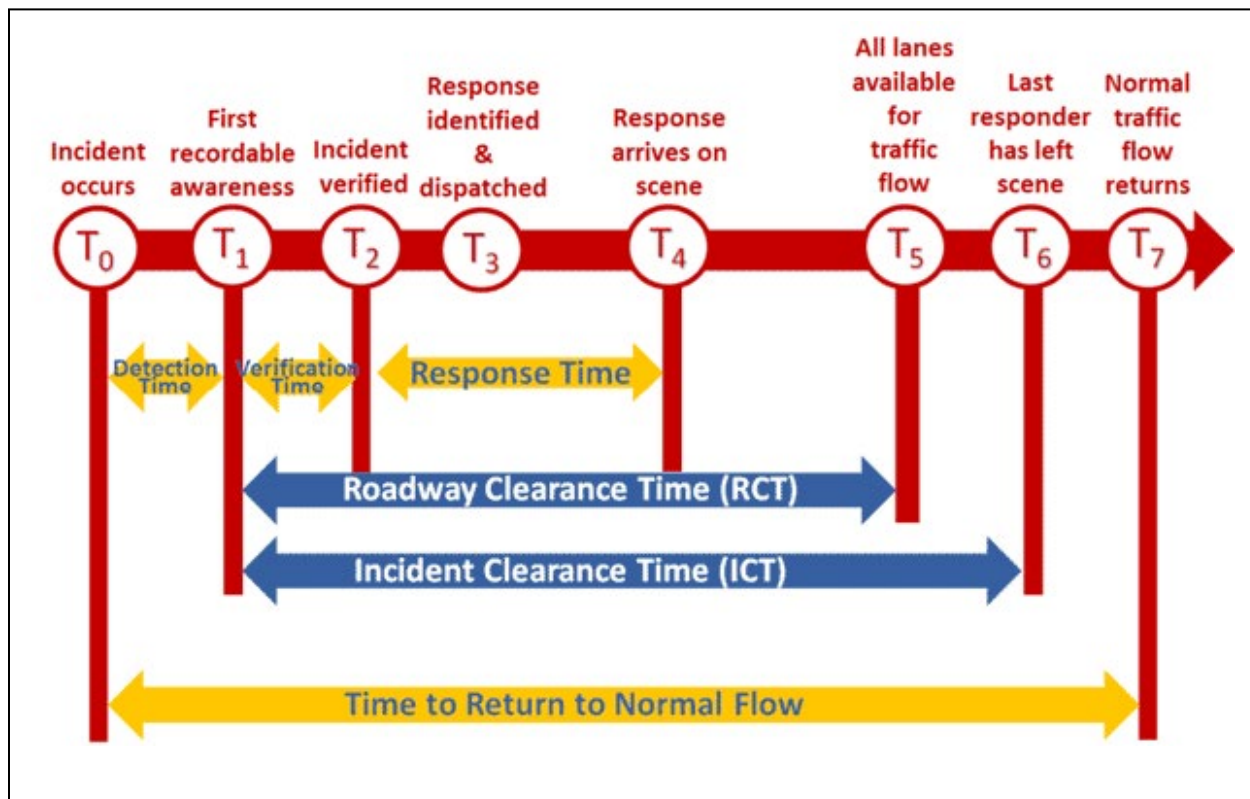


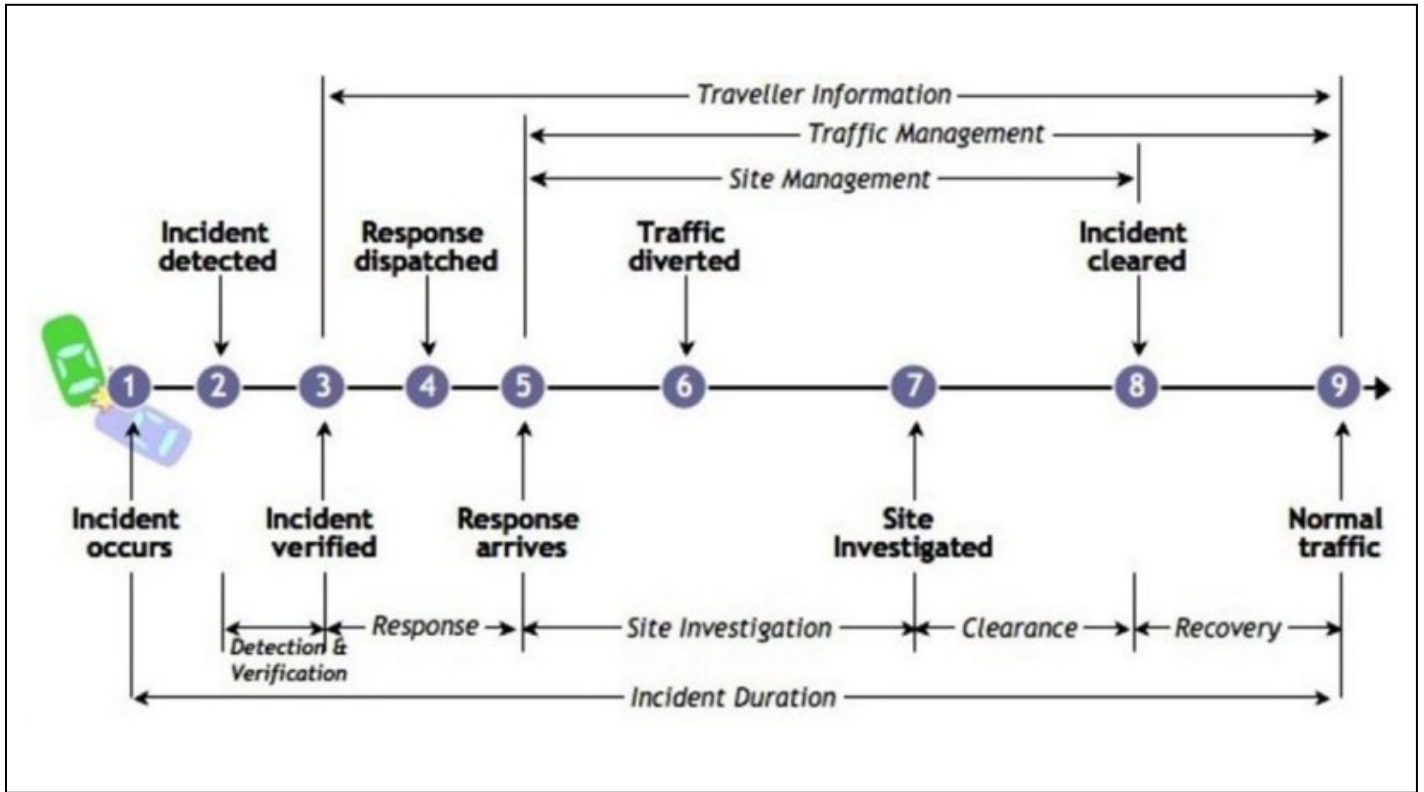
10. INCIDENT MANAGEMENT SYSTEMS

ITS improves incident response through:

- Automatic detection
- CCTV monitoring
- Dispatch coordination
- Real-time traveler alerts

[Figure 9 – Incident detection and response workflow]







U.S. Department of Transportation

ITS for Traffic Incident Management

According to the Federal Highway Administration, effective [Traffic Incident Management \(TIM\)](#) reduces the duration and impacts of traffic incidents; improves the safety of motorists, crash victims, and emergency responders; and reduces the frequency of secondary crashes.¹

This document provides examples of ITS-enabled TIM strategies that focus on improving incident detection, scene clearance, and traveler information for demand management. The featured benefits and lessons learned are based on ITS project evaluations contained in the ITS Databases at: www.itsknowledgeresources.its.dot.gov.



Improved Traveler Information in Utah

Researchers analyzed message logs from 21 variable message signs and associated crash records on a 57-mile segment of I-15 in the Salt Lake City area. The study found that combined messages of "Prepare to Stop" along with the number of miles to the crash site could increase route diversion rates by drivers approaching major incidents.

Traffic Incident Management



Quicker On-Scene Clearance in South Carolina

The deployment of a collision and ticket tracking system for crash, personal contacts, and citation data reduced police investigation time by 63% and decreased average report processing time by 85%. This electronic data system also provided more timely, accurate, and complete crash data, which increased the reliability of the data for safety decision making and improved efficiency by supporting



Quicker Incident Detection in Georgia

Georgia DOT deployed an incident connectivity platform with a cloud-based call-taking app that allows traffic operators and emergency centers to quickly locate and continuously communicate with motorists. Based on a 3-month pilot program, this platform reduced the time to locate stranded motorists by 85%.

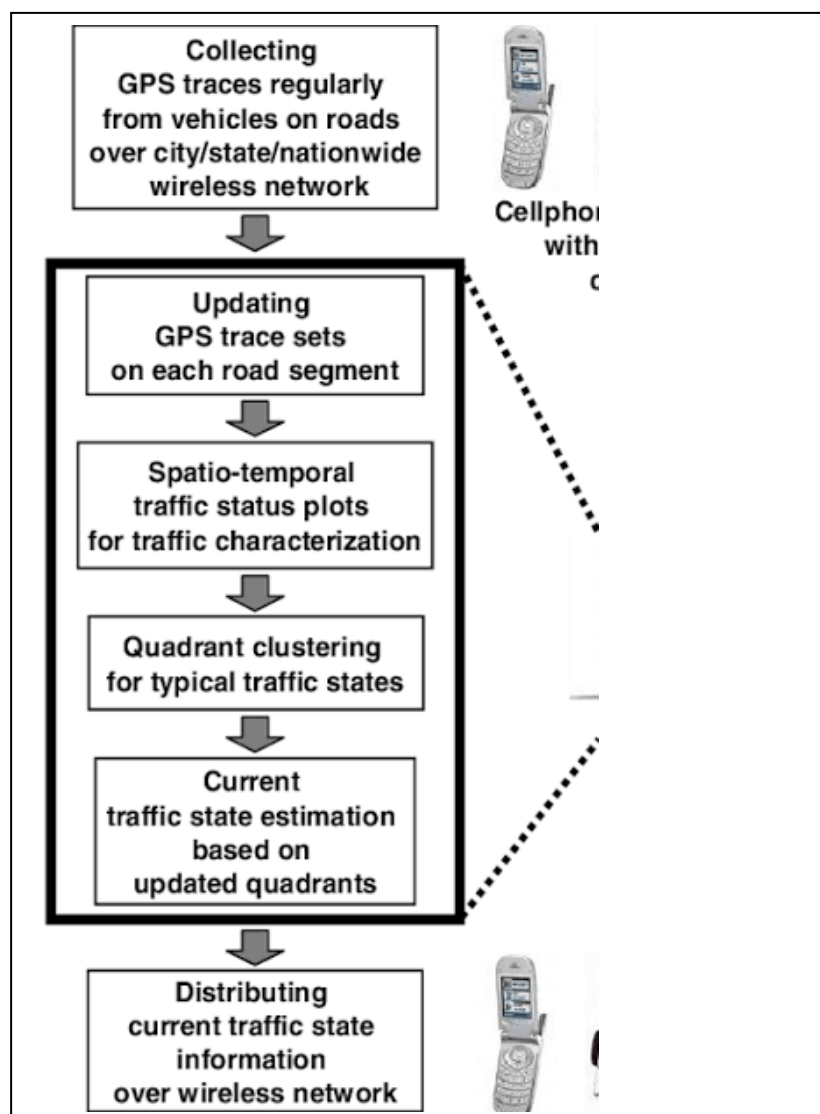
11. TRAVELER INFORMATION SYSTEMS

Information is provided through:

- Dynamic message signs
- Mobile applications
- Navigation systems
- Highway advisory radio

[Figure 10 – Traveler information dissemination methods]



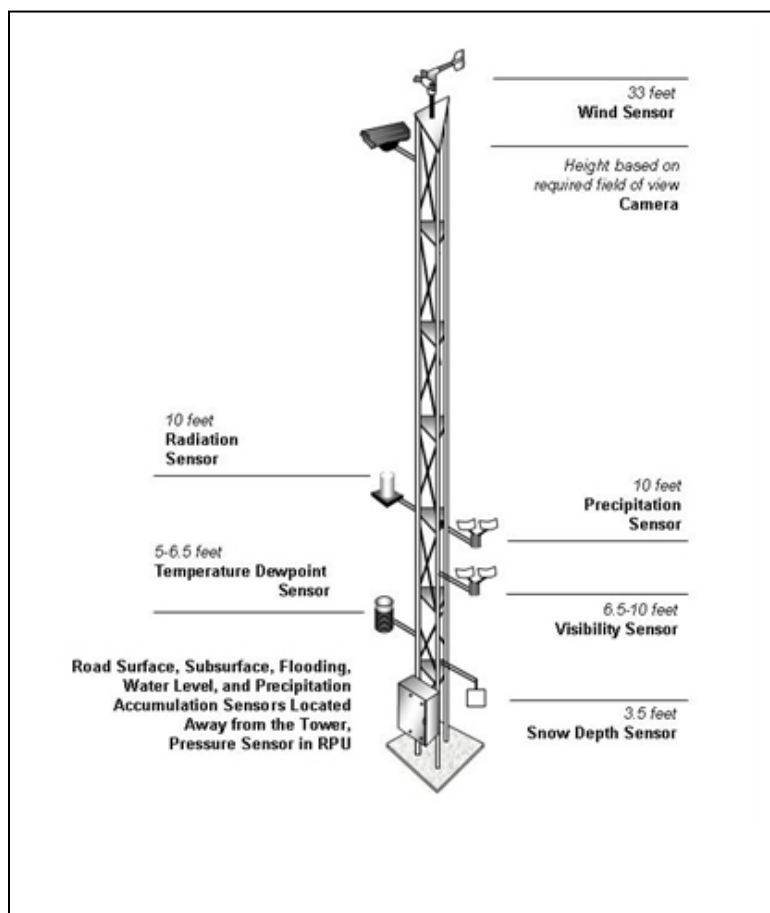


12. ROAD WEATHER MANAGEMENT SYSTEMS

These systems monitor:

- Pavement temperature
- Visibility
- Wind
- Precipitation

[Figure 11 – Road weather information system station]







13. SMART WORK ZONES

Smart work zones improve safety through:

- Queue detection
- Speed warning systems
- Portable message signs

[Figure 12 – Smart work zone ITS deployment]



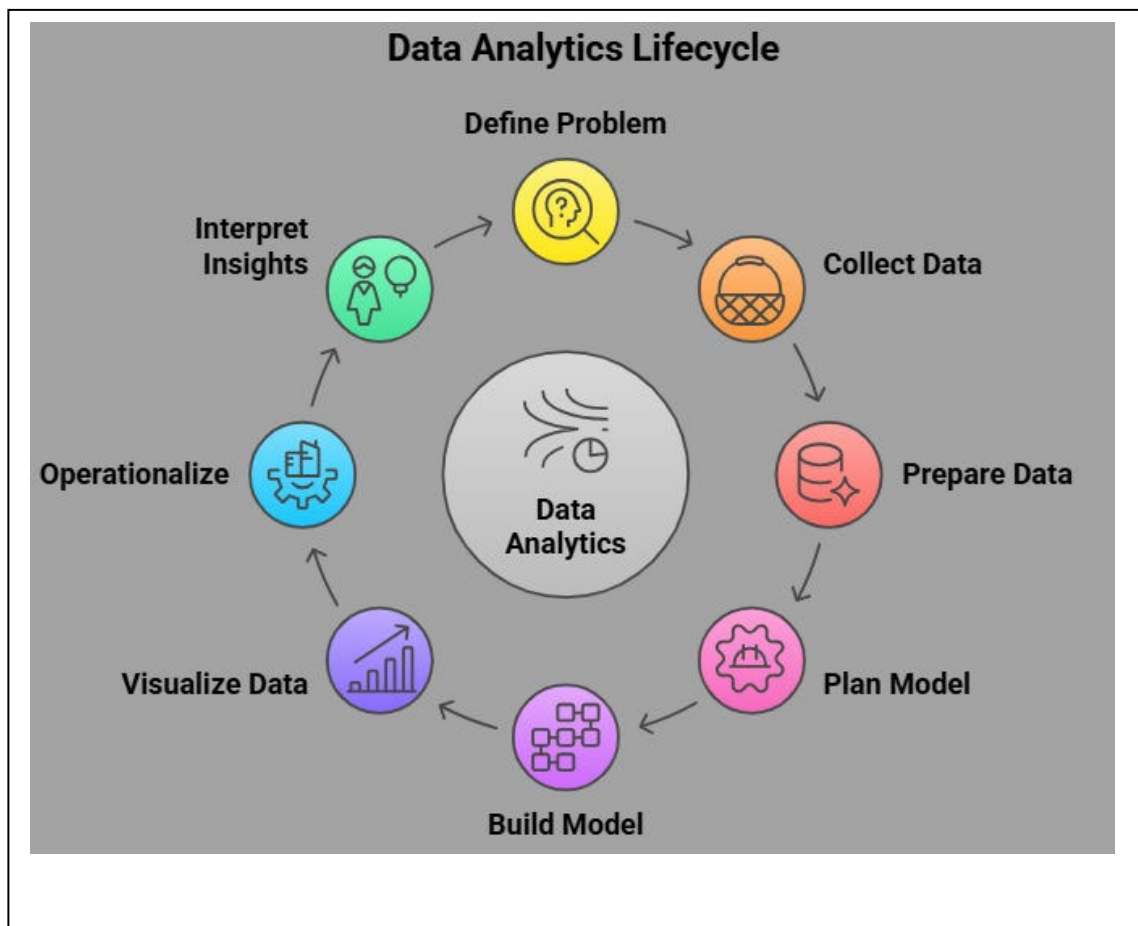


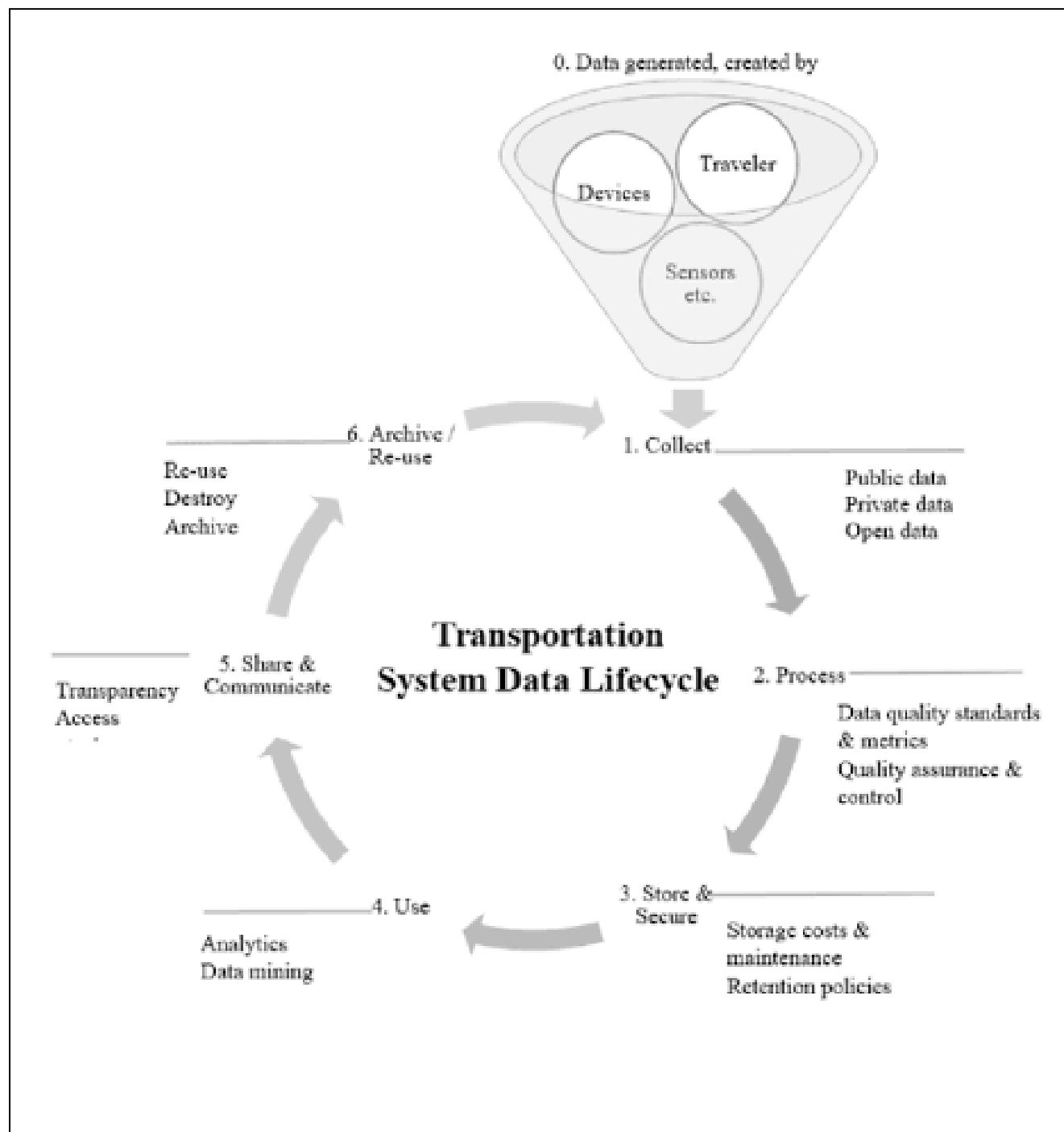
14. DATA COLLECTION AND TRANSPORTATION ANALYTICS

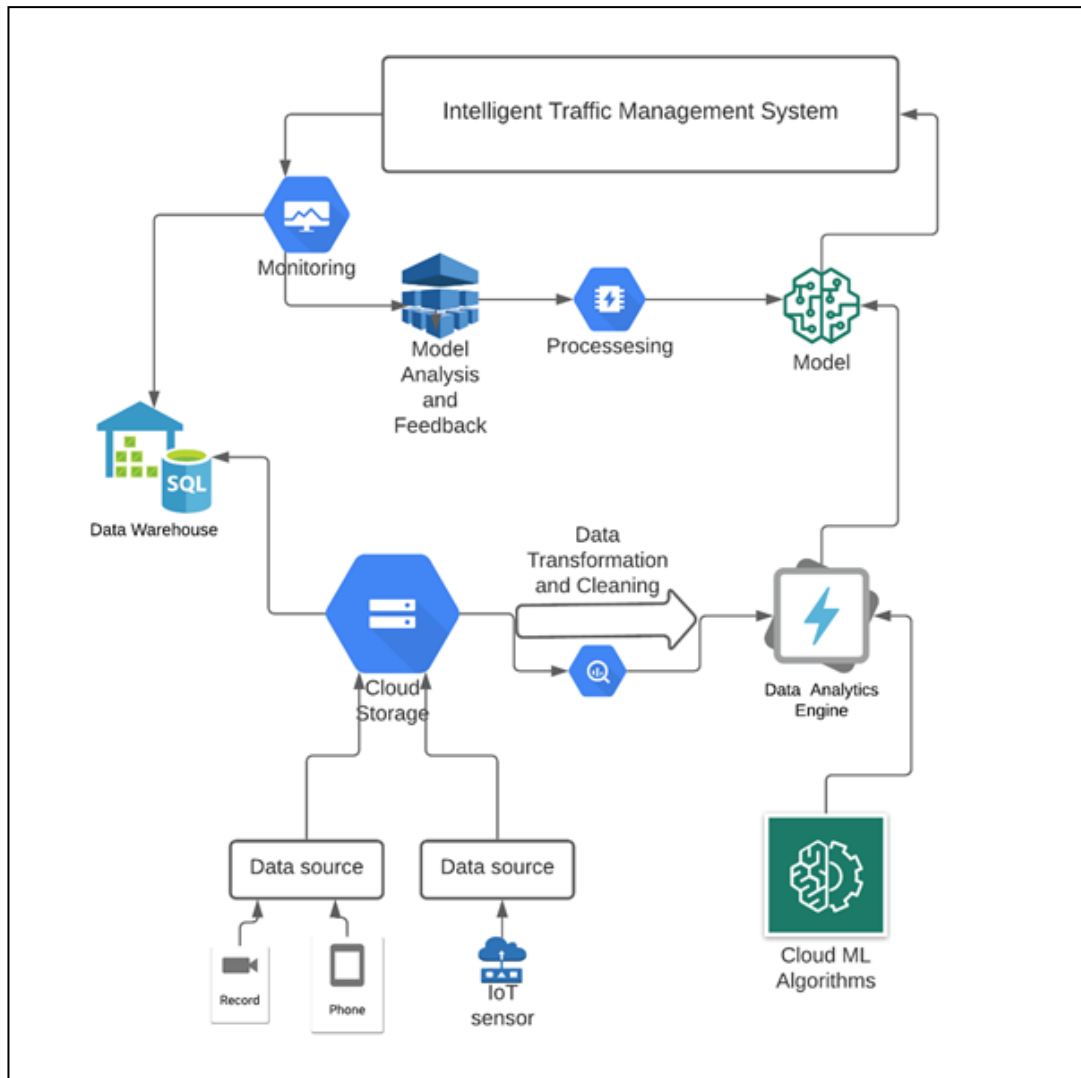
Data is used for:

- Performance monitoring
- Planning
- Predictive maintenance
- Congestion management

[Figure 13 – Transportation data lifecycle]







15. ROLE OF THE CIVIL ENGINEER IN ITS PROJECTS

Civil engineers are involved in:

- Planning
- Design
- Infrastructure integration
- Construction coordination
- Operations support

16. BENEFITS AND COST EFFECTIVENESS OF ITS

ITS provides:

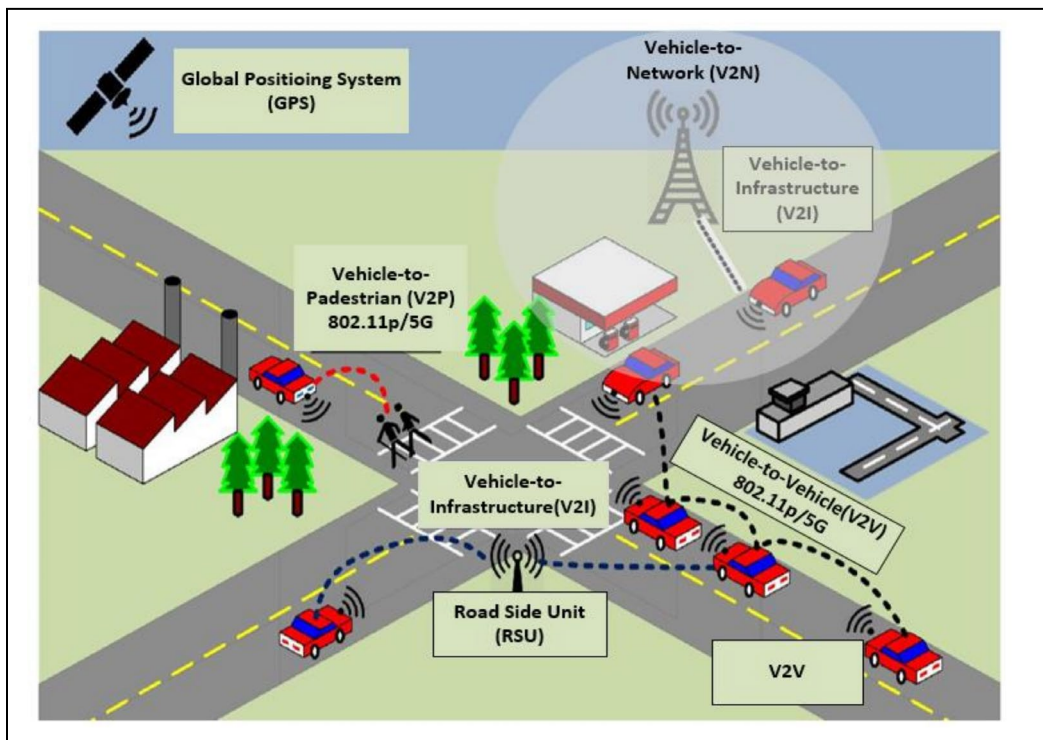
- High benefit-to-cost ratios
- Improved safety
- Reduced fuel consumption
- Lower emissions

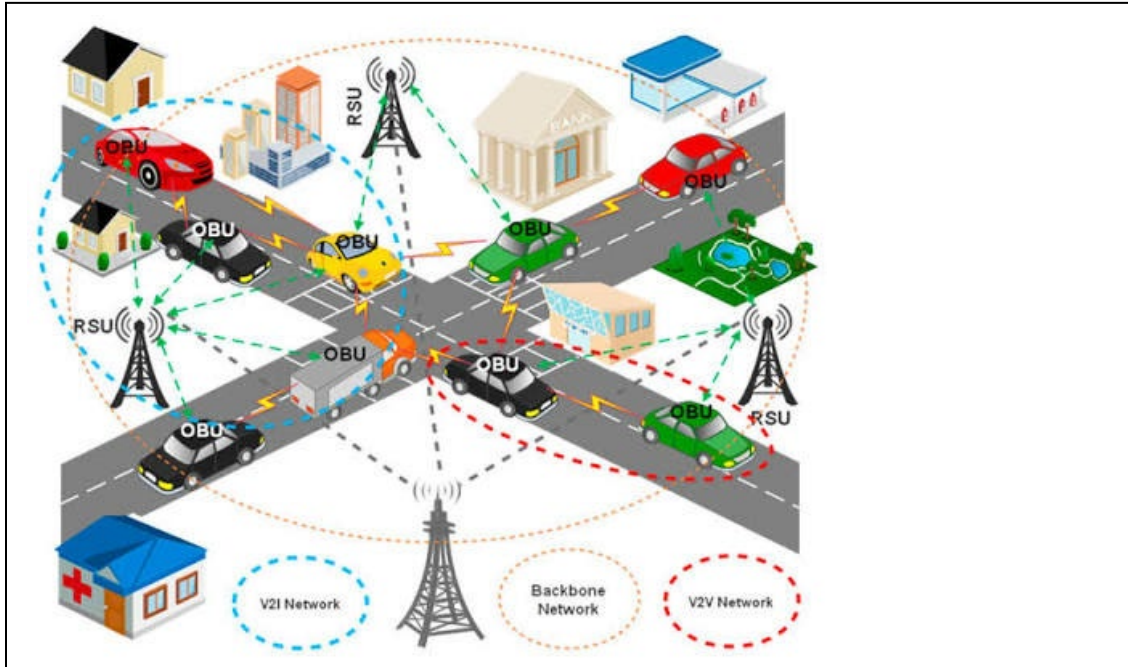
17. FUTURE OF INTELLIGENT TRANSPORTATION SYSTEMS

Future developments include:

- Connected vehicles
- Automated transportation
- Integrated corridor management
- Digital infrastructure

[Figure 14 – Connected transportation ecosystem]





18. SUMMARY

Intelligent Transportation Systems represent the transition from traditional infrastructure to a connected, data-driven transportation network that improves safety, efficiency, and reliability.