



Module 13: An Introduction to Integrated Corridor Management (ICM)

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1. Module Description

Integrated Corridor Management (ICM) focuses on managing a transportation corridor by creating a framework for interaction and coordination among the various agencies that operate facilities along that corridor, including transit agencies and operators. This is in contrast to traditional management, in which individual agencies manage their respective networks (e.g., a highway agency is concerned only with performance on the highway system). With ICM, agencies work together to optimize travel within the corridor by providing travelers with actionable information and implementing innovative operational practices and strategies, enabled by Intelligent Transportation Systems (ITS) technologies. For example, if a highway is experiencing higher than normal traffic (e.g., congestion caused by an accident), a diversion strategy can be crafted to redirect travelers to frontage roads or arterials and/or to park-and-ride lots to take transit.

To plan and implement these strategies, technology often plays a strong role. These technologies include parking management systems, Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC) technologies on transit, traffic-sensing technology on roads, and methods of information dissemination (e.g., variable message signs, 511, mobile alerts), both for travelers and transportation managers. It is anticipated that having access to and using this information will support better situational awareness and response than before ICM.

2. Introduction/Purpose

Transit agencies can play an important role in the process of improving mobility and reduce congestion on a busy corridor. This module provides an introduction to ICM and provides information on pertinent transit and other standards deployed using ICM case studies. There are four basic concepts within ICM that will be briefly described in this module: (1) Corridor modes of operation; (2) Strategic areas for ICM; (3) Conceptual levels within the corridor; and (4) ICM environment. Further, there are two sites that have fully-deployed ICM systems (Dallas and San Diego) and several others that are being deployed. The characteristics of three ICM systems (Dallas, San Diego and Virginia/DC) will be described in this module.

Finally, ITS standards have the ability to facilitate integration of ICM technologies and systems. Standards for facilities, centers and operators within a corridor support, corridor management strategy, interoperability of systems, control and sharing of technologies and data, and interchangeability of technologies. Several specific standards are considered as a part of ICM strategies, and these will be introduced in this module.

3. Samples/Examples

The U.S. Department of Transportation (USDOT) selected eight "Pioneer Sites" to act as critical partners in the development, deployment and evaluation of Integrated Corridor Management (ICM) strategies designed to help manage congestion in some of our nation's busiest urban corridors.

Figure 1 shows the cities that were ICM Pioneer Sites. Dallas and San Diego were then selected as demonstration sites. This module includes more information about ICM in these two sites.



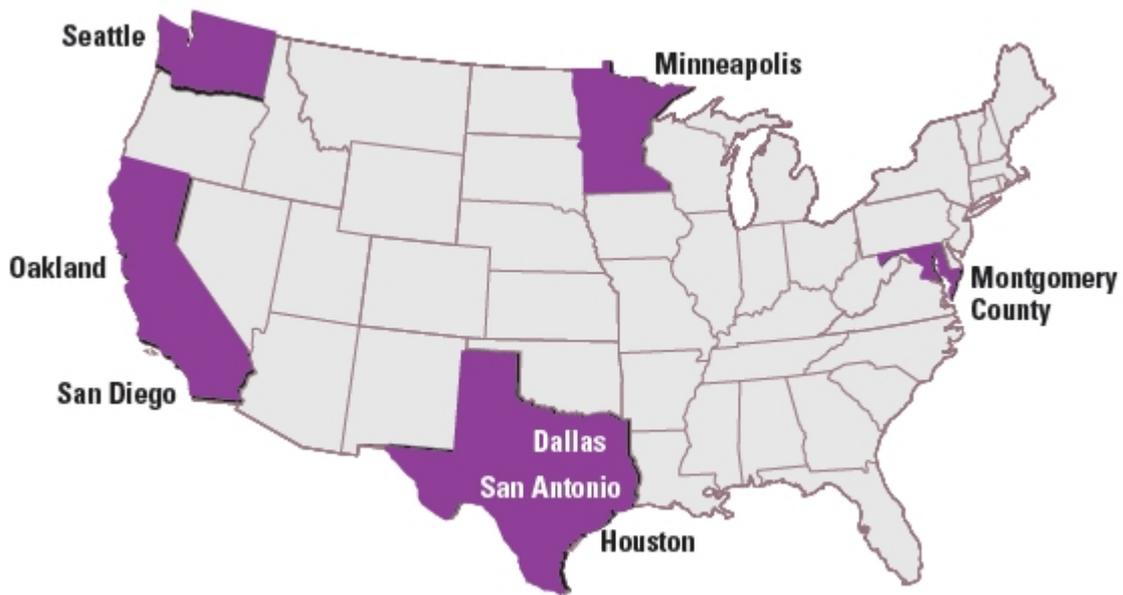


Figure 1. US DOT ICM Pioneer Sites¹

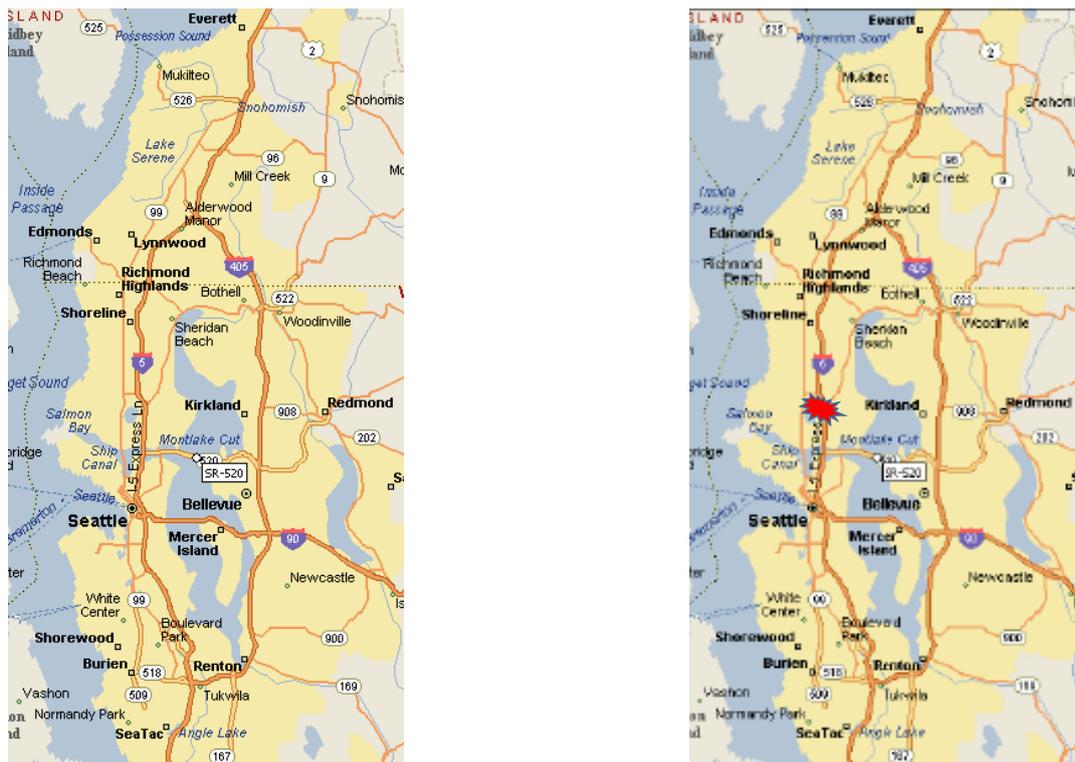


Figure 2. I-5 Operational Scenario (left is before, right is after)

Figure 2 shows the location of a sample ICM operational scenario as described in this module.¹

¹ Dallas, TX, and San Diego, CA were selected to demonstrate ICM concepts that may have applicability to a broad range of corridors around the country.

http://www.its.dot.gov/icms/docs/knowledgebase/HTML/pioneer_fact.htm

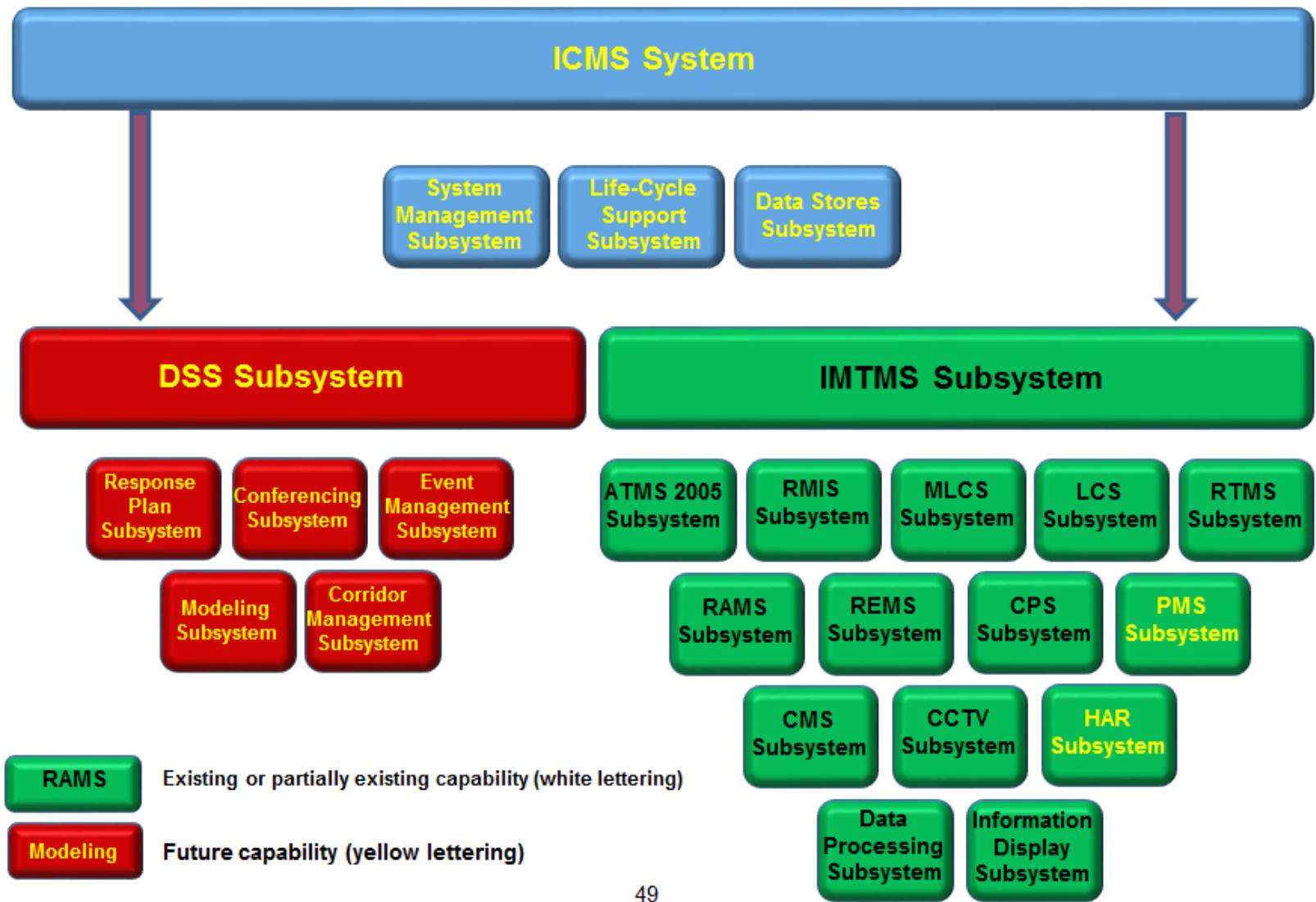


Figure 3. Conceptual Diagram of the San Diego ICM System

Figure 3 is a functional diagram that shows what the I-15 ICM System (ICMS) will do. Those areas of the diagram shaded in GREEN are the subsystems which are currently part of the Regional Intermodal Transportation Management System (i.e., traffic detection systems CCTVs, Ramp Metering System (RES), RAMS, Regional Transit Management System etc.) that are currently being used in the region, although a limited number are still stand-alone. Those shaded RED are considered ICMS candidate systems to be developed or enhanced. Those shaded in BLUE are the core functionality required under the ICMS delivery, and draw upon all underlying subsystems shaded RED or GREEN.

Of note here are the build-out components of a Decision Support subsystem (DSS), and the Modeling subsystem. These subsystems assist the decision making process that will be required for a multi-modal, inter-jurisdictional, and inter-disciplinary coordination, and ICM effort.

Figure 4 shows the Dallas ICM system, which is comprised of three major subsystems. One of the main components of the ICM System is SmartNET/ SmartFusion, which gathers data from a variety of sources and delivers it to multiple destinations. Information is gathered from transportation systems, emergency management systems, dispatch systems for law enforcement, and other types of systems. The ICM System then makes this information available via a web server to traditional users such as Traffic Operations Centers, the Media, and Agency and public websites.

Figure 5 shows one of the unique aspects of Dallas' Traveler Information features for the 511, which is the ability to display real time next bus times graphically with maps.

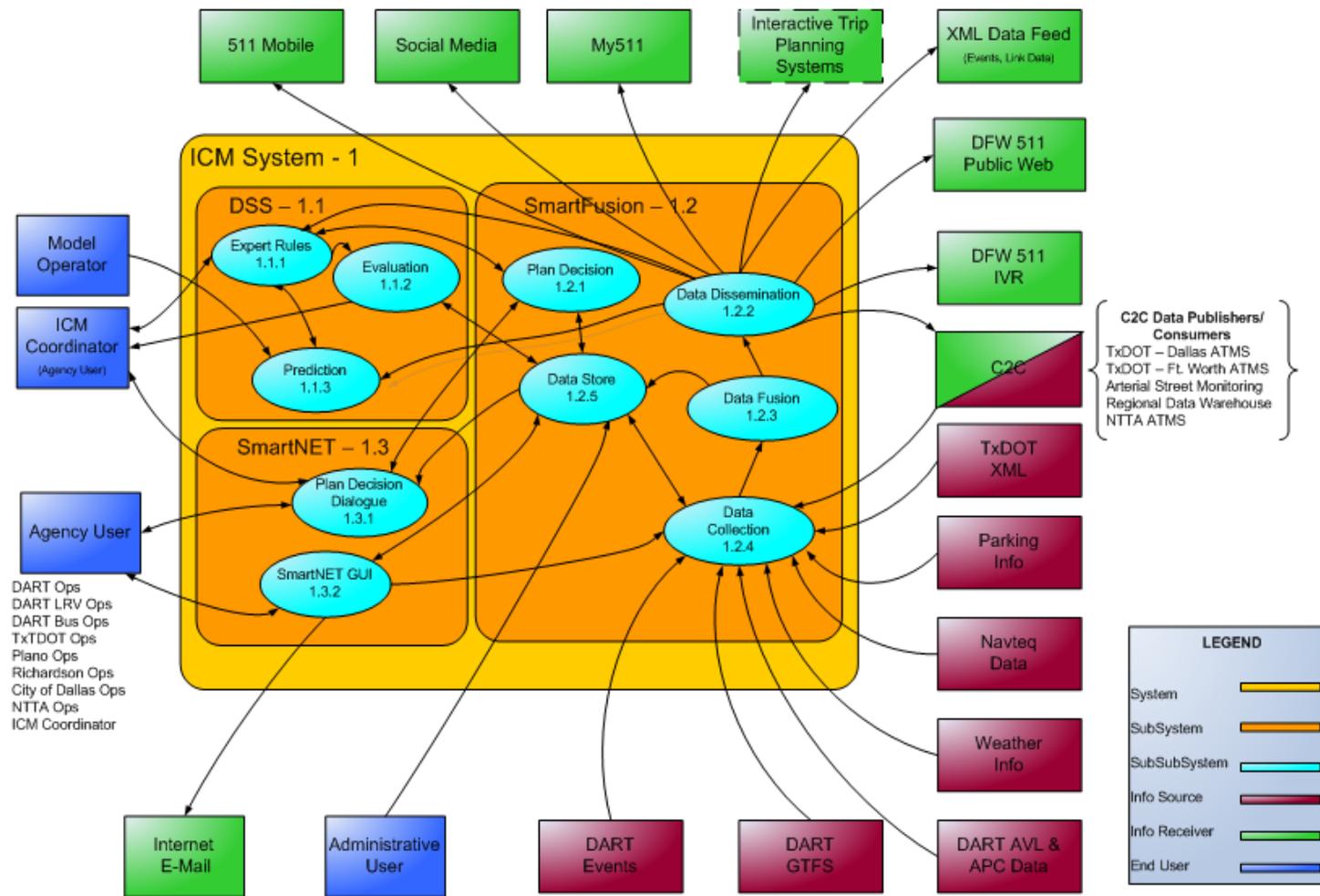


Figure 4. High-Level ICMS Conceptual Diagram (Source: Dallas Area Rapid Transit, March 22, 2013)



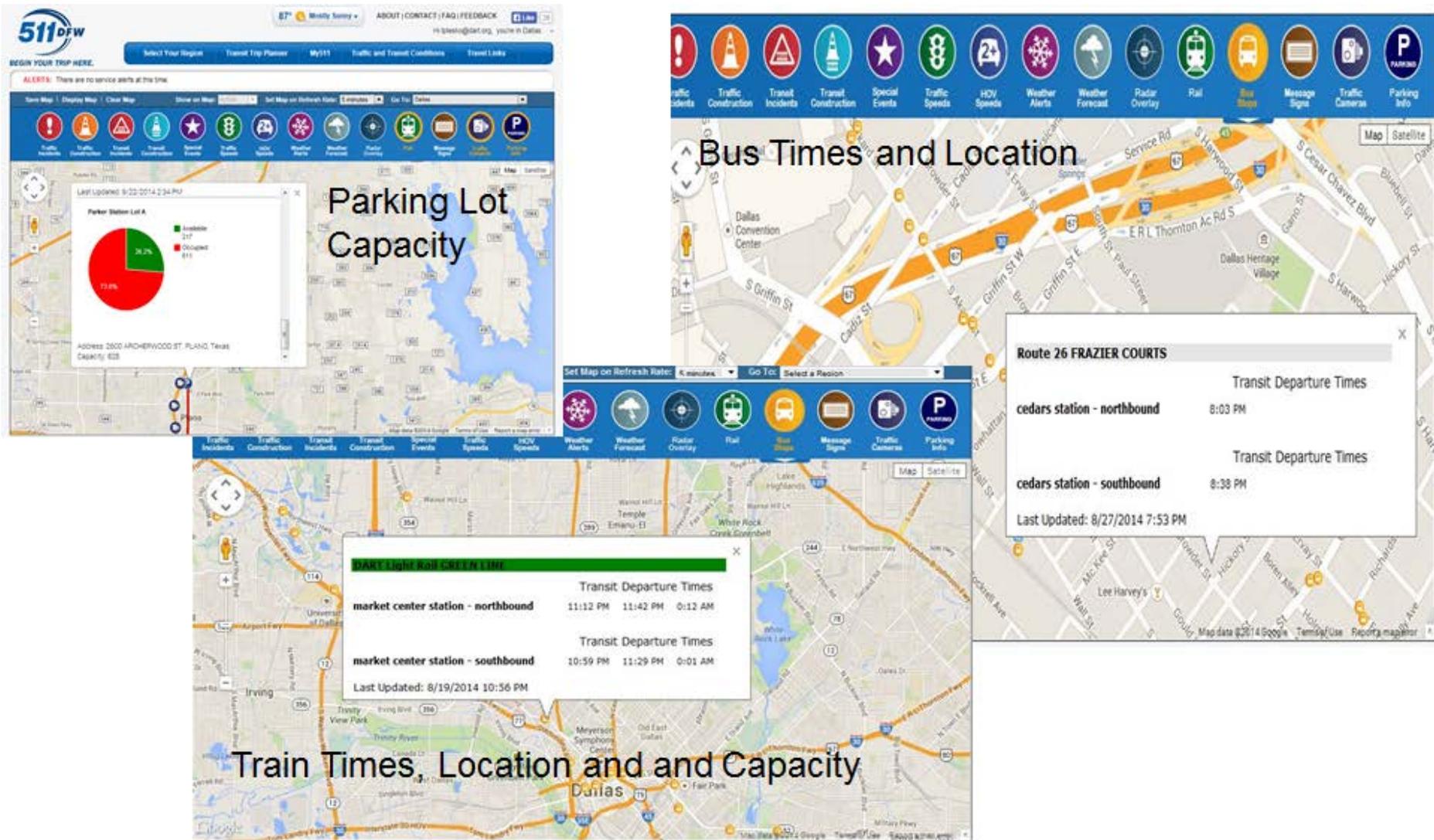


Figure 5. Real Time Transit Data Used for ICM and 511DFW

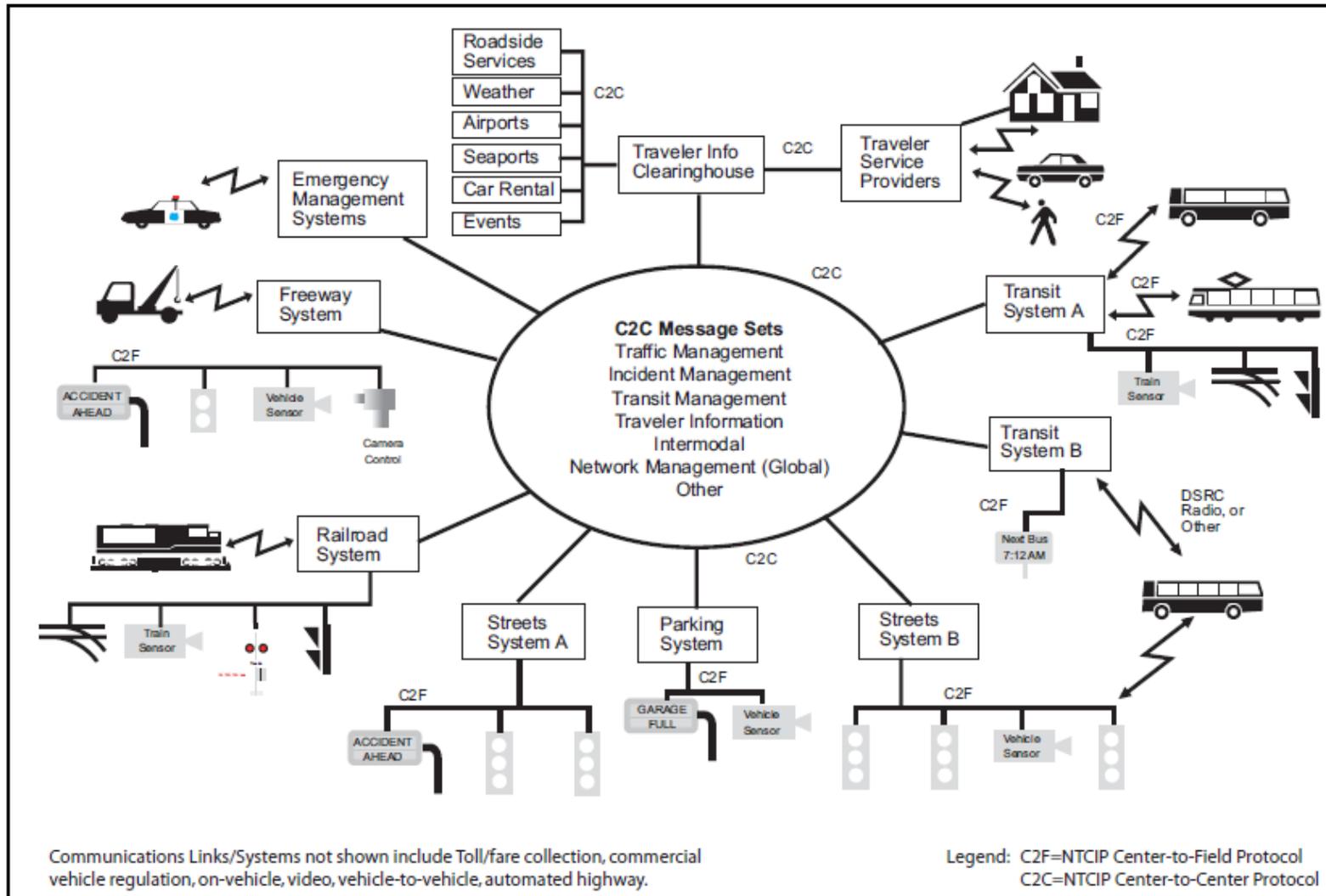


Figure 6. Example of ITS Integration Using NTCIP illustrates how various transportation management systems and devices can be integrated using NTCIP.

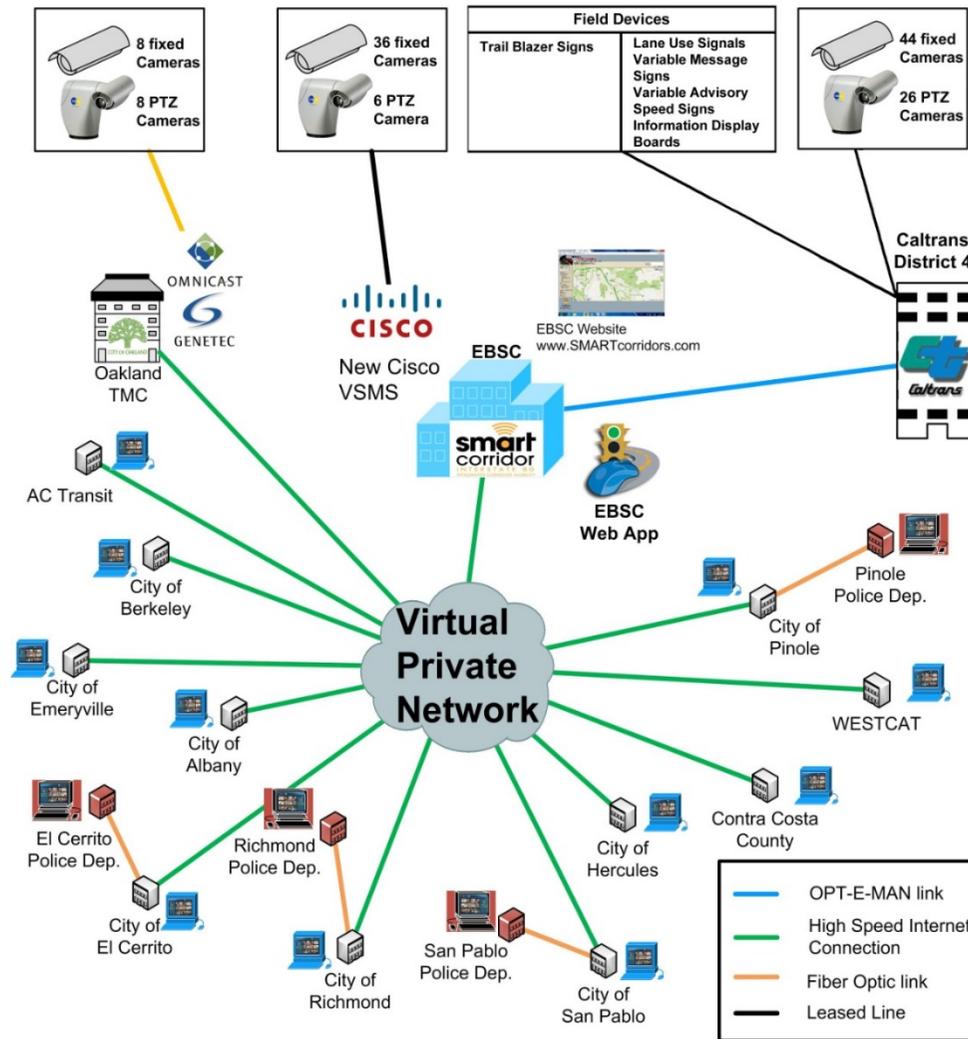


Figure 7. I-80 Systems Integration shows a schematic of the I-80 system integration among various cities, AC Transit, emergency management and Caltrans. System operations are automated, traffic management is coordinated along the corridor and there is information sharing among agencies.

4. Reference to Other Standards

This section contains additional information about the standards described in this module.

4.1. National Transportation Communications for ITS Protocol (NTCIP)

- Center to Field (C2F) Communications Examples:
 - Computer change signal timings as traffic conditions change, and controllers send status and traffic flow information to computer
 - On-board vehicle transit system communicating with traffic signal device to facilitate transit priority
 - Freeway management system communicating with detectors and ramp meters on freeways
 - Traffic management system controlling various types of infrastructure
- Center to Center (C2C) Communications Examples:
 - Two traffic management centers that exchange real-time information about inventory and status of traffic control devices
 - Two or more traffic signal systems exchanging information to achieve coordinated operation of traffic signals managed by different systems and to enable personnel at one center to monitor status of signals operated from another center
 - Transit system reporting schedule adherence exceptions to transit customer information system and regional traveler information system, while also asking traffic signal management system to instruct signals to give priority to behind-schedule transit vehicle
 - Emergency management system reporting an incident to freeway management system, to traffic signal management system, to two transit management systems and to traveler information system
 - Freeway management system informing an emergency management system of a warning message just posted on a dynamic message sign on the freeway in response to its notification of an incident
 - Weather monitoring system informing a freeway management system of ice forming on the roadway so that the freeway management system is able to post warning messages on dynamic message signs as appropriate

4.2. NTCIP 1211 v02 - Object Definitions for Signal Control and Prioritization (SCP)

- Provides vocabulary necessary for traffic management centers, including:

- Traffic management
- Emergency management
- Transit management
- Other fleet management centers and their respective vehicles

To interact with, control, manage, and monitor transportation signal controllers implementing vehicle prioritization schemes

- Includes description of signal control and prioritization scenarios and possible configurations
- Contains object definitions to support functionality of each scenario, conformance group requirements and conformance statements to support compliance with standard

4.3. Advanced Transportation Controller (ATC)

- ITE ATC Family of standards:
 - Defines field controller devices used in traffic management applications, particularly (but not exclusively) for traffic signal control
 - Has two types of users: Operational and Developers
 - Operational users: transportation and traffic engineers and technicians (or their consultants) who design, specify, procure, implement, operate, and maintain ITS field controller units
 - Developers: manufacturers who design, develop, and manufacture the field equipment in addition to software developers who design, develop, and program the software applications to run on it
 - Three components of ATC are:
 - Controller
 - Cabinet
 - Software
 - Standards define initial modular ATC software platform for Applications Programming Interface (API) (see slide 31), Cabinet and Controller
 - ATC Family describes open architecture field control devices and software applications that run on them

4.4. ATC Cabinet

- ITS Cabinet specifies functional physical design requirements for ITS cabinet that supports deployment of multiple ITS functions in single cabinet

- Defines major components installed in a cabinet:
 - Controller
 - Input Assembly(s)
 - Output Assembly(s)
 - Power Distribution Assembly
 - Service Panel Assembly
 - DC Power/Communications Assembly & Extension
 - RAW/CLEAN AC Power Assembly & Extension
 - Cabinet Monitoring System
 - Optionally, a Fiber Optic Splice Tray
- Includes other components, including traffic detectors, traffic signal load switches, malfunction monitors (that monitor the output of the cabinet for safety), fail-safe controls such as malfunction flash operation, special detection equipment, lightning protection, and power management

- Three standard cabinet assemblies are defined

4.5. NTCIP Center-to-Center (C2C)

- C2C communications is type of communication involving messages sent between two or more center systems
- Involves peer-to-peer communications between any number of center systems in a many-to-many network
- Type of communication similar to Internet
- Examples of C2C communications:
 - Two traffic management centers that exchange real-time information about inventory and status of traffic control devices
 - Two or more traffic signal systems exchanging information to achieve coordinated operation of traffic signals managed by the different systems
 - Transit system reporting schedule adherence exceptions to transit customer information system and to a regional traveler information system, while also asking a traffic signal management system to instruct its signals to give priority to a behind-schedule transit vehicle



- Emergency management system reporting an incident to a freeway management system, to a traffic signal management system, to two transit management systems and to a traveler information system
- Freeway management system informing an emergency management system of warning message just posted on DMS on freeway
- Weather monitoring system informing freeway management system of ice forming on roadway so that warning messages are posted on DMS as appropriate

5. Case Studies

5.1. San Diego

The San Diego ICM Corridor covers a 21-mile segment of I-15 and runs from SR-78 in the north to SR-163 interchange in the south. It serves commuter, goods, and services movement from northern San Diego to the downtown area. Weekday traffic volumes range from 170,000 to 290,000 vehicles on general purpose lanes. Managed Lanes and Bus Rapid Transit (BRT) operate in the Managed Lanes. Dynamic variable pricing in the managed Lanes will help manage traffic flow.

San Diego's ICMS aims to proactively and collaboratively manage the I-15 corridor to maximize transportation system performance and enable travelers the opportunity to make convenient shifts among modes and routes.

Improved mobility for people, goods, and services will be achieved by improving current levels of system integration and through continued collaboration among the corridor's institutional partners and their native functional environments or systems. With ICM, actions taken by individual agencies or networks will be made based on the condition of and the impact on the entire corridor.

All corridor operations will be coordinated through the ICMS where corridor networks and agencies will share data and information and make changes for the benefit of the corridor's operations. For example, operations personnel will adjust traffic signals and ramp meters to direct travelers to High-Occupancy Toll (HOT) lanes, bus rapid transit and other operations tools as needed. The DSS will forecast corridor performance problems and recommend response plans allowing proactive courses of action. Who's involved? The I-15 ICM Demonstration is a collaborative effort led by the San Diego Association of Governments (SANDAG) in collaboration with the U.S. DOT, California Department of Transportation (Caltrans), the Metropolitan Transit System, the North County Transit District, and the cities of San Diego, Poway, and Escondido.

The ICM project leverages the region's extensive Intelligent Transportation System (ITS) modal networks to measure and manage performance from a corridor perspective. Existing assets include the Intermodal Transportation Management System (IMTMS), Regional Arterial Management System (RAMS), Advanced Freeway Traffic Management System (ATMS), Regional Transit Management System (RTMS), 511 advanced traveler information system, and FasTrak®. ICM enables multiple systems to "talk" to each other to coordinate operations and maximize efficiency regardless of who owns or operates the individual system; monitors changing conditions and congestion based on real-time information; generates automated response plans; and reevaluates and generates new response plans as traffic conditions change. Operations in the corridor are managed using a Decision Support System (DSS), the first of its kind developed in the nation, to assist operators with prediction

and evaluation of complex traffic interactions and coordinate selection of appropriate multi-network response strategies to manage congestion during commute times or major incidents. Similar to earthquake or tsunami prediction systems, the DSS uses predictive algorithms and modeling tools to forecast corridor performance problems and recommend response plans. Predictions and recommendations are generated in 15-, 30-, and 60-minute horizons based on real-time and historical performance data. As a result, local transportation managers are able to carry out a coordinated response.

The standards in use or planned for use in developing ICMS subsystem interfaces are as follows:

- Interface: Intermodal Transportation Management System (IMTMS) Distribution:
 - TMDD
 - NTCIP 2306
 - IMTMS Systems Design Document (SDD) – Section 4 2.1 Draft 1.0
- 511 Dissemination:
 - TMDD
 - NTCIP 2306
 - IMTMS-511 Interface Design Document (IDD) 2.1 Draft 1.0
- OrbCAD (RTMS) Interface Control Document (ICD) FE-ICD202 1.0

The deployed I-15 ICM system has demonstrated its ability to:

- Identify incidents and unusual congestion events
- Develop traffic management strategies integrating freeway, arterial, and transit operational elements
- Implement recommended strategies either automatically or following approval by relevant system operators

The system has also demonstrated the feasibility of using a microscopic traffic simulation model in a real-time operational environment to forecast corridor operations under alternative scenarios. Simulation evaluations have further consistently shown operational benefits exceeding deployment costs.

5.2. Dallas

The Dallas ICM Corridor covers a 28-mile segment of US-75 and is the primary connector between Dallas and northern suburbs. It serves commuter, commercial, and regional trips. Weekday mainline traffic volumes reach 250,000 vehicles with 30,000 on frontage roads. There are 167 miles of arterial roadways. And there are High Occupancy Vehicle (HOV) lanes, Light Rail Transit (LRT), Bus Service, and Park-and-Ride lots.

The Corridor for the Dallas Pioneer Project is the US-75 Corridor (aka the North Central Expressway Corridor). This Corridor is a major north-south radial Corridor connecting downtown Dallas with many of the suburbs and cities north of Dallas. The primary Corridor consists of a freeway,



continuous frontage roads, light-rail line, transit bus service, park-and-ride lots, major regional arterial streets, toll roads, bike trails, and intelligent transportation systems. A concurrent-flow, high-occupancy vehicle lane in the Corridor, opened in December 2007, added significant expansion of the intelligent transportation systems for the freeway and arterials street systems are programmed. The US-75 Corridor has been defined at two levels. The immediate Corridor consists of the primary freeway Corridor and light-rail line Corridor and all arterial streets within approximately two miles of the freeway, as described above. In addition, a full “travelshed” influence area has been defined that includes additional alternate modes and routes that may be affected by a major incident or event. The travelshed area is generally bound by the downtown to the south, the Dallas North Tollway to the west, SH 121 to the north, and a combination of arterials streets and the DART Blue Line to the east. This US-75 Corridor contains Dallas’ first major freeway completed around 1950. This section of freeway was totally reconstructed with cantilevered frontage roads over the depressed freeway section and re-opened in 1999 with a minimum of eight general purpose lanes. The freeway main lanes carry over 250,000 vehicles a day, with another 20,000-30,000 on the frontage roads. The Corridor also contains the first light-rail line constructed in Dallas, part of the 20-mile DART starter system, opened in 1996. The Red Line now expands into cities of Richardson and Plano and passes next to the cities of Highland Park and University Park. This facility operates partially at-grade and partially grade separated through deep-bored tunnels under US-75. There is also another rail line, the Blue Line, which operates in the US-75 Corridor near downtown Dallas and extends along the eastern edge of the Corridor boundary. In the downtown, there is also a connection from these lines to the regional commuter rail line that extends to downtown Fort Worth. The Corridor serves commuting trips into downtown Dallas via the freeway, bus routes, light-rail line, and arterial streets. There are also a significant number of reverse commuters traveling to commercial and retail developments in the northern cities and neighborhoods. The Corridor also serves significant regional traffic during off-peak periods. The freeway is a continuation of Interstate 45; and thus, it also serves interstate traffic into Oklahoma. The Corridor is also a major evacuation route and experienced significant volumes during the Hurricane Rita evacuation in 2005. There are three major freeway interchanges in the Corridor. US-75 has an interchange with the downtown freeway network connecting to Interstate 45 and Interstate 35E. At the midpoint in the Corridor, there is a newly constructed interchange with Interstate 635. In the northern section, there is an interchange with the President George Bush Turnpike (PGBT).

The US-75 ICM Project is a collaborative effort between Dallas Area Rapid Transit (DART), City of Dallas, Town of Highland Park, North Central Texas Council of Governments (NCTCOG), North Texas Tollway Authority (NTTA), City of Plano, City of Richardson, Texas Department of Transportation (TxDOT), the City of University Park and many local emergency service providers. The Team defined the Vision for the Corridor as “Operate the US-75 Corridor in a true multimodal, integrated, efficient, and safe fashion where the focus is on the transportation customer.”

Using the Vision Statement as a starting point, the US-75 Steering Committee developed four primary Goals for the ICM:

- Increase corridor throughput
- Improve travel time reliability
- Improved incident management
- Enable intermodal travel decisions

The ICM system is comprised of three major subsystems, as shown in this **Figure 4**. One of the main components of the ICM System is SmartNET/ SmartFusion, which gathers data from a variety of

sources and delivers it to multiple destinations. Information is gathered from transportation systems, emergency management systems, dispatch systems for law enforcement, and other types of systems. The ICM System then makes this information available via a web server to traditional users such as Traffic Operations Centers, the Media, and Agency and public websites. The main purpose of the Dallas ICM System is to:

- Provide an integrated platform for coordinating responses to incidents, construction, and special events in the corridor
- Provide an information exchange tool based on center-to-center standards, and Traffic Management Data Dictionary (TMDD)
- Provide a data fusion engine for the corridor to feed information to the regional 511DFW systems
- Provide DSS real-time information on incidents, construction, special events, transportation network status, and device status throughout the corridor
- Provide a response plan coordination tool for multiple agencies to coordinate actions in responding to incidents within the corridor

One of the unique aspects of the Traveler Information features for the 511 is the ability to display real time next bus times graphically with the maps.

The standards used in the Dallas ICM system are as follows:

- Traffic Management Data Dictionary (TMDD) – SmartNET utilizes TMDD version 2.1 as the basis of its data dictionary. The Dallas Regional Center-to-Center system is based on TMDD version 2.1, with some localization
- Message Sets for External TMC to TMC Communication (MS/ETMCC) - SmartNET and the Dallas Regional Center-to-Center system utilize the Message Sets for External TMC to TMC Communication
- Transit Communication Interface Protocol (TCIP) – The DART Data Portal is envisioned to utilize the Transit Communication Interface Profile for some of its data elements

The following are the benefits from the Dallas ICM project:

- Reduced congestion 740,000 person-hours saved / year
- Travel time reliability improved by 3%
- Fuel savings of 981,000 gallons annually
- Emissions reduction of 9,400 tons annually
- Benefit/Cost ratio of 20:1

Also, there are a number of lessons learned that are worthwhile mentioning:

- Since ICM projects are time consuming, requires significant funding and long term commitment of staff time, it needs to be part of the Regional ITS strategic plan.



- You need to plan for future growth upfront as you plan ICM.
- Deal with institutional issues upfront. Dallas thought they had, but really probably didn't adequately address the institutional issues fully. Develop ILA's if possible before you commit to ICM. "The lessons learned for the overall [Dallas] project deal mostly with the institutional issues and relationships which any region considering ICM should address. ICM programs should build on existing institutional arrangements; this is a key to building consensus. By setting expectations, and defining roles and responsibilities, regions can address the institutional issues of ICM from the beginning of the program. For ICM programs to be successful all agencies involved need to be committed to the program, and have some benefit to their agency in order for ICM programs to succeed." (Final Report: Dallas Integrated Corridor Management (ICM) Demonstration Project, page 29)
- Finally, sharing data is relatively non-controversial. However, institutional objectives sometimes trump the ICM mobility objectives. Some agencies chose not to share incident or ATMS information for business reasons that weakens the value to the product.

5.3. I-80 Integrated Corridor Mobility (ICM)/ Smart Corridor Project

This ICM Corridor covers the following:

- 20 mile corridor from Bay Bridge to the Carquinez Bridge
- Major corridor for commuters and transit
- National freight corridor
- Link to 2 international airports and the Port of Oakland
- Connects significant job centers (Alameda County ranked 2nd largest in Region)
- Spans across 2 counties and 9 cities

The selected corridor is:

- Not only a major corridor for cars and transit but also for freight
- Connection to 2 major airports
- Port of Oakland
- Major job centers
- Across many jurisdictions

The vision of this ICM project is as follows:

- Create a Well Balance System
- Maintain Optimal Operational Viability
- Proactively Avoid Flow Breakdown

- Detect and Respond to Congestion Events Faster
- Improve Safety
- Manage Congested Flow When it Does Occur
- Promote Transit Ridership and Mode Shifts
- Clear Local Arterials from Diversion

The vision of the Smart Corridor Project is to address these conditions on I-80:

- Over 20,000 vehicle-hours of delay per day
- Inconsistent level of service (C to F)
- Variable speeds (stop & go to 65 mph)
- High incident rates: over 2,000 incidents annually
- Un-reliability of travel (20 to >60 min)

The project concepts that are being deployed are as follows:

- Freeway & Incident Management
- Adaptive Ramp Metering
- Arterial Management
- Traveler Information
- Traffic Monitoring
- Transit Management:
 - Preferential Treatment for Transit
 - Transit Signal Priority
 - Ramp Meter Bypass
 - Park and Ride Facilities (future)
 - Provide Real-time information
 - Transit Traveler Information
 - Travel times
 - Directions to transit facilities



- Real time Transit Departure Times

In the transit management area, Transit Signal Priority is deployed on:

- San Pablo
- Crossing arterials
- Ramps with HOV Bypass lanes

This gives preferential treatment to buses at signals. The system is integrating with Park & Ride facilities, as well as the Bay Area 511 system and real-time transit information.

Figure 7 shows a schematic of the system integration among various cities, AC Transit, emergency management and Caltrans.

- System operations are automated
- Traffic management is coordinated along the corridor
- There is information sharing among agencies

As of April 29, 2015, signs are being tested on Westbound I-80. The installation of overhead signs across westbound I-80 between Richmond and Emeryville has been completed, and the new signs are being tested. Testing will continue intermittently through the summer, and will take place when traffic volumes are lowest. Motorists traveling the corridor during these times may see the word “TEST” displayed on overhead signs to warn motorists that electronic signs are being tested. Other symbols and numbers may be momentarily visible as well, such as green arrows, yellow arrows, red X’s, checkerboard patterns or electronic speed limit signs displaying various numbers. Motorists will be notified of testing by changeable message signs at the side of the roadway. Roadside electronic speed limit signs are also being tested.

5.4. NY/NJ ICM-495 Project

The ICM-495 corridor is centrally located in New York / New Jersey metropolitan area with population of over 20 million people. The Corridor connects the New Jersey Turnpike (NJTP, a section of I-95) to Van Wyck Expressway (I-678) and traverses Midtown Manhattan. There are diverse residential, commercial and industrial uses that interact with the Corridor along its entire length. There are two regional key facilities – Lincoln Tunnel (connects NJ and Manhattan), and Queens-Midtown Tunnel (connects Manhattan and Queens). The Corridor encompasses an extensive highway network, including expressway facilities, their approach roads, and the surrounding principal and secondary arterial networks providing the circulatory system for the movement of people, goods, and services.

The vision of this project is to enhance the current transportation management systems of the ICM-495 Corridor by using state of practice solutions to build integrated, balanced, responsive, efficient, effective, and equitable programs and systems that actively reduce traveler demand; monitor and control traffic; and improve the mobility, reliability, and safety of all users. Solutions and resources will create a balanced network that reflects integration of pre-existing programs and systems with modified and new deployments. Improving overall Corridor performance will be a priority by providing better knowledge about real-time conditions and alternative travel options within practical operational, institutional, and financial constraints.

There are two key facilities and their infrastructure that will be leveraged:

- The Queens Midtown Tunnel is a highway tunnel and toll road in New York City. The deployed ITS assets along the Queens Midtown Tunnel include:
 - CCTV cameras and Fiber
 - Weather System covering all the bridge facilities with both surface and atmospheric sensors
 - NTCIP compliant VMS and VSLs
 - TRANSMIT System
 - Lane Use Signal Control System
 - Video Incident Detection
 - Advanced Traffic Information System
 - The Operations Central Command Center (OCCC) is the nerve center of MTA B&T Operations, including linkages to individual facilities and the JTMC Integrates all the facilities to one another and to OCCC
- The Lincoln Tunnel connects NJ 495 to Midtown Manhattan. The three-tube configuration of the Lincoln Tunnel provides for unique operational flexibility. The directional ability of the tubes enables the tunnel facility to address varying traffic demands as they arise throughout the day. The Lincoln Tunnel ITS assets monitored and controlled from the communications desk include:
 - Dynamic Message Signs
 - CCTV surveillance cameras
 - Lane-Use Control Signals
 - Changeable Speed Limit Signs
 - Video-based vehicle detection system stations
 - TRANSMIT readers

ICM-495 will leverage and build upon ongoing programs, as follows:

- Congestion Management Process
- Drivers First Initiative
- Drive Smart & Bike Share
- I-495 Managed Use Lane
- Midtown in Motion



- New York & New Jersey 511 and Rideshare
- New York & New Jersey ITS Programs
- Off-Hour Deliveries
- PARK Smart
- Select Bus Service
- Smart Move Program
- Truck Routing and Bridge Strike Mitigation

6. Glossary

Term	Definition
Actuated Traffic Signal Controller (ASC)	Traffic signals operate in either pre-timed or actuated mode or some combination of the two. Actuated control can be characterized as fully-actuated or semi-actuated, depending on the number of traffic movements that are detected. Semi-actuated control uses detection only for the minor movements at an intersection. Fully-actuated control refers to intersections for which all phases are actuated and hence, it requires detection for all traffic movements.
Advanced Transportation Controller (ATC)	A field-hardened computer for embedded applications which, with the appropriate software and hardware modules, can perform many different ITS functions. The ATC Controller is made up of a central processing unit (CPU), an operating system (OS), memory, external and internal interfaces, and other associated hardware necessary to create an embedded transportation computing platform for control of field devices.
Advanced Traveler Information System (ATIS)	Any system that acquires, analyzes, and presents information to assist surface transportation travelers in moving from a starting location (origin) to their desired destination. Advanced Traveler Information Systems are aimed at providing users of the transportation system with more information to make decisions about route choices, estimate travel times, and avoid congestion.
Application Programming Interface (API)	A system of tools and resources in an operating system, enabling developers to create software applications.
Advanced Transportation Controller (ATC)	Transportation field device.
Bus Rapid Transit (BRT)	BRT is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the center of the road, off-board fare collection, and fast and frequent operations.

Term	Definition
Closed-circuit television (CCTV)	The use of video cameras to transmit a signal to a specific place, on a limited set of monitors.
Dynamic Message Signs (DMS)	Traffic control devices used to provide motorist en-route traveler information. They are commonly installed on full-span overhead sign bridges, post-mounted on roadway shoulders, and overhead cantilever structures.
High Occupancy Vehicle (HOV)	A motor vehicle with seating for several passengers, especially one that is carrying carpoolers.
Integrated Corridor Management (ICM)	Integrated Corridor Management (ICM) is a promising tool in the congestion management toolbox that seeks to optimize the use of existing infrastructure assets and leverage unused capacity along our nation’s urban corridors. With ICM, transportation professionals manage the transportation corridor as a multimodal system rather than taking the more traditional approach of managing individual assets.
Integrated Corridor Management System (ICMS)	System that is used to support transportation network managers and operators in applying ICM.
Location Referencing Message Specification (LRMS)	Describes a set of standard interfaces for the transmission of location references among different components of Intelligent Transportation Systems (ITS). The LRMS facilitates the movement of ITS data on a transportation network, providing a common language for the expression of location among the different components. LRMS interfaces define standard meanings for the content of location reference messages, and standard, public domain formats for the presentation of location references to application software.
Mark-Up Language for Transportation Information (MULTI)	A message syntax which allows objects to be grouped into a message object. The message object is analogous to a sentence in that both the message object and a sentence require a syntax, or ordering of the information objects (words), to be understood.
National Transportation Communications for ITS Protocol (NTCIP)	The National Transportation Communications for ITS Protocol (NTCIP) family of standards defines protocols and profiles that are open, consensus-based data communications standards. When used for the remote control of roadside and other transportation management devices, the NTCIP-based devices and software can help achieve interoperability and interchangeability.
Ramp Meter Control (RMC)	Ramp metering can be defined as a method by which traffic seeking to gain access to a busy highway is controlled at the access point via traffic signals. This control aims at maximize the capacity of the highway and prevent traffic flow breakdown and the onset of congestion. Ramp metering is the use of traffic signals to control the flow of traffic entering a freeway facility.



Term	Definition
Signal Control and Prioritization (SCP)	SCP operates in the context of a "system" that includes a priority requester, such as a transit vehicle, traffic signal controllers, and the management centers that configure and monitor the traffic signal controllers. It, therefore, imposes functional and communications requirements on all of these "system" components.
Signal Systems Master (SSM)	A method of interconnecting several signalized intersections with a master. The master provides a synchronization pulse and selects timing patterns to efficiently move platoons of vehicles through the system. Timing pattern selection through the master can be accomplished manually, by time of day or through traffic responsive means. In a closed loop system local controllers communicate with the master, sending back information regarding their operation.
Traffic Management Data Dictionary (TMDD)	TMDD Standards were developed to support center-to-center communications as part of the regional deployment of ITS in order for centers to cooperate in the management of a corridor, arterial, incident mitigation, event management, etc. Hence the TMDD provides the dialogs, message sets, data frames, and data elements to manage the shared use of these devices and the regional sharing of data and incident management responsibility. As a result, the TMDD standards often reference elements of the NTCIP standards, but deal with the devices at a higher level of abstraction.
Transit Communications Interface Profiles (TCIP)	TCIP is an interface standard whose primary purpose is to define standardized mechanisms for the exchange of information in the form of data among transit business systems, subsystems, components, and devices. The TCIP standard specifies the rules and terms for the automated exchange of information in transit applications such as operations, maintenance, planning, management, and customer services.
Transportation Sensor System (TSS)	Any system capable of sensing and communicating near real-time traffic parameters using NTCIP.

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8. Study Questions

1. Which of these is NOT a benefit of Integrated Corridor Management?
 - a) Reduced fuel consumption
 - b) Improved customer service
 - c) Reduced travel time variability
 - d) Better utilization of transit excess capacity
2. Which one of these device standards does not provide control and real time management?
 - a) NTCIP Ramp Metering
 - b) ATC Application Programming Interface (API)
 - c) NTCIP Transportation Sensor System (TSS)
 - d) NTCIP Dynamic Message Signs (DMS)
3. Which one of these standards is NOT used in the Dallas ICM system?
 - a) Message Sets for External TMC to TMC Communication (MS/ETMCC)
 - b) Transit Communication Interface Protocol (TCIP)
 - c) 511 Dissemination Interface
 - d) Traffic Management Data Dictionary (TMDD)

9. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concept listed out below, and/or to highlight a specific point in the training material.

- 1) **Background information:** General knowledge that is available elsewhere and is outside the module being presented. This will be used primarily in the beginning of slide set when reviewing information readers are expected to already know.



- 2) **Remember:** Used when referencing something already discussed in the module that is necessary to recount.



- 3) **Refer to Student Supplement:** Items or information that are further explained/detailed in the Student Supplement.



- 4) **Example:** Can be real-world (case study), hypothetical, a sample of a table, etc.

