FIVE-YEAR ITS PROGRAM PLAN

ITS

Intelligent Transportation Systems

U.S. Department of Transportation
2007

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On August 9, 2005, Congress passed the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).* The legislation specifically continued the Intelligent Transportation Systems (ITS) program, recognizing the critical role ITS plays in addressing the transportation problems facing our Nation.

Section 5301 of SAFETEA-LU directed the Secretary of the U.S. Department of Transportation ("the Department") to develop a five-year national ITS program plan. This *Five-Year ITS Program Plan* ("Program Plan") not only fulfills the requirements of the legislation but also provides Congress with a clear and comprehensive description of the ITS program and a plan for investment in ITS over the next five years. Efforts described in the Program Plan are designed to achieve the legislative goals and purposes described in SAFETEA-LU and to directly support the goals of the Department.

The efficiency and safety of the surface transportation system is critical to the economic and societal strength of the Nation. ITS improves transportation efficiency and safety, and thus quality of life, in communities across the country every day. Under SAFETEA-LU, the Department leverages this success with a renewed commitment to integrating intelligent infrastructure and intelligent vehicles, supported by a renewed focus on higher-risk research in partnership with the private sector.

This *Five-Year ITS Program Plan* documents the program's goals, organization, and changes over time. It describes current activities and investments planned for the next five years. The last Program Plan was delivered to Congress in 2000. This plan updates Congress on current achievements. It will be revised every two years. This Program Plan is both a "snapshot" of the present program and a roadmap for the near-term future.

We anticipate significant changes in direction for the ITS program over the next five years as we give greater emphasis to projects and research initiatives that address the goals of the Secretary's Congestion Initiative, announced in May 2006. ITS technology can play an important role in facilitating congestion pricing, speeding traffic flows on arterials, and enhancing the value of transit as a congestion-reducing strategy, and we intend to increase our exploitation of these technological opportunities in the coming five years.

ES.1 Establishing the ITS Foundation: 1991-2005

The ITS program was created by Congress in 1991 under the *Intermodal Surface Transportation Efficiency Act* (ISTEA) to encourage new and innovative research into the use of advanced technology to address transportation problems and issues. ISTEA funding provided for a series of early, proof-of-concept ITS deployments that demonstrated the feasibility of integrating technologies to reduce congestion, improve the safety of the traveling public, and support economic productivity. These early deployments were critical to the gradual evolution of basic ITS networks in several major cities, some rural areas, and across all surface transportation modes.

In 1998, the *Transportation Equity Act for the 21st Century* (TEA-21), while continuing to fund innovative ITS research, also encouraged support for more extensive ITS deployment. The concept of integrating stand-alone ITS systems was highly encouraged in the hope that transportation system operators and agencies would be able to achieve added synergistic benefits arising from improved management and coordination of transportation across jurisdictional boundaries. To support these more deployment-oriented

activities, the National ITS Architecture and ITS Standards were provided as guidance. Rigorous evaluation, outreach, and professional capacity-building components of the ITS program were strengthened.

As the Department focused its efforts on facilitating the deployment of advanced, integrated technology in transportation, explosive growth in the use of technology affected society on an evermore pervasive, global level: the ubiquity of the Internet, the extensive (and less expensive) use of cellular and satellite communications, and a revolution in computing capacity and power, leading to a proliferation of technologies of all kinds in our daily lives. Market accessibility of these technologies resulted in increased consumer demand and, therefore, a gradual mainstreaming of the most successful technologies from think tanks, labs, and research facilities around the world into the hands (and onto the desks) of ordinary people in ordinary workplaces—for travelers and transportation agencies alike. This growth in technology adoption enabled the ITS community and industry to further deploy and operate ITS systems, gain increased operator and user acceptance, and better assess the benefits and costs of ITS.

As the ITS program matured, ITS deployment became more mainstream and a global ITS industry and market emerged, as did new and innovative thinking about what could be accomplished with additional, focused research. In 2003, the Department undertook an effort to refocus the ITS program to address critical transportation problems facing the Nation.

Table ES.1: Transportation Problems Facing the Nation

Reduced Mobility Congestion Increases	**Safety** Roadway Safety Stalled	**Economic Productivity** Missed Opportunities
• Congestion has grown 400% in 20 years in small cities • Congestion will increase by 50% in the next 10 years • Americans will spend a week of every year stuck in traffic	• 43,000 deaths per year • 2.7 million injuries • 6 million crashes • $230 billion economic loss • Upward trend after 10-year plateau	• Improved operational efficiency, productivity, and security of the transportation system • National economic benefit • Global competitiveness

The program's reorientation created a more focused, cutting-edge research plan for maximizing ITS applications for decreasing congestion in urban areas; reducing the number of crashes, deaths, and injuries on our Nation's roadways; and improving the operations and accessibility of our transportation infrastructure for all users. The new research plan also emphasized the importance of industry involvement to more closely align research results with the opportunity to transfer successful applications to the market more rapidly.

In 2005, with the passage of SAFETEA-LU, the Department positioned the ITS program to meet the challenges of the future. The program is structured around nine major research initiatives and a coordinated program of deployment support to State and local agencies. The research plan builds on the solid foundation of ITS already in place across the Nation and on the foundational knowledge, capabilities, and experience the Department has gained over the past 15 years. The Department intends to develop and use these assets aggressively in its research program while clarifying the roles of public- and private-sector partners and stakeholders to work together to bring new technologies and solutions to the marketplace.

ES.2 The ITS Program Leadership and Management Structure

The ITS program represents Department-wide efforts to develop and deliver advanced technologies for all modes of surface transportation. The ITS Joint Program Office (ITS JPO) provides daily oversight and programmatic management of the ITS-related programs and initiatives among all the Modal Administrations. At the strategic level, decisions about the ITS program are guided by the ITS Management Council.

The purpose of the ITS Management Council is to guide and direct the Federal ITS program with respect to the Department's goals. The role of the ITS Management Council is to ensure the overall effectiveness of the ITS program and to provide a connection between the ITS program and each of the Modal Administrations. The ITS Management Council is chaired by the Department's Administrator for the Research and Innovative Technology Administration (RITA), with a principals-only membership, including:

- U.S. Department of Transportation Deputy Secretary
- Under Secretary for Policy
- Assistant Secretary for Transportation Policy
- Modal Administrators from the operating administrations:
  - Federal Highway Administration
  - Federal Motor Carrier Safety Administration
  - Federal Transit Administration
  - National Highway Traffic Safety Administration
  - Federal Railroad Administration
  - Maritime Administration
- U.S. Department of Transportation Chief Information Officer

At the functional level, the ITS Strategic Planning Group (ITS SPG) ensures coordination across the modes. The ITS SPG provides internal management coordination for the ITS program. The group is chaired by the ITS JPO Program Director and is composed of senior program managers across all the modes (Associate Administrators and Office Directors). In its meetings, issues and concerns regarding program activities are raised and, based on those discussions, a recommended course of action is presented to the ITS Management Council. While the ITS SPG provides programmatic advice to both the ITS Management Council and the ITS JPO, the ITS Management Council is responsible for making final decisions on ITS program activities and investments.

In establishing future priorities for the ITS program as well as maintaining a strong direction for the program, Congress has required that external stakeholders be engaged. SAFETEA-LU mandates the development of an ITS Advisory Committee and an ITS Standards Expert Panel. Both entities will include leaders from industry, academia, and professional associations representing the needs of the future marketplace. As of the writing of this report, the formation of both groups is underway.

The ITS program has a long history of engaging stakeholders for specific research areas. These established cooperative processes will continue. This Program Plan describes them for each initiative in Chapter 5. With the restructuring of the program in 2003, the Department developed a set of criteria for establishing new initiatives and making future investments that will continue to guide the evolution of the program.

ES.3 The Nine Major Research Initiatives: Problem Definition, Vision, and Research Approach

The Department's nine major ITS research initiatives are the centerpiece of the ITS program. They focus on innovative combinations of technologies to solve critical transportation problems related to safety, mobility, and global connectivity. Each is designed as a set of partnerships that include the Department's Modal Administrations, private-sector organizations pursuing similar research, State and local transportation agencies, professional associations, and other public-sector interests.

The nine major research initiatives are consistent with Congressional goals, purposes, and research objectives outlined in SAFETEA-LU and also with the Department's overarching goals of safety, congestion reduction, and productivity/global connectivity. Figure ES.1 shows the nine initiatives.

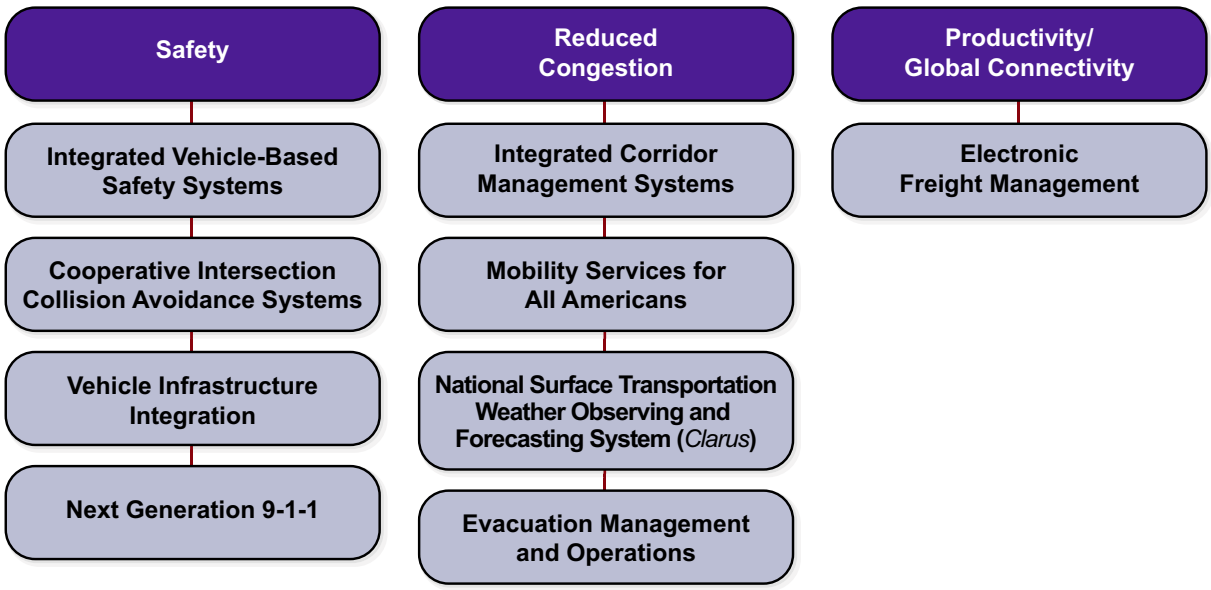


Figure ES.1: The Nine Major ITS Research Initiatives

Four of the initiatives directly address the Department's safety goals by focusing on preventing crashes (using vehicle-based, vehicle-to-vehicle, and vehicle-to-roadside technologies) and improving postcrash response times through developing a consensus-based architecture for a next generation 9-1-1 system.

Four other initiatives address the Department's congestion reduction goal by focusing on reducing recurring and nonrecurring congestion, enhancing the operational efficiency of transportation systems, and making it easier for users to move within and between transportation systems.

Finally, one initiative addresses the Department's global connectivity goal by focusing on electronically linking and integrating aspects of the freight supply chain.

As with most cutting-edge research, the initiatives expose the Department to higher risk but also offer a potentially higher reward if successfully executed. For the Department, they provide:

- A mechanism for Federal investment to act as a catalyst for private-sector investment in a dynamic transportation marketplace.
- A clear role for public-sector agencies to define requirements and future challenges in implementation.
- A channel to transfer cutting-edge research results into market-based products.

A solid business case was developed for each research initiative to justify investment. The ITS Management Council has considered and confirmed the problem focus and scope of each initiative, the relationship to the Department's vision, and the research approach. Each is summarized briefly below (in the order in which they appear in Figure ES.1).

Safety Initiatives

1. Integrated Vehicle-Based Safety Systems (IVBSS)

Problem Definition

- There are over 3.6 million rear-end, road-departure, and lane-change crashes per year; approximately 27,500 result in one or more fatalities.
- Previous analysis revealed that approximately 48 percent—or 1,836,000 police-reported crashes per year—could be prevented by rear-end, road-departure, and lane-change crash warning systems.
- Such warning systems exist, but as stand-alone systems that could create conflicts for the driver's attention.

Vision

The IVBSS Initiative will work with industry to equip all new vehicles with integrated driver assistance systems that help drivers to avoid the most common types of crashes (rear-end, run-off-road, and lane-change crashes).

Research Approach

- Integrate stand-alone safety systems with a consolidated and effective driver interface, thereby maximizing safety benefits.
- Develop performance specifications for a system to integrate:
  - Forward-looking collision warning.
  - Lane-departure warning.
  - Side-looking collision warning.
- Measure the real-world benefits of the integrated countermeasures.
- Transfer results to industry for rapid deployment.

2. Cooperative Intersection Collision Avoidance Systems (CICAS)

Problem Definition

- Approximately 2.6 million intersection crashes occur each year, representing nearly 45 percent of all vehicle crashes and approximately 25 percent of all traffic fatalities.
- In 2003 alone, 9,510 people died and almost 1.4 million suffered injuries as a result of intersection-related crashes.

Vision

The CICAS Initiative will partner with industry and State and local governments to develop cooperative intersection collision avoidance systems that can save lives and prevent injuries at the most hazardous intersections throughout the country.

Research Approach

- Build from research conducted under the Intelligent Vehicle Initiative (IVI) to combine existing technologies into cooperative vehicle-infrastructure systems that:
  - Detect and avoid crossing-path crashes at intersections.
  - Provide information to the driver in real time to increase situational awareness and provide immediate hazard warnings to forestall potential collisions that could be caused by driver distraction, reduced ability to judge the gap in oncoming traffic, improper signage, speed, or other factors.
- Develop a set of performance specifications for technology transfer to the private sector and marketplace.
- Facilitate the deployment of CICAS infrastructure with State and local transportation agencies.

3. Vehicle Infrastructure Integration (VII)

Problem Definition

- The ultimate goal of ITS is integrated infrastructure and vehicle systems.
- Previous research shows that the ability of a vehicle to communicate with other vehicles and with the roadway infrastructure would significantly reduce crashes.
- Research has also shown that real-time information on driving conditions can reduce congestion and increase mobility and economic productivity.

Vision

The VII Initiative, in partnership with industry and State and local governments, will facilitate a nationwide deployment of an integrated communications infrastructure on the roadways and in all production vehicles to

enable a broad range of safety and mobility services that today are unattainable. The VII Initiative will enable applications that:

- Achieve a significant reduction in vehicle crashes (particularly roadway-departure and intersection-based collisions, which account for more than 50 percent of all traffic fatalities).
- Reduce vehicle delay through State and local management of the surface transportation network based on real-time traffic information.
- Reduce the cost of road maintenance through State and local management of the surface transportation network based on real-time pavement and weather conditions.

Research Approach

- Utilize the most advanced communications technologies to develop, prototype, and test a system that can exchange real-time information vehicle-to-vehicle and vehicle-to-roadside.
- Prototype and test a system whereby communications equipment is placed both on the infrastructure and within the vehicle, with data then transmitted from vehicle to vehicle and between vehicles and the roadside.
- Research and resolve the technical, economic, and social issues that may arise from deploying a nationwide system of intelligent, integrated infrastructure and vehicles through engagement with organizations such as the automotive manufacturing firms, State and local governments, Tier 1 suppliers, public advocacy groups, and others.

4. Next Generation 9-1-1 (NG9-1-1)

Problem Definition

- The Nation's 9-1-1 systems, based on decades-old technology, cannot handle the text, data, images, or video that are increasingly common in personal communications and in communicating information about transportation incidents.
- The growing market penetration of both wireless and Voice-over-Internet-Protocol (VoIP) telephony underscores the limitations of the current 9-1-1 system.
- A new system that incorporates advances in information and communications technology can vastly improve the communication about transportation incidents.

Vision

The NG9-1-1 Initiative will partner with a broad range of public-sector agencies and private-sector organizations to develop a next generation platform that will enable emergency 9-1-1 calls from any networked communications device.

Research Approach

- Assist other agencies in the development of a foundation for public emergency communication services within a wireless, mobile society, paving the way for fundamental changes in the transmission of emergency information.
- Develop specifications related to transportation needs in order to upgrade the system to handle new wireless and networked technologies and send faster, more accurate, and more useful forms of information about incidents to 9-1-1 emergency call centers.

Reduced Congestion Initiatives

1. Integrated Corridor Management Systems (ICM)

Problem Definition

- Traffic congestion is concentrated in critical metropolitan corridors that link activity centers and carry high volumes of people and goods.
- The ability to shift travel demand between facilities and modes is complicated; however, significant unused corridor capacity exists on parallel routes, in the nonpeak direction on freeways and arterials, within single-occupant vehicles, and on transit vehicles.
- The chief obstacles to effective corridor management are unexpected events (in the form of adverse weather or unusually large traffic demand) and lack of institutional arrangements to operate a single corridor across separate jurisdictions.

Vision

The ICM Initiative will improve mobility through integrated management of transportation assets in major transportation corridors in metropolitan areas, including freeways, arterials, transit, and managed lanes.

Research Approach

- Develop models and strategies to increase mobility, safety, and productivity in major corridors through integration of assets.
- Demonstrate:
  - Efficient, effective, proactive use of ITS.
  - Improved use of real-time data sharing.
  - Effects of demand management strategies.

2. Mobility Services for All Americans (MSAA)

Problem Definition

- A segment of our Nation's population faces serious challenges in accessing the transportation system.
- Sixty-two separately funded Federal programs currently provide funding support for services for the transportation-disadvantaged.

- Delivery of human services transportation is plagued by inefficiencies, limited resources, and a lack of coordination.

Vision

The MSAA Initiative will create replicable and scalable models of Traveler Management Coordination Centers (TMCC) that will increase mobility and accessibility for the transportation-disadvantaged and the general public through transportation service coordination and will reduce the cost and increase the productivity of human services transportation.

Research Approach

- Integrate technology and service coordination processes to provide the transportation-disadvantaged with increased mobility and to achieve more efficient use of Federal human service transportation funding resources.
- Demonstrate the ability to coordinate human services transportation delivery among different agencies.
- Develop strategies that promote optimal allocation of resources and technology deployment among agencies.

3. National Surface Transportation Weather Observing and Forecasting System (*Clarus*)

Problem Definition

- Users of the surface transportation system need more timely, accurate, and relevant information about road conditions and weather. Nearly 1.5 million passenger vehicles are involved in weather-related crashes each year, resulting in approximately 600,000 injuries and 7,300 fatalities.
- Transportation agency investments in Road Weather Information Systems (RWIS) capture weather observations but are scattered among a diverse set of stakeholder communities, producing data of varying quality and with differing formats and communications protocols.
- RWIS networks are not integrated and thus do not provide full-scale data sharing.

Vision

The *Clarus* Initiative, in partnership with a wide range of stakeholders, will develop the *Clarus* System to reduce the impact of adverse weather for all road users and operators by creating a nationwide road weather observation network and forecasting system.

Research Approach

- Develop an open, integrated approach to observational data management to improve surface transportation weather information products that will help transportation agencies to more accurately assess the weather and pavement conditions that may impact their operations.

- Create high-resolution surface transportation weather forecasts and tailor them for decision support products that will be used by the surface transportation community.

4. Evacuation Management and Operations (EMO)

Problem Definition

- Evacuations of over 1,000 people happen an average of every three weeks in the United States. The leading causes are wildfires, floods, fixed pipeline and hazardous materials emergencies, tropical storms and hurricanes, and railroad accidents.
- Because transportation systems play a critical role in moving people to safety as well as allowing responders to reach the scene, transportation agencies must be prepared for emergencies. Key challenges include congestion, evacuating a large number of people, coordinating multiple modes that are owned and operated by a variety of entities, and providing mobility to people with limited transportation options.

Vision

The EMO Initiative will develop tools, guidance, and standards to provide faster and better response to major incidents, shorter incident duration, reduced impact to the transportation system, and more rapid restoration of normal travel conditions.

Research Approach

- Develop tools and processes to support transportation system operators during a wide range of evacuation-oriented emergencies.
- Apply ITS to support safe and efficient transportation operations during emergencies.
- Assist transportation agencies in planning for emergencies that require evacuations.
- Develop standards to facilitate incident response and integration.

Productivity Initiative

1. Electronic Freight Management (EFM)

Problem Definition

Freight movement is a complex set of processes involving the exchange of information between multiple entities (governmental and commercial) and multiple transportation carriers. A lack of effective information exchange leads to increased operating costs, congestion at cargo transfer points, and errors in data transfer.

Vision

The EFM Initiative will result in improved operational efficiency, productivity, and security of the transportation system through the use of a common electronic freight manifest and message portal that enables access to shipment information for all supply chain partners in real time.

Research Approach

- Build from previous initiatives (the O'Hare Air Cargo Security System and the Electronic Supply Chain Management), which showed the promise of cost savings and improvements in goods movement.
- Develop an electronic, Internet-based, "end-to-end" data exchange along a supply chain, from the point of original consignment to final delivery, to make data broadly available to any authorized and authenticated user in real time.
- Standardize electronic freight data elements to provide supply chain partners with a common language and ensure that electronic freight documents can be transferred across supply chains throughout the world.

ES.4 Deployment Support Activities

The ITS Deployment Support Programs form a critical foundation from which the ITS program can achieve its goals. These programs are crosscutting, interconnected efforts that comprise the ITS knowledge platform and transfer activities to State and local transportation agencies. The common factors among these program elements are:

- The capability to deliver learning, technical assistance, technology transfer, and guidance.
- The transfer of information on the ITS program's research results, technologies, and strategies.

The Deployment Support Programs play a valuable role in ensuring the success of the ITS program. They are the mechanisms the Department uses to understand the ITS needs of State and local agencies. They also provide the Department's capability to facilitate successful ITS deployments and to ensure that agencies understand both the value of ITS and the uses of the technologies and strategies.

Two programs—the National ITS Architecture Program and the ITS Standards Program—are essential to proper integration of technologies and systems that enable regional interoperability. By fostering the principles of effective integration around the Nation, these programs facilitate the ability of jurisdictions to operate collectively to harness the benefits of a regional approach to transportation problems. Integration and a regional perspective allow agencies to set meaningful performance metrics by which progress on solving transportation problems can be measured by local citizens.

Three programs—the ITS Professional Capacity Building Program, the ITS Program Assessment Program, and the ITS Outreach Program—collect and process information that forms the basis for disseminating knowledge to and developing skills within the broader ITS community. The information collected is turned

into a variety of resources that facilitate and enhance decision-making, learning, and successful deployment and operations. The resources can be tailored and customized to address the needs of varied audiences in a targeted manner.

By providing a focused deployment support effort at the Federal level, the Nation benefits by having:

- Consistent guidance on achieving interoperability.
- A collection of local experiences that can be shared by peers and decision-makers to assess what works and avoid what does not.
- A repository for ITS learning that addresses the essentials of effective ITS deployment and job performance.
- Programs that promote connections and learning opportunities.
- Outreach and awareness of available resources.
- In-depth technical assistance that guides consistent deployment and integration.
- Processes and knowledge to make solid investment decisions tailored to meet specific regional and local needs.

ES.5 SAFETEA-LU Programmatic Activities

SAFETEA-LU specified three ITS research priorities or programs for the Department:

- A rural interstate corridor communications study (Section 5507).
- A program for road weather research and development (Section 5308).
- A multistate corridor operations and management effort, specifically directed at the I-95 Corridor Coalition (Section 5211[b]).

The Department, through the ITS JPO, is actively pursuing these program areas through the following activities:

- **Rural interstate corridor communications study:** Fiber optic installation along freeway corridors is a critical and challenging topic for State and local transportation agencies. The decision to install fiber requires collaboration and expertise around a host of complicated issues, including:
  - Safety and other operational issues associated with the installation and maintenance of cable.
  - Environmental conflicts and real estate ownership issues.
  - The geographic location of rural access points necessary to serve rural communities and support the installation of the vehicle-to-roadside infrastructure.
  - Cost-benefit impact on economic development, homeland security, and education and health systems in rural communities.
  - Private-sector partnership opportunities.
  - Inventory and alternatives analysis of telecommunications capacity.

The Department initiated a study in the summer of 2006 to analyze these and other important issues. The study will build from and expand on the guidance developed in the Department's *Program Guide: Utility Relocation and Accommodation on Federal-Aid Highway Projects (2003)*[ES1] and enhance the Department's ongoing workshops on Fiber Optic Installation on Freeway Right-of-Way. The final study will be delivered to Congress by September 2007.

- **Road Weather Research and Development Program.** Recognizing that weather has severe impacts on the transportation system, Congress specified further research into weather-related congestion and safety issues. Additional resources provided as part of this program will be used to further integrate surface transportation weather and operations by:
  - Maximizing the use of information and technologies through institutional change and technological advancement among the transportation and meteorological communities.
  - Expanding efforts to enhance safety, capacity, and efficiency through the development of new tools for effective decision-making on the deployment of resources and road treatments.
  - Promoting technology transfer of effective solutions by delivering generic specifications and requirements that advance the state of the practice.

  The Road Weather Research and Development Program will build on work undertaken as part of the *Clarus* Initiative and from previous research conducted by the Department's Road Weather Management Program. Collectively, these programs will pursue opportunities to integrate surface transportation weather information, further leverage public-sector resources to build markets, and improve private-sector services.

- **Multistate Corridor Operations and Management.** By providing continued funding under SAFETEA-LU, Congress recognized the importance of multistate cooperative agreements, coalitions, and other arrangements to promote regional cooperation, planning, and shared project implementation. The I-95 Corridor Coalition has successfully served as a model for multistate/multijurisdictional interagency cooperation and coordination for over a decade. The coalition provides a forum for key decision- and policy-makers to address transportation management and operations along the I-95 corridor of the East Coast of the United States.

  Under SAFETEA-LU, the Department will work with the I-95 Corridor Coalition to expand its focus on coordinated transportation systems operations; integrated travel information for trips that cross jurisdictional and modal boundaries; intermodal freight movement, security, and efficiency; common electronic payment methods; and public safety and security. The I-95 Corridor Coalition will work with the Department to integrate the latest ITS technologies and play a more active role in performing analyses of regional transportation management and operations issues.

[ES1] Available at *http://www.fhwa.dot.gov/reports/utilguid/if03014.pdf.*

ES.6 New and Future Priorities

In setting the direction for the ITS program over next five years, the Department has initiated a set of program activities that directly address the Congressional goals, purposes, and priorities set forth in SAFETEA-LU. The current program focuses on nine major initiatives and several deployment support programs. These activities also align with the Department's goals for safety, congestion reduction, and economic productivity, thus providing the Department with a focused means to advance technology applications in these areas for some of the most critical transportation problems facing the Nation. Additionally, this Program Plan represents a guiding vision for the Department. The activities described in this Plan were formulated with input from stakeholders based on present-day needs. As such, this Plan will guide the Department in addressing ITS needs of the Nation in the near term.

However, the Department recognizes that new challenges and priorities will emerge in the coming years that will require ITS to play an important role. The ITS program has the flexibility to address future high-priority issues as they emerge. For instance, in SAFETEA-LU Section 5306(b)(3)(a), Congress provided the Department with a mandate to invest in technologies and systems that can aid in reducing congestion by 5 percent by 2010. Shortly after the passage of SAFETEA-LU, former Secretary of Transportation Norman Mineta moved proactively to address escalating national congestion with the enactment of a new major initiative for the Department—the *National Strategy to Reduce Congestion on America's Transportation Network* (the "Congestion Initiative").[ES2] This enhanced emphasis was reaffirmed in the Department's adoption of a new Strategic Goal on Reduced Congestion in its new Strategic Plan for 2006-2011, issued on September 30, 2006. Using past research results and some of the products produced by the ITS program, the Department unveiled a set of proposed actions for aggressively confronting congestion within the next few years. These proposed actions include the following:

1. Relieve urban congestion.
2. Unleash private-sector investment resources.
3. Promote operational and technological improvements.
4. Establish a "Corridors of the Future" competition.
5. Target major freight bottlenecks and expand freight policy outreach.
6. Accelerate major aviation capacity projects and provide a future funding framework.

The Department has already taken steps to identify ways that the ITS program can address congestion. The ITS program has inventoried its accomplishments—tools, strategies, technologies, and systems—to identify how ITS has provided benefits in the form of reduced congestion. Under ISTEA and TEA-21, the ITS program has provided research on and investment in:

- The establishment of advanced traffic management systems with a specific focus on the establishment of traffic management centers in major urban areas.
- New modeling applications to understand the effects of ITS on mobility and congestion.
- The deployment of electronic toll collection systems to reduce congestion at toll plazas.

[ES2] Former Secretary Mineta proposed these actions during a speech to the National Retail Federation celebrating National Transportation Week on May 14, 2006. See *National Strategy to Reduce Congestion on America's Transportation Network* at *http://isddc.dot.gov/OLPFiles/OST/012988.pdf.*

- The development and facilitated deployment of low-cost adaptive traffic signal control software that eliminates the need to retime signals.
- The development and testing of bus rapid transit technologies and systems that more efficiently utilize capacity.
- The development of incident management systems and strategies to reduce the time necessary to clear incidents and restore roadway capacity.
- The development of operational strategies for deploying ITS in response to congestion under varying conditions.

Four of the major ITS research initiatives are directly focused on producing results that have an impact on the different causes of congestion and further the development of operational strategies and solutions for State and local agency managers. These initiatives are ICM, MSAA, *Clarus,* and EMO. Through these initiatives, the ITS program is making progress on:

- New ways to manage congestion in urban corridors.
- More accurate and timely road weather information.
- Enhanced communication during emergencies, especially evacuations.
- Increased accessibility for the disabled and disadvantaged.
- Support for efficient movement of freight through ports and across borders.

Additionally, the VII Initiative holds great promise in delivering:

- Access by decision-makers to vital real-time information on local congestion sources and levels.
- Improved decision-making by drivers and travelers regarding mode choice, time of departure, and choice of route.
- Optimization of existing capacity on the transportation networks.

In moving forward to confront congestion, the Department envisions an expanded role for the ITS program through new activities that specifically address innovative concepts for reducing congestion (for instance, congestion pricing or new traffic control strategies). At this juncture, the Department is determining whether current ITS program activities can form the basis for advancing the Congestion Initiative or whether new activities will need to be formulated.

The Congestion Initiative is only one example of how a key issue might influence the future direction of the ITS program in the coming years. As the current set of major initiatives come to their logical conclusion, the ITS program expects to establish other initiatives that address critical surface transportation issues in congestion, safety, and economic productivity.

To address new priorities as they emerge, the Department has established a set of assessment metrics that will guide the investment and planning processes for all new proposed activities. These metrics will help the Department to measure the merits of proposed new initiatives by applying criteria to ensure that:

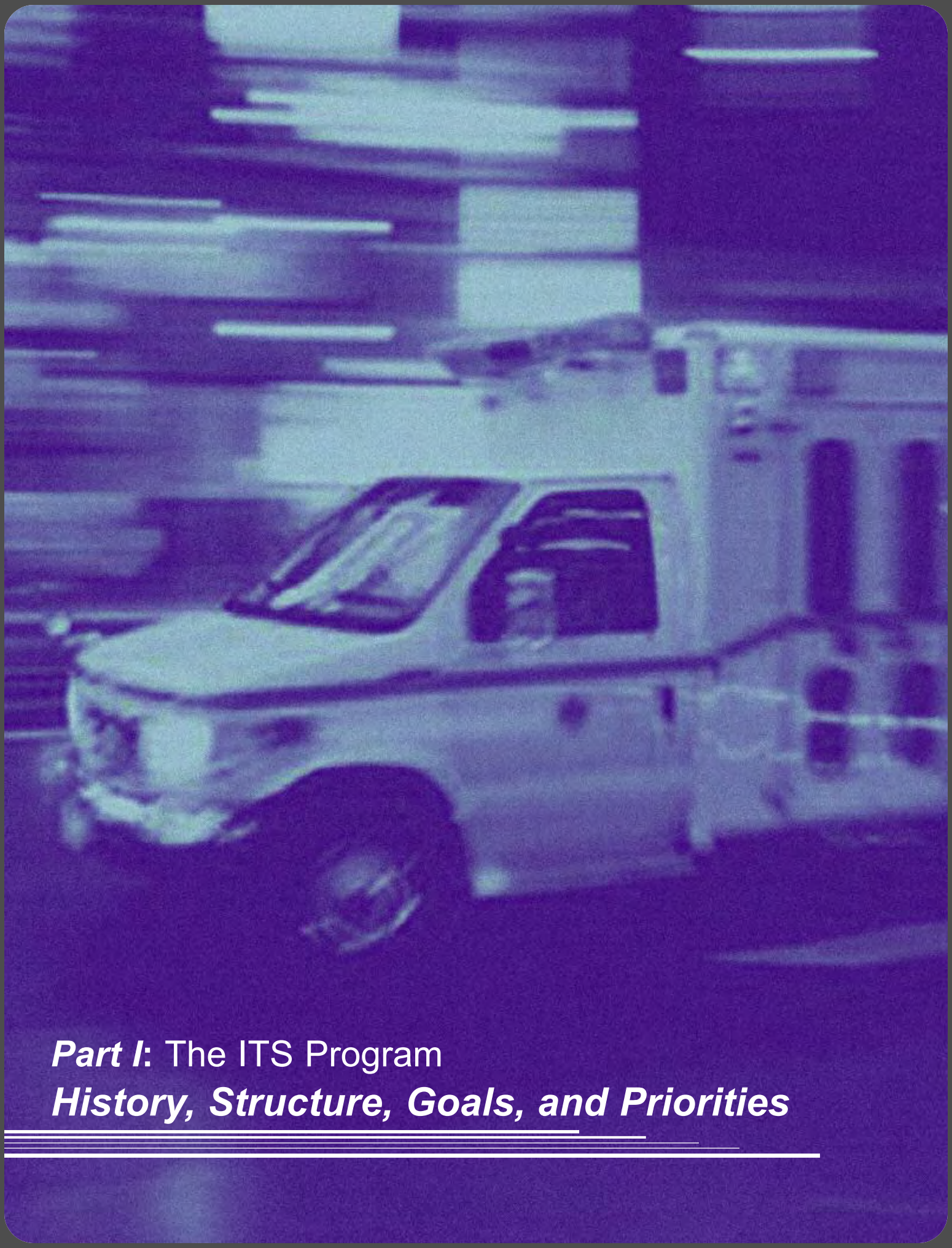
- The transportation problem's scope is clear, understandable, and aligned with one or more of the Department's priorities.

- The proposed resolution's impact and results:
  - Are quantifiable.
  - Have clear decision points and milestones.
  - Are presented with a market analysis and projected return on investment.
  - Address the public and private stakeholders who will have long-term responsibility for implementation and market development.
- The investment adheres to the principles of:
  - Following the President's Management Agenda and the Secretary's "Safer, Simpler, and Smarter" initiative.
  - Leveraging opportunities to integrate program, modal, or technological approaches.
  - Significantly engaging the private sector.
  - Providing effective bridges between conditions as they exist today and as they are envisioned in the future.
  - Developing replicable and scalable results.
  - Ensuring a balanced ITS program portfolio with regard to the risk factors, technology maturity, delivery schedules, architecture compliance, and costs.

ES.7 Conclusion

During the time period covered in this Program Plan, the ITS program will enter into its twentieth year. Throughout this time, the ITS program has delivered steady, solid progress and results for the Nation. Innovative applications have been developed across the surface transportation modes to address traffic management and operations, public transportation, motor vehicle operations, weather, freight, public safety, vehicle safety, traveler information, and security.

SAFETEA-LU both confirms the Department's direction in ITS and increases the focus on integration, mainstreaming, public-private partnerships, cooperative processes, and market expansion. With its recent reorganization, the ITS program is positioned to deliver the next generation of ITS through higher-risk/higher-reward research for the Nation. New, stronger internal processes guide investment, research processes, and portfolio growth and provide the Department with greater flexibility to evolve ITS in concert with critical market needs and new Congressional and Departmental priorities.



***Part I*: The ITS Program**
History, Structure, Goals, and Priorities

Introduction

1

This report, *Intelligent Transportation Systems (ITS) Program: Five-Year Program Plan* ("Program Plan"), presents the goals, activities, and milestones for the ITS program for fiscal years (FY) 2006 through 2010. It sets forth a detailed course of action for the U.S. Department of Transportation (the "Department") under the new transportation legislation, the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU).[1] The five-year vision established in this plan builds on the ITS research and deployment initiatives undertaken by the Department over the past decade. The plan reflects the increasing importance of ITS deployment while providing a renewed emphasis on the program's research component.

1.A Organization of the Plan

This Program Plan is divided into two parts.

Part I describes the ITS program:

- ***Chapter 1*** provides an introduction to the Program Plan.
- ***Chapter 2*** presents the history of the national ITS program and significant achievements to date.
- ***Chapter 3*** describes the ITS program's current focus and organization. It also describes the goals of the program and the connections among the ITS program's goals, the overall goals established by the Department, and the programmatic goals set forth in SAFETEA-LU.
- ***Chapter 4*** describes the process employed to develop and determine the ITS program's current and future priorities. The process comprises a series of connected activities that allow for internal Departmental strategic cooperation and coordination as well as external stakeholder involvement.

Part II describes the program's activities:

- ***Chapter 5*** describes the Department's ITS major research initiatives. For each initiative, the results to date and the expected accomplishments over the next five years are presented.
- ***Chapter 6*** describes the ITS Deployment Support Programs and their five-year plans.
- ***Chapter 7*** presents other program and research activities not directly addressed in Chapters 5 and 6, some of which include ongoing efforts that have matured and are nearing completion. Other activities include new requirements from SAFETEA-LU in such areas as road weather management or rural emergency response.
- ***Chapter 8*** concludes with a description of possible new and future priorities for the ITS program.

The following appendices complete this report:

- **Appendix A:** Alignment of ITS Program Activities with SAFETEA-LU
- **Appendix B:** Acronyms and Abbreviations
- **Appendix C:** References

[1] This report fulfills the requirement set forth in SAFETEA-LU Section 5301(b). It is also an update to the second *National Intelligent Transportation Systems Program Plan: Five-Year Horizon,* published in 2000. Available at *http://ntl.bts.gov/lib/9000/9900/9979/97r01_1.pdf.*

Legislative Requirement

Section 5301 of SAFETEA-LU states:

(a) IN GENERAL.—

(1) UPDATES.—Not later than 1 year after the date of enactment of the SAFETEA-LU, the Secretary, in consultation with interested stakeholders (including State transportation departments) shall develop a 5-year national Intelligent Transportation System (in this section referred to as 'ITS') program plan.

(2) SCOPE.—The national ITS program plan shall—

(A) specify the goals, objectives, and milestones for the research and deployment of intelligent transportation systems in the contexts of—

(i) major metropolitan areas;
(ii) smaller metropolitan and rural areas; and
(iii) commercial vehicle operations;

(B) specify the manner in which specific programs and projects will achieve the goals, objectives, and milestones referred to in subparagraph (A), including consideration of a 5-year timeframe for the goals and objectives;

(C) identify activities that provide for the dynamic development, testing, and necessary revision of standards and protocols to promote and ensure interoperability in the implementation of intelligent transportation system technologies, including actions taken to establish standards; and

(D) establish a cooperative process with State and local governments for—

(i) determining desired surface transportation system performance levels; and
(ii) developing plans for accelerating the incorporation of specific intelligent transportation system capabilities into surface transportation systems.

(b) REPORTING.—The national ITS program plan shall be submitted and biennially updated as part of the transportation research and development strategic plan developed under section 508.

History of the National ITS Program

2

This chapter provides a brief history of the Department's ITS program with respect to the legislative acts that established and shaped it: the *Intermodal Surface Transportation Efficiency Act of 1991* (ISTEA), the *Transportation Equity Act for the 21st Century* (TEA-21), and most recently, SAFETEA-LU. The final section of this chapter describes the program's achievements and progress to date.

2.A Establishment under ISTEA

In 1991, ISTEA established a Federal program to research, develop, and test ITS and to promote its implementation. The program was designed to transfer research into technologies that would enhance the efficiency, safety, and convenience of surface transportation, with the goals of increasing accessibility, saving lives and time, and enhancing economic productivity.

ISTEA authorized $659 million for ITS over fiscal years 1992-1997. With the addition of General Operating Expense funds, the total budget for six years under ISTEA reached $1.223 billion.[2] The ITS program, as enacted in ISTEA, was a three-pronged effort to foster the development of ITS through (1) basic research and development, (2) operational tests that served as a bridge between basic research and deployment, and (3) support activities that provided technical assistance needed for early adoption of ITS technologies in the field.

The initial stages of the Department's ITS program were oriented toward researching and testing the newest technologies and systems that showed promise in addressing metropolitan highway-oriented mobility problems—alleviating congestion, promoting safety and operational efficiency, and reducing environmental impacts of growing travel demand. With strong support and partnerships in the private sector, the early program placed the Department at the forefront of technological experimentation, with parallel development of intelligent vehicles and an integrated intelligent infrastructure.

ISTEA-Era: Focus on Research and Development

- Industry Born, Program Vision Established
- Highway, Mobility, and Metropolitan Orientation
- Technological Experimentation
- Gradual Broadening of Program
- Institutional Issues Emerge

By late 1995, early program evaluation results suggested that ITS technologies were technically feasible and cost-effective in addressing transportation problems. Results also indicated that, when ITS technologies were

[2] Available at *http://www.its.dot.gov/about.htm* and in *The National Intelligent Transportation Systems Program,* 1997 Report to Congress, page xvi.

integrated, they could provide a powerful platform for managing and operating transportation networks as well as vehicles. However, evaluation results also revealed that institutional and policy issues presented challenges to deployment that were equal to or greater than technological issues. The stakeholder community recognized that incorporating ITS into agency policies and procedures would require institutional shifts and changes to more effectively support the requirements of rapid technological advancement and deployment. With the next reauthorization under TEA-21, the Department received Congressional direction to shift the focus of the ITS program from primarily research and development to also address the policy and institutional challenges to widespread deployment of ITS around the Nation.

Figure 2.1 below presents a timeline of milestones for the ITS program under ISTEA. Notably, the TravTek and ADVANCE projects illustrated capabilities of two types of ITS infrastructure systems: (1) advanced traveler information systems and (2) advanced traffic management systems. Additionally, the Advanced Crash Avoidance Program helped the Department to better understand the role of advanced technologies in avoiding crashes. Other important efforts also were initiated under ISTEA:

- The National ITS Architecture was launched in 1994, with private-sector firms partnering with the Department to deliver a final document in 1996 that has since established the foundation for national and regional ITS deployment.
- The ITS Standards program began in 1996 with a list of critical interfaces delivered by the National ITS Architecture team.
- Operation Timesaver began in 1996 with the definition of metrics to form a baseline for deployment. Metrics categories included the presence of real-time data, service patrols, coordinated signalized systems, electronic toll lanes, equipped transit buses, and emergency management systems.
- The Automated Highway System (AHS) demonstrated the possibilities of vehicle and infrastructure cooperation.

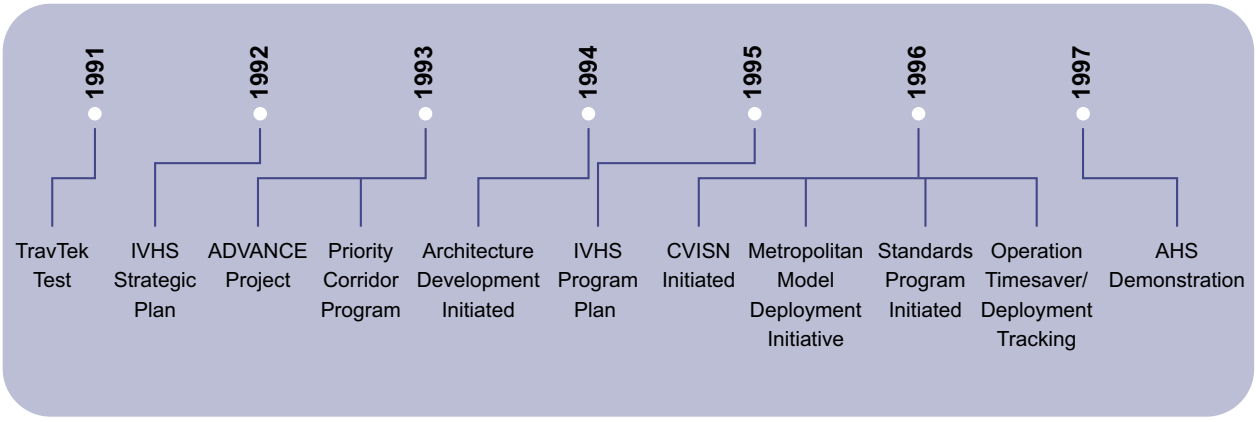


Figure 2.1: Program and Evaluation Milestones for the ITS Program under ISTEA

2.B ITS Program Continuation under TEA-21

The next transportation authorization, TEA-21, continued to support the Department's ITS program. TEA-21 authorized the ITS program at $1.3 billion from 1998 through fiscal year 2003.[3] Table 2.1 below illustrates the annual allocation of funds.[4]

Table 2.1: Annual Allocation of Funding under TEA-21

	1998	1999	2000	2001	2002	2003	2004	2005
ITS Research & Development	$95M	$95M	$98M	$100M	$105M	$110M	$110M	$110M
ITS Deployment Program	$101M	$105M	$113M	$118M	$120M	$122M	$122M	$122M
Total	**$196M**	**$200M**	**$211M**	**$218M**	**$225M**	**$232M**	**$232M**	**$232M**

In TEA-21, Congress created two separately funded activities—the ITS Research and Development Program and the ITS Deployment Program.

- **The ITS Research and Development Program** reaffirmed the role of the Department in advancing the research, development, and integrated deployment of ITS. It continued the Department's focus on the creation and testing of an integrated infrastructure- and vehicle-based ITS system. TEA-21 also called for innovative approaches to creating and fostering policy and institutional change and integration.

- **The ITS Deployment Program** provided the Department with the opportunity to fund a set of innovative deployments that integrated existing ITS systems within and across jurisdictions. TEA-21 funded two separate programs under the ITS Deployment Program:

  - **The ITS Integration Program:** In Section 5208, TEA-21 directed the Secretary to conduct a comprehensive program to accelerate the integration and interoperability of ITS systems in metropolitan and rural areas. The intent was (1) to fund projects that would serve as models to improve transportation efficiency, promote safety, increase traffic flow, reduce emissions, improve traveler information, enhance alternate transportation modes, and (2) to fund other similar projects that required integration. TEA-21 limited funding to metropolitan area projects that were undertaking the integration of existing or planned ITS deployments. In rural areas, Congress acknowledged that there were limited opportunities to integrate existing systems and directed that these funds could be used in rural areas for actual ITS deployment in addition to integration. Section 5208 also contained specific

[3] Financial information from the ITS Joint Program Office. Available at *http://www.its.dot.gov/about.htm.*

[4] The chart extends to 2005 to reflect the extension of TEA-21 from 2003 to 2005 due to the delay in its reauthorization.

language to encourage multistate cooperative agreements, coalitions, and other arrangements intended to promote regional cooperation, planning, and shared project implementation for ITS projects. Two areas of implementation that received special Congressional focus were the *Great Lakes ITS Implementation*, which resulted in greater collaboration among the States to address incidents, and the *Northeast ITS Implementation*, which resulted in the development of the I-95 Corridor Coalition. The latter has been of great benefit to travelers and freight movement along the East Coast of the United States and, as demonstrated during the 9/11 tragedy, has aided in evacuation management.

- **The Commercial Vehicle ITS Infrastructure Deployment Program (CVISN Program):** In Section 5209, TEA-21 directed the Secretary to carry out a comprehensive program to deploy intelligent transportation systems that:
  - Improved the safety and productivity of commercial vehicles.
  - Reduced costs associated with commercial vehicle operations and Federal and State commercial vehicle regulatory requirements.

The CVISN Program advances the technological capability and promotes the deployment of ITS applications to commercial vehicle operators. Priority was to be given to projects that:

- Encourage multistate cooperation.
- Improve the safety of commercial vehicle operations.
- Increase the efficiency of regulatory inspection procedures.
- Advance electronic processing of vehicle registration and other credentialing processes.
- Promote information exchange among States.
- Enhance the safe passage of commercial vehicles across the United States and international borders.

In the late 1990s and early 2000s, the traveling public and transportation operating agencies began experiencing the benefits of ITS deployments. Travelers were using new, advanced technology applications such as E-ZPass, real-time travel and traffic information media, and in-vehicle safety

TEA-21 Era – Moving Toward Deployment

- Deployment Focus Emerges – Goals and Policies
- Constituency and Goals Broaden
- Institutional Issues Dominate Technical Issues
- ITS Emerges on FCC Agenda
- ITS Visible to Public with Deployments such as:

- GM's OnStar©
- E-ZPass
- *511*
- Operations strategies
- ITS in use for security and evacuations
- Cell phones and PDAs in use for traveler information

systems such as General Motor's (GM) OnStar.© Agencies were realizing new opportunities for real-time monitoring and management of their traffic systems. Markets were evolving for incorporating formerly high-risk technologies into mainstream transportation activities, including construction projects and everyday operations.

As TEA-21 neared completion, the Department recognized that years of steady, solid progress and of demonstrated results had achieved desired levels of ITS deployment. Figure 2.2 below highlights many of the Department's ITS achievements under TEA-21. Notably, a baseline level of deployment under ISTEA allowed the program to move toward innovative applications for weather, freight, public safety, operations, and security under TEA-21. For example, the AHS results launched a more targeted development of intelligent vehicles under the Intelligent Vehicle Initiative (IVI). Finally, the need for a strong, reliable telecommunications link between infrastructure and vehicles resulted in the Federal Communications Commission (FCC) granting the Department a band of communications spectrum dedicated to transportation. This milestone in turn helped to promote research on ITS systems integration.

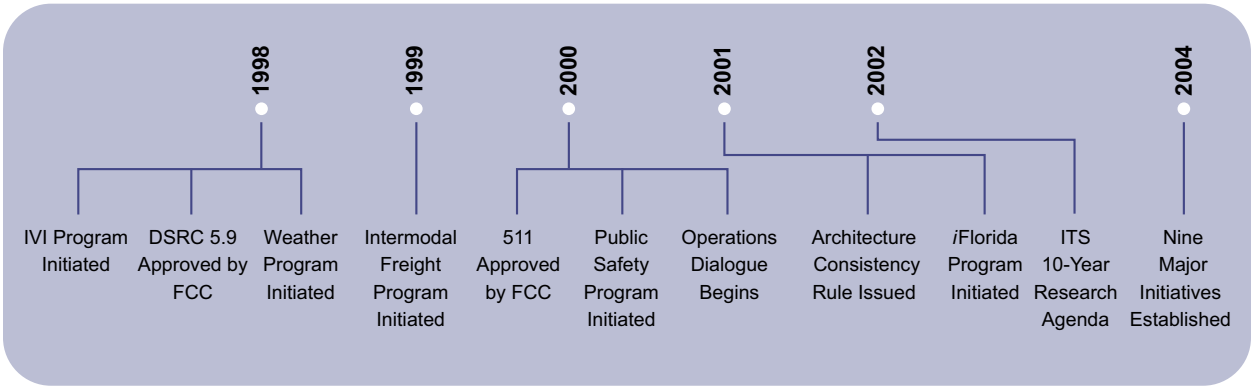


Figure 2.2: ITS Deployment Highlights under TEA-21

The Department's ongoing effort under TEA-21 increased ITS deployment and integration around the Nation. As TEA-21 ended, the Department recognized opportunities for research into the next generation ITS systems, in which technologies could be combined to exploit the benefits of integration between infrastructure and vehicles.

Key Features of the Major ITS Initiatives

- Problem-driven/results-oriented
- Directly support the Department's goals of safety, reduced congestion, and global connectivity
- Multimodal
- Clear roles for the private sector and the public sector
- Opportunities to push the frontier in application of ITS
- Significant research and development as well as testing and evaluation components

Although the next generation ITS initiatives would pose a higher risk for the Department, they were expected to produce higher benefits for the Nation. Each initiative required the private sector to play a role in researching, developing, and transferring new technologies to market. Similarly, each initiative required the public sector also to play a role in defining requirements and future challenges of ITS implementation. These initiatives are described in detail in Chapter 5.

2.C ITS Program under SAFETEA-LU

With the passage of SAFETEA-LU, Congress authorized $550 million, or $110 million per year, for the ITS program over five fiscal years (2005-2009). SAFETEA-LU also contains a number of other provisions intended to further mainstream ITS into the transportation planning and deployment process and to increase general awareness of improved operations.

While the goals and purposes of the ITS program remain largely unchanged from TEA-21, overall SAFETEA-LU increases the Department's focus on integrating systems, technologies, devices, and agencies, shifting from TEA-21's emphasis on demonstration projects. SAFETEA-LU reaffirmed the Department's commitment to major research initiatives, continued the requirement for establishing a cooperative process with State and local governments, and emphasized private-sector participation in the ITS program to ensure successful transfer of new technologies and strategies to the commercial market. SAFETEA-LU also provided resources to deployment support programs in order to meet State and local needs.

ITS Program under SAFETEA-LU

- Focuses on fewer "major initiatives"
  - Larger, higher risk, higher payoff
  - Nine major initiatives approved
- Allows for the completion of ongoing efforts and exploratory studies
- Funds deployment support activities – architecture, standards, professional capacity building, assessment, and outreach

The ITS provisions in SAFETEA-LU designate three new priority research activities:

- A rural interstate corridor communications study.
- A road weather research and development program.
- A multistate corridor operations and management program that specifically continues funding of the I-95 Corridor Coalition.

SAFETEA-LU directs the Department to establish two new stakeholder processes:

- An ITS Advisory Committee to systematically, comprehensively, and objectively assess the ITS program's progress and needs and make recommendations for improvement, if necessary.
- An ITS Standards Experts Panel to "expedite and streamline the process of developing standards."[5]

[5] SAFETEA-LU Section 5307(a)(3)(A).

2.D ITS Program Progress and Achievements

Three major pieces of authorizing legislation for the ITS program, from ISTEA to SAFETEA-LU, have in effect established a nearly 20-year window—from 1991 through 2009—from which one can view the progress and success of the Department's ITS program and the extent of ITS research, development, and deployment. Steady progress has been made in advancing the state of the art and the state of the practice, as well as increasing ITS deployment, and should be viewed in the context of this long-term effort as (1) bringing ITS technologies to the mainstream not only in transportation but in the consumer market, (2) integrating these technologies for maximum benefit, and (3) involving the private sector both as a research partner and a market stakeholder.

In 1996, a comprehensive effort was launched to measure deployment and integration of ITS technology and infrastructure and to convey that information to the public and to stakeholders. Since that time, deployment penetration data have been made available for a wide range of ITS technologies, including freeway management; incident management; arterial management; transit management; electronic fare payment; electronic toll collection; emergency management; highway-rail intersections; road weather; crash prevention and safety; traffic management; traveler information; and rural operations and maintenance.

Tracking the deployment of ITS infrastructure is an important element of ITS program assessment, as deployment of ITS technology is an indirect measure of ITS effectiveness (and also of the effectiveness of the program). Information regarding deployment activities also provides feedback on progress that can help stakeholders to establish strategies for continued market growth. Understanding the extent of ITS deployment can lead to insights on future program direction, refinement of goals, or new program research.

The following figures and tables demonstrate the progress in ITS deployment over the last eight years:

- **Figure 2.3** provides examples of "success" stories—positive, significant changes that have occurred through ITS deployment.[6]
- **Table 2.2** presents progress in deployment by illustrating the growth in specific components of the ITS infrastructure and systems, as defined by the deployment tracking metrics in use since 1997.[7]
- **Table 2.3** presents progress in deploying statewide/rural ITS to meet the needs of medium-sized cities and highly visited tourist areas.[8]
- **Figure 2.4** is a set of two maps that compare the levels of integrated ITS deployment in the 75 largest major metropolitan areas in 1997 and in 2005.[9] In 1997, only 14 percent of major metropolitan areas had a "high" level of integrated ITS deployment compared to 37 percent in 2005.

6 *ITS Benefits, Costs, and Lessons Learned: 2005 Update*. Available at *http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/14073.htm.*

7 Available at *http://www.itsdeployment.its.dot.gov/pdf/goals_report2005.pdf.*

8 Before 2002, deployment tracking was limited to metropolitan areas. In 2002, the tracking survey was expanded to include five categories of ITS in medium-sized cities and tourist areas that constituted the demand for statewide and rural deployments in each state. Supporting materials can be found at *http://www.itsdeployment.its.dot.gov/pdf/statewide_rural_summary_report2004.pdf.*

9 Seventy-five major metropolitan areas were designated by the Department in 1996 based on size and congestion. Statistics obtained from *http://www.itsdeployment.its.dot.gov.*

Figure 2.3: ITS Deployment "Success" Stories

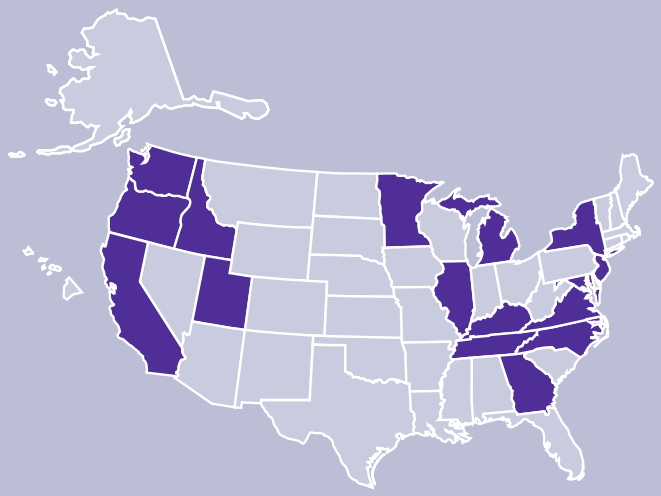
Freeway Management Systems

Oakland County, Michigan: A freeway management system increased average vehicle speeds up to 5.4 miles per hour, decreased average trip time by approximately 4.6 minutes, and reduced commuter delays by as much as 22 percent.

Seattle, Washington: A before/after study of a ramp metering system documented a 38 percent reduction in the accident rate after six years of operation.

Arterial Management Systems

Los Angeles, California: Los Angeles's Automated Traffic Surveillance and Control Program consists of computerized signal control systems in operation since 1984. A 1994 study found that the system reduced vehicle stops by 41 percent, travel times by 18 percent, and fuel consumption by 13 percent.



Syracuse, New York: Signal coordination at 145 intersections in the city reduced the total delay experienced by vehicles during the morning, midday, and evening peak periods by 14 to 19 percent.

Incident Management Systems

Baltimore, Maryland/Washington, D.C.: The Maryland Coordinated Highways Action Response Team (CHART) Program cut incident duration by more than half in the Baltimore-Washington region. Researchers estimate that the system saves over a hundred million dollars each year by saving time, reducing fuel consumption, and decreasing emissions.

Salt Lake Valley, Utah: Incident management teams respond to thousands of incidents each year in Salt Lake Valley. After incident management team operations, emergency communications, and traffic surveillance (through video surveillance and traffic detection) were centralized, the average incident duration decreased by approximately 20 minutes in the coverage area.

Transit Management Systems

Portland, Oregon: Automatic vehicle location systems with computer-aided dispatch (AVL/CAD) helps buses arrive on time. Data collected before and after implementation of an AVL/CAD system showed a 9.4 percent improvement in on-time performance measured at the final destination of routes under study.

Seattle, Washington: A study found that transit signal priority systems reduced average bus delay by approximately 5 percent per equipped intersection, reduced bus travel time variability by 35 percent, and kept side-street delay to a minimum.

Traveler Information Systems

Virginia: *511* systems help travelers choose routes to avoid congestion. In the vicinity of I-81 in Virginia, nearly half of the *511* users surveyed adjusted travel plans based on the traveler information provided.

California: A test within the San Francisco area found that 81 percent of traveler information users changed their travel plans after receiving route-specific information on the Internet; 45 percent, after using a telephone travel advisory system; and 25 percent, after receiving relevant information from radio or television broadcasts.

Electronic Toll/Fare Payment Systems

New Jersey: Implementation of the E-ZPass System by the New Jersey Turnpike Authority reduced delay for all vehicles at toll plazas by 85 percent.

Oakland County, Michigan: An electronic toll collection system installed at the border enabled preprocessed vehicles, trade goods, and commuters to pass through border checkpoints with expedited processing, reducing the time that trucks spent between station entry and exit by approximately 50 percent.

Road Weather Management Systems

Idaho: With the use of anti-icing programs in northern Idaho, roadway surfaces on US Highway-12 were pretreated and then monitored electronically for frost buildup. A before/after study indicated that the program decreased abrasive usage by 83 percent, reduced labor hours by 62 percent, and reduced the frequency of winter accidents by 83 percent.

Minnesota: Minnesota DOT installed an automated anti-icing system on a 1,950-foot eight-lane bridge near downtown Minneapolis on I-35W. In the first year of operation, the system significantly improved roadway safety through a 68 percent decline in crashes compared to that in prior winters with similar conditions.

Commercial Vehicle Operations

Chicago and New York: Electronic supply chain manifest systems reduced the amount of time that carriers spent processing manifests and transferring loads from one mode to another. Before/after test results showed that the time spent by participants on manifesting and processing load transfers decreased by 57 to 100 percent.

Georgia, Kentucky, North Carolina, and Tennessee: Safety for truck drivers can be enhanced by automated inspection systems. A year-long test was conducted on the performance of an infrared brake screening system to inspect commercial vehicles as they entered weigh stations. Of vehicles selected for inspection, 84 percent had some form of brake impairment compared to 34 percent under ordinary inspection selection procedures.

Table 2.2: Deployment Statistics, 1997-2005

Deployment	Statistics		Benefits
	1997	2005	
Freeway miles with real-time traffic data collection technology	16%	44%	• Improved detection of incidents • Improved system operations • Reduced congestion
Freeway miles covered by on-call service patrols	30%	51%	• Decrease in incident duration • Decrease in incident response time • Fewer lane closures
Arterials covered by on-call service patrols	0%	11%	• Decrease in incident duration • Decrease in incident response time • Fewer lane closures
Signalized intersections under centralized or closed loop control	47%	57%	• Vehicular delay reduction • Total stops reduction • Average fuel consumption reduction • Average vehicle emissions reduction • Vehicle speed increases • Travel time reduction • Improved air quality
Toll collection lanes with electronic toll collection capability	36%	80%	• Improved traffic conditions • Reduced congestion • Reduced emissions at tollbooths
Fixed-route transit equipped with automatic vehicle location	23%	69%	• Improved schedule reliability and on-time performance • Decrease in headway variability • Enhanced communication between bus operators and dispatchers with information on schedule adherence, delays, traffic incidents, and operating problems
Fixed-route buses accepting electronic fare payment	30%	70%	• Reduction in boarding times • More accurate revenue base
Emergency management vehicles under computer-aided dispatch	43%	82%	• Improved coordination with transportation operators to reach incidents more quickly
Freeway conditions disseminated to public	12%	33%	• Advanced notice of traffic conditions and lane closures • Improved safety; decrease in accident rate • More route diversion to alleviate congestion

Table 2.3: Deployment Statistics for Rural Areas, 2004

Deployments (ITS Technologies and Systems)	No. of States	Benefits
Crash Prevention and Safety Warning Systems that include: • Environmental Road Hazards • Roadway Geometry Warnings • Road/Rail Intersection Systems • Dangerous Road Intersections • Animal Crossings • Presence of Bicyclists/Pedestrians	25	Presents warnings to drivers to: • Detect hazards or unsafe conditions • Evaluate the severity of the hazard
Surface Transportation and Weather Systems that include: • Environmental Sensor Stations • Communications with Maintenance Crews • Traveler Information Systems	40	• Provides travelers with real-time weather conditions and warns about unsafe driving conditions • Provides operating agencies with information for decision support
Operations and Maintenance Systems that include: • Automatic Anti-Icing Systems • Avalanche/Slide Management Systems • Work Zone Management Systems • Maintenance Fleet Management Systems	31	• Provides transportation agencies with detailed information to address safety and increase operational improvements • Improves the ability of operational agencies to more rapidly address road conditions based on real-time information • Reduces costs through effective use of maintenance resources; maintenance vehicles become a source of systems information
Traveler Information Systems that include: • Media for Information Dissemination • Traveler Information Websites • Statewide *511* Systems	47	Provides information to drivers on: • Construction areas and work zones • Incidents • Road surface and weather conditions • Congestion • Public transit schedules • Tourism
Traffic Management Systems that include: • Closed Circuit Television Camera Systems • Dynamic Message Signs • Road Closure Systems • Route Diversion Management Systems • Traffic Management Centers	43	• Provides agencies with a network for monitoring and information dissemination to support numerous activities such as incident detection and verification, weather and roadway conditions monitoring, dynamic message sign message verification, and event management • Alerts drivers to problems on the roadways and provides alternate solutions

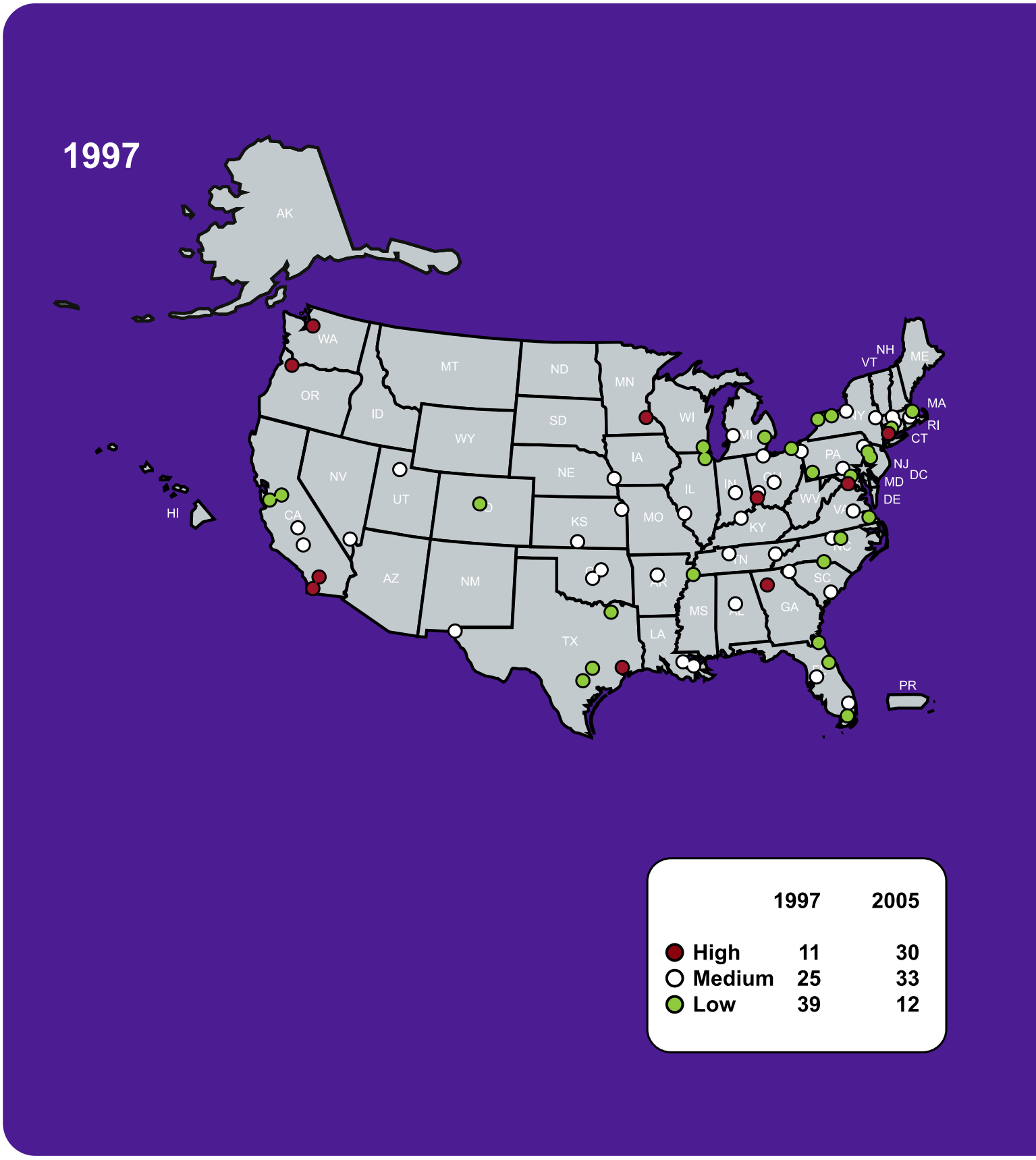
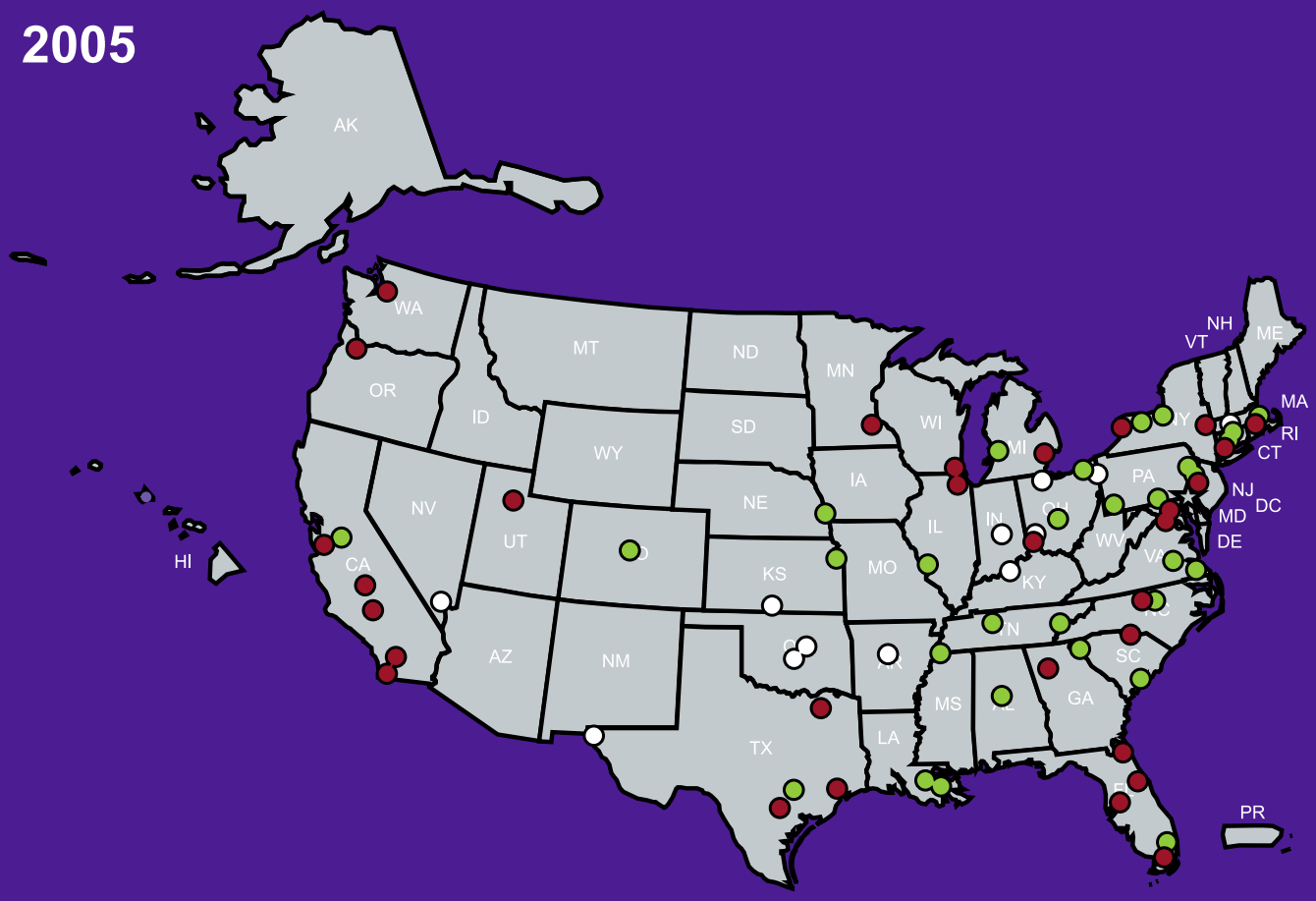


Figure 2.4: ITS Deployment in Seventy-five Metropolitan Areas, 1997 and 2005

2005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ITS Program Structure and Five-Year Goals 3

3.A Leadership and Management Structure of the ITS Program

The ITS program represents the Department-wide efforts to develop and deliver advanced technologies for all surface transportation. The ITS Joint Program Office (ITS JPO) provides the daily oversight and programmatic management of the ITS-related programs and initiatives among all the Modal Administrations. At the strategic level, decisions about the ITS program are guided by the ITS Management Council. At a functional level, the ITS Strategic Planning Group (ITS SPG) ensures coordination across the modes.

3.A.1 ITS Management Council

The ITS Management Council acts as the Department's "Board of Directors" for the ITS program. The purpose of the ITS Management Council is to guide and direct the Federal ITS program with respect to the Department's goals. The role of the ITS Management Council is to ensure the overall effectiveness of the ITS program and to provide a connection between the ITS program and each of the Modal Administrations. The ITS Management Council is chaired by the Department's Administrator for the Research and Innovative Technology Administration (RITA), with a principals-only membership, including:

- U.S. DOT Deputy Secretary
- Under Secretary for Policy
- Assistant Secretary for Transportation Policy
- Modal Administrators from the operating administrations:
  - Federal Highway Administration
  - Federal Motor Carrier Safety Administration
  - Federal Transit Administration
  - National Highway Traffic Safety Administration
  - Federal Railroad Administration
  - Maritime Administration
- U.S. DOT's Chief Information Officer

3.A.2 ITS Strategic Planning Group (ITS SPG)

The ITS Strategic Planning Group provides internal management coordination for the ITS program. The group is chaired by the ITS JPO Program Director, and its membership comprises senior program managers across all the modes (Associate Administrators and Office Directors). In its meetings, issues and concerns regarding program activities are raised and, based on those discussions, a recommended course of action is presented to the ITS Management Council. While the ITS SPG provides programmatic advice to both the ITS Management Council and the ITS JPO, the ITS Management Council is responsible for making final decisions on ITS program activities and management.

3.A.3 ITS Management Council and the ITS SPG: Establishing Priorities

The ITS Management Council and the ITS SPG work together to establish priorities for the ITS program. The ITS SPG acts as the mechanism through which program managers can provide advice and input to the ITS Management Council on the establishment of priorities. The ITS Management Council uses this input to formulate overall strategies and program direction. Comprising the U.S. DOT Modal Administrators, the ITS Management Council represents a broader departmental view on advanced technology needs throughout the transportation community. Through engaging the Modal Administrators, the ITS Management Council also provides an opportunity for integrating ITS within existing Departmental programs and for assessing the effectiveness of ITS within these programs.

ITS Management Council

- Internal "Board of Directors"
- Chaired by RITA Administrator
- Includes all Modal Administrators

ITS Strategic Planning Group

- Internal Management Coordination
- Chaired by ITS JPO Program Director
- Includes senior managers for all modes

3.A.4 ITS Joint Program Office

The management and coordination of the ITS program is the responsibility of the ITS Joint Program Office. The office comprises:

- Program Director.
- Managing Director.
- Technical Program Coordinators for the Department's multimodal ITS research initiatives.
- Deployment Support Coordinators for the ITS deployment support programs.
- Program Support Staff (including financial and program analysts).

Figure 3.1 on the following page illustrates the composition of the office.

In 2003, the ITS Management Council conducted a multiyear review of the ITS program to determine its future direction. For the Department to more effectively meet its ITS goals, the ITS Management Council determined that the ITS research program should be restructured, resulting in a limited number of initiatives oriented toward solving real-world problems, producing measurable results, and pushing the frontier of ITS applications. Federal investments would be directed at "targets of opportunity" that have the potential for significant payoff in improving safety, mobility, and productivity. These targets of opportunity would include both infrastructure and vehicles and would focus on integration between the two modes of transportation and among jurisdictions. Although higher risk, these actions could also yield a higher return on investment.

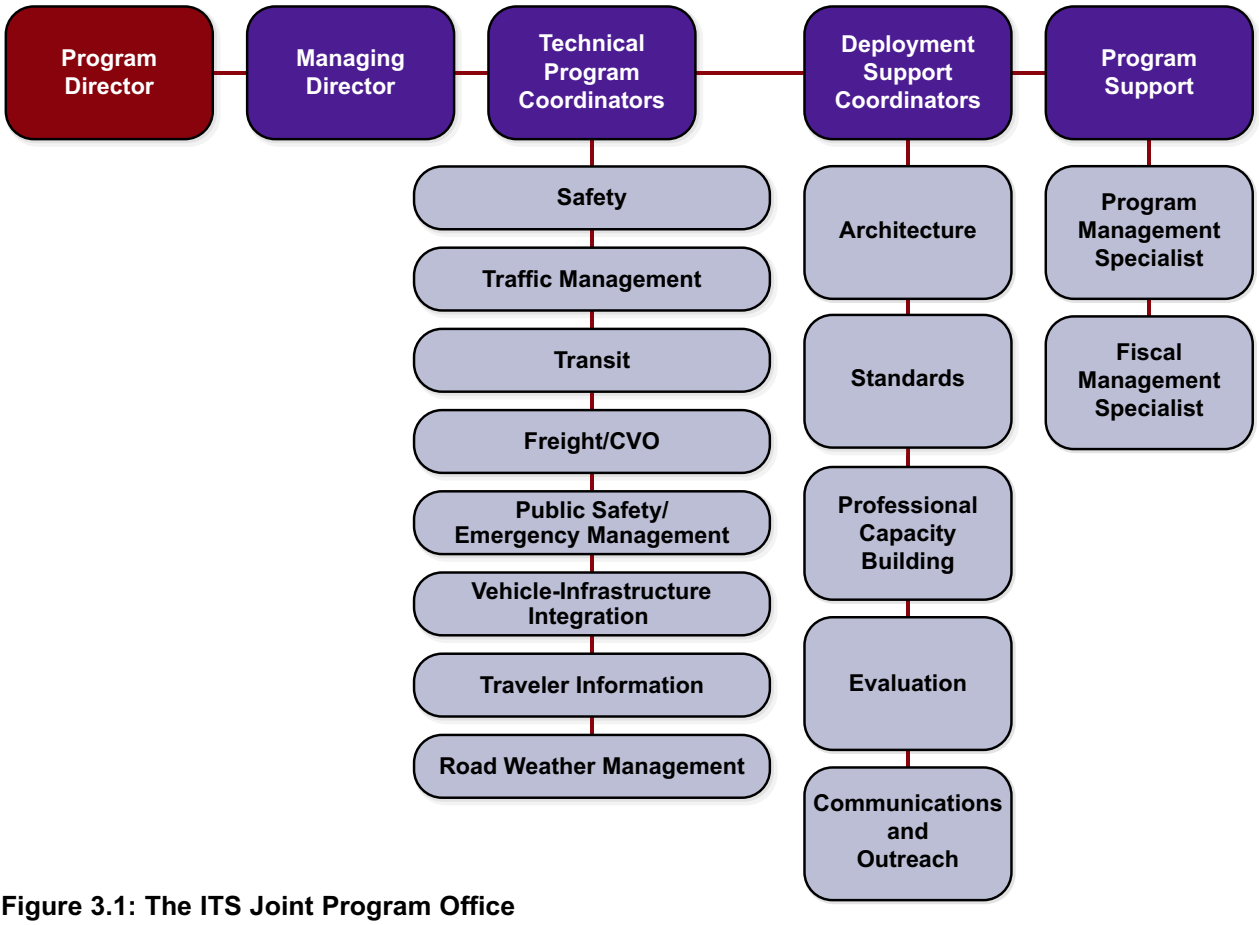


Figure 3.1: The ITS Joint Program Office

As Figure 3.2 on the following page illustrates, nine major initiatives currently serve as the centerpiece of the ITS program. These major research initiatives were selected specifically because they are:

- Problem-driven and results-oriented.
- In direct support of the Department's goals for safety, reduced congestion, and global connectivity as well as Congressional goals, purposes, and research priorities for the ITS program.
- Multimodal in nature and requiring a high degree of integration.
- Clearly defined with respect to the Federal role as well as private-sector roles.
- Focused on significant research and development and incorporating testing and evaluation.

Additional activities are included in the ITS Deployment Support Program function. These activities support and facilitate the integration and deployment of ITS throughout the country. Deployment support provides mechanisms to ensure that:

- Guidance exists to support integration and interoperability.
- Projects are evaluated and analyzed and data is collected to form a statistical picture of progress.
- Evaluation findings are documented and disseminated.
- Information on benefits, costs, lessons learned, and best practices is gathered, analyzed, and incorporated into ITS learning, technical assistance, and technology transfer activities.

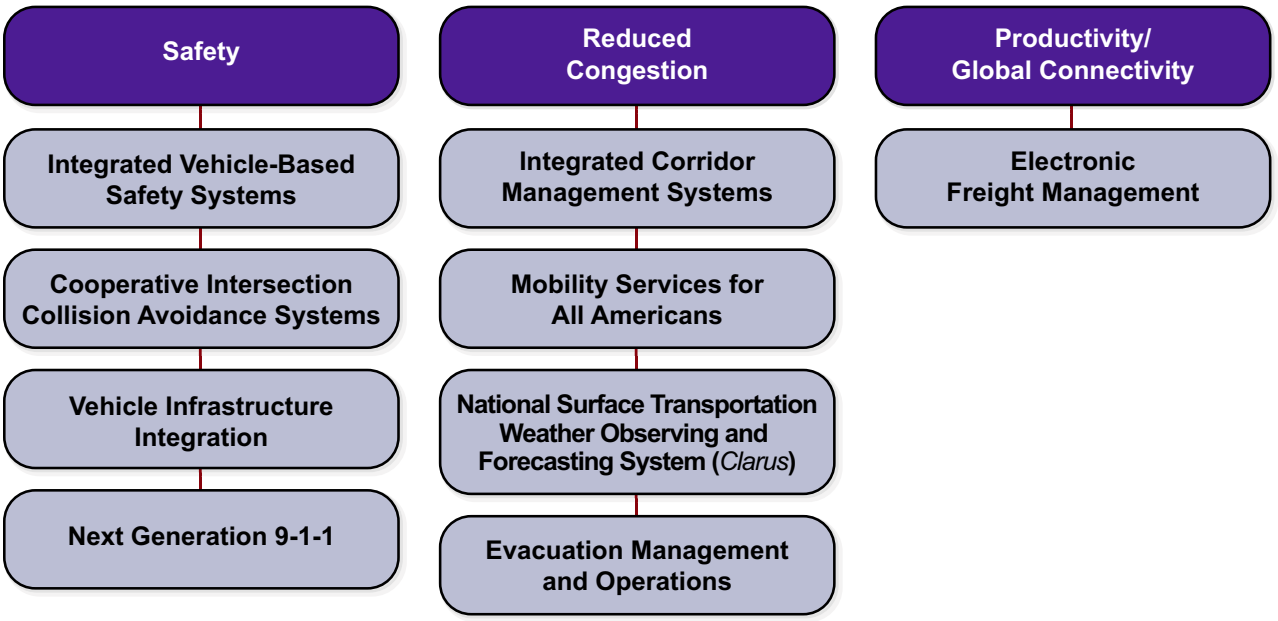


Figure 3.2: Major ITS Research Initiatives, Aligned by Departmental Goals

- Outreach efforts include information about ITS program goals, major initiatives, and deployment activities, and that the information is broadly disseminated with the expectation that it will increase ITS deployment and facilitate more efficient and successful ITS system performance.

Although ITS JPO staff are responsible for daily oversight and management of the research initiatives and deployment support programs, the ITS program is a multimodal initiative within the Department. Staff from the Modal Administrations work closely with the ITS JPO staff and share responsibility for execution of ITS research and development activities. Modal Administration staff also provide technical assistance and dissemination of best practices to State and local governments. Close collaboration between the ITS JPO and the Modal Administrations greatly reduces program redundancy and fosters integration of ITS throughout the Department. The text box on the following page illustrates how the modal technical expertise enhances the integrated nature of the ITS program.

In 2005, the Department created the Research and Innovative Technology Administration (RITA) to more effectively coordinate and manage the Department's research portfolio, expedite implementation of crosscutting innovative technologies, and strengthen partnerships with the private sector for research and technology transfer to the market. The RITA Administrator will chair the ITS Management Council, work closely with the Director of the ITS program to set the programmatic direction and budget, and review progress against goals.

3.B Five-Year Goals for the ITS Program: Legislative and Departmental Direction

The overall direction of the Department's ITS program is guided by the goals set by Congress in SAFETEA-LU and by the overall goals of the U.S. DOT. The remainder of this chapter describes these goals and aligns them with the existing and planned efforts of the ITS program.

Role of the Modal Administrations in the ITS Program

When the ITS program was initiated under ISTEA, the Department positioned the program to provide research on technology needs and interoperability issues across the surface transportation modes. While the JPO serves as the principal planning and coordinating entity for the ITS program, the Modal Administrations are the primary source for application development and testing of new ITS technologies and strategies. The principal modal partners in the ITS program are the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the Federal Transit Administration (FTA), and the Federal Motor Carrier Safety Administration (FMCSA). The following describes the roles of the different Modal Administrations and highlights some of their key contributions.

FHWA: FHWA has been a primary force behind facilitating ITS deployment on our Nation's roads. FHWA addresses the needs of State and local transportation agencies with respect to application of advanced technologies. FHWA staff have brought to the ITS program expertise and research capabilities related to traffic management systems, traveler information systems, operations strategies, and planning tools. FHWA also has primary responsibility for several large-scale demonstrations and evaluations of the performance, effectiveness, and interoperability of ITS systems, such as TravTek, Advance, and *i*Florida. In addition, FHWA has played an important role in the development and testing of the *511* program, real-time adaptive traffic signal control systems, decision support tools for road weather management, planned special event management, and the next generation of traffic simulation technologies.

NHTSA: With a focus on improving public safety, NHTSA has been a critical force behind the development of the intelligent vehicle. NHTSA staff have provided technical expertise to develop and deliver the IVI, which set the research foundation for some of the current major initiatives addressing active safety systems. NHTSA has also supported large-scale field tests and evaluations on the performance of various vehicle-based crash avoidance systems. NHTSA has played an important role in development and testing of prototype rear-end collision avoidance technologies and road-departure and lane-change collision avoidance systems.

FTA: FTA has advanced the state of the practice in ITS through research, development, and deployment of advanced public transportation systems. FTA has provided basic research, cost-benefit analysis, architecture, standards, planning and operational strategies, and training to transit agencies. FTA has played an important role in development, testing, and deployment of the intelligent bus, bus rapid transit technologies, electronic fare payment systems, rail-grade crossing systems, and rural ITS transit systems, and is developing a strategic ITS rail plan.

FMCSA: FMCSA has brought a focus on motor carrier safety to the ITS program. It has been instrumental in developing ITS technologies and strategies to achieve the Department's goal of reducing crashes, fatalities, and injuries involving large trucks and buses. Through the ITS/Commercial Vehicle Operations (CVO) Program, FMCSA staff tailored the National ITS Architecture to produce a CVO-specific version known as Commercial Vehicle Information Systems and Networks, or CVISN. FMCSA staff have facilitated the creation of CVISN business plans in each state, as well as undertaking State-based training, demonstrations, and evaluations. FMCSA has played an important role in the development and testing of ITS technologies for hazardous materials, drowsy driver detection devices, roll stability and control devices, and wireless inspection research.

3.B.1 Goals: Legislative Direction in SAFETEA-LU

Congress set overall guidance for the ITS program in SAFETEA-LU by specifying efforts and priorities through:

- Five programmatic goals.
- Eight programmatic purposes.
- Seven research and development priority areas.

In setting the vision for the next five years, the Department has considered these goals, purposes, and priorities, and has worked to ensure that the program is oriented to address them to the maximum extent possible. Many of the major initiatives and deployment support activities are already well on the path toward meeting the legislative direction provided in SAFETEA-LU. In areas where the legislation provides new direction, the ITS JPO and its modal partners are establishing activities to address those new needs.

3.B.1.1 Programmatic Goals in SAFETEA-LU

SAFETEA-LU Section 5303(a) sets forth five overarching goals for the national ITS program. These goals provide an overall direction to the ITS program with respect to achieving broad transportation goals for the Nation. These goals, which originated in TEA-21, are in alignment with the Department's goals and form the basis for many of the major initiatives. The articulation of these goals as part of SAFETEA-LU provides a renewed emphasis on the key challenges facing our transportation system, which ITS should address. The five goals are:

- Improve the efficiency of existing surface transportation facilities to meet a significant portion of future transportation needs, and reduce regulatory and financial costs to public agencies and system users.
- Decrease the number and severity of crashes by improving the safety of motor vehicles and nonmotorized transportation and by improving incident response.
- Protect the natural environment and communities affected by surface transportation, with particular emphasis on assisting State and local governments to achieve national environmental goals.
- Accommodate the needs of all users of surface transportation systems, including operators of commercial and passenger motor vehicles, motorcyclists, bicyclists, pedestrians, and individuals with disabilities.
- Improve the Nation's ability to respond to natural and man-made disasters, and enhance national defense mobility.

3.B.1.2 Programmatic Purposes in SAFETEA-LU

SAFETEA-LU Section 5303(b) prescribes a clear role for the ITS program through several "purposes" that provide the Department with an opportunity to reemphasize many of the activities underway in the ITS program. As set forth in SAFETEA-LU, the national ITS program shall:

- Expedite the deployment and integration of ITS in both metropolitan and rural areas.
- Ensure that Federal, State, and local transportation officials have adequate knowledge of ITS to facilitate its inclusion in the planning process.
- Improve regional cooperation and operations planning for effective intelligent transportation system deployment.
- Promote the innovative use of private resources.
- Facilitate the introduction of vehicle-based safety-enhancing systems.
- Support the application of ITS to increase the safety and efficiency of commercial vehicles.

- Create a workforce capable of developing, operating, and maintaining intelligent transportation systems.
- Provide continuing support for operations and maintenance of ITS.

3.B.1.3 Programmatic Research Priorities in SAFETEA-LU

Congress provided further guidance on priorities for future research, development, and investments. With the research and development of priority areas, Congress allowed for the creation of new or increased investment to address some of the most complex transportation problems facing our Nation today. It is within these priority areas that ongoing research within the initiatives and support programs is being realigned and new research efforts are being established. As described in Section 5306(b), priority will be given to investments in the following activity areas:

- Reduce congestion and enhance productivity through improved traffic management, incident management, transit management, freight management, road weather management, toll collection, traveler information, highway operations systems, and remote sensing products.
- Utilize interdisciplinary approaches to develop traffic management strategies and tools to address multiple impacts of congestion concurrently.
- Address traffic management, incident management, transit management, toll collection, traveler information, and highway operations systems with the goals of reducing congestion, ensuring an interoperable *511* system, improving incident management response, and improving communication between emergency care providers and trauma centers.
- Incorporate research on the impact of environmental, weather, and natural conditions on ITS systems, including the effects of cold climates.
- Enhance intermodal use of ITS for diverse groups, including emergency and health-related services.
- Enhance safety through improved crash avoidance and protection, crash and other notification, commercial motor vehicle operations, and infrastructure-based or cooperative safety systems.
- Facilitate the integration of intelligent infrastructure, vehicle, and control technologies.

Collectively, the goals, purposes, and priorities prescribed by Congress for the Department's ITS program add clarity to current activities and give guidance on how to build from the accomplishments under the previous legislation. The program-area descriptions in Chapters 5 and 6 will highlight how this guidance is being enacted through a dynamic set of activities that assist the Department with meeting the ITS program's goals over the next five years.

Appendix A shows further detail on how these activities align with Congressional direction.

3.B.2 Goals: U.S. DOT Strategic Goals

The *U.S. DOT Strategic Plan: FY2003-2008* has articulated five key goals for itself in the areas of reduced congestion, safety, global connectivity, environmental stewardship, and security, preparedness and response:[10]

- **Safety:** Improving the safety of the Nation's transportation system is a top priority. In 2002, over 42,000 people were killed in traffic accidents. The Department has established a goal of reducing the highway fatality rate to not more than 1.0 per 100 million vehicle miles traveled by 2008 (from 1.7 per 100 million vehicle miles traveled in 1996).

[10] *U.S. DOT Strategic Plan: FY 2006-2011.* Available at *http://www.dot.gov/stratplan2011/strategic_plan.htm.*

- **Reduced Congestion:** Transportation congestion is a significant problem, with negative impacts on the economy as well as the environment. Traffic congestion now costs motorists in top urban areas approximately $68 billion a year in wasted time and fuel. Addressing the Nation's growing mobility needs is critical and requires the creative application of technology, investment in infrastructure, better asset management, and traveler information. In addition, an integral aspect of mobility is accessibility; to be inclusive, transportation must be accessible to all (including those with low incomes, the elderly, and persons with disabilities).
- **Global Connectivity:** The existence of safe and efficient transportation connections within and among nations is critical to accelerated economic growth, freer trade, and greater cultural exchange. In an increasingly global economy, efficient transportation is necessary for maintaining America's competitiveness.
- **Environmental Stewardship:** Current trends in transportation are exerting pressure on environmental resources worldwide. The Department is committed to providing transportation solutions that are consistent with sound environmental planning. The need for a safe and efficient transportation network needs to be balanced with the importance of preserving environmental quality. The central strategy for achieving balance will be to consolidate and streamline programs and improve system performance.
- **Security, Preparedness and Response:** The security of our transportation facilities from terrorist attack as well as from foreign and domestic criminal enterprise is a critical goal, as is preparedness to respond to emergencies that affect the viability of the transportation sector. The transportation system must also remain a vital link for mobilizing armed forces for military contingencies and for supporting safe and efficient response during emergencies.

The Department's ITS activities focus most intensively on meeting Departmental goals in the areas of safety, reduced congestion, and global connectivity, as described in the following Sections 3.B.2.1–3.B.2.3.

3.B.2.1 Safety and ITS

In the 1990s, the state of the practice in transportation safety was a well-established use of passive passenger safety systems such as seatbelts, air bags, and other restraints. However, industry and consumers were asking important questions about advanced technologies, such as "*Can we move beyond trying to reduce damage from crashes and actively try to prevent them?"*

Under TEA-21, the U.S. DOT established the IVI and formed cooperative agreements with the automotive industry to accelerate the development and deployment of vehicle-based and cooperative driver assistance systems that could warn drivers of dangerous situations, recommend actions, and even assume partial control of vehicles to avoid collisions. These systems, known as "active safety systems," proactively attempt to manage or prevent a crash situation.

The cooperative research under IVI achieved important results. Detailed and sophisticated analyses on some of the key factors related to crashes revealed important insights on the role of the driver, the role of distractedness, and vehicle safety performance metrics. Using these results, industry developed the first generation of active safety systems for the marketplace. Consumers have since been introduced to products such as electronic stability control, lane-keeping systems, and automated collision notification systems.

These results also formed the basis for a more dynamic approach by the Department to address critical safety needs. Building from the IVI research and other public safety research efforts, the ITS program consolidated the most forward-reaching research and development efforts into four new major research initiatives that address critical national safety needs. These initiatives are:

- Integrated Vehicle-Based Safety Systems (IVBSS)
- Cooperative Intersection Collision Avoidance Systems (CICAS)
- Vehicle Infrastructure Integration (VII)
- Next Generation 9-1-1 (NG9-1-1)

Specifically, the role of the ITS program is to:

- ***Provide major investment and coordination*** to move the state of the art in industry forward. With active safety systems, the Department sees an opportunity to engage in high-risk, high-reward research in partnership with industry. Four new safety research initiatives will help create state-of-the-art active safety systems with a goal of commercializing these new technologies within our lifetimes.
- ***Focus research on technology and systems integration*** to deliver important benefits to drivers. The Department recognizes that advanced technology systems released into the market separately has limited safety and market potential. With technical input from NHTSA, the ITS program is researching the process for integrating various active safety systems to eliminate hazards for the driver (such as driver attention overload). With the new safety research initiatives, the Department's ITS program will provide a set of generic requirements and standards to ensure that the private sector's proprietary components are integrated in favor of the driver.
- ***Facilitate technology transfer and commercialization within the private sector and market awareness within the public sector.*** Each safety initiative is being conducted in partnership with industry, thus establishing a transfer mechanism for requirements and specifications to be brought rapidly into commercial production. Additionally, the Department will deliver evaluation results from the safety initiatives to support public-sector investment decision-making. Cost-benefit and system performance data will be developed to assist public-sector agencies in determining which active safety systems most effectively address their needs and to help reduce danger on their roadways.

Although each safety initiative will produce results relating to one or more aspects of the safety problem, in combination they lay the foundation for an even more futuristic vision—the day when vehicles will be able to communicate with each other to help prevent crashes. Vehicle-to-vehicle communications is a long-term goal that is being explored with industry as part of the VII Initiative. Results from the current research initiatives will produce platforms, systems, and processes that will create the foundation for vehicle-to-vehicle systems that improve driver and road safety.

3.B.2.2 Reduced Congestion and ITS

Congestion is one of the most public displays of increasing transportation immobility faced by our Nation. Rising congestion due to population and economic growth and change negatively impact our Nation's financial and social well-being. In 2003, as the ITS research initiatives were being defined, congestion growth was exponentially outpacing roadway capacity. Surveys estimated that congestion resulted in 3.7 billion hours of delay and $2.3 billion of "wasted" fuel. Figure 3.3 illustrates the steep rise in congestion over a 20-year period in the Nation's 13 largest cities.[11]

[11] Texas Transportation Institute. *2005 Urban Mobility Study* and Cambridge Systematics, Inc. 2005. *Traffic Congestion and Reliability: Trends and Advanced Strategies for Mitigation*.

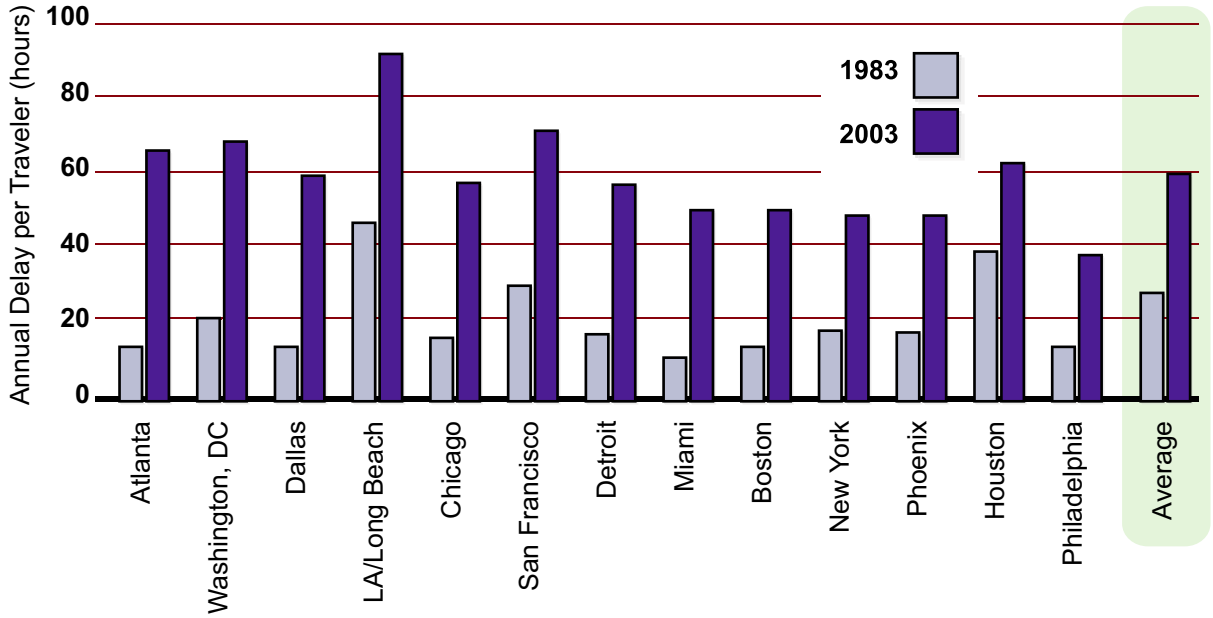


Figure 3.3: Growth in Congestion in Major Metropolitan Areas, 1983 and 2003

Roughly half of the congestion experienced by Americans is known as recurring congestion; this congestion is caused by daily demand exceeding capacity. The other half is due to nonrecurring congestion—traffic incidents (disabled vehicles, crashes), work zones, weather, and special events. Nonrecurring events suddenly and dramatically reduce the available capacity and reliability of the entire transportation system. Travelers and shippers are particularly sensitive to unanticipated disruptions to tightly scheduled trips.

The Department has determined that ITS can play a critical role in alleviating both recurring and nonrecurring congestion and improving overall mobility. The same survey that provided estimates of congestion in 2002 also noted that the use of ITS and other operational strategies provided between 260 and 340 million hours of relief from congestion from 2002 to 2005.

ITS, in combination with operational strategies, clearly has the opportunity to:

- Manage demand.
- Better utilize underutilized capacity.
- Provide enhanced traveler information and travel management.
- Facilitate data exchange among multiple stakeholders.
- Improve fleet scheduling.

In May 2006, former Secretary of Transportation Norman Mineta announced a National Strategy to Reduce Congestion on America's Transportation Network.[12] The Department's strategy seeks

[12] Former Secretary Mineta proposed these actions during a speech to the National Retail Federation celebrating National Transportation Week on May 14, 2006. See *National Strategy to Reduce Congestion on America's Transportation Network* at *http://isddc.dot.gov/OLPFiles/OST/012988.pdf.*

to combine some of the most innovative and powerful resources in transportation to address the congestion problem. The strategy comprises six action points:

1. Relieving urban congestion by increasing available capacity, shifting demand for capacity, and, where warranted, using pricing strategies to balance demand and capacity.
2. Unleashing private-sector-resource investments in more States by working with the States to enact appropriate public-private partnership legislation and overcoming institutional resistance through training, education, and technical assistance.
3. Promoting operational and technical improvements that increase information dissemination and incident response capabilities.
4. Establishing a "Corridors of the Future" competition, which will highlight the use of new financing and operational models that more effectively utilize multistate, multijurisdictional coordination strategies.
5. Targeting major freight bottlenecks and expanding freight policy outreach through improvements in two areas—better coordination among major stakeholders at critical gateways such as the ports in Southern California and operational and infrastructure improvements at major border crossings.
6. Accelerating major airport capacity projects and providing a future funding framework through congestion pricing and demand management strategies and prioritization of new capacity investments and the Next Generation Air Transportation System.

Some of the Department's past ITS accomplishments comprise elements of these strategies. For example:

- **Electronic toll systems** have been deployed to provide variable pricing programs, most notably along State Route 91 in Orange County, California. Additionally, the ITS program has provided oversight to a set of congestion/variable/value pricing pilot programs, including three implementation projects in Lee County, Florida, San Diego, California, and Houston, Texas. There are also six pre-project, or feasibility, studies: in Portland, Oregon; Los Angeles, California; San Francisco and Sonoma County, California; Boulder, Colorado; Minneapolis and St. Paul, Minnesota; and Westchester County, New York. Lessons learned on the successes and failures of public-private partnerships in those deployments are documented.

- **Advanced public transportation systems** have demonstrated the use of flexible transit services along fixed routes and can highlight best practices in use around the Nation. The ITS program has also been involved in developing bus rapid transit technologies and strategies.

- The **National *511* Program** has been making deployment progress throughout the Nation. *511* provides travelers with real-time information on congestion and alternate routes. The most significant example is currently being demonstrated in and around the Orlando area by the *i*Florida Program and the Florida DOT in partnership with the ITS program. With the installation of sensors and communications technologies throughout the roadways and the integration with traffic signals, the *i*Florida demonstration will provide the Department and the Nation with a model for using ITS to reduce congestion.

- The **Integrated Corridor Management (ICM) Initiative** is exploring how a truly integrated system of technologies for traffic condition monitoring, computerized traffic control systems, traveler information systems, public transit information management systems, *511*, innovative weather sensors and weather information networks, bus rapid transit, and other technologies can reduce congestion and increase mobility along densely populated corridors.

- The ***Clarus* Initiative** is addressing how improved dissemination of weather information to travelers can be a key element in reducing the impact of weather-related congestion.

- The **Mobility Services for All Americans (MSAA) Initiative** is focused on improving the efficiency and service of various subsidized transportation services.

- The **Evacuation Management and Operations (EMO) Initiative** is exploring how to improve evacuation operations. This initiative offers the potential to significantly increase mobility during emergencies.

As the Department further defines the actions it will take to implement its Congestion Strategy, the ITS program will work in close concert with the Modal Administrations to define ways to integrate the existing baseline of ITS deployments into new combinations to combat congestion.

3.B.2.3 Global Connectivity and ITS

Strengthening the role of transportation in increasing economic productivity is an important goal for the Department. The Department recognizes that advanced technologies can play a key role in developing and delivering a more dynamic, real-time information exchange to increase the operating efficiency, safety, and security of goods movements.

To better understand the opportunities that a system for global data exchange might deliver, the Department worked with private-sector partners to form an Intermodal Freight Technology Working Group (IFTWG). The group created a process map that illustrated the physical movement of a container through a supply chain with its attendant information flow. The results identified areas where advanced communications technologies could aid improvements in speed, accuracy, and visibility of goods movements, all of which have the potential to result in increased productivity through:

- Better planning for just-in-time manufacturing.
- Identification of alternative routes to avoid congestion.
- More efficient transportation across jurisdictional lines.

ITS can play a particularly important role in light of the existing and predicted physical capacity constraints. International trade is now 25 percent of the U.S. gross domestic product and is expected to grow. Ports are already congested, and manufacturers are making decisions about moving their plants and warehouses offshore for better transportation accessibility. Statistics reveal that:[13]

- Freight volumes through our Nation's primary ports could more than double from 1998 to 2020.
- U.S. foreign trade rose from $1.2 to $2.6 trillion between 1990 and 2003.
- Over the past two decades, U.S. foreign trade in goods by value has quadrupled.

[13] U.S. DOT. 2006. *Electronic Freight Management Initiative.* Available at *http://www.ops.fhwa.dot.gov/freight/intermodal/efmi/index.htm.*

- The volume of trade moved on the U.S. transportation system is projected to increase 65 to 70 percent by 2020 compared to 1998 levels.

Through the Electronic Freight Management Initiative (EFM), the Department is addressing one aspect of these problems. The EFM Initiative capitalizes on lessons learned through the application of ITS, operations strategies, and web technologies for delivering real-time traffic information. Using this knowledge, the EFM is developing a service-oriented system that streamlines the movement of goods, the complex processes related to the exchange of information between multiple entities (governmental and commercial), and the transfer mechanisms within and among modes of transportation.

This new system will advance data and message transmissions and facilitate business transactions from one end of the supply chain to the other as a means of enhancing movement between ground and air cargo functions. The service will allow for improved shipment visibility throughout the entire supply chain, a reduction of redundant data entry, improved diagnostic tracking, simplified interfaces with government authorities, and enhanced security.

The EFM Initiative offers the Department a piece of the solution for addressing freight bottlenecks as part of the Congestion Strategy. Through the EFM, the ITS program hopes to fundamentally change how goods movements, both domestically and internationally, are handled. If successful, the adoption of these technologies by other cargo supply chains may be a catalyst for their adoption in other modes of transportation such as water and rail.

Establishing, Assessing, and Maintaining Programmatic and Strategic Priorities

4

To establish future priorities and maintain the current direction of the program, several processes have been implemented to guide the ITS program. Each of these processes engages different stakeholders to set program priorities and apply the criteria used to identify new research initiatives and to assess their progress. These processes are:

- Stakeholder Engagement Processes for:
  - Establishing an ITS Advisory Committee (new).
  - Continuing cooperative processes with stakeholders.
  - Establishing an ITS Standards Expert Panel (new).
- Internal Engagement Processes for:
  - Assessing the potential of proposed new research initiatives.
  - Applying investment criteria to all initiatives.

4.A Establishing Priorities: Stakeholder Engagement

4.A.1 ITS Advisory Committee

SAFETEA-LU Section 5305(h) requires the establishment of an ITS Advisory Committee to systematically, comprehensively, and objectively assess the ITS program's progress and needs and make recommendations for improvement if necessary. The legislative language is included on the following page.

The ITS Advisory Committee will play an important role in shaping how the ITS program will operate and also how it will meet Department and legislative goals now and in the future. Through creation of the ITS Advisory Committee, SAFETEA-LU has created a formal mechanism for broadening the scope of stakeholder involvement in and impact on the establishment of the Department's ITS program priorities.

4.A.1.1 Formation of the Advisory Committee

The formation of the ITS Advisory Committee is underway as of the writing of this report. The ITS Advisory Committee is subject to the Federal Advisory Committee Act and therefore must comply with specific regulations and processes, which include development and adoption of a Charter and establishment of the membership. The Department has developed a plan for identifying candidates who meet the specific criteria set forth in the legislation. It is expected that Committee meetings will be held quarterly. The ITS Advisory Committee will also provide the program with additional stakeholder input, as will the ITS Standards Expert Panel, discussed later in this chapter.

4.A.2 Cooperative Processes with Stakeholders to Establish Priorities

SAFETEA-LU mandated that the Department establish a cooperative process for the broader ITS stakeholder community to participate in establishing programmatic ITS needs, recognizing priorities for new research investments, and identifying new use cases for ITS. A number of processes are currently being used to elicit this type of input. For example, many programs have conducted community-based needs assessments, held forums and listening sessions before creating new requirements, and established consortia to represent ongoing stakeholder interests. Table 4.1 lists many of these efforts.

Section 5305 (h): Advisory Committee

(1) IN GENERAL.—The Secretary shall establish an Advisory Committee to advise the Secretary on carrying out this subtitle.

(2) MEMBERSHIP.—The Advisory Committee shall have no more than 20 members, be balanced between metropolitan and rural interests, and include, at a minimum—

(A) a representative from a State highway department;
(B) a representative from a local highway department who is not from a metropolitan planning organization;
(C) a representative from a State, local, or regional transit agency;
(D) a representative from a metropolitan planning organization;
(E) a private sector user of intelligent transportation system technologies;
(F) an academic researcher with expertise in computer science or another information science field related to intelligent transportation systems, and who is not an expert on transportation issues;
(G) an academic researcher who is a civil engineer;
(H) an academic researcher who is a social scientist with expertise in transportation issues;
(I) a representative from a nonprofit group representing the intelligent transportation system industry;
(J) a representative from a public interest group concerned with safety;
(K) a representative from a public interest group concerned with the impact of the transportation system on land use and residential patterns; and
(L) members with expertise in planning, safety, and operations.

(3) DUTIES.—The Advisory Committee shall, at a minimum, perform the following duties:

(A) Provide input into the development of the Intelligent Transportation System aspects of the strategic plan under section 508 of title 23, United States Code.
(B) Review, at least annually, areas of intelligent transportation systems research being considered for funding by the Department, to determine—
(i) whether these activities are likely to advance either the state-of-the-practice or state of-the-art in intelligent transportation systems;
(ii) whether the intelligent transportation system technologies are likely to be deployed by users, and if not, to determine the barriers to deployment; and
(iii) the appropriate roles for government and the private sector in investing in the research and technologies being considered.

(4) REPORT.—Not later than February 1 of each year after the date of enactment of this Act, the Secretary shall transmit to the Congress a report including—
(A) all recommendations made by the Advisory Committee during the preceding calendar year;
(B) an explanation of how the Secretary has implemented those recommendations; and
(C) for recommendations not implemented, the reasons for rejecting the recommendations.

Table 4.1: Existing Stakeholder Relationships

Initiative/Program	Stakeholder Group	Representation
Integrated Vehicle-Based Safety Systems	• IVBSS Team	• U.S. DOT (NHTSA, FHWA, FTA, FMCSA, Volpe National Transportation Systems Center) • National Institute of Standards and Technology • Standards Development Organizations • Industry partners • Light, commercial, and transit vehicle market • Vehicle manufacturers and their suppliers • Commercial and transit fleet operators
Cooperative Intersection Collision Avoidance Systems	• Public Agency Stakeholder Group • CAMP (Crash Avoidance Metrics Partnership)	• State and local Departments of Transportation • Automotive manufacturers • U.S. DOT (NHTSA, FHWA) • University transportation research groups • Device manufacturers
Vehicle Infrastructure Integration	• VII Coalition and the VII's Executive Leadership Team and Working Group • Initiative Outreach Group	• State and local DOTs • Auto companies and Tier 1 suppliers • Telecommunications industry • Information service providers • General public
Next Generation 9-1-1	• 9-1-1 Technology Forum • ITS Public Safety Advisory Group • 9-1-1 Community Forums	• State and local 9-1-1 agencies • Public safety and emergency management agencies • IT/telecommunications industry • Emergency services industry • Federal agencies (U.S. DOT, Department of Commerce, Department of Homeland Security, Department of Justice, Federal Trade Commission) • National organizations with active interests in 9-1-1 • Standards Development Organizations
Integrated Corridor Management Systems	• ICM Stakeholder Group • Initiative Outreach Group	• Multimodal managers (freeway, arterial, transit, public safety) • Pioneer site demonstration agencies • General public • ITS America
Evacuation Management and Operations	• Initiative Outreach Group • Public Safety Team	• Cross-section of the emergency transportation operations community • Standards Development Organizations • Federal, State, and local government agencies • Private-sector firms

Table 4.1: Existing Stakeholder Relationships, continued

Initiative/Program	Stakeholder Group	Representation
Clarus	Initiative Coordinating Committee and: • Initiative Management Team • *Clarus* Project Task Force	• State and municipal DOTs (traffic and maintenance managers) • Public weather forecasting agencies (NOAA) • Public weather consumer agencies (USDA, DoD, DHS) • Private weather information providers • Electronic and print media • Rail (Norfolk Southern Railroad) • General public
Mobility Services for All Americans	• United We Ride Collaboration • U.S. DOT Intermodal Program Management Team • Federal Interagency Program Support Group • Stakeholder Steering Group	• General public (especially the transportation-disadvantaged) • Public human service transportation program offices, including Federal, State, tribal, and local agencies • Transportation-disadvantaged advocates • National transportation organizations • Public transit agencies • Community and nonprofit transportation agencies • Private industry, such as technology vendors
Electronic Freight Management	• Intermodal Freight Technology Working Group • EFM Steering Group	• Freight shippers and carriers • Air cargo handlers • Logistics providers • Freight forwarders • Air carriers • Rail lines • Ports • Technology service providers • Standards Development Organizations • Federal Agencies (DOT, Transportation Security Administration, Customs and Border Patrol)
National ITS Architecture Program	• Regional ITS Architecture Workshops	• State and local DOTs • Metropolitan planning organizations • Transit agencies • Offices of commercial vehicle operations
ITS Standards Program	• TRB Reviews	• Standards experts • Standards users
ITS Professional Capacity Building Program	• Biannual Needs Assessments • Validation Forums	• State and local DOT ITS agency managers • Private-sector experts • Metropolitan planning organizations staff • Academia
ITS Program Assessment Program	• Knowledge Resource Usability Testers	• Broad cross-section of the transportation profession
ITS Outreach Program	• Conferences	• Broad cross-section of the transportation profession

4.A.3 ITS Standards Expert Panel

The ITS Standards Program has developed and encouraged the deployment of ITS Standards to help achieve increased mobility. To ensure wider stakeholder input into the ITS Standards development process, SAFETEA-LU mandated the organization and empowerment of an expert panel. The Department has expanded the objective of the expert panel to include an assessment of the full life cycle of ITS technology standards from development through deployment. Of interest to the Department is the strategic direction of the future ITS Standards Program and the definition of an appropriate Federal role in development and deployment.

Section 5307 (a)(4): ITS Standards Expert Panel

(A) DESIGNATION.—The Secretary shall designate a panel of experts to recommend ways to expedite and streamline the process for developing the standards and protocols to be developed pursuant to paragraph (1).

(B) NONAPPLICABILITY OF ADVISORY COMMITTEE ACT.—The expert panel shall not be subject to the Federal Advisory Committee Act (5 U.S.C. App.).

(C) DEADLINE FOR RECOMMENDATION.—Not later than September 30, 2007, the expert panel shall provide the Secretary with a recommendation relating to such standards development.

In spring 2006, the ITS Standards Program developed a set of objectives for the Standards Expert Panel and a plan for engaging the panel and developing the reports as required in SAFETEA-LU. This plan also recognizes the need for a broad and diverse set of stakeholders on the Panel, including participants with experience in the following areas:

- Procurement
- Integration
- System life-cycle processes
- Standards development (outside of ITS)
- Quality control process (verification and validation)
- Operations
- Automotive standards development
- CVO standards development
- Data interchange
- Industry trade groups

The Department asked the National Academy of Science to provide leadership and management for the Panel. The Panel is expected to first convene in the fall of 2006. Outcomes are expected to include:

- **An assessment of the current ITS Standards development processes and a set of recommendations on how to expedite development of new and revised ITS Standards.** The Panel's efforts will result in: (1) a recommended process for shortening the present development cycle; (2) an evaluation of alternative processes as compared to the current process; and (3) a recommendation to the Department on the most appropriate process to use for new ITS Standards development.

- **An evaluation of and recommendation on the role and focus the Department should play in future ITS Standards development and deployment.** The Panel's effort will result in: (1) the identification of the types of support needed for ITS Standards deployment, such as training and guidance materials; (2) recommendations regarding which support elements should have a defined Federal role; and (3) identification of criteria that should be used in determining the appropriate Federal role.

4.B Establishing Priorities: Internal Criteria

4.B.1 Management Council

Upon receiving input from the broader stakeholder community, the ITS Management Council has established an internal process to determine whether an ITS problem/need justifies investment in a new major initiative (or merits continued investment in an existing major initiative). The process has three components:

PROBLEM: A research initiative should address a clear and understandable transportation problem in a way that the general public will understand and appreciate. In stating this problem, an initiative proposal will have a clearly stated focus on one or more of the Departmental priorities, such as safety, mobility, or economic productivity.

PROCESS: A major initiative should:

- Include quantifiable impacts/results with clear milestones and go/no-go decision points.
- Reflect a clear project plan.
- Include a market analysis and a projected return on investment.
- Address the managers and stakeholders who will have long-term responsibility for the initiative.

PRINCIPLES: A set of principles guides the decision to invest in a new research initiative or to continue investing in an existing initiative. Such initiatives should:

- Reflect the principles of the President's Management Agenda and the Secretary's "Safer, Simpler, Smarter" initiative.
- Take advantage of opportunities to integrate program, modal, or technological approaches.
- Significantly engage the private sector.
- Provide for an effective "bridge" between conditions as they exist today and conditions as they are envisioned in the initiative (how we will get from "here to there").
- Yield results and impacts that are replicable on a meaningful scale.
- Be chosen, to the extent possible, to reflect a balanced ITS portfolio among factors such as risk, maturity of technology, delivery schedule, compliance with architecture, and cost.

4.B.2 Criteria for Success of Initiatives

Once a research initiative is approved and work is underway, an additional set of criteria is continuously and rigorously applied as the initiative moves through its initial stages to completion. These criteria are:

- *Does the initiative continue to adequately address the problem?*
- *Has there been sufficient progress regarding the development of frameworks for technical and institutional implementation?*
- *Are stakeholders being effectively engaged?*
- *What evaluation or performance assessment activities have been undertaken?*

These criteria reflect the emphasis that the Department places on solving real-world problems, producing identifiable (measurable) outcomes, and fostering stakeholder involvement. The establishment of these criteria facilitates a more formal decision-making process and provides a reasonable, consistent method for assessing whether the initiatives are on track.

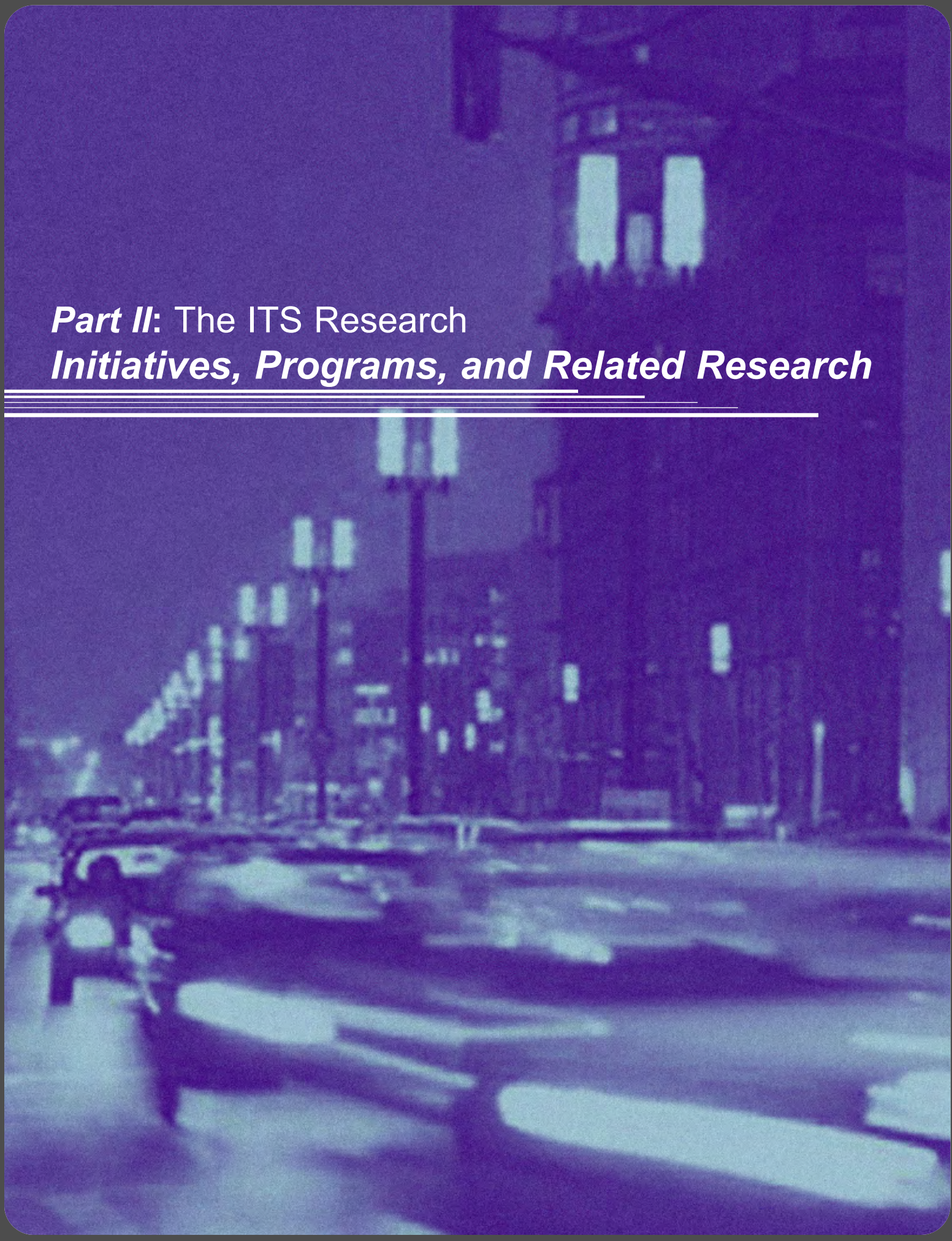
4.C Five-Year Horizon

Over the next five years, the Department will continue its efforts to increase ITS deployment, provide forward-looking research on advanced technologies and systems that apply to surface transportation modes, and support the Department in efforts to combat congestion. The direction established under SAFETEA-LU effectively builds from past accomplishments to move the state of ITS forward in areas where critical transportation needs exist.

Internally, the ITS Management Council and the ITS SPG will continue to provide regular internal representation and coordination for the Department's ITS program. These groups will be joined by the newly formed ITS Advisory Committee, which will:

- Become the external strategy oversight and management component of the program in support of the Management Council.
- Provide insight on future ITS developments from industries related and unrelated to ITS from both the public- and private-sector perspectives as well as academia.
- Bring individual perspectives to the ongoing evolution of the ITS program.

Additionally, over the next five years, the ITS JPO will continue to use (and refine) the internal criteria it developed to assess possible investments in research and development. Input from the Standards Expert Panel will also help to refocus a critical element of the ITS program.



Part II: The ITS Research *Initiatives, Programs, and Related Research*

5. Major Research Initiatives

5

Since 1991, when Congress formally recognized the need for the ITS program in ISTEA, the program has made solid progress toward achieving its vision. Program activities and policies have facilitated the deployment of advanced, integrated systems around the Nation, coinciding with the explosive growth in advanced technologies in other fields and industries and the equally explosive demand by consumers for immediate information and connection at all points in their daily lives. In meeting new consumer demands for real-time information, increased safety, and more efficient operations, ITS has transformed the transportation services marketplace.

The ITS program's nine research initiatives build upon this solid foundation of ITS in place across the country. With the experiences of deployment over the past decade, the program has developed the knowledge, capabilities, and skills to focus on more innovative combinations of existing technologies to solve critical transportation problems related to safety, reduced congestion, and global connectivity. Additionally, the products resulting from the research initiatives—the next generation of ITS—will continue the progress toward providing the integrated systems initially envisioned by Congress when it established the ITS program.

As described in Part I of this report, the major initiatives satisfy:

- Congressional research and deployment goals in SAFETEA-LU.
- Departmental goals for safety, reduced congestion, and global connectivity, as illustrated in figure 5.1.

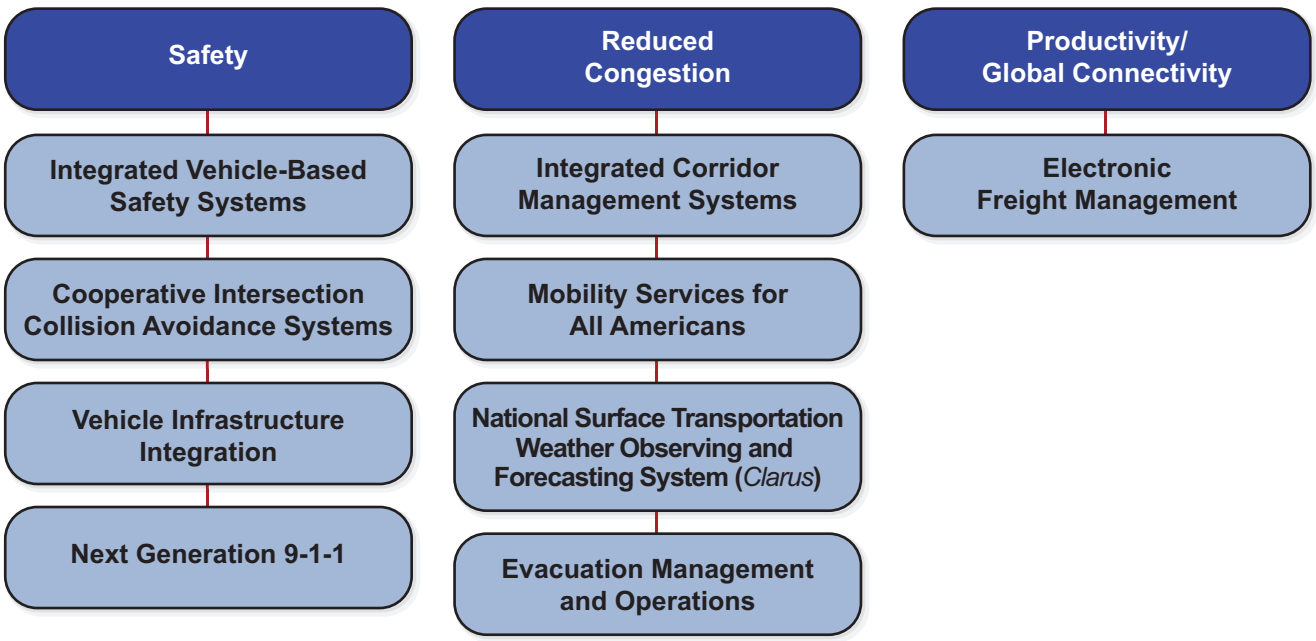


Figure 5.1: Relationship of the Department's Goals to the Nine Major ITS Initiatives

The remainder of this chapter provides a detailed description of each initiative, including:

- The critical transportation problem that the initiative is set up to research and resolve.
- The application and the projected outcome.
- Why ITS is a critical part of the solution.
- Programmatic activities, key decision points, and a five-year roadmap.
- How stakeholders are playing a critical role and how they are being engaged.
- The initiative's status and accomplishments to date.

These descriptions highlight two elements. First, each major initiative faces at least one critical, key decision point throughout the course of its progress. These key decision points allow all involved stakeholders, including the Department in the form of the ITS Management Council, to address whether the initiative's results continue to be relevant and effective in meeting transportation needs. Each key decision point is based on an evaluation of the effectiveness of past investment and an assessment of how continued investment will provide for robust delivery in fulfillment of the initiative's vision.

Second, in building toward greater integration over the last several years, an important lesson has been reinforced for the ITS program—solving complex critical problems in transportation requires partnerships between the private and public sectors that bring the experience, skills, and latest marketplace innovations and ideas to the table and, eventually, to the user. Moreover, all partners must be willing to make high-risk investments and work together to incorporate technological solutions into future planning and deployment activities. The proposed solutions in the nine major initiatives are not achievable unless the government, industry, State and local agencies, and academia work together and make the necessary commitments. Therefore, the stakeholders' engagements in each initiative are described in greater detail.

5.A Safety Initiatives

Four of the nine major initiatives are focused on improving safety. As described below, three of the four initiatives address issues related to crash prevention:

- Integrated Vehicle-Based Safety Systems (IVBSS)
- Cooperative Intersection Collision Avoidance Systems (CICAS)
- Vehicle Infrastructure Integration (VII)

The fourth initiative is focused on improving response time to crashes and other serious events, thereby improving victim outcome and responder safety as well as reducing the risk of secondary crashes:

- Next Generation 9-1-1 (NG9-1-1)

5.A.1 Integrated Vehicle-Based Safety Systems (IVBSS)

An integrated countermeasure system could prevent over 48 percent of rear-end, run-off-road, and lane-change crashes. This represents more than 1.8 million target crashes.

5.A.1.1 Problem Statement

Of the 3.6 million rear-end, road-departure, and lane-change crashes per year, 27,500 such crashes result in one or more fatalities. These fatal crashes represent three quarters of all fatal crashes. Analysis of crash data shows that about 48 percent could be prevented by rear-end, road-departure, and lane-change crash warning systems. Further, the integration of separate safety systems with a consolidated and effective driver interface can mitigate potential conflicts that separate safety systems may induce, thereby maximizing safety benefits. The Department is working with vehicle manufacturers, vehicle component suppliers and manufacturers, and the traffic safety community to improve driver performance in crash avoidance through the Integrated Vehicle-Based Safety Systems (IVBSS) Initiative.

The IVBSS Initiative is expected to reduce driver workload and driver reaction time; prevent conflicting warnings; reduce false alarms; and reduce unintended consequences, such as causing a road-departure crash while trying to prevent a rear-end crash. The integration of these individual crash warning systems is expected to improve overall system performance, increase safety, reduce system cost, improve consumer and fleet operator acceptance, and enhance product marketability.

5.A.1.2 Description of IVBSS

NHTSA and FMCSA are conducting the IVBSS program to develop performance specifications and measure the real-world benefits of integrated technologies for:

- **Forward-Looking Collision Warning:** Provides drivers with warnings that assist them in avoiding or reducing the severity of crashes between the front of their vehicle and the rear of a lead vehicle traveling in the same lane and direction that may be stationary, decelerating, or moving at a slower constant speed.
- **Lane-Departure Warning:** Assesses the threat of a lateral-drift lane- or road-departure incident and issues alerts when the threat is too high. This function may incorporate side-looking sensors to detect the presence of another moving vehicle in an adjacent lane and warn the host vehicle when it is drifting into the lane occupied by the other vehicle. In addition, this function could integrate a forward-looking sensor to identify parked cars, guardrails, or other roadside objects to determine the available maneuvering room if the host vehicle is departing the travel lane.

- **Lane-Change Collision Warning:** Warns the driver of an impending crash with another vehicle in the adjacent lane when the driver is changing lanes, turning, or passing a vehicle in front.

Figure 5.2 illustrates the different warning systems that will be integrated into one system on vehicles.

5.A.1.3 Projected Outcomes

The widespread deployment of advanced integrated driver assistance systems has the potential to reduce rear-end, road-departure, and lane-change crashes. In addressing the Department's safety goals, IVBSS will provide better hazard information from multiple sensors, enabling coordinated warnings to reduce driver distraction as well as driver reaction time.

At the completion of this initiative, the project team will have developed:

- Information on how best to communicate an integrated warning to a driver.
- Objective tests and criteria for performance of systems that simultaneously address rear-end, road-departure, and lane-change crashes.
- Integrated vehicle-based safety systems on public roads with real drivers to understand the safety benefits, followed by field-testing of the systems.

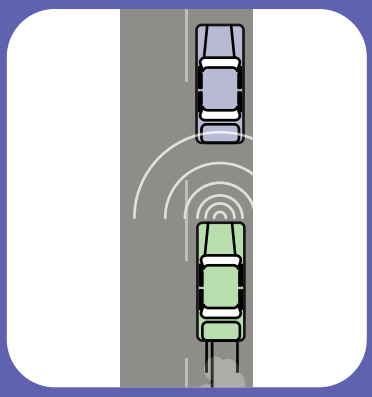
5.A.1.4 Why ITS?

Vehicle-based safety systems require advanced sensors to detect potentially hazardous conditions that might otherwise be undetected by the driver or be detected too late to prevent a collision. The advanced sensors require a communications backbone within the vehicle to aggregate the data, as well as logic-processing and display components to activate a warning to the driver in real time. The system—composed of computers, display devices, communication links, and sensors—represents an automated extension of the normal human sensory processes engaged in driver situational awareness, perception, and reaction during the driving task. This functionality is inherently a characteristic of ITS.

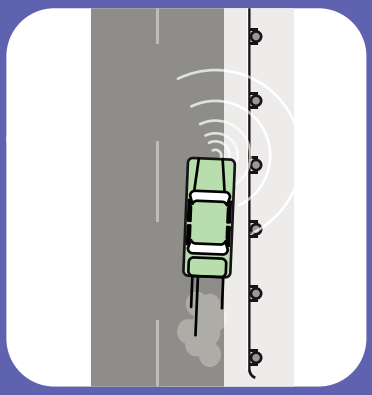
5.A.1.5 Five-Year Horizon

The IVBSS Initiative will be conducted in two phases—Phase 1 of the project will develop the integrated collision avoidance system, and Phase 2 will conduct a field operational test (FOT) of advanced technologies in both light vehicles and commercial heavy trucks. Stakeholders will be engaged throughout the initiative.

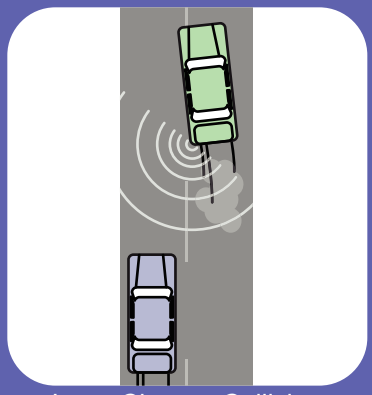
Phase 1: Development of the Collision Avoidance System. Phase 1 activities include the system design, the development of a driver-vehicle interface, and the design and development of one or more engineering test vehicles. A prototype vehicle will be developed for each platform (light



Forward-Looking Collision Warning



Lane-Departure Warning



Lane-Change Collision Warning

Figure 5.2: IVBSS Warning Systems

>>>

vehicle and commercial heavy truck) and will include all required functions of the integrated driver-warning system. In Phase 1, the FOT experimental designs will be prepared and the data acquisition system for each vehicle platform will be fabricated and tested. The work activities in place are based on a preparatory analysis completed by the IVBSS Initiative in 2005.

A key decision point occurs at the end of Phase 1. The prototype vehicles will be subjected to a series of tests to evaluate the IVBSS performance. Using these results, a decision will be made regarding the continuation of the initiative into Phase 2. These initial test results are expected to show that:

- The various systems can be integrated.
- The integrated systems are demonstrating a reduction in driver workload and driver reaction time.
- The system is not subject to an unacceptably high number of false alarms.

Phase 2: Field Operational Test. During Phase 2, a vehicle fleet comprising both light vehicles and commercial heavy trucks that incorporate the integrated warning system and data acquisition system will be fabricated and tested. An initial fleet of prototype vehicles will be developed for a set of "on-road characterization tests" that will create a baseline for the safe operational limits of the system and produce a larger statistical base for evaluating false-positive and false-negative performance. Then a full fleet of vehicles will be developed for the FOT. The pilot test will provide preoperational evidence of FOT readiness, generate early feedback on driver acceptance, and highlight issues or problems to be avoided during the actual FOT process. Phase 2 will ultimately produce a limited FOT that demonstrates:

- The frequency of driver encounters with driving conflicts and near crashes under different conditions such as lighting, weather, road type, traffic volume, and travel speed. In addition, the test will measure driver response to resolving different types of driving conflicts representing major precrash scenarios that lead to rear-end, lane-change, and off-roadway crashes.
- The frequency and severity of near crashes, which are usually rare within an FOT. Such analysis may provide an indication of the usefulness of the integrated safety system in preventing crashes.
- Unintended consequences—whether or not the integrated safety system has negative (or positive) side effects on normal driving performance and behavior. In addition, the test will measure the effect of system use on driver inattention.
- Driver acceptance as to whether or not drivers find the system easy to use, understandable, and intuitive.
- Fleet management (for heavy trucks only) acceptance of the system, including:
    - Ease of incorporating the system into operations.
    - Likelihood that truck drivers will accept and use the system.
    - Economic benefits from the system.
- Liability issues that the system might introduce.
- Overall system capability and operational performance.

Throughout the entire initiative, an independent evaluator will be engaged to objectively evaluate costs, benefits, and safety improvements.

Figure 5.3 presents a five-year roadmap for the IVBSS Initiative.

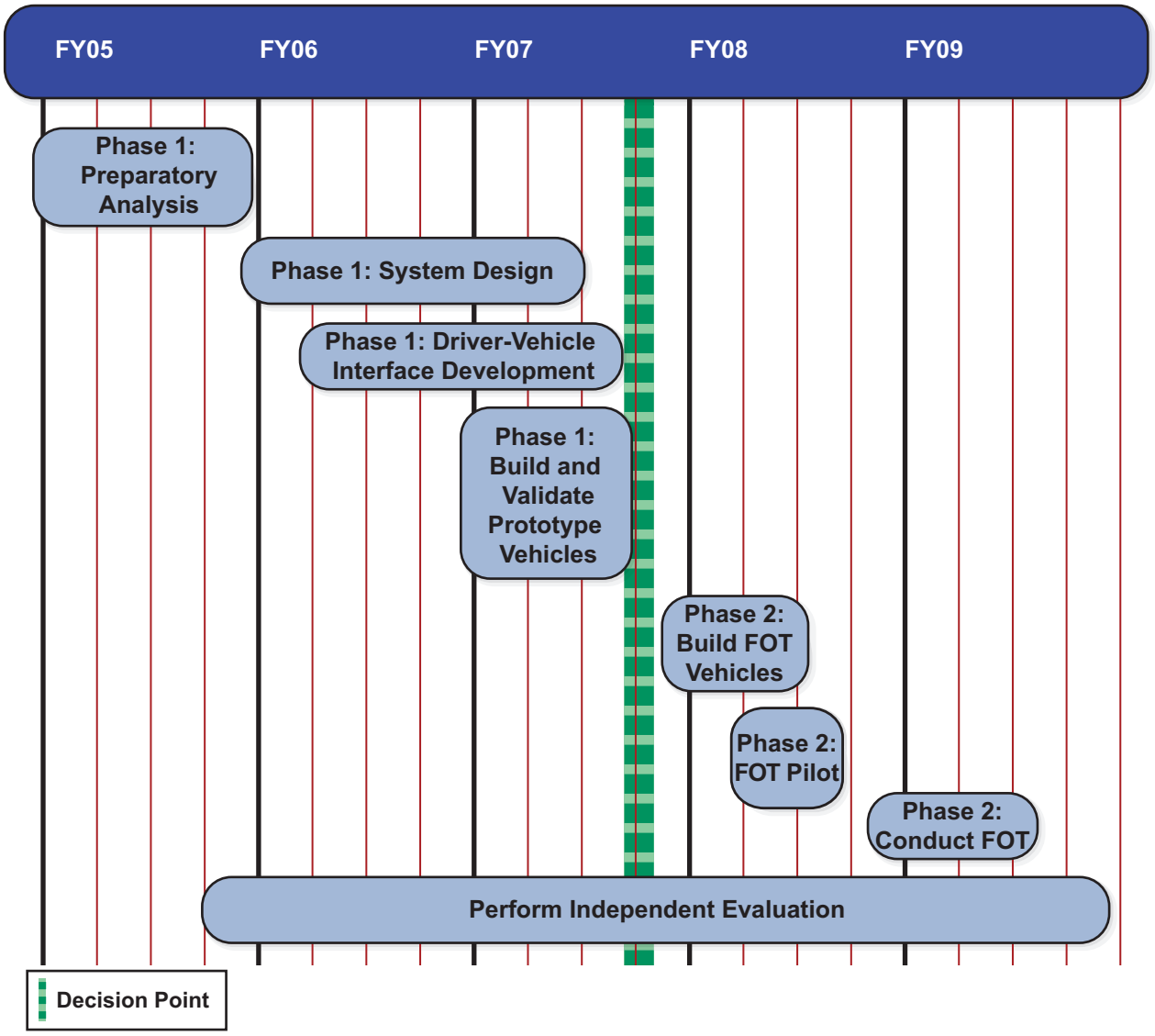


Figure 5.3: Five-Year IVBSS Roadmap

Over the next five years, major activities scheduled for the IVBSS Initiative include:

Phase 1: Development of the Collision Avoidance System

- Develop functional requirements and system architecture.
- Design system, develop system, and integrate components into one system.
- Develop a set of integrated system performance specifications.
- Develop the driver-vehicle interface design for light and heavy vehicles.
- Build pilot vehicles.
- Develop objective test procedures for light and heavy vehicles.
- Develop data acquisition system to collect data on board the prototype vehicle.
- Perform proof-of-concept testing.

- Prepare for the key decision point with industry and present results to ITS Management Council.
- Develop an FOT plan and secure necessary approvals.

Phase 2: Field Operational Test

- Develop final FOT design plan, including site selection.
- Conduct pilot FOT.
- Conduct on-road characterization tests.
- Conduct FOT to assess system performance, determine driver acceptance, analyze impact on each crash type, and recommend changes in system design to improve crash-avoidance effectiveness.
- Perform data analysis and develop benefits estimation for IVBSS.

5.A.1.6 Engagement of Stakeholders

The Department will work closely with industry partners to accelerate the commercialization of the advanced safety technologies developed during the IVBSS program. The IVBSS program will seek to inform and solicit input from interested parties, including:

- Automobile and truck manufacturers.
- Component suppliers to automobile and truck manufacturers.
- Representatives of the safety community.

The program is being conducted in cooperation with a consortium including auto and truck manufacturers (Honda North America and Kenworth Truck Company); Tier 1 suppliers (Visteon Corporation and Eaton Corporation) that provide components to a broad range of auto and truck manufacturers; academia (University of Michigan Transportation Research Institute); and other partners offering the specific expertise necessary to successfully complete the program.

To ensure that the broader auto, truck, and safety communities are included in the stakeholder outreach and participation process, the IVBSS Initiative will continue its successful practice of holding public meetings to inform and solicit input from industry and other interested parties. During Phase 1, a public meeting will be held to obtain input on system performance specifications and the objective test suite, and to provide information on preliminary test results. During Phase 2, a public meeting will be held to discuss preliminary results. An additional public meeting will be held after completion of the program to describe the results, review lessons learned, and solicit input for future efforts.

As reports are prepared describing functional requirements, performance specifications, and test results, they will be made available to the public.

5.A.1.7 Current Status and Accomplishments to Date

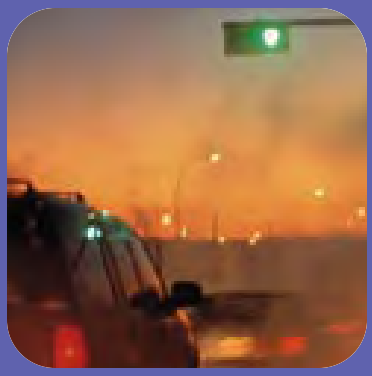
A cooperative agreement with the private-sector partners was awarded on November 23, 2005.[14] As of early 2006, objective test procedures and the driver-vehicle interface design were under development.

The current IVBSS project is expected to be complete by the end of calendar year 2009. Key activities that will take place after the project is completed will include:

- Timely dissemination of results and lessons learned to industry and other stakeholders.
- Determination of the “next frontiers” in crash avoidance technology.

[14] Partners include University of Michigan Transportation Research Institute, Visteon Corporation, Eaton Corporation, Honda North America, Kenworth Truck Company, AssistWare, Battelle Science and Technology International, and State of Michigan DOT.

5.A.2 Cooperative Intersection Collision Avoidance Systems (CICAS)



Intelligent intersection systems can save lives and prevent injuries by helping drivers avoid crashes.

5.A.2.1 Problem Statement

Intersection collisions are a significant cause of deaths and injuries in the United States. Annually, approximately 2.6 million intersection collisions occur, representing nearly 45 percent of all vehicle crashes and approximately 25 percent of all traffic fatalities. In 2003 alone, 9,510 people died and almost 1.4 million suffered injuries as a result of intersection-related crashes. Collision-avoidance technologies can address a sizeable share of the intersection-collision problem by enhancing driver decision-making at intersections.

Building on research conducted under the Intelligent Vehicle Initiative (IVI), the Cooperative Intersection Collision Avoidance Systems (CICAS) Program focuses on how existing technologies can be combined to form a system of vehicle and infrastructure components working cooperatively via dedicated short-range communications (DSRC) to detect and avoid potential crossing-path crashes at intersections.

5.A.2.2 Description of CICAS

CICAS is a critical component of the ITS program's move toward preventing crashes through the development and deployment of active safety systems. Crash avoidance can be achieved through the delivery of driver warnings in the vehicle, through infrastructure-based warning devices, or a combination of both. Information is provided to the driver in real time to increase situational awareness and provide immediate hazard warnings to forestall potential collisions caused by driver distraction, reduced ability to judge the gap in oncoming traffic, improper signage, speed, or other factors. Figure 5.4 on the following page illustrates the primary crash scenarios addressed by CICAS.

CICAS specifically addresses crossing-path intersection crashes and related factors such as the potential involvement of pedestrians and bicyclists during a crossing-path crash. Other types of crashes, including rear-end, non-crossing-path pedestrian and bicyclist, and single-vehicle, are addressed by other ITS program technologies, such as those developed under the IVBSS Initiative.

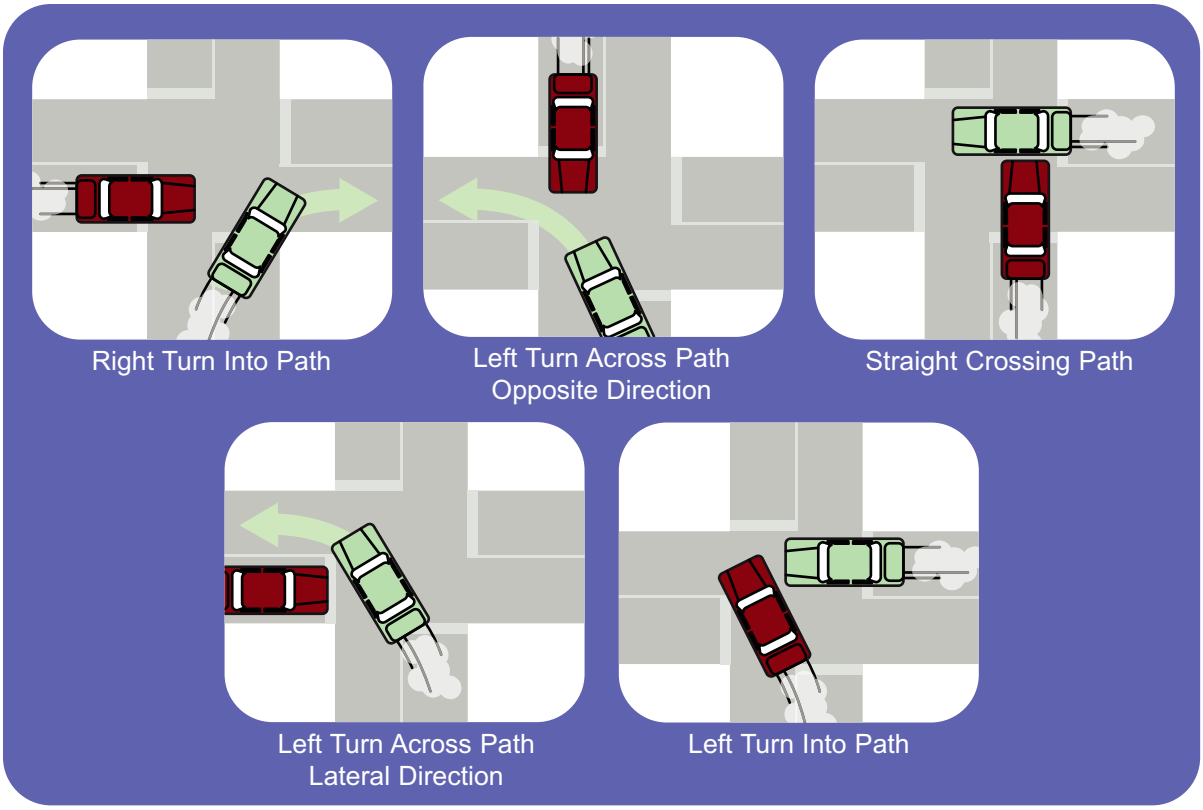


Figure 5.4: Crash Scenarios

To make an impact on the crossing-path problem, the CICAS Initiative is combining technologies into three types of systems, described below.

CICAS Signal and Stop Sign Violation Warning System (CICAS-V): The CICAS-V System is a vehicle-based driver warning system that alerts drivers to potential violations of stop signs or red traffic lights. As illustrated in Figure 5.5, the CICAS-V system will:

- Collect and process data from enhanced map databases, positioning technologies, and wireless communications devices that provide traffic signal phase and timing plans.
- Synthesize this data with split-second timing to determine the likelihood of a violation.
- If the risk of violation is high enough, transmit a warning to the driver through DSRC-based communications technology with enough time to allow the driver to take appropriate action—for example, by applying the brakes or braking at a faster rate.

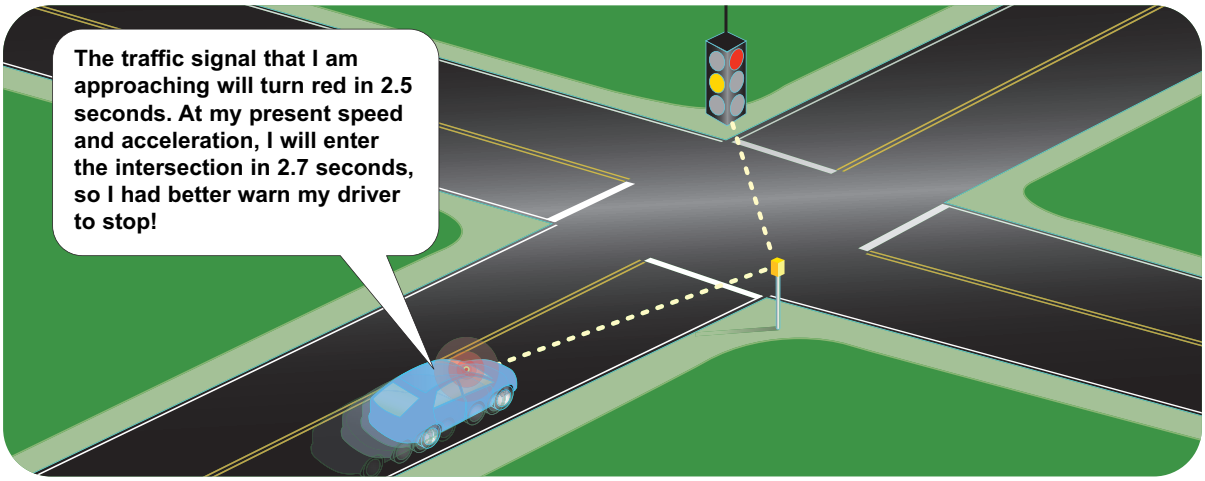


Figure 5.5: Violation Warning System

The CICAS-V system is expected to reduce intersection crashes that occur from a variety of driver-based causal factors such as distraction, aggression, impairment, inexperience, or inattention.

CICAS Gap Assist Systems (CICAS-Gap): Technologies will combine to form systems that assist the driver in judging the gap between oncoming vehicles for safer turning into traffic and crossing traffic. Research and development efforts under CICAS-Gap will deliver two types of systems:

CICAS Stop Sign Assist System: The Stop Sign Assist System is an infrastructure-based system designed to help drivers on low-volume roads who, after stopping at a stop sign, wish to cross or turn into traffic on higher-volume, higher-speed roads. The system will synthesize data from roadside sensors, processors, messaging signs, and communications technologies to provide information to drivers on the gaps in traffic that allow for safe passage. As illustrated in Figure 5.6,[15] the Stop Sign Assist System will alert the driver to traffic conditions through a dynamic infrastructure sign. Sensors along the roadside will transmit data about the vehicle to the infrastructure regarding the vehicle type, weight, and classification. Also, the driver's intent to turn as well as other driver-specific information could be communicated to the infrastructure through wireless communications. This will allow for tailored driver assistance and a wide range of alert options to better meet individual driver needs. For example, an older driver may need a larger gap to cross into traffic; a heavier vehicle may also require a larger gap in traffic for safe passage.

CICAS Signalized Left Turn Assist System: The Signalized Left Turn Assist System is an infrastructure-based system that will provide information to drivers performing unprotected left turns to judge the gaps in oncoming traffic as well as inform them when other users, such as pedestrians or bicyclists, pose hazards to completing a safe left turn. As illustrated in Figure 5.7 on the following page, the Signalized Left Turn Assist System will combine roadside sensors, infrastructure-based messaging signs, communications and positioning technologies, dynamic maps, and traffic signal interfaces. Notably, this system builds from the development of the positioning technologies completed under CICAS-V to produce more dynamic positioning technologies that can address complex, multilane traffic environments.

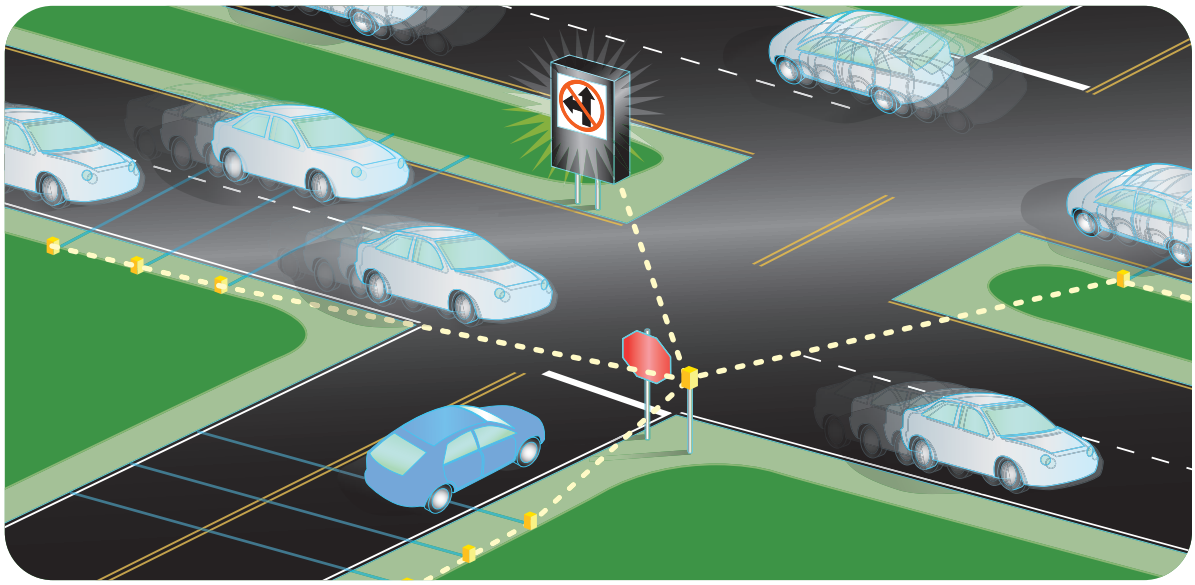


Figure 5.6: Stop Sign Assist System

[15] Figures 5.6 and 5.7 employ a dynamic sign as an example of an infrastructure-driver interface that will be tested. Other interfaces will also be examined as part of the overall CICAS Initiative in cooperation with the MUTCD stakeholder community.

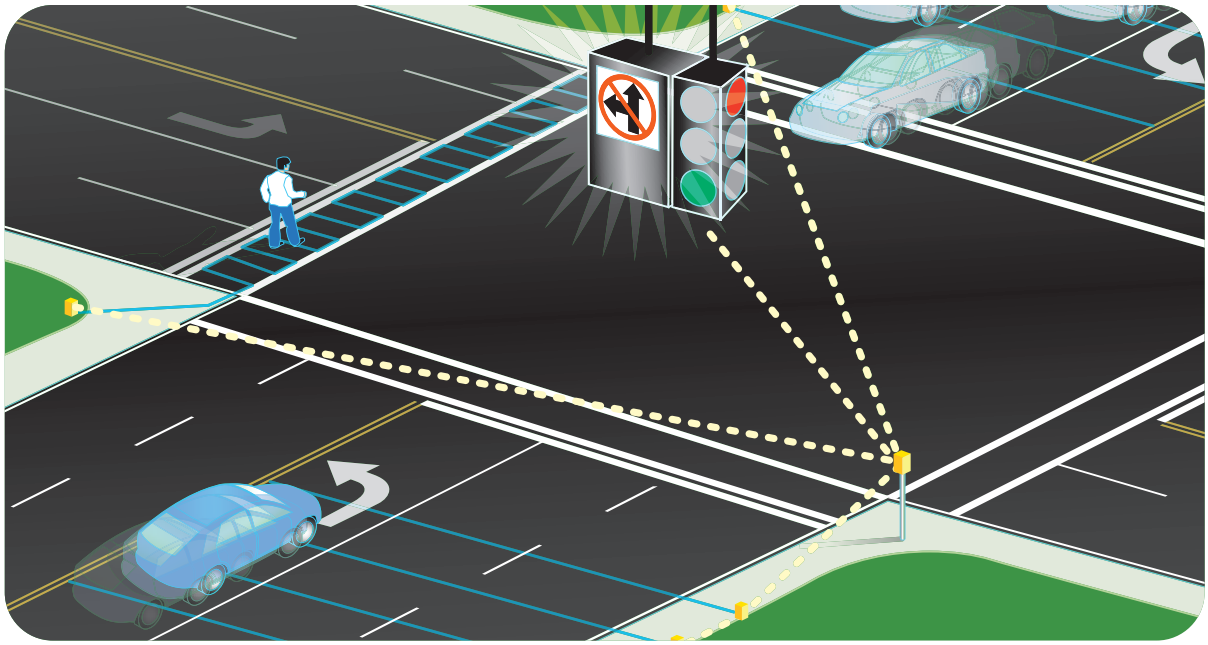


Figure 5.7: Signalized Left Turn Assist System

5.A.2.3 Projected Outcomes

The CICAS Initiative will develop systems that are effective in reducing targeted crossing-path collisions due to traffic control violations and misjudgments relating to speed and distance of oncoming traffic. The CICAS Initiative will work with State and local agencies to identify opportunities for widespread deployment at high-hazard intersections. An indirect benefit will be the improvement of mobility through a reduction in incident-related delays at deployment sites.

The work being done under the CICAS Initiative will form an important foundation for future safety systems. This initiative will produce generic specifications and test procedures for industry to adopt for manufacturing light vehicles equipped with cooperative crash avoidance systems. Work products from this initiative will be available to transit and motor carrier enterprises with the intention of the application being modified for transit and heavy vehicles. Additionally, the human factors research and technology development under CICAS could form the basis for vehicle-to-vehicle systems currently envisioned.

5.A.2.4 Why ITS?

The use of ITS technologies, integrated in a system to provide real-time warnings, can substantially improve driver perception of situational hazards and reaction times. CICAS combines existing ITS technologies, including:

- Vehicle-based technologies and systems—sensors, processors, in-vehicle driver assistance systems, maps, and positioning technologies.
- Infrastructure-based technologies and systems—roadside sensors and processors to detect potential conflicts, and roadside systems that include signal systems and messaging signs.
- Communications systems that enable a cooperative two-way information exchange in real time to communicate warnings, assistance, and other information to drivers under two scenarios:
  - Between the equipped infrastructure and equipped vehicles.
  - Between the equipped infrastructure and unequipped vehicles.

CICAS systems will be built according to DSRC standards.

5.A.2.5 Five-Year Horizon

The CICAS Initiative focuses on developing, testing, and demonstrating three systems:

- Signal and Stop Sign Violation Warning System
- Stop Sign Assist System
- Signalized Left Turn Assist System

For each of these systems, the CICAS Initiative will conduct four phases of activities:

- Phase 1: Research
- Phase 2: Design and Development
- Phase 3: Prototyping
- Phase 4: Testing

For the initiative as a whole, two further phases will be conducted:

- Phase 5: Cost-Benefit Analysis
- Phase 6: Technical Assistance and Outreach for Deployment

It should be noted that CICAS-V and CICAS-Gap systems are at different stages. With the accomplishments in research under IVI, the CICAS-V research issues are better understood. The technologies and their combinations are closer to evolving to a commercially viable system. Thus, the prototype and testing of CICAS-V can be executed within a four-year time horizon. CICAS-Gap requires a more complicated combination of technologies to develop into systems. Some of the technologies needed are not as mature as those for CICAS-V. Additionally, the applications, particularly for signalized left-turn assist, will reside in a much more complex environment. Therefore, more research is needed on driver behavior before proceeding to the design, development, and prototype phases.

The following defines the intent of each of the phases of CICAS.

Phase 1: Research. For all three systems, the CICAS Initiative will complete research on human factors that determines:

- The most effective combination of technologies to deliver the warning through the driver-vehicle interface or driver-infrastructure interface.
- The warning timing that will result in the maximum effectiveness and minimum nuisance for the driver.

Specifically, for the CICAS-V and the CICAS Signalized Left Turn Assist Systems, further research will be conducted in cooperation with the traffic control industry to determine the interface with traffic signal systems. For the CICAS Signalized Left Turn Assist System, additional research is required to advance the technological capability to dynamically identify the position of vehicles within their lanes in a multilane environment.

Phase 2: Design and Development. The design for all three systems emphasizes a cooperative infrastructure-vehicle relationship to ensure a maximum benefit from the combination of technologies. On all three systems, the CICAS partners both represent and will work closely with industry, States, and academia to develop a set of generic, cooperative specifications. These baseline specifications will then be adaptable to the specific designs required by each automotive manufacturer's fleet. Similarly, generic specifications for the CICAS-Gap systems will be developed so that State and local agencies can adapt them to meet their local infrastructure needs. The two CICAS-Gap systems include the use of infrastructure-based sensors and, in each case, a process to determine the most effective sensor suite is underway. The Signalized Left Turn Assist System will further incorporate sensing systems to identify pedestrians within the intersection.

Due to the complexity of the system, the Signalized Left Turn Assist System faces a key decision point upon completion of its system design. Observational and experimental data collected during the design phase will help determine whether the design will produce a feasible system. If the decision is made to continue, this system will proceed to the prototyping phase.

Phase 3: Prototyping. Over the next five years, the CICAS Initiative will produce varying levels of working prototypes for each of the three systems. Prototype testing will ensure that the components form a unified system and that the system performs as expected in a controlled environment. Specifically, Phase 3 of the CICAS Initiative will produce:

- CICAS-V prototypes that include both the in-vehicle warning system and the infrastructure-based sensing and positioning components. A small number of prototypes will be produced for system performance testing through 2008. The test results will form the basis for a key decision point in late 2008 to determine whether to build a larger fleet in anticipation of joining the VII proof-of-concept testing in 2009.
- A CICAS Stop Sign Assist prototype that includes infrastructure-based sensing and interface technologies supplemented with cooperative capabilities. System performance testing is expected to be conducted before 2009. Based on progress with the CICAS-V system, there may be a potential to test the Stop Sign Assist System with CICAS-V-equipped vehicles. With these results, a key decision point is scheduled for mid-2009 to determine whether to proceed with a larger-scale field operational test (FOT).
- A CICAS Signalized Left Turn Assist prototype to demonstrate the capability of assisting drivers in a complex driving environment. The prototype will include infrastructure-based sensing and positioning technologies. A key decision point will occur after completion of the prototype and system performance testing and before moving into more widescale testing.

Phase 4: Testing. For each system, a plan for testing under real-life conditions will be developed and an independent evaluation will be performed that will determine, at a minimum:

- System effectiveness
- Safety benefits
- Driver acceptance
- Unintended consequences
- Other related impacts to the transportation system

CICAS-V will proceed with FOT in 2008. The CICAS-Gap systems will proceed with field testing later than the CICAS-V System, and the test beds for those two systems will be chosen later.

At the end of each of the testing activities, the Department and its partners—the Modal Administrations, automotive companies, State and local agencies, and other industries—will evaluate the progress and test results. The efforts needed for adoption and deployment will be determined as preparation for the final key decision point.

Phase 5: Cost-Benefit Analysis. Across all phases of the CICAS Initiative, data collection and analysis will be performed to assess the value and acceptance of all cooperative intersection collision avoidance systems. The analysis will provide insight into the anticipated effectiveness of the CICAS systems and will be used to support all key decision points.

Phase 6: Technical Assistance and Outreach for Deployment. The CICAS Initiative will provide technical assistance and outreach to State and local agencies and to industry to: (1) facilitate technology transfer to private industry, (2) create a marketplace for CICAS systems at the State and local levels, and (3) facilitate deployment. Throughout the course of the CICAS Initiative, outreach meetings will be held to obtain input from the public and private sectors to ensure review and feedback at major stages.

The roadmap in Figure 5.8 reflects the timing of these activities over the next five years. In total, these activities address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

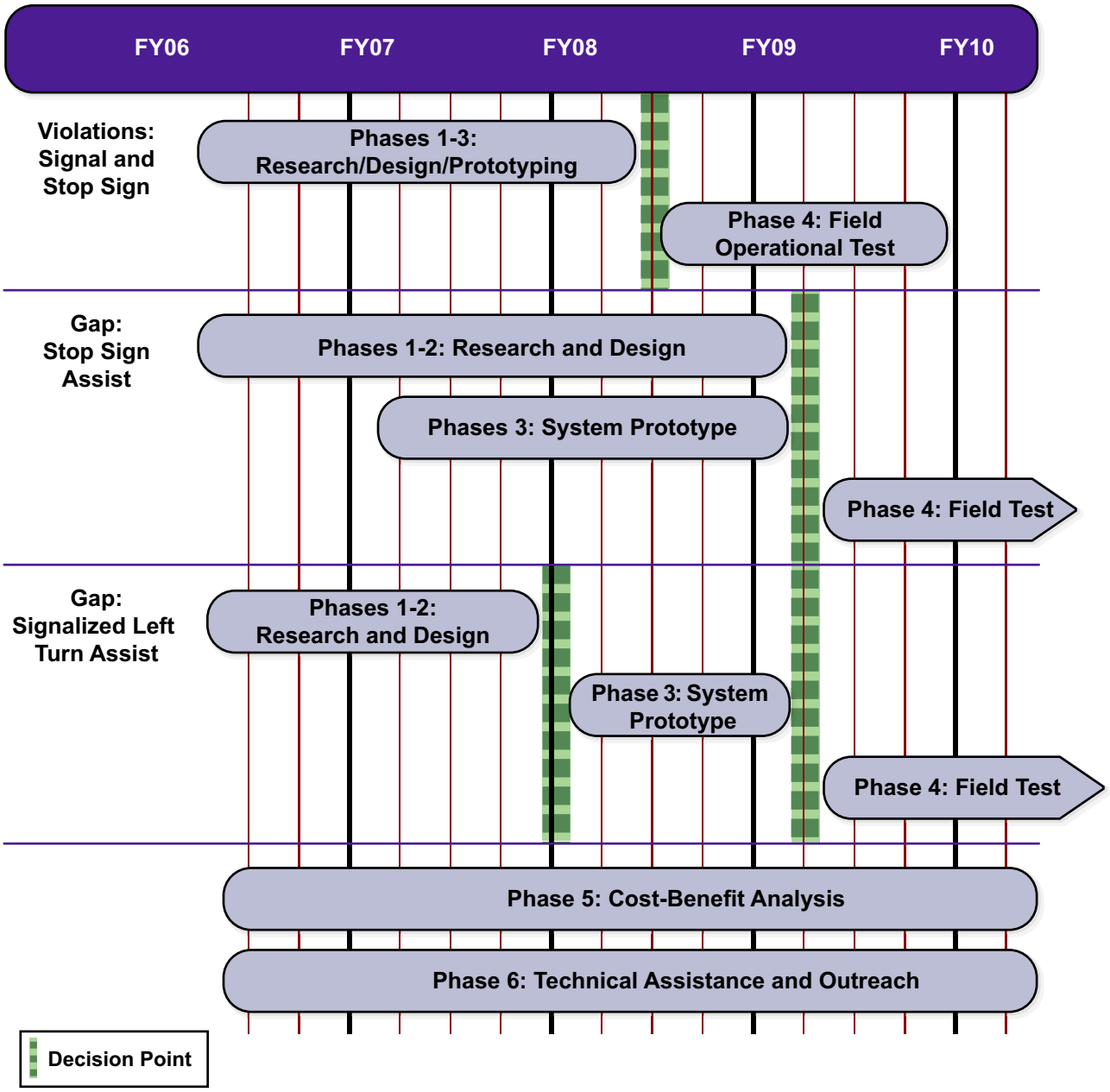


Figure 5.8: Five-Year CICAS Roadmap

Over the next five years, major activities scheduled for the CICAS Initiative include:

Phase 1: Research

- Finalize the research on the driver-vehicle interface to allow for selection of the most effective device to enter into the CICAS-V design.

- Conduct further research for the CICAS-Gap systems on driver behavior, driver interfaces, alert timing, and sensor suites.

Phase 2: Design and Development

- Create systems architectures, designs, specifications, and interfaces.
- Review with public- and private-sector stakeholders.

Phase 3: Prototyping

- Develop system prototypes.
- Develop a set of objective test procedures.

Phase 4: Testing

- Develop test plans and procedures.
- For CICAS-V, integrate CICAS into the VII test bed.
- For CICAS-Gap systems, select testing sites and integrate CICAS into the test bed.
- Conduct proof-of-concept testing and FOT.

Phase 5: Cost-Benefit Analysis

- Develop an approach for determining costs, benefits, and system effectiveness.
- Based on results of the FOT, assess the costs and benefits.

Phase 6: Technical Assistance and Outreach for Deployment

- Review testing results with public- and private-sector stakeholders and decide whether to proceed with deployment.
- Develop outreach materials to provide guidance on implementing CICAS systems.
- Conduct outreach to provide the transportation community with outreach materials and the necessary tools and strategies for implementing CICAS systems.

5.A.2.6 Engagement of Stakeholders

The development of the CICAS systems is a cooperative research process being performed by the ITS JPO, NHTSA, FHWA, the automotive companies (Ford Motor Company, Daimler Chrysler Corporation, Honda North America, Toyota, and General Motors), State and local transportation agencies, other related industries such as signal vendors and systems integrators, and university research centers.

The CICAS Initiative builds on research previously conducted under the IVI during which the Department formed a cooperative relationship with a research collaborative of auto manufacturers—the Crash Avoidance Metrics Partnership, or CAMP.[16] In moving CICAS forward, CAMP will be responsible for the development of CICAS vehicle-based systems and will play a supporting role in the development of infrastructure-based systems and in integration. States are also playing active roles in developing CICAS systems with both laboratory research and field demonstrations:

- California is focusing on systems integration and the left-turn-across-path problem, particularly at urban and suburban signalized intersections. California is also developing a test bed for applications testing.
- Michigan is developing a prototype of an early cooperative system to test DSRC and the capability of

[16] CAMP was formed by auto companies to cooperate with the Federal government on precompetitive research that was too high-risk/high-investment for any one company to undertake. Ford Motor Company and General Motors form the core of the CAMP agreement with the U.S. DOT. Other auto companies participate in research that is of particular interest to them—for instance, driver workload, in-vehicle mapping applications, and vehicle communications. In the past, such companies have included BMW, Daimler-Chrysler, Honda, Nissan, Toyota, and Volkswagen.

broadcasting signal information to equipped vehicles. Similar to California, Michigan is developing a test bed. Michigan is also supporting California in the left-turn-across-path intersection research.

- Minnesota is focusing on crashes when minor roads intersect major highways, particularly in rural areas. Minnesota is currently developing an infrastructure-based collision-avoidance system for rural intersections and is leading an eight-State pooled-fund study to discern differences across varying types of applications.
- Virginia is playing a role in supporting the CICAS-V effort through the use and instrumentation of intersection locations during the development and testing phases.
- Other States are participating in ongoing stakeholder meetings to provide input to critical problem definition and to participate in reviews of important results.

The CICAS Initiative is also reaching out to local agencies at the municipal level to engage operators and engineers for a better understanding of how CICAS systems will be integrated with existing infrastructure.

University research centers that previously conducted research under the IVI are continuing their role under the CICAS Initiative.[17] The universities are partnering with their States and with automotive companies to further the research in human factors, assist in the design and execution of FOTS, and help develop prototype systems.

The CICAS Initiative is being closely coordinated with the VII Initiative (described later in this chapter). The VII Initiative will be responsible for the integration of CICAS vehicle-based and infrastructure-based frameworks into one cooperative system. To date, the CICAS Initiative has convened meetings for:

- Traffic signal manufacturers to determine how to structure a working partnership based on common interests in the design of the signal interface and in signal communications to the infrastructure.
- Representatives of the insurance industry to discuss how intersection collision avoidance systems may be of interest in the future.
- A public agency stakeholder group open to and comprising State and local agencies to gain a perspective on deployment scenarios.

As CICAS moves from development to demonstration, the Initiative will begin a focused effort with States to understand issues with deployment. It is anticipated that professional associations such as the Transportation Research Board (TRB), the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and others will be engaged to move beyond FOTs to commercial-ready deployments.

5.A.2.7 Current Status and Accomplishments to Date

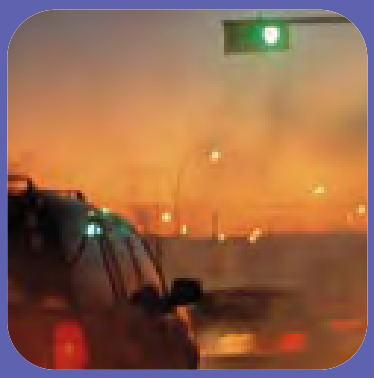
As of the summer of 2006, the CICAS Initiative has initiated work with CAMP to develop a Violation Warning System prototype, with Minnesota DOT (MnDOT) to develop a Stop Sign Assist system prototype, and with California DOT (Caltrans) to develop a Signalized Left Turn Assist system prototype. The Initiative has also launched the development of a cost-benefit analysis tool to provide better estimates of CICAS's value and its potential for deployment.

A June 2006 "kickoff" meeting brought together the working partners across all three systems to discuss areas of integration and overlap. In fall 2006, a public meeting will be held to present the initial Concept of Operations for CICAS-V to a wider audience of industry, States, and other stakeholders for comment and input.

In addition, the CICAS Initiative has convened, and will continue to convene, outreach sessions with a variety of audiences. Over the course of the CICAS Initiative, there will be a series of periodic public meetings to allow stakeholders to provide critical reviews of work products before they are finalized.

[17] Participating universities include the University of California at Berkeley, University of Minnesota, University of Michigan, and Virginia Polytechnic Institute and State University.

5.A.3 Vehicle Infrastructure Integration (VII)



An important accomplishment to date is the work on privacy issues completed by the VII Coalition. Through work with stakeholder groups and experts, a method has been developed for data collection and exchange that is completely anonymous. No information that identifies a vehicle or person is collected. The VII Program has also developed and standardized a secure communications link to prevent eavesdropping or tracking of individual vehicles.

5.A.3.1 Problem Statement

A key finding from the IVI research is that developing the capability for vehicles to communicate with each other and with the roadway infrastructure would significantly enhance the ability to reduce crashes.

Research has also shown that real-time information on driving conditions can reduce congestion and increase mobility and economic productivity. The vision for the VII Initiative is to achieve nationwide deployment of an integrated communications infrastructure on the roadways and in all production vehicles to enable a broad range of safety and mobility services that today are unattainable.

5.A.3.2 Description of VII

The VII is an information infrastructure that utilizes the most advanced communications technologies to exchange real-time information between the roadside and vehicles. Communications equipment is placed both on the infrastructure and within the vehicle. Uses of data transmitted from vehicle to vehicle and between vehicles and the roadside include:

- Safety
  - Warn drivers of unsafe conditions or imminent collisions.
  - Warn drivers if they are about to run off the road or speed around a curve too fast.

- Mobility
  - Inform system operators about real-time congestion, weather conditions, and incidents.
  - Provide operators with information on corridor capacity for real-time management, planning, and provision of corridor-wide advisories to drivers.
  - Adjust signals to optimize traffic conditions.
  - Inform drivers of real-time traffic conditions.

5.A.3.3 Projected Outcomes

VII seeks to:

- Achieve a significant reduction in vehicle crashes, in particular crash types that include roadway departure and intersection-based collisions, which account for more than 50 percent of all fatalities.

- Reduce vehicle delay through State and local management of the surface transportation network based on real-time traffic information.
- Reduce the cost of road maintenance through State and local management of the surface transportation network based on real-time pavement and weather conditions.

The VII Initiative attempts to answer the fundamental question of whether it is technically feasible, economically viable, and socially acceptable to coordinate the deployment of a nationwide communication system on the road infrastructure and in all vehicles sold in the U.S. The VII Initiative is organized to answer these basic questions in order to support a joint decision by the public and private sectors to deploy VII in the U.S.

5.A.3.4 Why ITS?

The basic definition of ITS is the application of advanced technologies to the transportation infrastructure; the ultimate application of ITS is real-time vehicle-to-vehicle and vehicle-to-infrastructure communication. In this respect, VII is inherently ITS. It requires communications devices on board the vehicle and on the roadside. Through these communications links, data is integrated, processed, and transmitted to create a dynamic exchange that increases safety and mobility within the transportation system. Advanced technology applications for VII focus on data exchange for specific safety and mobility issues to improve drivers' decision-making.

5.A.3.5 Five-Year Horizon

Program activities are organized into five major phases: Technical Development, Policy Research, Development of Business Models, Outreach, and Applications Development.

Phase 1: Technical Development. The technical development phase includes three major activity areas:

- In cooperation with industry, State, and local transportation agencies, the VII Initiative will manage the development of a system architecture that meets the U.S. DOT needs for safety, security, and reliability; that can accommodate industry applications; and that uses appropriate ITS standards.
- A prototype system implementing the system architecture will be designed.
- A vigorous proof-of-concept testing program will be conducted to verify and validate the performance, security, and reliability of the system.

Phase 2: Policy Research. The policy phase includes efforts to address issues on protecting the privacy of the public, liability, and data ownership that may stand in the way of consumer acceptance and deployment.

Phase 3: Development of Business Models. The business model phase will include the development of scenarios that:

- Envision how the VII system will be deployed, operated, and maintained over the long term.
- Propose different financing possibilities.
- Explore different implementation, staging, and deployment options.

This phase also includes a cost-benefit analysis that will estimate (in present-value terms) the life-cycle costs of the VII infrastructure, in-vehicle equipment, and application development versus the benefits (safety, mobility, environmental, and others) of VII-enabled applications over a 40-year horizon. The cost-benefit analysis will also help determine whether the VII Federal investment and stakeholder collaboration is likely to produce, via various applications, sufficient societal benefits to justify total costs. In parallel, the auto industry is examining its own business model to determine the viability of VII. These inputs are critical for a deployment decision by the auto industry and the transportation community on whether to deploy VII.

Phase 4: Outreach. Efforts under the outreach phase ensure the continuous and timely engagement of a wide range of stakeholders through public forums and electronic media.

Phase 5: Applications Development. Under the fifth phase of the VII Initiative, the ITS program is working with the industry to develop specific applications that will serve as a core suite and that will be available during the initial deployment of VII. Applications will be integrated into the VII end-to-end system to demonstrate proof of concept using a development test environment. Applications that have been chosen represent the needs of various stakeholders. The suite of initial applications is as follows:

- Emergency electronic brake lights
- Curve speed warnings
- Traffic signal and stop sign violation warnings
- In-vehicle signing
- Traffic information
- Offboard navigation
- Electronic payments (tolls, gasoline, and parking)
- Road and weather conditions
- Traffic signal optimization
- Traffic management and control

These applications will enable a test of the functionality of the VII system and provide results that will form the basis for a deployment decision. Upon completion of the proof-of-concept testing and with a joint public-private decision to deploy the VII system, additional applications development work will take place in preparation for an initial national rollout. The roadmap on the following page reflects the timing of these activities over the next five years. In total, these activities address a broad range of both technical and nontechnical issues in preparation for deployment.

Major activities scheduled for the VII Initiative over the next five years include:

Phase 1: Technical Development

- Complete the system design and prototype (the architecture and system requirements are completed).
- Develop test plans.
- Conduct proof-of-concept testing.
- Prepare for the key decision point with industry and present results to the ITS Management Council.

Phase 2: Policy Research

- Finalize the VII privacy policy for public and private sectors.
- With stakeholders, research and develop liability and data ownership policies.

Phase 3: Development of Business Models

- Finalize the approach to the cost analysis for deployment and benefits estimation; refine with test data.
- Develop and discuss business models with stakeholders—original equipment manufacturers, State and local agencies, telecommunications and computer industries, and other industries.

Phase 4: Outreach

- Continue meetings with stakeholders at regular intervals to review and provide input on needs, requirements, and progress on the VII system development, policies, and business models.

Phase 5: Applications Development

- Complete the architecture and system designs for the various applications.
- Integrate the applications into the VII test site for proof-of-concept testing.

Figure 5.9 presents a five-year roadmap for the VII Initiative.

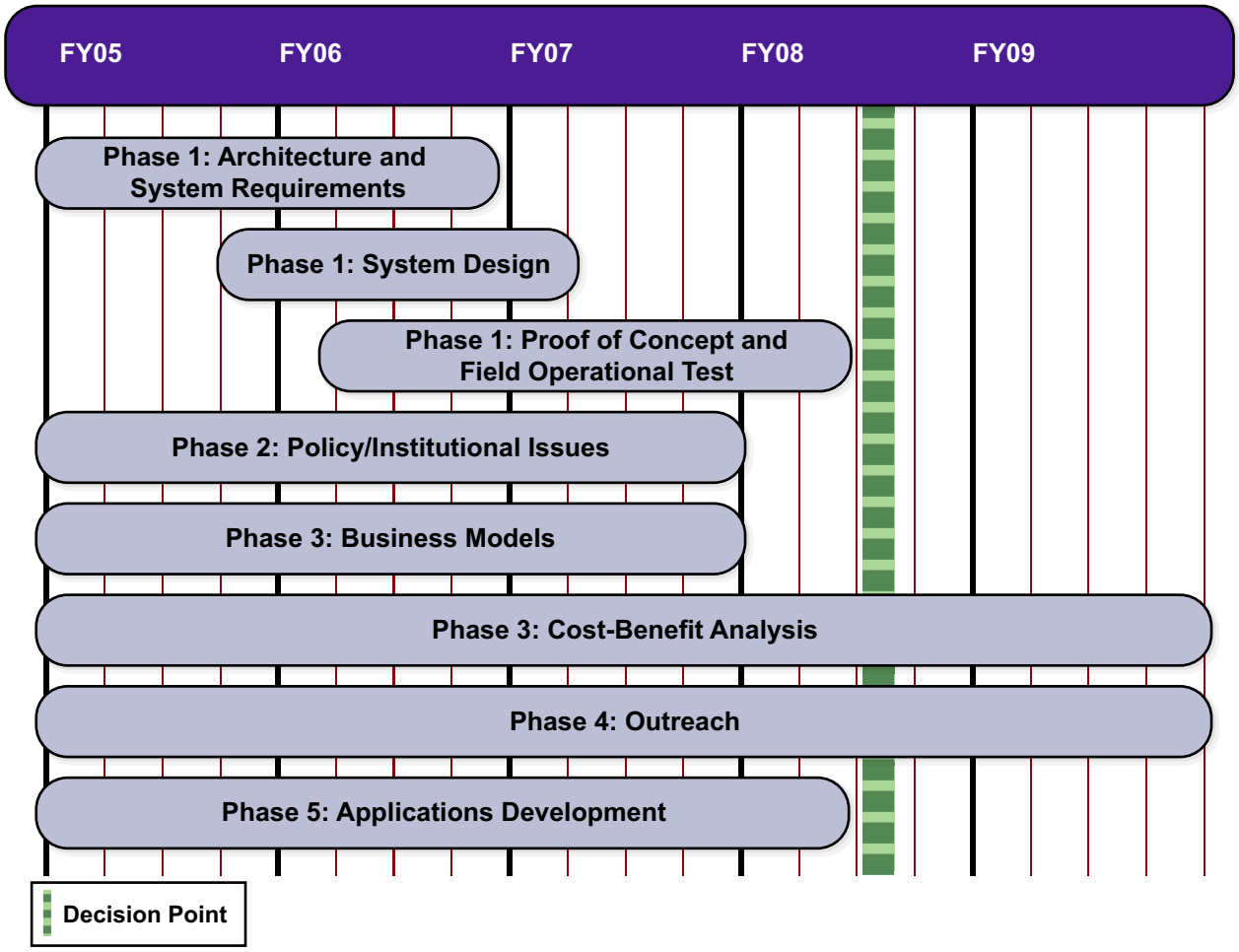


Figure 5.9: Five-Year VII Roadmap

5.A.3.6 Engagement of Stakeholders

Because VII is, by nature, a cooperative system between vehicles and road infrastructure, collaboration among partners representing both interests is critical for success. A coordinated deployment by industry and government will provide drivers with the highest benefits from each VII application. This requires a commitment from the automotive industry to produce vehicles with VII applications and from public-sector transportation agencies to deploy and maintain VII on major U.S. roadways. As a result of the level of commitment needed for deployment, stakeholder involvement has been and will be continuous so that deployment decisions can be coordinated and proceed in parallel.

To ensure that stakeholder involvement is seamless, the Department has convened a VII Coalition comprising auto manufacturers, American Association of State Highway and Transportation Officials (AASHTO), ten State DOTs, and other key stakeholder groups to complete the work that is essential to the deployment decision. The coalition has formed an Executive Leadership Team and a Working Group. This team is composed of senior officials from all

Coalition member organizations and is responsible for strategic leadership and policy guidance. The Working Group is responsible for carrying out the research and analysis necessary to determine the feasibility and approach for deploying VII.

To date, there is consensus within the Coalition that a national deployment will provide considerable benefit to the Nation. The auto industry sees significant safety benefits for its customers and a cost-effective way of communicating with customers and vehicles. The Department sees the possibility of VII enabling major improvements in highway safety through crash prevention and more effective operation of the State and local transportation systems through collection of valuable information about the real-time status of the roadways.

The VII Initiative has reached out to other stakeholders through a number of formal and informal mechanisms. A national workshop was held in San Francisco in 2005 to brief interested groups and seek input on the preliminary VII architecture. Two workshops were held with privacy advocates to explore the issues related to VII deployment and discuss proposed approaches to addressing those issues. The VII Initiative is also conducting outreach to a broader audience through presentations at conferences, posting of key documents to websites, developing articles for trade magazines, and (via the Department) addressing the national media.

5.A.3.7 Current Status and Accomplishments to Date

The VII Initiative is underway and making progress in each of the five program areas. To date, accomplishments include:

Technical Development: An initial system architecture has been developed and approved by stakeholders. The DSRC standards and system design are complete. System integration and testing will begin in early 2007. All applications will be integrated into the prototype test facility by the end of 2007.

Policy: Privacy principles and specific VII guidelines have been developed. Privacy advocates have been included in the development and review process. Liability and data ownership issues are currently being addressed.

Business Models: A preliminary deployment model has been developed and reviewed by the stakeholders. Data is being collected on the costs of the proposed system. An initial cost-benefit model has been developed, the first iteration of which will be available in the fall of 2006.

Outreach: Several public meetings on the VII Initiative, its architecture, and use case scenarios have been held with a wide range of stakeholders, resulting in useful feedback. Plans are in place for more meetings to address the preliminary design of the entire system.

Applications Development: A set of applications to be used for the test program has been defined and approved by stakeholders. The applications development is underway. The goal is to have the applications available in early 2007 for initial deployment as part of the test program.

5.A.4 Next Generation 9-1-1 (NG9-1-1)

Improved technology for 9-1-1 will enhance driver safety and mobility by enabling motorists to quickly send more accurate and more useful forms of information about incidents to emergency dispatch centers.

5.A.4.1 Problem Statement

Trends in telecommunications mobility and convergence[18] have put the Nation's 9-1-1 system at a crossroads. The growing market penetration of both cellular and voice-over-Internet-protocol (VoIP) telephony has underscored the limitations of the current 9-1-1 infrastructure. The 9-1-1 system, based on decades-old technology, cannot handle the text, data, images, and video that are increasingly common in personal communications. The current 9-1-1 system ". . . is an analog technology in an overwhelmingly digital world."[19]

Many of the limitations of the current 9-1-1 system stem from its foundation on 1970s circuit-switched network technology. Currently, public safety answering points (PSAP) receive 9-1-1 calls and location data through a patchwork of landline voice, wireless/cellular voice, landline teletype/telecommunications devices for the deaf, and VoIP systems. Except for caller location, the present system is not capable of receiving information that is not voice-based.

The 9-1-1 system is a critical component of the Department's mission to increase safety and mobility. There is consensus within the Department and within the public safety community on the shortcomings of the present 9-1-1 system and the need for a new, more capable system that can take advantage of advances in information and communications technology.

5.A.4.2 Description of NG9-1-1

The Next Generation 9-1-1 (NG9-1-1) Initiative will establish the foundation for public emergency services in a wireless mobile society by enabling 9-1-1 calls from most types of communications devices. This will pave the way for fundamental changes in the movement of emergency information and access to 9-1-1 services. Through research and development activities, a design team will produce a national framework and transition plan to upgrade the current 9-1-1 system to handle new wireless and networked technologies. The new system will enable 9-1-1 callers to quickly send more accurate and more useful forms of information about incidents to 9-1-1 emergency call centers. For example, the NG9-1-1 system will be able to handle a 9-1-1 call from a wireless phone, PDA, or computer. Automatic crash notification data, photographs, and data sets can be transmitted with the call, and medically relevant data can be routed to appropriate emergency

[18] "Convergence" is the integration of traditional telecommunications and newer information technology services.

[19] Dale N. Hatfield, former FCC Office Chief, *A Report on Technical and Operational Issues Impacting the Provision of Wireless Enhanced 911,* October 2002.

medical services. Moreover, emergency centers will be able to send location-targeted hazard alerts and evacuation guidance to motorists and other mobile device users through reverse messaging.

5.A.4.3 Projected Outcomes

Objectives for the NG9-1-1 Initiative include:

- Enable 9-1-1 calls from most networked communications devices.
- Enable geographic-independent call access, transfer, and backup among PSAPs and also between PSAPs and other authorized emergency organizations.
- Create an open systems design for exchanging and managing 9-1-1 calls from most types of communications devices.
- Demonstrate a working proof of concept showing coordinated performance among the system's components.
- Prepare a plan for transitioning from disparate 9-1-1 systems to a national next generation system (or "system of systems").
- Reduce emergency services capital, operating, and maintenance costs.

The products of this initiative are a national architecture for the NG9-1-1 system and a transition plan for the system's implementation.

The NG9-1-1 Initiative will promote the vision of a nationally interoperable emergency services network and will provide a working model for 9-1-1 stakeholders to lay out a path for achieving that vision. While actual deployment is not part of this initiative, the results of NG9-1-1 will provide a model "backbone" for a new system that will enable stakeholders to move forward with 9-1-1 deployment.

Once implemented, the NG9-1-1 system will enable:

- Quicker and more accurate information delivery to responders.
- Better and more useful forms of information (data, images, and video).
- More flexible, secure, and robust PSAP operations.
- Lower public capital and operating costs for emergency communications services.

5.A.4.4 Why ITS?

The convergence trend in telecommunications and information technology provides an opportunity to make integrated voice, data, and graphical communications practical. Through integration with ITS, the Department has the opportunity to capitalize upon this trend to improve transportation safety. With its involvement, the Department ensures that advanced transportation safety technologies, including automatic crash notification and hazardous materials security alerts, will be integrated with public safety communications systems, creating an NG9-1-1 system that transmits emergency information on transportation incidents. As an example, in a recent FOT conducted by the Minnesota DOT to test the MAYDAY/9-1-1 system, the Department and its stakeholders demonstrated, for the first time, that 9-1-1 calls from service providers such as GM's OnStar© can be automatically routed to an appropriate PSAP. The FOT also demonstrated a data-routing system that enabled crash data to be shared with other users such as the Mayo Clinic and local transportation agencies.

5.A.4.5 Five-Year Horizon

The NG9-1-1 Initiative was designed to be executed in three overlapping phases: Engagement of Stakeholders, Establishing the Vision, and Defining the Future.

Phase 1: Engagement of Stakeholders. Implementation of NG9-1-1 will generate significant changes across the public safety and telecommunications industries, demanding that a wide range of organizations invest in technological updates and transform their operational procedures. Since these changes will impact a broad community, it is essential that stakeholders be fully engaged throughout to develop a consensus-based architecture and transition plan. The Department is playing a critical role in facilitating the active engagement of stakeholders from the public, private, and nonprofit sectors. Several mechanisms, both formal and informal, are being and will continue to be used to carry out this engagement. These are discussed in further detail below in Section 5.A.4.6.

This first phase is ongoing and will be continued for the duration of the initiative.

Phase 2: Establishing the Vision. By establishing stakeholder relationships, the Department was able to complete and publish a consensus-based preliminary concept of operations.[20] The concept of operations provides a user-oriented vision of the initiative within the context of an emergency services network for use by stakeholders with a broad range of operational and technical expertise. The document communicates the vision of this system to stakeholders so that they can be actively engaged in its development and deployment. It is the foundation for the development of the NG9-1-1 requirements and drives the design of the overall system. The preliminary concept of operations has been completed and will be updated throughout the NG9-1-1 Initiative effort, as the thinking related to the implementation of NG9-1-1 capabilities becomes clearer and more precise. Additionally, a preliminary requirements analysis exists in draft form.

Phase 3: Defining the Future. A design team will produce a high-level system architecture and a transition plan for migration to NG9-1-1 services. This phase will be accomplished in four overlapping stages:

- Stage 1: Development of Requirements and a Consensus-Based Architecture
- Stage 2: Preliminary Transition Analysis
- Stage 3: System Design and Demonstration
- Stage 4: Final Transition Analysis

Stage 1: Development of Requirements and a Consensus-Based Architecture. The development task is focused on producing a concept of operations, high-level and detailed system requirements, and an analysis of alternative national system architectures. Stage 1 activities build upon results from the Department's Wireless E9-1-1 project, which were instrumental in generating the preliminary concept of operations and a foundational set of stakeholder requirements for the NG9-1-1 Initiative.

Building on these results, a more robust concept of operations and requirements documentation will be developed. Additional research will be conducted to understand existing technological deficiencies and gaps that could hinder the deployment of the NG9-1-1 system. This research will answer the following questions:

- *What are the shortcomings of the current approach?*
- *Where will the system be used?*
- *What jurisdictions will use it and how will they use it?*
- *What geographic area will it cover?*
- *What functions will the system be capable of performing?*
- *Which system functions are the highest priorities?*
- *What are the performance expectations?*
- *Under what conditions will users interact with the system?*
- *What are the measurements for evaluating the post-deployment system?*

[20] U.S. Department of Transportation. 2005. *Next Generation 9-1-1 System Preliminary Concept of Operations. Available at http://www.its.dot.gov/ng911/next_gen_911_sys.htm.*

During Stage 1, the NG9-1-1 Initiative will integrate related standards development activities of the Internet Engineering Task Force, the Alliance for Telecommunications Industry Solutions Emergency Services Interconnection Forum, the International Telecommunications Union, the Telecommunications Industry Association, the Association of Public-Safety Communications Officials International (APCO), and the National Emergency Number Association (NENA).

Stage 2: Preliminary Transition Analysis. Activities in Stage 2 will focus on developing preliminary estimates of national NG9-1-1 system performance, benefits, and costs. It will also include the identification of critical system deployment issues and the development of a preliminary plan for transitioning from today's 9-1-1 system to a national NG9-1-1 system.

Preliminary Transition Analysis results will establish a baseline for measurement during the proof-of-concept demonstration in Stage 3. Technical, operational, and institutional issues will be explored and addressed. Potential issues could include:

- Organizational implications of the proposed NG9-1-1 capabilities for emergency services.
- Security, reliability, and privacy implications of an Internet protocol (IP)-based 9-1-1 system.
- Funding mechanisms.
- Location-determination issues, especially for wireless IP applications.

Stage 3: System Design and Demonstration. The objectives of Stage 3 are to design, develop, demonstrate, and assess a proof-of-concept system. A system design will be produced using the requirements from Stage 1. Critical components for the system will also be developed and will include:

- The software required to route simulated or actual 9-1-1 calls from various communications devices and services, process calls and data at a simulated or actual IP-capable PSAP, and transfer calls and data to other emergency call centers.
- An effective human-machine interface that incorporates new features of the NG9-1-1 system and options for multimedia calls and interfaces.

All components will be tested during the demonstration, as will system performance, user interface, data access, database, and security.

Prior to launching a demonstration, the NG9-1-1 Initiative will reach a key decision point. Using the results from Stages 1 and 2 and based on the technological advancements achieved with the development of new routing software, a decision will be made on whether to proceed with a proof-of-concept demonstration. The demonstration will require participation and commitment from a wide range of stakeholders.

During the demonstration, the initial deployment experience will be closely monitored and data will be collected to (1) assess potential system performance, costs, benefits, risks, and responsibilities for nationwide deployment and (2) identify enhancements that will improve design (such as reducing operating costs, updating the user interface, or simplifying data access). The experience will establish the foundation for an initial set of technical assistance tools to guide future deployments.

This third stage will incorporate standards that will provide a bridge between this initiative and the ongoing IP-telephony standards development.

Stage 4: Final Transition Analysis. Using the baseline established in Stage 2, Stage 4 will produce a final cost-benefit analysis and a final plan for transitioning from today's 9-1-1 system to a national NG9-1-1 system.

Figure 5.10 reflects the timing of these activities over the next five years. In total, these activities address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

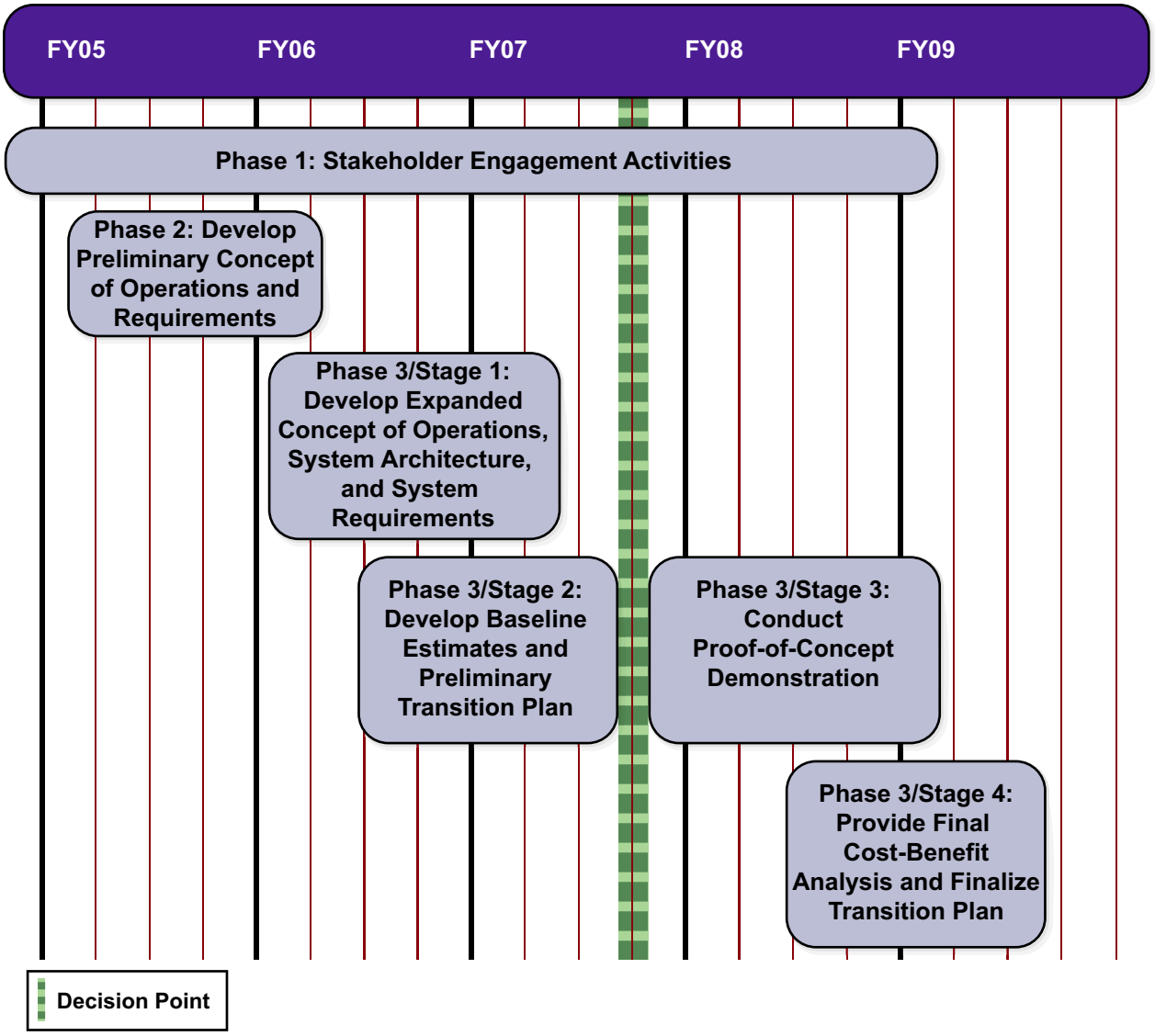


Figure 5.10: Five-Year NG9-1-1 Roadmap

Major activities scheduled over the next five years for the NG9-1-1 Initiative include:

Phase 1: Development

- Develop an expanded concept of operations.
- Develop high-level and detailed system requirements.
- Produce an analysis of alternative national systems architectures.
- Develop consensus with stakeholders for systems architecture that incorporates related standards.

Phase 2: Preliminary Transition Analysis

- Develop preliminary estimates of system performance, benefits, and costs as a baseline for Stage 3 testing.
- Identify critical system deployment issues.
- Develop a preliminary transition plan.

Phase 3: System Design and Demonstration

- Develop a system design.
- Develop software routing and human-machine interface components.
- Coordinate the development or modification of the NG9-1-1 standards.
- Integrate standards into the proof-of-concept system.
- Demonstrate and assess the proof-of-concept system.
- Provide tests for system performance, user interface, data access, database, and security.
- Identify system enhancements.
- Document initial deployment experience for future technical assistance guidance.

Final Transition Analysis

- Produce a final cost-benefit analysis.
- Produce a final plan for transitioning from today's 9-1-1 system to a national NG9-1-1 system.

5.A.4.6 Engagement of Stakeholders

The Department's role in this initiative involves facilitating the active engagement of stakeholders from the public, private, and nonprofit sectors, including:

- Local, State, and Federal agencies that address policy, regulation, funding, emergency communications, and emergency response.
- Nongovernmental organizations:
  - Professional and industry associations (public safety and telecommunications).
  - Standards Development Organizations.
  - Citizen and special-interest advocacy organizations (such as privacy groups and advocates for the disabled).
  - Private emergency response and recovery organizations such as tow-truck operators.
  - Research and academia.

- IT/telecommunications service providers:
  - "Traditional" telecommunications.
  - Public safety/emergency.
  - Other IT/telecommunications application.
  - IP–network-access infrastructure.
  - Equipment and support.
  - Public safety/emergency services network equipment.
  - Personal communications devices.
- Third-party emergency call centers and service providers such as poison control, medical alert, central alarm monitoring, relay services, and NG9-1-1 services.

Several significant stakeholder engagement activities have been completed:

NG9-1-1 Request for Information: On February 17, 2005, the Department published a request for information to solicit comments on eight questions about the NG9-1-1 Initiative. The Department received 32 responses from 9-1-1 organizations and related industries, communications technology and service providers, information technology research and implementation organizations, and other professional associations. Every responder supported the concept of NG9-1-1, and most explicitly endorsed Federal initiatives to develop and implement NG9-1-1 in cooperation with other public and private stakeholders. Most expressed a willingness to participate as partners in Federally sponsored NG9-1-1 activities.

Participation in annual conferences of national public and private stakeholder groups: Information on the NG9-1-1 Initiative has been presented to numerous stakeholder groups, including local, State, and Federal Government agencies; public safety and private telecommunications associations; Standards Development Organizations; special-interest advocacy organizations; and IT/telecommunications providers.

5.A.4.7 Current Status and Accomplishments to Date

Stakeholder engagement activities have been initiated through a variety of strategies and will be maintained for the duration of the initiative. Phase 2 activities are underway, and the preliminary concept of operations document has been completed and is posted on the ITS program's website. In Phase 3, an RFP was issued and a contract was awarded for a design team to complete a two-year, four-phase project that will produce a high-level system architecture and a migration plan to the next generation of 9-1-1 services.

5.B Reduced Congestion Initiatives

Four of the nine major initiatives are focused on reducing congestion. As described in the following text, three initiatives address reducing congestion through system operations. These initiatives are:

- Integrated Corridor Management (ICM)
- Evacuation Management and Operations (EMO)
- National Surface Transportation Weather Observing and Forecasting System (*Clarus*)

The final initiative, which focuses on improving personal mobility and providing more equitable access to the transportation system, is:

- Mobility Services for All Americans (MSAA)

5.B.1 Integrated Corridor Management (ICM)

Proven and promising ITS technologies will be used to improve mobility and enhance productivity on major corridors in large metropolitan areas.

5.B.1.1 Problem Statement

Much of the Nation's traffic congestion is concentrated in critical metropolitan corridors that link activity centers and carry high volumes of people and goods. Improving movement through these corridors could yield significant benefits in reduced travel time and increased reliability and predictability of travel. The ICM Initiative is working with State and local DOTs, transit agencies, metropolitan planning organizations, and private-sector consultants and suppliers to better manage corridor-wide travel.

The current state of the practice is highly disaggregated—for example:

- Freeway facilities are often subject to unrestrained demands significantly greater than available capacity. This can be further complicated by incidents that can dramatically reduce capacity.
- Significant unused corridor capacity exists on parallel routes and facilities; in the nonpeak direction on freeways and arterials; within single-occupant vehicles; and on transit services. However, the ability to shift travel demands between facilities and modes during traffic incidents, roadway work zone activity, adverse weather, or under circumstances of unusually large traffic volume is severely hampered by lack of information about current conditions (particularly on the arterial networks), lack of institutional collaboration and coordination, and an inability to develop workable, integrated operational strategies and procedures that focus on maximizing the efficiency of the entire corridor.
- Among the chief obstacles to effective corridor management are current institutional strategies and policies that allocate responsibility for corridor networks to different entities. In most instances, the networks that serve a corridor are operated by separate jurisdictional entities:
  - Freeway networks are usually operated by State transportation agencies.
  - Enforcement is carried out by the State and/or local police.
  - Arterial networks are operated by the various jurisdictions along the length of the corridor.
  - Transportation management and enforcement duties on arterials tend to be split between different jurisdictional units.
  - Transit service in a corridor is typically provided by a regional authority and/or a jurisdictional-based entity.
  - Typically, interactions among system operators are limited only to normal operations due to the focus on performance optimization of each particular network. Network operators may

have existing agreements to change signal timing or bus routes in response to incidents, but they have limited ability to vary those plans to react effectively to the details of a specific incident.

- Network managers do not have the necessary tools to identify, analyze, and implement systems that would facilitate crossnetwork operations, which perpetuates the status quo.

These are only some of the technical and institutional challenges that present obstacles in the shift from individual network management to integrated management across corridor networks.

5.B.1.2 Description of ICM

The ICM Initiative will demonstrate how ITS solutions can be applied to proactively manage the movement of people and goods through major metropolitan transportation corridors. The Initiative will facilitate future deployment of integrated corridor management systems by providing State and local agencies with guidance on:

- Developing institutional agreements to operate in a multijurisdictional environment.
- Shifting travel demand to unused capacity by delivering real-time travel data through in-vehicle devices, changeable message signs, and *511* services, as well as through various traffic and transit management schemes, including pricing strategies, adaptive traffic signals, and ramp metering systems.
- Integrating disparate travel management tools that can balance corridor demands, reduce delays, and increase travel time reliability.
- Developing and integrating operational strategies that employ ITS applications.

A planned FOT will show, under real-world conditions, how ITS technologies and agency partners work together to improve corridor optimization of capacity and end-user level of service.

5.B.1.3 Projected Outcomes

The ICM Initiative will demonstrate effective corridor management systems and strategies that maximize mobility and productivity. This will be achieved through successful coordination among corridor agencies, ITS deployment, and proactive implementation of operational strategies to fully utilize existing corridor capacity. End products will include:

- Operational strategies enabled by integrated ITS technologies such as ramp meters, advanced traffic control, variable speed limit signs, and parking notification.
- Analysis and evaluation tools to support strategy development and selection.
- Guidance to practitioners on conducting a corridor resource and component inventory.
- A study of ITS supply and demand management practices that can be implemented at the junctions of corridor networks.[21]
- Alternatives for shared operations management and systems integration.
- Guidance documents concerning the distribution of responsibilities and sharing of control between management systems for institutional support of integrated corridor operations.

When ICM systems are deployed, expected outcomes include reduced travel time and increased reliability and predictability of travel.

5.B.1.4 Why ITS?

Ultimately, it is the coordination of partner agencies and the implementation of new operational strategies that will achieve optimal utilization of a corridor transportation network (spanning both road and other modal networks). The technical means for accomplishing this goal relies upon the use of communications standards[22] and advanced technologies in sensors and surveillance, traffic and transit management systems, and traveler information systems.

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[21] Junctions or interfaces, such as freeway ramps, are the transfer points between networks.

[22] The ICM Initiative will use the ITS Standards Program's center-to-center communications protocols.

5.B.1.5 Five-Year Horizon

The ICM Initiative consists of four phases: Foundational Research; Development of Tools, Strategies, and Guidance; Development of Concept Demonstration Sites; and Knowledge and Technology Transfer. Within these four phases, there are two key decision points.

Phase 1: Foundational Research. In 2005, the Department convened working groups of stakeholders from a variety of government and public-sector organizations to reach an understanding of the institutional, operational, and technical integration needs and issues associated with developing and deploying an integrated corridor management system. Building on these activities, Phase 1 will:

- Develop definitions and identify corridor types, develop operational approaches and strategies, and generate integration requirements based on user needs assessment.
- Review existing and simulated corridor operations.
- Develop initial guidance for integrated corridor management planning and implementation.
- Develop a concept of operations for a generic corridor.

The first decision point for this initiative occurred at the end of Fiscal Year 2005. Using the results from the initial needs assessment in 2005, the Department determined that the initiative should continue, as there appeared to be sufficient technical resolutions to ICM integration issues and sufficient benefits to warrant further ICM development.

Phase 2: Development of Tools, Strategies, and Guidance. The objective of Phase 2 is to develop the tools, strategies, and guidance necessary to support regional ICM implementation. During Phase 2, the ICM Initiative will develop a set of operational strategies and simulation tools that will be used to test the strategies. Testing may include laboratory and limited field-testing of component integration interfaces and operations. In partnership with the ITS Standards Program, ITS standards will be applied to determine whether they need to be modified or expanded to support integrated corridor management. The required ITS standards include those that address open data exchange, communications, and decision controls.

In exploring technical integration issues, the ICM Initiative will develop guidance on the strategies that appear effective from the testing and simulation results. Strategies already displaying relevant results include alternative shared operations management schemes and crossnetwork operations strategies, among others.

Phase 3: Development of Concept Demonstration Sites. Phase 3 activities will be conducted in three stages. In Stage 1, the ICM Initiative will select a set of "pioneer" demonstration sites. Agencies that are chosen will be provided with funding and support to develop site-specific concepts of operations and design requirements for their proposed corridors. In Stage 2, a down-select process will occur to choose the most promising "pioneer sites" for further in-depth analysis. The criteria for the down-select include:

- The capability of the available tools to model the ICM strategies.
- The relative capability of the "pioneer sites" to support cost-benefit assessment for integrated corridor management.
- The ability to acquire viable data for performing an evaluation, including a cost-benefit assessment.

The tools developed in Phase 2 will be applied to analyze the proposed concept of operations.

The results of Stage 2 will form the basis for the ICM Initiative's second key decision point—whether to invest in a real-world demonstration. Following this decision point, the ICM Initiative will move into Stage 3 for demonstration. From the selected "pioneer sites" in Stage 2, one or more sites will be chosen for demonstration purposes. The selection will be based on a site's ability to demonstrate the concept of operations under real-world conditions and to develop successful partnerships along its corridor for ICM system implementation. The pioneer deployment sites will show the application of institutional, operational, and technical integration approaches in the field and will document implementation issues and operational benefits. An independent evaluation will document the results.

Phase 4: Knowledge and Technology Transfer. The fourth phase comprises activities to transfer the knowledge, tools, and technologies developed as part of the ICM Initiative to State and local agencies. Outreach activities will be ongoing throughout the initiative to disseminate results as they are delivered. Continuous delivery of results will assist State and local agencies in defining their own corridor issues. As knowledge, tools, and technologies become available, the Department will develop training and technical assistance to guide implementation.

The following roadmap reflects the timing of these activities from 2004 to 2010. In total, these archives address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

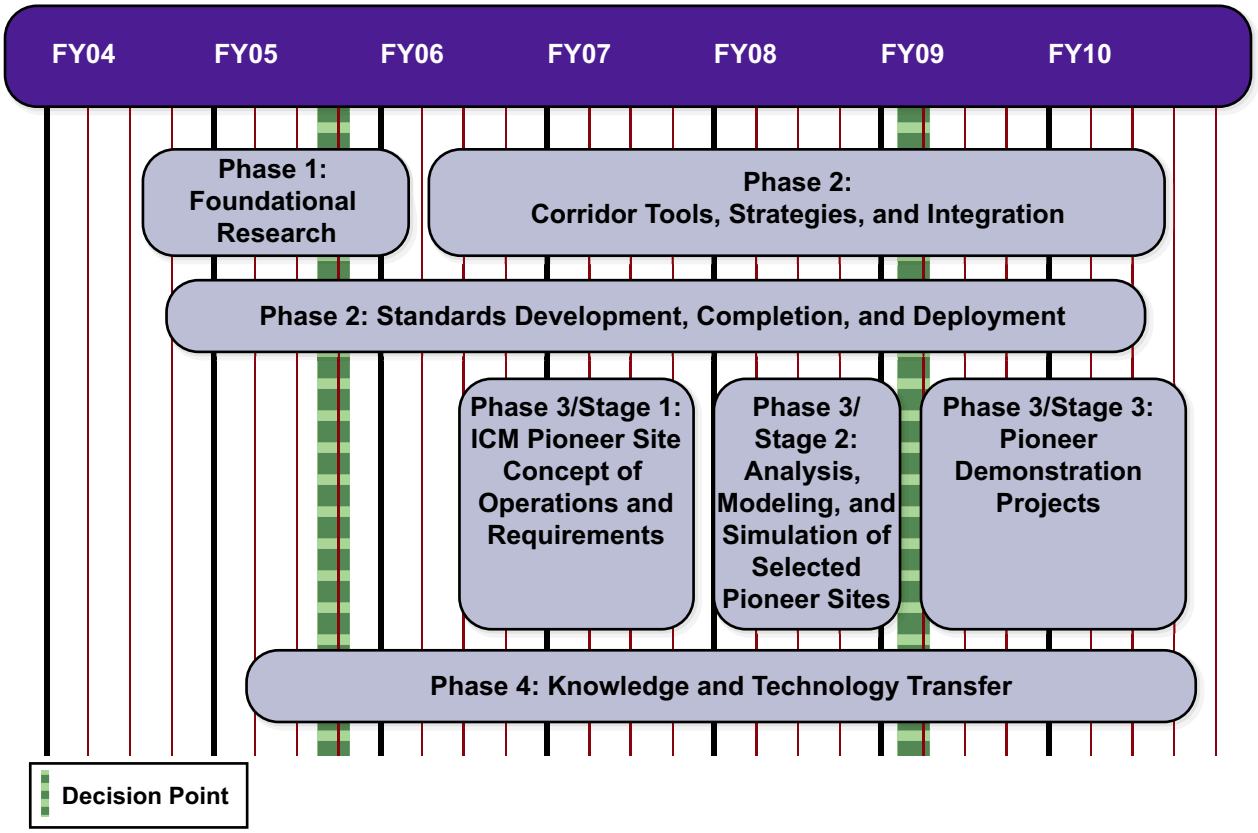

Figure 5.11: Five-Year ICM Roadmap

Over the next five years, major activities scheduled for the ICM Initiative include:

Phase 1: Foundational Research

- Develop the ICM concept and identify successful local integration efforts.
- Identify corridor types, operational approaches, and strategies, and develop analysis tools required for ICM.
- Research the feasibility of ICM development.
- Hold focus groups to explore technical issues and system level requirements for integration, gaps in the modeling and analysis capabilities of current tools, and issues and requirements for transit operations.

Phase 2: Corridor Tools, Strategies, and Integration

- Identify, enhance, or develop the analysis, modeling, and simulation tools needed for Phase 3 and beyond.
- Develop the ICM system prototypes; create ICM interfaces and integration processes.

- Develop operations management schemes.
- Prioritize and select proof-of-concept tests.
- Conduct laboratory and field tests of component interfaces and operations.

Phase 3: Corridor Sites Concept Development

- Select “pioneer” sites.
- Work with sites to develop concept of operations for their proposed corridors.
- Review concepts, select a limited number of sites, and perform further analysis, modeling, and simulation.
- Based on analysis and results, select demonstration sites.
- Conduct ICM demonstrations and evaluations.

Phase 4: Knowledge and Technology Transfer

- Develop an ICM resource compendium.
- Develop outreach materials to provide guidance on implementing integrated corridor management systems.
- Conduct outreach, including conferences, training, and technical assessments.

5.B.1.6 Engagement of Stakeholders

At the beginning of this initiative, the Department partnered with ITS America to establish a working group of key stakeholders that consists of:

- Five representatives of State DOTs.
- Five representatives from public transportation agencies.
- Three representatives from city and county DOTs.
- One representative from a metropolitan planning organization.
- Two representatives from system suppliers.
- One academic.
- Three systems integrators.

The working group met several times (in person and via teleconference) to provide input on Phase 1 deliverables. The working group analyzed the process for implementing the ICM Initiative and provided user input to the concept of operations and requirements development. It is expected that the stakeholder working group will continue to advise the Department on this initiative through its lifetime.

Based on the working group input, the Department adjusted the demonstration phase to allow for more pioneer sites. This will enable the program to address a wider variety of metropolitan corridor transportation solutions.

The ICM Initiative has engaged other stakeholders by issuing a public request for information to seek broad stakeholder input and generate interest on the vision, goals, and approach. These activities also help to identify and collect information on tried, existing, and potential corridor operations strategies, including components of the strategies. At the end of Phase 1, the ICM Initiative held an open meeting to discuss the results of the request for information and provide another opportunity for input on the program.

Early in Phase 2 of the initiative, three focus groups were conducted to assess specific issues with respect to analysis, modeling and simulation, systems integration, and transit systems. Attendees commented on the planned approach for the Phase 2 systems integration and the analysis and modeling tasks.

For Phase 3, the Department will form a Pioneer Sites Working Group consisting of representatives from each site—technical experts from the State DOT, the transit authority, and the city or county traffic signal unit. The working group will meet to analyze the draft concepts of operations and the draft requirements documents and will provide input on the analysis and modeling tasks.

5.B.1.7 Current Status and Accomplishments to Date

This initiative has completed the first phase of Foundational Research to assess the feasibility of the ICM and to develop a generic concept of operations and requirements document that supports stakeholders' needs.

The first decision point for this initiative was reached at the end of fiscal year 2005. The ITS Management Council determined that the initiative should continue since sufficient progress has been made with integration issues, and associated benefits are likely to warrant future ICM development.

The Department has also issued a request for applications and expects to select pioneer sites by early fall of 2006. Development of analytical and modeling simulation tools is underway.

5.B.2 Evacuation Management and Operations (EMO)

ITS technologies will help to identify the appropriate response, manage large-scale evacuations, and get the correct equipment and emergency personnel to and from the scene quickly and safely.

5.B.2.1 Problem Statement

An evacuation of 1,000 or more people occurs an average of every three weeks in the U.S. The leading causes of these evacuations are wildfires, floods, fixed pipeline and hazardous materials emergencies, tropical storms and hurricanes, and railroad accidents. During such events, transportation systems serve a critical dual role in that they:

- Support the evacuation of people from homes, schools, hospitals, and businesses in order to remove them from the impending danger.
- Allow a range of responders to quickly reach the scene of an emergency to aid victims and ensure the safety of travelers and residents.

These types of events require the United States to be prepared for a multitude of emergencies that have the potential to significantly endanger the general public and affect the normal operations of transportation systems. Transportation and public safety personnel must be prepared to operate as safely and efficiently as possible during such times. Key challenges facing transportation system managers and operators include:

- The potential for an evacuation of large numbers of people in a short period of time and over great distances (on average, a large hurricane usually requires the evacuation of hundreds of thousands of citizens). Many of these citizens may have limited or no access to transportation services.
- The coordination of multiple modes of transportation, which are owned and operated by both public and private entities.
- The response to a transportation-related emergency when the system is congested or has been damaged.

Evacuations, like other transportation-related emergencies, can create demands for transportation services that overwhelm systems not designed for such operations.

5.B.2.2 Description of EMO

The purpose of the Evacuation Management and Operations Initiative is to foster the development of tools and processes that support transportation system operators during evacuations and large-scale emergencies. In close partnership with the public safety community, State and local departments of transportation, and public transportation service providers and emergency managers, this initiative focuses on:

- Engaging a wide range of stakeholders to determine their needs.

- Applying ITS to support safe and efficient transportation management and operations strategies during evacuations.
- Planning for and managing a wide range of transportation-related emergencies, including those requiring evacuation.

5.B.2.3 Projected Outcomes

The outcome of this initiative will be the tools, techniques, demonstrated benefits, technical guidance, and standards necessary for State and local agencies and their private-sector partners to effectively manage and ensure the safe and efficient operation of transportation systems during large-scale emergencies. Types of emergencies that will be addressed in this initiative include:

- "Advance notice" evacuations from such large-scale events as hurricanes and wildfires.
- "No notice" evacuations such as those resulting from hazardous materials emergencies or terrorist attacks.

5.B.2.4 Why ITS?

In conjunction with improved voice and data communications systems, ITS technologies are proving to be essential tools for the management and operation of the transportation system during evacuations. They are used for collecting data, coordinating knowledge of transportation system conditions among many partners, and implementing operational and logistical strategies in real time.

Additionally, during times of emergency, ITS provides the capability for transportation and public safety service providers to communicate and coordinate operations and resources. The use of efficient and reliable voice and data communication resources provides these agencies with the ability to share information related to the operational conditions of the transportation facilities and the location of response resources, and to provide updates on the status of the emergency. Each stakeholder category has special needs for improved data communications and ITS services:

- For ***responders,*** advances in logistical and decision-making tools enable commanders and dispatchers to implement strategies as conditions change. Advances in communication and information systems have provided an opportunity to access essential real-time data about conditions on routes throughout the affected region. The need for real-time data is especially critical during evacuations and emergencies, when conditions are continuously changing. ITS technologies can be used to help identify the appropriate response and get the correct equipment and emergency personnel to and from the scene quickly and safely.
- For ***travelers,*** it is critical to receive information on road conditions and/or closures during emergencies. During evacuations, it is critical to receive information related to means of transport other than the personal automobile. This is especially true when coordinating evacuations of the transportation-disadvantaged.
- For ***transportation agencies,*** the availability of real-time data on transportation conditions, coupled with decision-making tools, enables more effective response and coordination of resources during evacuations and emergencies. ITS technologies also enhance the ability of transportation agencies to coordinate response with other stakeholders.

5.B.2.5 Five-Year Horizon

The EMO Initiative has two distinct phases: Research and Gap Analysis, and Development and Testing of Decision Support Tools.

Phase 1: Research and Gap Analysis. When the EMO Initiative was launched, research efforts addressed a broad range of issues related to transportation operations during emergencies. Research focused on how ITS technologies could be used to support decision-making during transportation-related emergencies, coordination of response resources, and assistance with evacuations. The results of this research were critical to understanding the range of potential technological solutions that enable enhanced coordination and communications for transportation agencies during emergencies.

One research effort in particular highlighted an important and growing problem area in transportation—decision-making capacity during evacuations and large-scale emergencies. The research conducted in this problem area has resulted in an important deliverable, a *State-of-the-Art/State-of-the-Practice* report[23] that documents best practices currently in use.

Using the detailed data collected as part of this research, the EMO Initiative has begun a gap analysis to identify where State and local agencies need enhanced tools to support decision-making during evacuations and emergencies. After completion of the gap analysis, the EMO Initiative will face a key decision point to focus priorities for the next phase of work. Weather-related emergencies of 2005, including hurricanes Katrina and Rita, underscored for the Department the need to provide a stronger foundation for the use of ITS in evacuation management and planning.

Phase 2: Development and Testing of Decision Support Tools. Using early results of Phase 1 research, the EMO Initiative has identified critical gaps in required resources in two areas—evacuation planning and real-time management strategies, and decision support tools. In each area, the ITS program proposes the following actions:

- **Develop evacuation planning methodologies and real-time management strategies.** An important lesson from the hurricanes of 2005 was that more comprehensive and coordinated planning is required in anticipation of future emergencies. Existing plans had not anticipated either the enormity of the impact or the full scope of transportation-related problems, such as:
  - The appropriate use of vehicles to evacuate the transportation-disadvantaged and special needs population.
  - Fuel shortages on evacuation routes.
  - The effect that contra-flow strategy implementation would have on roadways outside the evacuated urban area.
  - The challenge of simultaneously evacuating residents and bringing response commodities into an area.
  - The challenge of collecting highly accurate real-time traffic data and quickly communicating it to the public to influence critical travel decisions.
  - Coordination of evacuation plans and actions with neighboring jurisdictions.

  Since the devastation of Katrina, agencies around the country have been focusing on the development of such plans for their regions. However, many agencies are also turning to the Federal Government to play a stronger role in developing more comprehensive real-time management strategies and in providing technical assistance and table-top exercises to practice real-world scenarios. Agencies are interested in the Department providing models and simulations for evacuation using existing data. Agencies are also interested in receiving information on best practices in use around the country. Additionally, agencies have asked the Federal Government to provide guidance on methodologies for:
  - No-notice evacuation management, including route planning and diversion, infrastructure recovery, and regional transportation planning.
  - Technical assistance and continued support in ensuring the coordination of transportation and public safety procedures during an evacuation.
- **Develop Decision Support Tools.** One of the major challenges of managing an evacuation is the dynamic nature of both the incident and traveler behavior. Those responsible for coordinating evacuations must be prepared to immediately identify and implement operational strategies as conditions change. In response to these needs, the ITS program sees a role for the EMO Initiative in developing tools and technologies for agencies to use for decision support before, during, and after evacuations take place. The EMO Initiative proposes to develop models and simulation tools that will facilitate local planning for State and local transportation systems managers. Working with stakeholders, the EMO Initiative proposes to provide the technical assistance needed for agencies to tailor these tools to meet their local requirements and produce

[23] *State-of-the-Art/State-of-the-Practice,* Booz Allen Hamilton, 2005.

realistic scenarios for discussion and implementation. In addition, recognizing that planned scenarios cannot encompass all foreseeable problems, the EMO Initiative proposes to develop decision support tools tied into real-time roadway data collection systems and traffic management systems to assist managers during actual events. Specifically, this effort will include the development of adaptive evacuation management software to help improve the safe and efficient movement of travelers, responders, and resources.

Similar to the Integrated Corridor Management Initiative, the end result of Phase 2 will be to provide the institutional guidance, operational capabilities, and ITS tools and strategies needed for effective evacuation management and planning. It is expected that any required concept testing or pilot demonstrations will be coordinated with State and local agencies.

The five-year roadmap for the EMO Initiative is reflected in Figure 5.12.

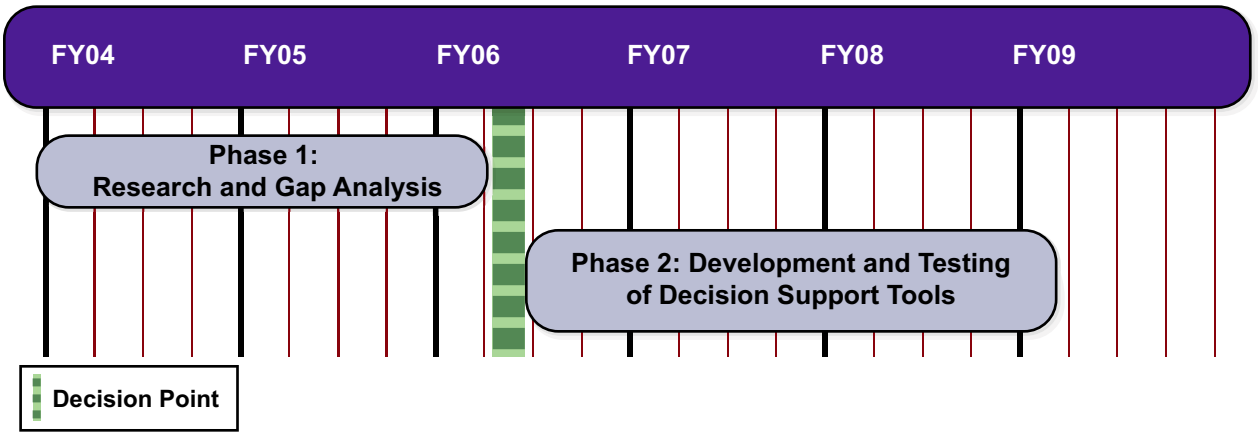

Figure 5.12: Five-Year EMO Roadmap

Major activities scheduled for the EMO Initiative include:

Phase 1. Research and Gap Analysis

- Complete the gap analysis.

Phase 2. Development and Testing of Decision Support Tools

- Develop evacuation planning methodologies and real-time management strategies.
- Develop decision support tools and technologies.
- Perform concept testing or pilot demonstrations at selected sites.
- Transition finalized tools to State and local agencies for deployment.
- Provide technical assistance and instruction.

5.B.2.6 Engagement of Stakeholders

Evacuation planning and management requires the participation of a broad range of stakeholders, including:

- Governmental agencies:
  - Federal, State, and local transportation agencies
  - Federal, State, and local emergency management agencies, including the Federal Emergency Management Agency (FEMA) and the Department of Homeland Security (DHS)
  - Federal, State, and local transit agencies
  - Federal, State, and local public safety agencies
  - Federal, State, local, and tribal enforcement and security agencies, including DHS, Transportation Security Agency, Department of Justice (DOJ), and Federal Bureau of Investigation (FBI)
  - Metropolitan Planning Organizations
  - Metropolitan Council of Governments
  - Federal and State health and environmental services agencies
- Nongovernmental organizations:
  - Standards Development Organizations
  - Private emergency response and recovery organizations
- Private-sector firms:
  - Telecommunications equipment and service providers
  - Commercial traveler information providers
- Businesses and public agencies responsible for the evacuation of institutions such as schools and hospitals

The EMO Initiative has engaged many of these stakeholder groups to provide valuable input to the research conducted to date that has resulted in the *State-of-the-Art/State-of-the-Practice* report. Their involvement will grow increasingly important as the gap analysis process is completed and next steps are developed.

Workshops and events focused on information exchange have also brought together members of transportation, public safety, and emergency management communities to learn from one another's experiences. Three workshops and one research effort are of particular note:

- **The Florida Contra-Flow Workshop, February 14-15, 2006.**[24] This workshop was designed to gain information on past evacuations and current practices on contra-flow and traffic management. The Department was a contributing sponsor and brought information on best practices and lessons learned about ITS during evacuations and emergency responses during disasters. Other attendees included participants from "hurricane states" to assist in planning for and responding to hurricanes. The workshop had exercises to identify problems in these states that have yet to be resolved. Attendees also included State police and highway patrols, FEMA, and FHWA.
- **Applications of Technology to Transportation Operations in Biohazard Situations Workshop.** This workshop was conducted to develop a more comprehensive and actionable understanding of the role of transportation agencies during a biohazard situation. Utilizing scenario-based exercises, participants discussed their transportation-related needs from the perspective of public health, law enforcement, and other responding agencies. Many of the findings were an assessment of whether transportation agencies were prepared to fill those needs. The documents and tools produced as a result of this workshop will help State and local transportation agencies to better perform in the operational role expected of them during all phases of a biohazard incident.

[24] Proceedings can be found at *www.teachamerica.com/ContraFlow/ContraFlow.pdf.*

- **The Public Safety/Transportation Information Exchange Project.** This project is a joint effort between the Department and the DOJ to standardize information exchanges between systems that support highway incident responders and traffic managers. At the heart of the project, the IEEE 1512.2 standards are being applied to standardize all ITS incident management messages exchanged between public safety and transportation information systems. Led by the DOJ, stakeholders have been brought together to mitigate the differences between data standards used in these two communities. Participants include the DOJ's Office of Justice Program, the Standards and Infrastructure Committee of the Global Information Sharing Advisory Committee, the ITS Joint Program Office, and the FHWA. Additionally, a steering committee that was formed to represent State and local interests includes:
  - IEEE representatives from the 1512 Working Group
  - Madison, Wisconsin Policy Department
  - City of Cleveland, Ohio
  - Washington State DOT
  - Utah State Department of Public Safety
  - North Carolina DOT
  - Houston TranStar
  - Louisiana Sheriff Departments
  - State of California
  - CapWIN Traffic Management Center staff from the Maryland State Highway Administration
- **Interviews with Evacuation Transportation Managers.** Several large metropolitan areas within the U.S. were selected to participate in a combined survey and interview process to assess what is known about planning and management of transportation needs during evacuations of all types. These findings were published in a white paper that documents emergency evacuation plans and practices employed by transportation management organizations. The white paper provides initial guidance to agencies to use during their planning processes. It also provides the EMO Initiative with input to develop tools for real-time management of evacuations.

As the EMO Initiative continues, workshops and listening sessions will be held to ensure that stakeholders' needs are understood. Continued meetings will also allow stakeholders to review products and results for their effectiveness and relevance.

5.B.2.7 Current Status and Accomplishments to Date

Phase 1 of the EMO Initiative is nearing completion. As noted earlier, many of the early research efforts were focused on a broad range of incident and emergency management problems for the quick and efficient recovery of roadway capacity. Notable results from this research include:

- Two FOTs that successfully demonstrated the integration of computer-aided dispatch (CAD) systems used by public safety and emergency responders with ITS traffic management systems. Integration of CAD and ITS provides transportation agencies with the ability to use real-time emergency dispatch information to more efficiently manage traffic and other transportation-related impacts of emergencies. It also provides public safety agencies with instant access to real-time road condition and traffic information, making it easier for emergency responders to access and manage incident scenes.
- The demonstration of automated transfer of 9-1-1 calls from private-sector service providers to public-safety answering points (PSAP) as a part of the Mayday/9-1-1 FOT.

Phase 1 has also produced the *State-of-the-Art/State-of-the-Practice* report, a significant accomplishment that will help to focus the EMO Initiative as it moves forward.

5.B.3 National Surface Transportation Weather Observing and Forecasting System (Clarus)

Clarus will make use of the over 2,100 environmental sensor stations that are already installed along America's highways to help reduce the impact of adverse weather for road users and operators.

5.B.3.1 Problem Statement

Users of the surface transportation system need more timely, accurate, and relevant information about road conditions and weather. Based on national statistics averaged over the past 10 years, nearly 1.5 million passenger vehicles are involved in weather-related crashes each year. This has resulted in an average of 600,000 injuries and 7,300 fatalities annually. Delay caused by adverse weather has reached nearly one billion hours per year. Improving the quality and delivery of road weather information is critical to enhancing safety as well as productivity.

While weather-observing networks have grown in number, sophistication, and level of detail, surface observation capabilities remain at a disadvantage for accurate weather prediction. For example, the National Oceanic and Atmospheric Administration (NOAA) supports a nationwide network of ground-based atmospheric observation points located primarily at airports. However, almost none of the forecasting tools apply the surface observations because not enough is understood about the complex nature of surface weather phenomena. This is a challenge that the weather and transportation communities have a vested interest in resolving.

Many transportation agencies have made investments in road weather information systems (RWIS) to capture observations along roadsides and other surface transportation properties. Public investments made to date in RWIS, largely through the deployment of environmental sensor stations (ESS) by State DOTs, have been scattered among a diverse set of stakeholder communities, producing data of varying quality and with differing formats and communications protocols. RWIS networks do not provide full-scale data sharing, and as a consequence the benefits of existing road weather information networks are limited. Because the available sources of RWIS data are not integrated, it is not possible to develop a comprehensive and coherent picture of surface transportation conditions.

5.B.3.2 Description of Clarus

The *Clarus* Initiative will create high-resolution surface transportation weather forecasts and tailored decision support products for the surface transportation community by integrating a diverse set of reliable, calibrated, maintained, and available observational data systems. The challenge for the initiative is that existing data sources are not organized or managed as integrated networks. This deficiency was well documented in the National Academy of Sciences report *Where the Weather Meets the Road: A Research Agenda for Improving Road Weather Services*.[25] This report

[25] National Academies. 2004. *Where the Weather Meets the Road: A Research Agenda for Improving Road Weather Services* (National Academies, Washington, D.C.).

described the need for a robust, integrated road weather observational network and database management system. Such a network can fulfill the needs of transportation communities as well as other stakeholders such as NOAA, the U.S. Department of Agriculture, the private sector, and researchers.

Using the findings from this report, the *Clarus* Initiative developed a concept for the *Clarus* System, an open and integrated approach to observational data management that will directly overcome existing deficiencies and provide the data necessary to improve public- and private-sector surface transportation weather information products. The *Clarus* System will enable public agencies to more accurately assess weather and pavement conditions and their impacts on operations. This knowledge is critical for planning, conducting, and evaluating the effectiveness of activities such as winter road maintenance, weather-responsive traffic management, traveler information dissemination, safety management, transit vehicle dispatching, and flood control. As emerging mobile and remote sensing technologies are deployed, the tools enabled by the *Clarus* System will be refined to address the needs of the stakeholders who will be responsible for the sustained deployment and maintenance of the *Clarus* System.

Figure 5.13 illustrates the variety of information outlets that *Clarus* might support and some of the associated benefits.

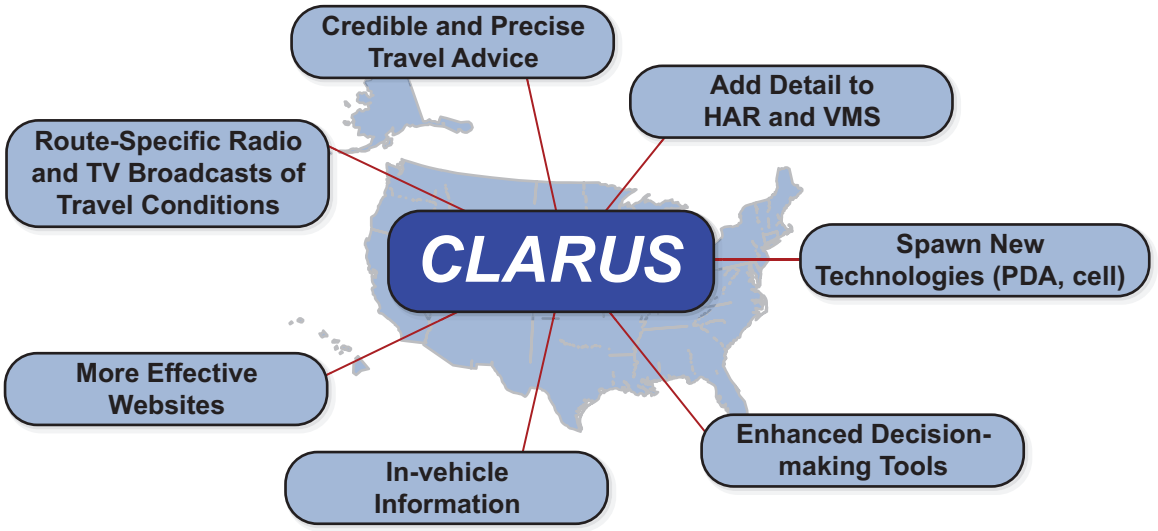

Figure 5.13: Clarus System of Data Exchange

5.B.3.3 Projected Outcomes

The *Clarus* Initiative will develop and demonstrate an integrated system for surface transportation weather observation, forecasting, and data management. It will also establish a partnership to create a nationwide road weather observation network. This initiative will deliver a suite of advanced road weather information products and tools (enabled by the new system) that can be deployed nationwide. The initiative's prototype deployment will serve as a model for other regions of the country. It is intended to stimulate the marketplace for transportation weather products.

The deployment of the *Clarus* System directly addresses stakeholder needs for improved data communications and services as follows:

- For ***system operators and transportation managers,*** surface-transportation-based weather observations will be integrated with data available from NOAA, thereby providing broader coverage of surface transportation conditions as well as enhanced road and weather information to improve the safety, mobility, reliability, and security of the roads for transportation users. In tailoring the *Clarus* System to local needs,

managers will benefit from information customized for weather-related management operations.

- For the ***transportation and weather stakeholder communities,*** the development of working partnerships will allow the *Clarus* Initiative to leverage and share resources for both research and operations.
- For ***travelers,*** the *Clarus* System will provide consolidated information to allow them to make better-informed travel decisions.

The *Clarus* Initiative also supports the mandate in SAFETEA-LU for the establishment of a Road Weather Research and Development Program.

The transportation community and travelers greatly share the benefits of applied weather information in transportation operations. In my view, the Clarus Initiative will advance our capabilities to deliver safer and more reliable mobility.

Dennis Belter
Aurora Program Chair
Maintenance & Administration Manager
Indiana DOT

5.B.3.4 Why ITS?

ITS technologies provide real-time surface-transportation-based weather observations in support of real-time operational responses to weather. In addition, the use of national ITS standards and architectures allows for the integration of data and widespread data sharing and accommodates emerging technologies such as closed circuit television cameras, mobile sensing, and remote sensing. In the future, as these technologies are integrated into the *Clarus* System, they will significantly enhance data quality, leading to more effective decision-making, better forecasting, and better-informed operations management.

5.B.3.5 Five-Year Horizon

The objective of the *Clarus* Initiative is to develop and deliver two primary components to the transportation community. The first component is the *Clarus* System—a processing system for the collection, consolidation, quality control, and exchange of surface transportation weather data and related road and rail conditions. The second component is the development of tailored forecasts, models, and decision support tools that permit more effective use of the *Clarus* System and its processed data by the surface transportation community.

The development and delivery of these components will be executed in three phases: System Design, Multistate Regional Demonstration, and Model Deployment and Evaluation. There is one key decision point in Phase 2.

Phase 1: System Design. Development of the system design will include the concept of operations, high-level system requirements, detailed system requirements, architecture analysis, and design gap analysis. A proof-of-concept demonstration on a limited data collection network will be used to test system performance and to further refine the system. The result of Phase 1 will be an open-source system design that is stable and ready to be introduced into a real-world working environment.

Phase 2: Multistate Regional Demonstration. The Phase 1 system design will be introduced into a multistate regional demonstration that will include rigorous testing of the system and forecasting tools that the *Clarus* System enables. Performance will be assessed in a real-world environment so that limitations of the design can be identified. Evaluation of the demonstration will consider how the outputs of the system impact roadway mobility and safety as well as agency productivity. A parallel effort will integrate cutting-edge vehicle-based and remote-sensing technologies.

The objectives of the Multistate Regional Demonstration are:

- To demonstrate that the *Clarus* System can function as designed.
- To demonstrate the benefits of *Clarus*-enabled surface transportation weather information to the full breadth of users and operators identified in the *Clarus* concept of operations, with emphasis on new and innovative uses of *Clarus*-enabled technologies and information.

Based on the results of Phase 2, the *Clarus* Initiative will face a key decision regarding whether to proceed with a large-scale model deployment and evaluation.

Phase 3: Model Deployment and Evaluation. The final design for the *Clarus* System will be applied to a model deployment that consists of multiple states. An evaluation of the model deployment will showcase the benefits of the *Clarus* System's network as well as the true implementation costs and a realistic assessment implementation effort.

Under Phases 2 and 3, deployment outcome questions that will be explored include:

- *Can the transportation community successfully overcome challenges to integrating surface weather and transportation operations?*
- *Can route-specific weather forecasts and customized decision support tools improve transportation operations?*
- *Can Clarus System data be used to improve land/surface modeling?*
- *Can Clarus System data enable greater validation of surface transportation weather products?*

During system development and implementation, integrated products will be created for transportation system operators or users. End users will identify improvements to the regional demonstration products and the *Clarus* System in the operational stage. During the model deployment stage, the *Clarus*-enabled products will be enhanced, deployed in operational environments, and evaluated to determine impacts.

Figure 5.14 shows the timing of these activities over the next five years. In total, these address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

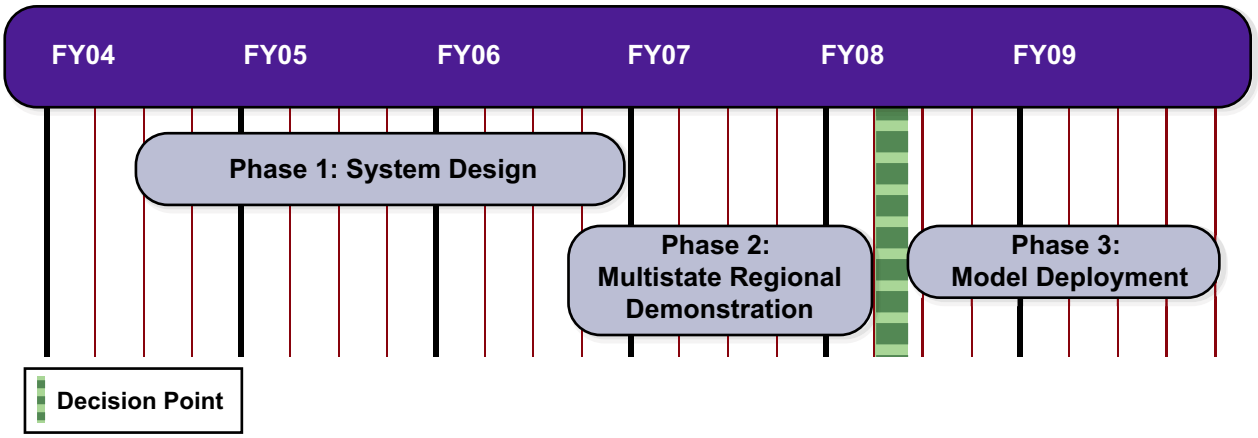

Figure 5.14: Five-Year Clarus Roadmap

Over the next five years, major activities scheduled for the *Clarus* Initiative include:

Phase 1: System Design

- Complete the *Clarus* System prototype design.
- Conduct proof-of-concept testing with three States (Alaska, Minnesota, Utah).
- Publish a common surface transportation weather interface specification.
- Coordinate with NOAA for inclusion in National Weather Service's National Surface Weather Observing System.

Phase 2: Multistate Regional Demonstration

- Issue a Request for Proposals to solicit interest in participation in the demonstration.
- Perform regional demonstration and proof-of-concept testing.
- Collect and evaluate data.

Phase 3: Model Deployment and Evaluation

- Conduct full-scale model deployment and data collection through 2009.
- Perform evaluation of the model deployment through 2009.

5.B.3.6 Engagement of Stakeholders

The *Clarus* Initiative depends on the active participation of a broad spectrum of involved stakeholders. The *Clarus* System will affect the services of the public sector and the market opportunities of the private sector in delivering information services to travelers, providing information products to public agencies, and deploying weather observation monitoring equipment.

Clarus Initiative stakeholders fall into three key groups:

- The owners and operators of the observing systems that provide information to the *Clarus* System.
- The users directly accessing the data contained within the *Clarus* System.
- "Consumers" of the value-added products.

To ensure that the interests and perspectives of these stakeholders are represented throughout the development of the *Clarus* System, the Department has formed the *Clarus* Initiative Coordinating Committee (ICC). The ICC is a multimodal, interdisciplinary source of guidance comprising experts in weather observing and forecasting, transportation operations, networking, and data management across the public and private business sectors. ICC members are representatives from:

- U.S. DOT
- Traffic and maintenance divisions of State and municipal DOTs
- NOAA and other public weather forecasting agencies
- Private weather information providers
- Public "weather consumer" agencies such as:
  - U.S. Department of Agriculture
  - Department of Defense
  - DHS

- Electronic and print media firms
- Mass transit agencies
- Railroad agencies, both public and private sector
- The general public

The ICC comprises two subsets—the Initiative Management Team and the *Clarus* Project Task Force. The Initiative Management Team is a smaller group of members that are responsible for the decisions and execution of the *Clarus* Initiative's activities. The team consists of FHWA and ITS JPO staff, NOAA, and staff from ITS America, the American Meteorological Society, the Institute of Transportation Engineers, the Transportation Research Board (TRB), and AASHTO.

The Project Task Force is a temporary group that provides technical feedback on specific tasks, products, or issues associated with the *Clarus* Initiative. Project Task Force groups are formed as needed and are assigned very specific responsibilities for development or review of a deliverable. Each task force group is composed of not more than ten subject matter experts.

The ICC will remain in existence for the duration of the *Clarus* Initiative to guide technical and programmatic considerations from the system's design through the model deployment.

5.B.3.7 Current Status and Accomplishments to Date

Phase 1, System Design, is underway. Task forces have been established to provide technical input and guidance. The concept of operations, high-level system requirements, and detailed system requirements have also been completed. The proof-of-concept test is underway with participation of Aurora Program member States Alaska, Minnesota, and Utah.[26]

Phase 2: Multistate Regional Demonstration is under development and is planned for execution beginning in 2007.

[26] Aurora is an international program of collaborative research, development, and deployment in the field of road- and weather-information systems, serving the interests and needs of public agencies.

5.B.4 Mobility Services for All Americans (MSAA)

ITS technologies provide the means to create a one-stop, customer-based travel reservation, information, and trip planning service for human services transportation.

5.B.4.1 Problem Statement

For most people, getting to work, to the doctor, or to worship services means getting in the car. But for others, it is not that easy. There are often challenges that individuals face when trying to "get a ride." In fact, 62 separately funded Federal programs provide money for services for the transportation-disadvantaged. Due to inefficiencies, lack of resources, and lack of coordination, delivery of human services transportation is a challenge and often leads to:

- Poor quality of transportation service.
- Confused customers and service providers.
- High cost and underutilized capacity.

The Department has created the Interagency Transportation Coordinating Council on Access and Mobility (CCAM), made up of representatives from 11 Federal Government agencies, to improve mobility of the handicapped and other historically transportation-disadvantaged communities by:

- Promoting interagency coordination and eliminating redundancy in service provision.
- Facilitating cost-effective expanded mobility options.
- Formulating policies to implement mobility-enhancing activities.
- Monitoring progress of new initiatives.

In addition, the Mobility Services for All Americans (MSAA) Initiative will rely on input from a stakeholder steering group comprising State and local transportation and human services agencies, transportation providers, advocacy groups, businesses, and transportation service users.

Generally, there are five critical elements of transportation mobility: (1) service provision, (2) user awareness of the service and how to use it, (3) ability to physically access the service, (4) service reliability, and (5) service flexibility to accommodate unexpected changes in travel plans.

While many transportation services exist for the transportation-disadvantaged, there are significant accessibility and mobility gaps:

- Certain areas of the country, especially rural areas, have no public transportation service available. Other geographic areas offer only sparse service.
- Inexperienced or new users often have difficulty locating information on transit services and find it difficult to understand how to use the transportation system.

- Para-transit customers in particular must book transportation far in advance, limiting the flexibility of the service that is available to them.
- Despite accommodations that have been instituted to make transportation physically easier to access, some transportation-disadvantaged groups find these accommodations inconvenient or inadequately operated and maintained.
- All users still experience difficulties in planning and taking a trip that requires the use of multiple transit services. Connections and fare payment can be confusing and burdensome.

5.B.4.2 Description of MSAA

The goals of the MSAA Initiative are to increase mobility and accessibility for the transportation-disadvantaged and the general public, and to achieve more efficient use of Federal human services transportation funding through technology integration and service coordination. To meet these goals, the MSAA will develop replicable, scalable models of traveler management coordination centers (TMCC) that:

- Provide one-stop, unified, customer-based travel information and trip planning services.
- Support coordination of human services transportation management and operations across various social welfare programs and service providers, modes, and geographic areas.

Human services transportation has become a top priority for many agencies since the Presidential Executive Order on Human Service Transportation Coordination was released in 2004. This Executive Order (13330)[27] requested the establishment of the CCAM to enhance transportation access, minimize duplication of Federal services, and facilitate the most appropriate, cost-effective transportation for individuals with low incomes, people with disabilities, and older Americans. CCAM launched the United We Ride (UWR) program to engage Federal departmental partners in seeking coordinated solutions to human services transportation delivery. The MSAA Initiative builds upon and collaborates with UWR and other ongoing initiatives to provide coordinated mobility to the transportation-disadvantaged and the general public.

5.B.4.3 Projected Outcomes

The product of the MSAA Initiative is the creation of replicable and scalable models of TMCC that reduce the cost and increase the productivity of human services transportation. The ultimate success of the initiative, however, is dependent on the level of nationwide deployment of TMCC so that all Americans, particularly the transportation-disadvantaged, can enjoy the benefits of improved human services transportation. This initiative will benefit users by providing one-stop, unified, customer-based travel information and trip planning services. At the same time, improved service coordination will result in more efficient use of Federal human services transportation funding. In this way, MSAA directly supports the ITS program goals of improving the efficiency of existing surface transportation facilities and accommodating the needs of all users of surface transportation.

5.B.4.4 Why ITS?

New capabilities and opportunities are being created in both the transportation and health and human services communities through the use of emerging technologies and innovative services. However, the two communities are often unaware of the research, new approaches, and advances that the other is making, and neither may have direct communication with the transportation-disadvantaged community at large. The MSAA Initiative seeks to bring all communities together to provide a coordinated effort and apply technological solutions to barriers to accessibility and mobility for the transportation-disadvantaged.

ITS technologies act as the enabler of MSAA, enhancing service coordination and system accessibility through many fronts, including:

- Integrated point-of-access for traveler support.
- Improved fleet scheduling, dispatching, and routing.

[27] Available at *www.whitehouse.gov/news/releases/2004/02/20040002-9.html.*

- Streamlined reporting, billing, and financial transactions.
- Simplified fare payment, collection, and processing.
- Enhanced traveler information and travel management capability with accessibility features.
- Advanced Geographic Information Systems and demand response systems that use more robust systems for door-to-door service.

5.B.4.5 Five-Year Horizon

Embracing the concepts of interagency coordination and technology integration, the MSAA will focus on more efficient use of existing resources to enhance processes and improve collaboration. The initiative proposes a four-phase approach with two key decision points over a four-year period (FY2005–FY2008).

The four phases of the MSAA Initiative, performed in collaboration with stakeholders and user communities, are: Foundational Research, TMCC Model System Planning and Design, TMCC Model Deployment and Evaluation, and Technology Transfer, Technical Assistance, and Outreach.

Phase 1: Foundational Research. The main purpose of the foundational research was to identify the needs, gaps, barriers, past and current innovations, and emerging opportunities within the transportation and human services communities. During this phase, an information inventory was developed and public-sector human services transportation initiatives were identified. Subsequent MSAA activities will build on existing knowledge and will be coordinated with related efforts. Workshops were conducted in different parts of the country to obtain stakeholder input.

The first key decision point was reached at the completion of Phase 1. The Department determined that there was sufficient benefit to pursuing further MSAA development and that technical integration issues could be resolved.

Phase 2: TMCC Model System Planning and Design. Partnering with UWR and building upon existing knowledge and stakeholder input obtained in Phase 1, Phase 2 will develop up to ten "deployment-ready" detailed designs for local models of TMCC that deliver enhanced human services transportation across a variety of operational environments and scenarios.

Before moving into Phase 3, the MSAA program will reach a decision point regarding the readiness of the models for real-world implementation.

Phase 3: TMCC Model Deployment and Evaluation. The Department will select two or more communities to deploy and evaluate the TMCC models that were planned and designed in Phase 2. A key criterion for site selection is the ability to maintain and operate the TMCC beyond the MSAA program funding. An independent evaluation will determine the return on investment and measure the overall success of each TMCC in achieving program goals.

Phase 4: Technology Transfer, Technical Assistance, and Outreach. The ultimate success of MSAA is dependent on the level of nationwide deployment. During Phase 4, the program will engage in technology transfer and customer outreach. Professional capacity-building activities, pursued through the ITS Professional Capacity Building Program, will build on the success of the TMCC deployment to promote widespread practice of ITS-enhanced human services transportation.

Figure 5.15 shows the timing of these activities from 2004 to 2009. In total, these activities address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

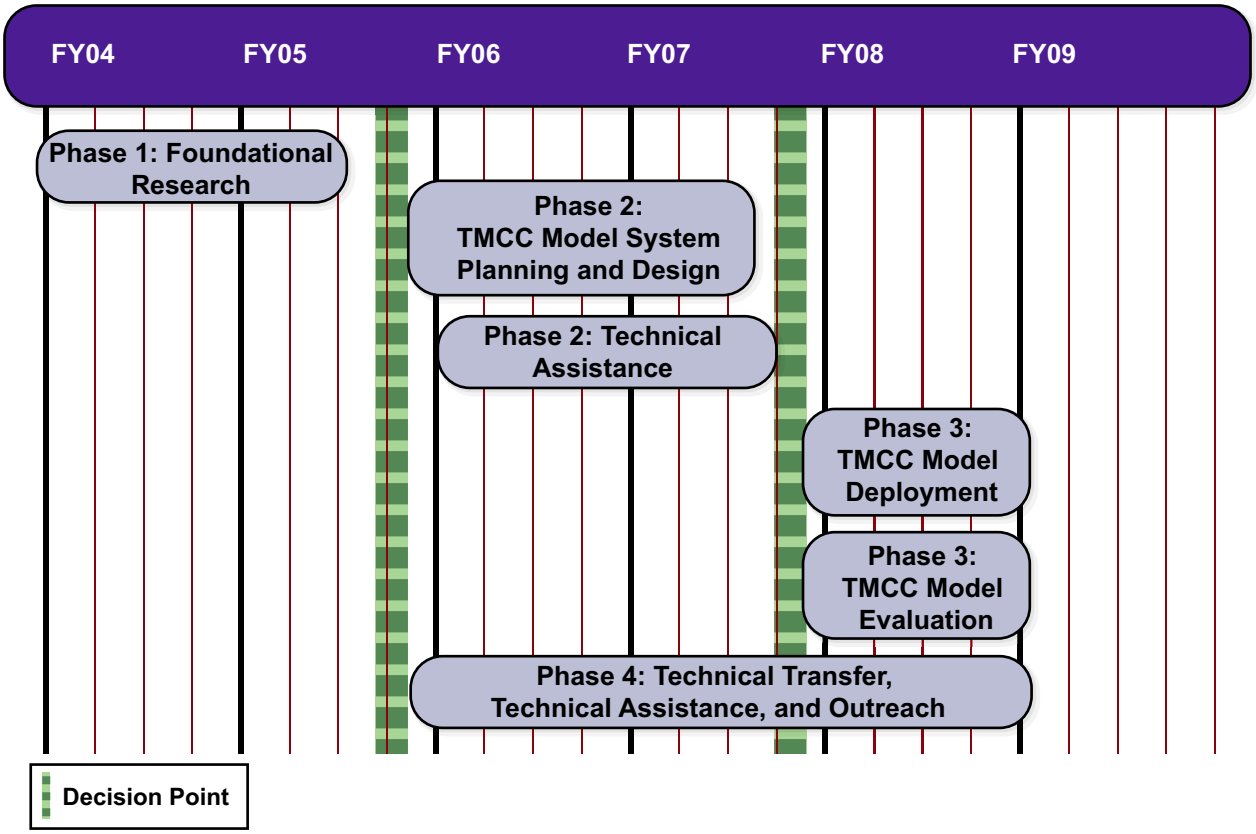

Figure 5.15: Five-Year MSAA Roadmap

Major activities scheduled for the MSAA Initiative over the next four years include:

Phase 1: Foundational Research

- Conduct needs assessments.
- Provide an inventory of existing resources.

Phase 2: TMCC Model System Planning and Design

- Select up to ten communities for the planning and design of local models of TMCC (demonstration sites).
- Establish an independent and interdisciplinary technical and management assistance team as a resource to provide general technical assistance to the demonstration sites and to exchange information among them.

Phase 3: TMCC Model Deployment and Evaluation

- Select two or more communities from among the demonstration sites to deploy the model TMCCs.
- Evaluate the model TMCCs to determine the return on investment and to measure their success in achieving program goals.

Phase 4: Technology Transfer, Technical Assistance, and Outreach

- In partnership with the ITS Professional Capacity Building Program and the ITS Outreach Program, develop resources, guidance documents, and communications materials that support technology transfer, customer outreach, and workforce development.

5.B.4.6 Engagement of Stakeholders

Coalition building is a key element to the success of MSAA, as improved operational efficiencies and coordination are dependent on creating a bridge between the transportation, ITS, and human services communities. Three levels of coalition building are utilized for the performance of key functions, ranging from day-to-day program management to technical support, advisory input, and oversight.

Level 1: **U.S. DOT Intermodal Program Management Team,** including the FTA, FHWA, and FMCSA. This core group performs essential program planning, management, and decision-making functions; monitors the course of the initiative; and is ultimately responsible for program outcomes.

Level 2: **Federal Interagency Program Support Group,** including all CCAM Federal partners, which form the Interagency Transportation Coordinating Council. This council includes representatives from 11 Federal agencies that have functions related to the provision of human services transportation. These agencies are:

- Department of Transportation
- Department of Health and Human Services
- Department of Labor
- Department of Education
- Department of Agriculture
- Department of Housing and Urban Development
- Department of the Interior
- Department of Justice
- Social Security Administration
- National Council on Disability

The Council has established six working groups:

- Education and Outreach
- Consolidated Access
- Regulatory Barriers
- Coordinated Planning
- Cost Allocation
- Useful Practices

Each working group is composed of 11 representatives from the participating agencies.

Level 3: **Stakeholder Steering Group,** consisting of community/consumer groups, industry organizations, transportation service providers, trade associations, and private businesses. These stakeholders participate in various capacities, including providing recommendations and assistance in coordination, outreach, and technology deployment. Additionally, special expert panels will be formed as needed throughout the course of the program to address specific subjects or issues such as defining performance measures.

In addition to the above three levels of stakeholder engagement, the MSAA Initiative is committed to, and will continue to promote, public awareness, community dialogues, and exchange of knowledge and information with stakeholders on challenges and opportunities facing today's human services transportation delivery. This public outreach effort has taken many different formats. Examples include:

Public Listening Sessions

- ITS Best Practices Workshop on Linking Technology with Mobility for Seniors and People with Disabilities (San Francisco, California, July 2004)
- Human Service Transportation Enhancement Public Listening Session (St. Louis, Missouri, May 2005)
- Mobility for All Session (Orange County, California, May 2006)

Focus Group Meetings (Washington, D.C., March/April 2005) comprising:

- Community transportation providers
- Public transit operators
- Public administrators
- Customer and advocacy groups
- Private industry and vendors

Expert Panel Discussions (by invitation only):

- Coordinating Human Services Transportation Performance Measurement, Expert Panel Discussion #1 (Arlington, Virginia, June 2005)
- ITS Technology Advancing Human Services Transportation, Expert Panel Meeting (Dallas, Texas, September 2005)
- Coordinating Human Services Transportation Performance Measurement, Expert Panel Discussion #2 (Arlington, Virginia, January 2006)
- Human services transportation and ITS in rural areas (Big Sky, Montana, August 2006)

5.B.4.7 Current Status and Accomplishments to Date

Phase 1 of the project, Foundational Research, was completed in October 2005. MSAA published its foundational research findings and developed a generic TMCC concept of operations. This concept of operations provides a TMCC system framework that is adaptable to specific site contexts and local needs.

MSAA is currently in Phase 2 of the program. Partnering with UWR, it will select up to ten communities for the planning and design of local models of TMCC. During this phase, an independent and interdisciplinary technical and management assistance team will be established to provide general technical assistance and exchange information across the project sites as needed. MSAA also will continue to promote stakeholder participation and education.

5.C Global Connectivity Initiative

One initiative is focused on integrating freight and transportation services. By establishing global connectivity through electronic networks, transportation connections are streamlined, leading to greater economic productivity. These activities fall under:

- Electronic Freight Management Initiative (EFM)

The intent of EFM is to demonstrate the use of an Internet-based information portal to improve the operation of a supply chain by providing authorized users with real-time information about the location and status of cargo shipments, and to reduce the paperwork associated with freight shipment.

5.C.1 Electronic Freight Management (EFM)

A common electronic freight manifest would improve the speed, accuracy, and visibility of information transfer in freight movement, reducing the cost of shipping and contributing to our Nation's economic growth.

5.C.1.1 Problem Statement

International trade comprises 25 percent of our gross domestic product. Current economic forecasts indicate that domestic freight volume will increase by 70 percent between 1998 and 2020.[28] Freight volume through our primary ports of entry could more than double. Freight movement, particularly international freight movement, is a complex set of processes involving the exchange of information between multiple entities (governmental and commercial) and multiple transportation carriers. A lack of effective information exchange leads to inefficiencies, including an increase in operating costs, congestion at the cargo transfer points, and errors in data transfer. Given existing and predicted capacity constraints within the United States, finding ways to improve the efficiency of moving freight into and out of our Nation's ports is critical to economic vitality.

5.C.1.2 Description of EFM

The goal of the Electronic Freight Management (EFM) Initiative is to bring improved operational efficiency, productivity, and security to the transportation system by promoting electronic data exchange along a supply chain from the point of original consignment to final delivery. Using the Internet to make data broadly available to any authorized and authenticated user in real time is key to improving the exchange of information along a given supply chain.

The EFM Initiative builds on two previous projects that focused on domestic supply chains: the O'Hare Air Cargo Security System and the Electronic Supply Chain Management. The EFM effort will test the technology and business-case elements of electronic sharing of information for an international supply chain deployment. The EFM Initiative includes the development of two key components: International Electronic Freight Standards and the Freight Information Highway.

International Electronic Freight Standards: Standardization of electronic freight data elements provides supply chain partners with a common language for connecting with other partners and ensures that electronic freight documents can be transferred across supply chains throughout the world. EFM works with international Standards Development Organizations to create data-level standards that are applicable globally and across many different contexts of freight movement—across modes, geographic regions, and industries.

[28] *http://ops.fhwa.dot.gov/freight/freight_news/FAF/talkingfreight/faf.htm.*

Freight Information Highway (FIH): This system will allow electronic messages to move through a web portal for all supply chain partners. Through the FIH, electronic message types and data elements will be linked, as will service architectures, allowing each component to be accessed in real time with a user view tailored to a specific user community.

5.C.1.3 Projected Outcomes

The end-state milestone of the EFM Initiative is the demonstration of a complete end-to-end transaction information system for an international supply chain along with the advantages of such a system. The ultimate goal, however, is the widespread implementation of EFM in the private sector. The EFM Initiative recognizes that achieving this goal will require close collaboration between government and industry. Stakeholder coordination, as well as outreach and awareness efforts, will be undertaken during all phases of the initiative.

Deployment of EFM could significantly increase the efficiency of freight by improving information transfer and sharing techniques among supply chain partners. Projected benefits are:

- Improved efficiency in the supply chain.
- Reduced paperwork associated with the movement of goods.
- Improved cycle times and reduced congestion, resulting in benefits to the individual participants as well as overall societal benefits of improved transportation networks.
- Reduced complexity in accessing information by authorized parties.
- Full cargo and asset visibility throughout the supply chain, with the ability to identify opportunities for increased efficiencies and improved security.

5.C.1.4 Why ITS?

The EFM Initiative seeks to employ the efficiencies of the Internet and advances in communications technologies to streamline paperwork and information processes associated with freight management. The resulting application will integrate transportation agencies and the freight industry to assist supply chain partners by using ITS to:

- Exchange standardized electronic information.
- Provide real-time information.
- Provide an open architecture in which shippers across all modes can access needed information.
- Allow information concerning freight to be made available for security screening.

5.C.1.5 Five-Year Horizon

The planned life cycle of the EFM Initiative is FY2004 to FY2007. It consists of three phases of activity: Developing the Foundational Infrastructure, Deployment Testing and Evaluation, and Outreach and Industry Awareness. The initiative has one key decision point.

Doing international business is rarely simple. For a seller to find a buyer, for a sales contract to be signed, for the goods to be shipped by the producer and received by the consumer, or for the payment to be made within the contractual deadline, each phase must take place within a preestablished system based on specific rules for trade.

The United Nations/Economic Commission for Europe (UN/ECE) has learned that the best results are gained through basing trade facilitation on a combination of business process facilitation and the opportunities offered by information technologies. By harmonizing and standardizing procedures and information flows, this combination of techniques simplifies and integrates the trading process.

The results: reduced trade-cycle time, simpler paperwork, incentives to harmonize national standards to international ones, and substantial cost savings.

From *Memorandum of Understanding on Standardization in the Field of Electronic Business,* 2000, between UN/ECE, International Electrotechnical Commission, International Standards Organization, International Telecommunications Union

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Phase II Electronic Supply Chain Manifest Project (ESCM) Facts and Figures:[29]

- **$20:** savings per shipment
- **32:** number of ESCM participants
- **3:** types of supply chain participants—manufacturers, motor carriers, airlines
- **81.8:** percentage of participants who said ESCM improved upon their current methods and could save time and effort
- **91:** percentage of participants who said ESCM has the potential to allow for better/easier scheduling of shipments under a wide-scale deployment scenario
- **54:** percentage of participants who recommended developing a "critical mass" of ESCM users to reduce or eliminate the need for duplicative efforts
- **100:** percentage of participants who indicated ESCM met or exceeded their expectations

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Phase 1: Developing the Foundational Infrastructure. Building on previous research, the goal of Phase 1 is to develop the supporting technical infrastructure that will support widespread adoption of EFM.

The foundational research for EFM is based on the results of the O'Hare Air Cargo Security System project and the Electronic Supply Chain Management project, which collectively delivered an automated system for approving truck-delivered air cargo. This initial deployment of an electronic system integrated ITS and private-sector company and cargo data. While the ITS program's evaluation revealed integration issues, the test also showed cost savings based on a comparison of processing time between manual processing and test-specific transactions.

These early results formed the basis of the EFM Initiative's first key decision point with the ITS Management Council. In November 2005, the Department determined that the initiative should continue since the results showed sufficient benefits and that the apparent integration issues could be resolved.

Phase 1 activities include:

- **Developing the EFM Freight Information Highway,** including a concept of operations and system architecture. The architectural specification that defines the Internet conduit for exchanging information will be openly published for adoption by supply chain parties and technology vendors. Advances in web services technology will also be incorporated into this phase of the initiative.
- **Continuing efforts to develop EFM International Standards,** which support the architecture and enable disparate companies in a particular supply chain to share data based on understood definitions and syntaxes. The EFM Initiative is working with national and international standards organizations to ensure harmonization of the data elements of the electronic manifest with the data elements that are reported to governmental agencies. This will ensure coordination with key programs such as:
  - U.S. Customs and Border Protection's next generation trade processing system, the Automated Commercial Environment (ACE).
  - The International Trade Data System, a multiagency component of ACE.
  - Other related government programs, such as the World Customs Organization's security framework.
  - Commercial initiatives such as the International Air Transport Association's eFreight and Cargo 2000.
- **Creating the EFM business case** that will include the initial deployment test plan and the high-level system design document. The business case will begin with a business process mapping of the "as is" supply chain to be used. This will lead to setting forth use-case documentation and identification of business requirements.

[29] *http://ops.fhwa.dot.gov/freight/intermodal/efmi/.*

Phase 2: Deployment Testing and Evaluation. The goal of this phase is to operationally test the EFM scaled to one supply chain. The demonstration test of the component capabilities will be designed in 2006 and conducted and evaluated in 2007. A U.S.-based retailer, Limited Brands, Inc., will test the EFM along a portion of its international supply chain. It is expected that, in using a single manufacturer's supply chain, the research team can better manage and evaluate the system inputs and outputs.

Figure 5.16 below illustrates the many players within such a supply chain.

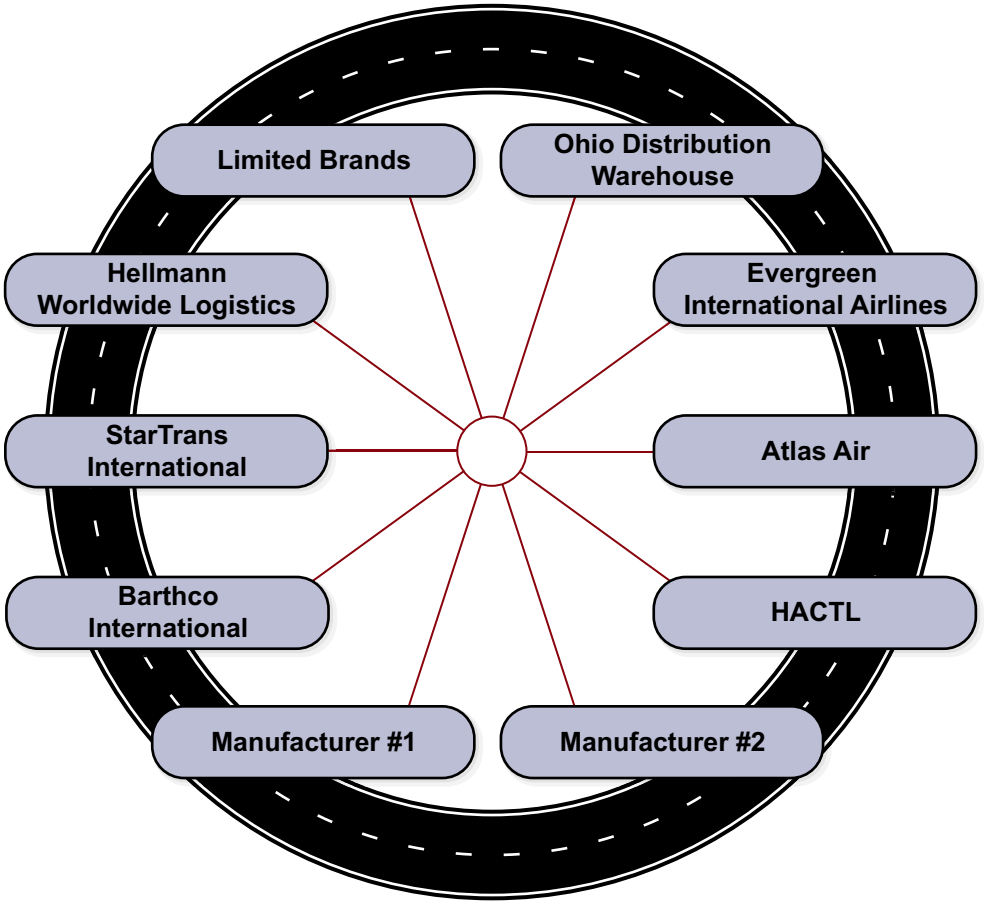


Figure 5.16: A Framework of Virtual Connections Between Supply Chain Partners

For the EFM evaluation, performance metrics will be designed to provide quantifiable data on EFM's achievements in the areas of stimulating productivity, developing international standards, and enhancing transportation efficiency. The evaluation will also be instrumental in defining the role of the FHWA and other government agencies and the impact of intermodal activities. The test will help answer questions such as:

- *Who will see the data exchanged via the EFM?*
- *What protections are accorded the data?*
- *Where will the data be stored?*
- *Who will have access to the data?*
- *What will be done with the data?*

These issues must be defined in consideration of the Privacy Act. Adoption will be based on clear legal restrictions guiding the collection, storage, and access of the data.

Phase 3: Outreach and Industry Awareness. Parallel to the EFM deployment and testing activities, the EFM Initiative will prepare a marketing plan to promote adoption of the EFM best practices. The plan will be developed around building awareness of the EFM results throughout industry. In cooperation with industry associations, the EFM Initiative will identify industry representatives who are seeking productivity gains with new information transfer and sharing techniques. The plan will also include technical assistance efforts that help shippers and other supply chain parties to prepare for adoption of the EFM.

Throughout Phase 3, the EFM Initiative will conduct outreach and build awareness through:

- Joint presentations with project partners at conferences in 2006 and 2007.
- Partnerships with industry associations to monitor the EFM tests and assist in continuously engaging new participants in the EFM Initiative.
- Development of articles that highlight features and best practices of EFM for trade journals.
- Development of a portal website to distribute critical guidance documents and technical guidance measures.

The outreach effort will also include measuring the type and number of industries adopting EFM best practices to determine the success rate for expansion.

The following roadmap illustrates the timing of these activities over the next five years. In total, these activities address a broad range of both technical and nontechnical issues that will need to be resolved before deployment.

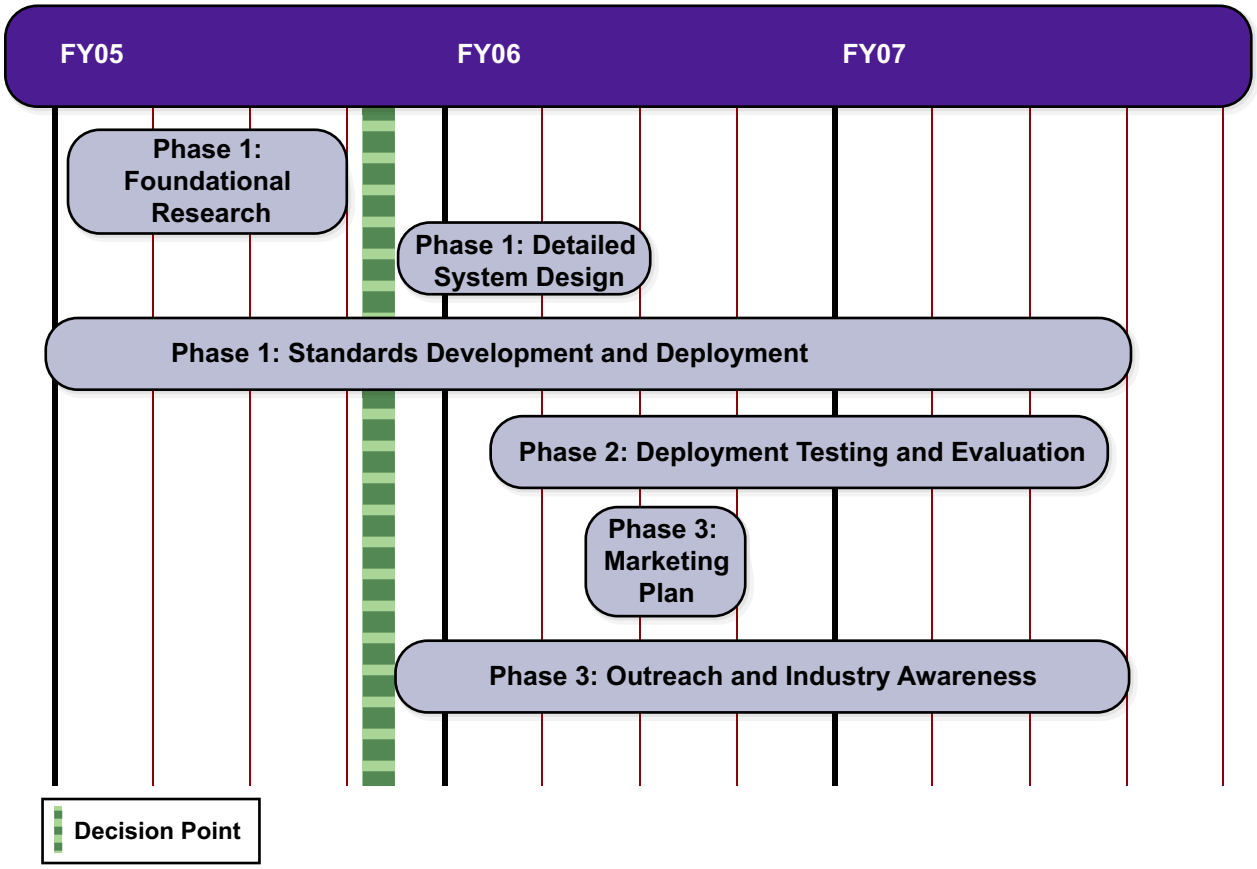


Figure 5.17: Five-Year EFM Roadmap

Major activities scheduled for the EFM Initiative include:

Phase 1: Developing the Foundational Infrastructure

- Work with an expert panel comprising web services experts, including users.
- Build relationships with supply chain shippers who are technology leaders.
- Continue outreach to various standards bodies to ensure compliance with developing standards.
- Complete the EFM system design and concept of operations.
- Tailor the concept of operations with Limited Brands and their supply chain partners.

Phase 2: Deployment Testing and Evaluation

- Develop the EFM system with Limited Brands in Columbus, Ohio.
- Develop a test and evaluation master plan to guide the execution of the EFM deployment.
- Implement, integrate with existing systems, and test the systems.
- Conduct evaluation, testing, data collection, and analysis.
- Define the role of FHWA and other government agencies.

Phase 3: Outreach and Industry Awareness

- Conduct outreach and build awareness within industry through conference presentations and publications in trade journals.
- Provide technical assistance and guidance.
- Measure results.

5.C.1.6 Engagement of Stakeholders

The success of EFM is dependent on the development of effective partnerships between government and industry. Some of the key stakeholder groups are freight shippers, freight carriers, air cargo handlers, and logistics providers, each of which has different information needs. By incorporating stakeholder involvement in all phases of the project, the EFM Initiative seeks to create a universal freight manifest that will meet the needs of all its users. The Federal role will focus on:

- Clearing institutional barriers.
- Demonstrating standardization of information exchange between supply chain partners.
- Building public-private partnerships that showcase operational improvements.
- Identifying criteria that move the industry toward implementation of this freight technology and associated operational practices.

Stakeholders involved in the EFM Initiative include:

- Freight shippers
- Freight carriers
- Air cargo handlers
- Logistics providers
- Freight forwarders
- Air carriers

- Rail lines
- Ports
- Technology service providers
- Standards organizations focused on freight movement
- Transportation Security Administration
- Customs and Border Patrol

For the EFM Initiative, the Department is engaging the Intermodal Freight Technology Working Group (IFTWG)[30] through the Intermodal Association of North America to raise industry awareness through presentation panels at the IFTWG's semiannual meetings. The IFTWG is a public-private partnership focused on the identification and evaluation of technology-based options for improving the safety, efficiency, and security of intermodal freight movement. It comprises representatives throughout the intermodal freight industry and community, including major companies such as Union Pacific and Maersk, small logistics service providers, and carriers.

Additionally, the EFM Initiative has formed an EFM Stakeholder Panel to advise specifically on the technical aspects of EFM and the Freight Information Highway. The panel comprises representatives with expertise in web services design, freight logistics, transportation standards, and air cargo transportation. The EFM Stakeholder Panel has provided substantial input on the EFM concept of operations and business-use case documents. This group is currently providing feedback on the preliminary system design. They are also engaged in providing ongoing advice and review on detailed designs, standards issues, and overall project plans.

5.C.1.7 Current Status and Accomplishments to Date

The EFM Initiative has developed the Phase 2 project plan and has completed a concept of operations that lays out a specific architecture identifying business processes and how they should relate to each other. The EFM Initiative is now developing the detailed design of the system and continues to coordinate standards development. It is also developing a specification for the web services technologies and a means for exchanging information. This specification will be used to define a platform that government can use for its various information exchanges in supply chains.

[30] Available at *http://ops.fhwa.dot.gov/freight/intermodal/iftwg.htm.*

6. ITS Deployment Support Programs

6

The ITS Deployment Support Programs form a critical foundation for the ITS program to achieve its goals. These programs are crosscutting, interconnected efforts that comprise the ITS knowledge platform and information transfer activities to State and local transportation agencies. The common factor among these programs is the ability to deliver learning opportunities, technical assistance, technology transfer, and guidance, and to disseminate information on the research, technologies, and strategies that are developed by the ITS program.

The ITS Deployment Support Programs play a valuable role in ensuring the success of the ITS program. They are the mechanisms through which the ITS program directly learns of the ITS needs of State and local agencies. They are also the ITS program's mechanisms to facilitate effective, successful deployments and to ensure that agencies understand both the value of ITS and the uses for the technologies and strategies. Additionally, the ITS Deployment Support Programs are instrumental in meeting the purposes of the ITS program as stated in SAFETEA-LU, Section 5303(b).

ITS Deployment Support Programs

- National ITS Architecture Program
- ITS Standards Program
- ITS Professional Capacity Building Program
- Program Assessment Program
- ITS Outreach Program

Two of the five deployment support programs—the National ITS Architecture Program and the ITS Standards Program—are essential to proper integration of technologies and systems to enable regional interoperability. By fostering the principles of effective integration around the Nation, these programs facilitate the ability of jurisdictions to operate collaboratively to harness the benefits of a regional approach to transportation problems. Integration and a regional perspective allow agencies to set meaningful performance metrics to measure progress on solving transportation problems.

The three other programs—the ITS Professional Capacity Building Program, the ITS Program Assessment Program, and the ITS Outreach Program—compile and process the information that forms the basis for disseminating knowledge to, and developing skills within, the broader ITS community. These programs produce a variety of resources that facilitate and enhance decision-making, learning, and successful deployment and operations. The resources can be tailored and targeted to address the needs of a variety of audiences.

These support programs evolve as the ITS program's needs change. Each stands ready to incorporate needs identified with the new research initiatives.

By providing a focused effort at the Federal level, the Nation benefits by having:

- Consistent guidance on achieving interoperability.
- A collection of local experiences that can be shared by peers and decision-makers to utilize what works and avoid what does not.
- A repository for ITS learning materials that addresses the essentials of effective ITS deployment and job performance.
- Programs that promote professional connections and learning opportunities around the Nation.
- Outreach and awareness of available resources.

- In-depth technical assistance that guides consistent deployment and integration around the Nation.
- Processes and knowledge needed to make solid investment decisions tailored to meet specific regional and local needs.

For each Deployment Support Program, this chapter provides:

- A program description.
- Accomplishments to date.
- Activities on the five-year horizon.
- International activities (if applicable).

Table 6.1 shows how each deployment support program meets the Congressional purposes as stated in SAFETEA-LU, Section 5303(b).

Table 6.1: Purposes of the ITS Deployment Support Programs

Purposes	National ITS Architecture	ITS Standards	ITS Professional Capacity Building	ITS Program Assessment Program	ITS Outreach Program
(1) Expedite deployment and integration of ITS for consumers of passenger and freight transportation in urban and rural areas	X	X			
(2) Ensure that Federal, State, and local transportation officials have adequate knowledge of ITS for consideration in the transportation planning process			X	X	X
(3) Improve regional cooperation and operations planning for effective ITS deployment	X	X			
(4) Promote the innovative use of private resources			X	X	X
(5) Facilitate the introduction of vehicle-based, safety-enhancing systems in cooperation with the motor vehicle industry		X		X	X
(6) Support the application of intelligent transportation systems that increase the safety and efficiency of commercial motor vehicle operations			X	X	
(7) Develop a workforce capable of developing, operating, and maintaining intelligent transportation systems			X		
(8) Provide continuing support for learning and information exchange for ITS operations and maintenance	X	X	X	X	X

6.A National ITS Architecture

The National ITS Architecture and ITS Standards define the framework and interconnections guiding deployment of ITS in the U.S.

6.A.1 Description of the Program

The National ITS Architecture provides a common framework for planning, defining, and integrating ITS. It defines the functions that agencies need for information flows to and from the road infrastructure, traffic management centers, in-vehicle devices, and other systems. The National ITS Architecture provides a menu of options for agencies to determine which functions meet their region's needs. Additionally, the National ITS Architecture is the foundation for identifying where and how ITS Standards are applied within systems.

The National ITS Architecture Program was established in 1992 to coordinate the development and maintenance of the National ITS Architecture, using teams from industry, the public sector, and academia. Today, the program continues to be responsible for facilitating the delivery of technical assistance, training, and outreach to State and local agencies.

In response to a TEA-21 provision, FHWA issued a final rule in January 2001 on ITS Architecture and Standards that requires all State and local agencies to develop their own regional ITS architectures.[31] Similarly, the FTA issued a notice on ITS Architecture Policy on Transit Projects.[32] Both the rule and the policy took effect in April 2005. With these regulations, all ITS projects must adhere to the regional architectures to receive Federal funding. The Department instituted these requirements recognizing that regional ITS architectures facilitate the ability of agencies to plan, design, and deploy interoperable systems and to better share information, manage traffic, and increase safety and mobility across jurisdictions.

6.A.2 Accomplishments to Date

The National ITS Architecture Program has delivered several significant accomplishments. It has:

- Developed four new user services:
  - Disaster Response and Evacuation
  - Maintenance and Construction Operations
  - Archived Data
  - Highway-Rail Intersection
- Increased program focus on national *511* support and transportation security, which addresses the security concerns of transmittal of data and communications within a transportation system.
- Enhanced the National ITS Architecture with four major revisions that

[31] Available at *http://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm.*

[32] Available at *http://ops.fhwa.dot.gov/its_arch_imp/policy_2.htm.*

address needs identified by Federal, State, and local agencies.

- Developed the Turbo Architecture software tool to assist in developing regional and project architectures that are consistent with the National ITS Architecture.
- Conducted more than 150 architecture training courses around the country for more than 3,000 public- and private-sector professionals.
- Facilitated implementation of the ITS Architecture and Standards Rule/Policy, including the development of the *Regional ITS Architecture Guidance* document[33] and other guidance to assist in the development of regional ITS architectures around the Nation.
- Conducted more than 100 workshops around the country to assist agencies in developing their regional ITS architectures.
- Facilitated the completion of 242 regional ITS architectures; another 34 are in development, as illustrated in Figure 6.1.
- Delivered the National ITS Architecture to the Canadian government to develop the Canadian National Architecture, using almost all of the U.S. user services and adding several unique ones. The team developing the Canadian architecture included members of the U.S. Architecture Team currently maintaining the National ITS Architecture.

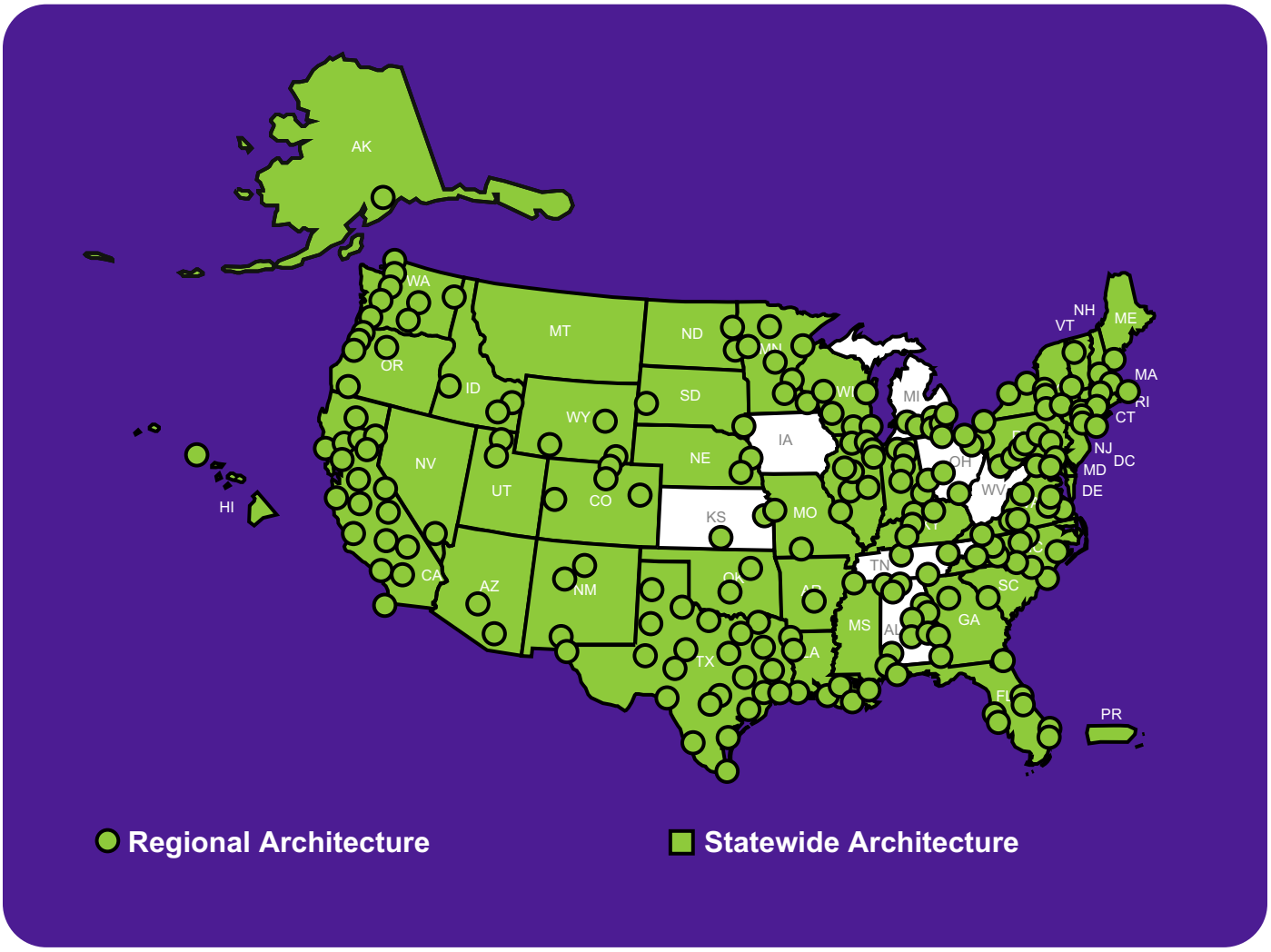


Figure 6.1: Status of Regional ITS Architectures in the U.S. as of Summer of 2006[34]

[33] Available at *http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13598.pdf.*

[34] From FHWA Office of Operations, *http://ops.fhwa.dot.gov/its_arch_imp/regarch_map.htm.*

- Distributed copies of the U.S. National ITS Architecture to transportation officials from six continents, reflecting a worldwide interest. Several of these countries have developed their own National ITS Architectures based on the U.S. model.
- Completed a program with Canada to develop the Border Information Flow Architecture, a template for border crossings between the U.S. and Canada. The Department worked in close partnership with U.S. trade regulatory agencies such as the Bureau of Immigration and Customs Enforcement, the Bureau of Customs and Border Protection, and their Canadian counterparts. In 2006, the U.S. began working with Mexico to establish a similar program along the U.S.-Mexican border.
- With the National ITS Architecture Deployment Team, facilitated the use of a systems engineering process in ITS project implementation by developing guidance and delivering training and workshops around the Nation and providing technical assistance as needed by State and local agencies.

6.A.3 Five-Year Horizon

National ITS Architecture Program activities on the five-year horizon are listed below.

Maintenance of the National ITS Architecture

- Respond to stakeholder feedback and industry trends as the ITS program evolves by maintaining the National ITS Architecture.
- Define new National ITS Architecture market packages and user services as necessary.
- Ensure that the Turbo Architecture software tool stays up to date and is useful in the development and maintenance of regional and project ITS architectures.

Outreach and Training

- Support regional and project ITS architecture development through training, workshops, and technical support before, during, and after regional ITS architecture development.
- Continue outreach to ITS deployers regarding systems engineering and the available training on the National ITS Architecture and Turbo Architecture.

Stakeholder Engagement

- Continue to work with Mexico to establish a Border Information Flow Architecture for border crossings between the U.S. and Mexico.

The National ITS Architecture is a living document that responds to needs as the environment changes. The ITS program anticipates that new Department research initiatives will result in updates and changes as they create an increased need to communicate and exchange data. The successful use of the National ITS Architecture can be seen in the integration of regional ITS architectures with the transportation planning process at the State and local levels.

6.B ITS Standards

The National ITS Architecture and ITS Standards define the framework and interconnections guiding deployment of ITS in the U.S.

6.B.1 Description of the Program

ITS Standards are critical to the goals of interoperability and integration of regional and local transportation systems. Effective regional transportation operations rely on the ability of the various ITS deployments to integrate across devices manufactured by different ITS vendors. For instance, a city may seek to link its traffic management center (TMC) to dynamic message signs (DMS) in a neighboring town to allow the operation of the signs on weekends when the town's staff is not present. By using standards-based ITS systems, open data exchange and control can occur without the costly fix of linking the proprietary software systems. The city and town benefit from interoperable operations, and manufacturers find a wider marketplace for their ITS devices and systems.

ITS Standards are the path to interoperability of regional ITS systems. They are protocols that establish the communication rules for how ITS devices and centers "talk" to one other. They are also the definitions for shared information. Standards are complex communication interfaces that are designed through a formal, consensus-based approach by groups of manufacturers, State and local transportation professionals, professional associations and experts, and Federal ITS specialists.

The ITS Standards Program has established partnerships with a number of Standards Development Organizations (SDOs) for the development of ITS Standards and for the coordination of development activities. In addition to developing standards, the SDOs have played an important role in helping to promote the use of standards among both manufacturers and deployers. They provide a network for the distribution of ITS Standards information to State and local agencies and transportation professionals around the Nation.

The use of ITS Standards is encouraged by the Department to ensure effective regional transportation operations. The ITS Standards Program provides Federal leadership that supports the development and testing of ITS Standards, assists in the delivery of technical assistance to State and local jurisdictions that undertake ITS deployments, works with SDOs to maintain the technical validity of existing standards, and works with the broader transportation community to identify when new ITS Standards are needed. The ITS Standards Program delivers training and workshops; develops experience-based deployment guidance and tools; and provides up-to-date information about ITS Standards for the Nationwide transportation community.

6.B.2 Accomplishments to Date

To date, 81 ITS Standards have been finalized. They have been developed, approved by a community of experts, voted on, and published by the SDOs. The ITS Standards Program and the SDOs have made information on all ITS Standards available to the transportation community. An additional 19 standards are in the process of being balloted and published, and approximately 10 standards are still under development. Several published standards, such as the one governing DMS, are in their second version.

As the new research initiatives get underway, the ITS Standards Program has identified how the existing ITS Standards map to the new initiatives. For example, many of the center-to-center standards and center-to-device standards will support the ICM Initiative. The dedicated short-range communications (DSRC) standards are the basis for the VII and CICAS Initiatives.

Other accomplishments include:

Training: Over the last five years, in partnership with the Institute of Transportation Engineers, the ITS Standards Program has provided free one-day courses on ITS Standards Overview, Center-to-Center Standards, Dynamic Message Signs Standards, and Advanced Transportation Controller Standards. The courses are offered at locations across the country. They provide transportation professionals with ITS Standards awareness and basic understanding of each standards application area and the applicable standards. The courses are updated regularly to reflect the newest standards developments each year.

Nebraska Division of Roads and ITS Standards. The Nebraska Division of Roads provides an example of a State agency that has deployed a standards-based Highway Conditions Reporting System. The system consists of a network of data collection devices, sensors, and software systems that relay information about road conditions, closures, restrictions, incidents and status in order to:

- Immediately update the Nebraska *511* website and inform the *511* call center operators.
- Provide data to the Nebraska State Police about transportation system conditions and incidents.

This system is based on three key ITS Standards:

- Message Set for Advanced Traveler Information Systems
- Location Referencing Message Specification
- International Traveler Information Systems Phrase Lists

Standards Guides: The ITS Standards Program has developed three technical reference guides to assist ITS project managers with the implementation of:

- The National Transportation Communications for ITS Protocols, a family of standards that defines protocols and profiles that are open, consensus-based data communications standards.
- The IEEE 1512 standards related to Incident Management.
- The Traffic Management Data Dictionary and the Message Sets for External Traffic Management Center Communication standards.

These guides explain the benefits of each family of standards and how the standards are used in ITS deployments, and provide a summary of the technical aspects of the standards. Each guide contains sections for program managers and for engineers new to ITS Standards.

ITS Standards Website: The ITS Standards website (*www.standards.its.dot.gov)* was launched in 1998. It is the program's primary outreach and communications tool. The current website features a recently updated interface, a searchable standards development status database, and content and database functions that are integrated with the National ITS Architecture website. Monthly visits to the website have tripled since its relaunch.

ITS Standards Advisories: ITS Standards Advisories are short (three-to-seven-page) documents that provide "snapshots" of the development, testing, and deployment status of ITS Standards. Between January 2003 and August 2004, the program published Advisories for DMS, environmental sensor stations (ESS), DSRC, Archived Data User Service, and Incident Management User Service. In 2006, the program will develop Advisories for center-to-center and center-to-field communications and will provide updates to the existing DMS and ESS Advisories.

ITS Standards Fact Sheets: The ITS Standards Program has produced a set of ITS Standards Fact Sheets—concise (one-page) descriptions of an ITS Standard. Each Fact Sheet contains basic technical information about the contents of the standard, how the standard is used, and where to obtain the standard. Standards Fact Sheets are distributed via the Standards Program website.

6.B.3 Five-Year Horizon

For the next five years, the ITS Standards Program has identified some key activities, listed below.

ITS Standards Expert Panel

- Define and establish the ITS Standards Expert Panel, as required in SAFETEA-LU Section 5307(a)(4).

Standards Development

- Complete 110 standards by 2007.
- Identify how existing standards might be modified to better support the new research initiatives and when new standards will be needed.
- Continue the ITS Standards testing program wherein published standards are tested by an independent test team. Test results are provided as feedback to the appropriate SDOs. The appropriate standards working groups incorporate the feedback into the next version of the standard.

Standards Deployment

- Facilitate standards use by State and local transportation agencies. The ITS Standards Program, in partnership with the ITS Professional Capacity Building (PCB) Program, will develop and deliver a structured learning program on ITS standards. New web-based learning materials will be produced and provided to the ITS community.
- Continue the delivery of a solid base of technical assistance and awareness.
- Continue production of educational and outreach materials—fact sheets, advisories, standards guides.

The success of completing the standards has been possible due to the collaborative efforts between the ITS Standards Program and the SDOs. Future success of ITS standards will be evident through greater State and local interoperability and interjurisdictional coordination.

6.C ITS Professional Capacity Building (PCB)

The ITS Professional Capacity Building Program is a dynamic learning gateway for those involved with ITS across all modes.

6.C.1 Description of the Program

Successful on-the-job performance for ITS transportation professionals requires Federal, State, and local agencies to prioritize workforce and professional development. The Department launched the ITS Professional Capacity Building (PCB) Program in 1996 to equip transportation professionals at all levels of government with the ITS-related knowledge, skills, and abilities to perform effectively in their jobs. The ITS PCB Program accomplishes this goal by:

- Developing training, curricula, and other learning materials that support the professional development of current transportation professionals and decision-makers in ITS.
- Facilitating the development of the future generation of ITS professionals in partnership with universities and colleges.
- Providing technical assistance that connects peers and allows them to share valuable experiences.
- Integrating lessons learned, best practices, and cutting-edge information into learning materials.
- Promoting awareness of the program's resources through outreach activities.

6.C.2 Accomplishments to Date

The ITS PCB Program has played a vital role in creating the energized and capable workforce needed for successful deployment of ITS across the Nation. Since 1996, key program activities have included:

- Training via classroom and distance learning.
- Education and certificate programs.
- Technical assistance through the use of experts, peers, and online resources.
- Core curriculum development.
- Local PCB programs.

6.C.2.1 Training

The ITS PCB Program develops and delivers training to Federal, State, and local ITS professionals throughout the Nation. Since 1996, the program has:

- Trained over 20,000 transportation professionals through classroom and web-based training. Learning has focused on effective deployment skills; best practices and lessons learned from deployments; changes in policies and regulations; and new Department initiatives.

- Brought together a multimodal audience for training that includes ITS and non-ITS professionals in highways, transit, commercial vehicles, planning, and operations, from the awareness level to the specialized level.
- Incorporated an instructional systems design approach to the development of all training products to more effectively foster adult learning.
- Developed new and innovative methods, such as the Talking Transportation and Technologies (T3) webinars, to more effectively deliver ITS learning. To date, 26 T3 webinars have been hosted.[35]
- Developed a partnership with the CITE Consortium, which shares web-based training in ITS with over 70 universities worldwide. The CITE Consortium has developed and hosted the ITS PCB web-based training. It recently developed new certificates in ITS learning for graduate students and professional continuing education. Additionally, the CITE Consortium, with the ITS PCB Program, modeled a new approach to the delivery of ITS training called blended learning. Blended learning combines the important features of web-based learning (available anytime; flexible and convenient) with classroom learning (networking with peers; one-on-one instruction from a professor). With the blended learning approach, completion of web-based training has increased to nearly 92 percent of participants.
- Worked with customers and partners to conduct needs assessments to identify new needs and gaps and to expand the reach of the program.

6.C.2.2 Education

The ITS PCB Program works with universities to develop the next generation ITS workforce. The relationship between the ITS PCB Program and academia is based on a four-point strategy for closer coordination and collaboration. The strategies include:

- Developing the next generation workforce through exchange of learning materials and ongoing discussions about curriculum design.
- Providing continuing education for ITS professionals by sharing ITS training materials with university-based Local Technical Assistance Programs and universities that are part of local PCB programs, and through certificate programs.
- Instituting a technology transfer and information exchange mechanism as part of the ITS PCB Program to transfer relevant ITS research to practicing ITS professionals in a timely manner.
- Coordinating the development of innovative training and education approaches by leveraging the efforts under the University Transportation Center legislative earmarks.

Accomplishments to date also include the development of new ITS certificate programs at Virginia Polytechnic Institute and State University for graduate students and professional continuing education. The certificate program provides a model for other schools to replicate.

6.C.2.3 Technical Assistance

The program has incorporated the ITS Peer-to-Peer (P2P) Program into its operations to provide hands-on, specific technical assistance to ITS professionals in unique situations. The P2P Program has provided opportunities for ITS professionals to learn from their peers. Since 2000, it has sponsored over 500 peer site visits to agencies and practitioners facing difficult challenges in ITS deployment.

6.C.2.4 Core Curriculum

The program has developed a set of products that fill important needs in learning:

- ITS Core Curriculum and Curriculum Guide:[36] A curriculum that guides professionals' learning in ITS and an online tool that helps tailor the curriculum to specific job types.
- ITS Foundation Course: A course for new Federal ITS Specialists that offers a sampling of core subjects to better prepare them for their roles and responsibilities.

[35] Archived T3 sessions are available at *http://www.pcb.its.dot.gov/T3/default.asp.*

[36] The *ITS PCB Curriculum Guide* can be found at *http://www.pcb.its.dot.gov/CG.asp.*

6.C.2.5 Local PCB Programs

Recognizing that one central program cannot meet all the learning needs around the Nation and that learning must be tailored based on project type and regional conditions, the ITS PCB Program has seed-funded the establishment of local programs. These local programs make use of the materials developed by the ITS PCB Program and tailor them for local needs. The seed-funding criteria state that the programs have to develop a replicable and financially sustainable business model. In addition, there is agreement to provide the ITS PCB Program with updates and changes to the learning materials so that the materials remain continuously relevant.

6.C.3 Five-Year Horizon

The ITS PCB Program's mission for the next five years is to provide a robust learning environment for transportation professionals and others in which to develop ITS knowledge, skills, and abilities for the enhancement of the safety, congestion reduction, global connectivity, and security of the transportation system.[37]

Results from a 2005 needs assessment suggest that, in addition to new ITS learning needs, the program must focus on creating a virtual and innovative environment for delivering learning. The ITS PCB Program is facing the same demands as the consumer market to move toward virtual interactivity and electronically accessible resources.

To meet these challenges, the PCB Program developed a set of strategies to guide it through a transformation that will increase opportunities for online learning and create a more accessible and interactive learning environment for ITS practitioners. The strategies are:

- Create a "push-pull" approach to learning.
- Develop a method for a continuous assessment of needs.
- Establish and deliver a comprehensive resource base.
- Better integrate technical assistance.
- Create a continuous learning framework for practitioners and agencies.
- Develop a virtual environment for learning and problem solving.
- Formalize a network of champions and partners.
- Provide a local perspective and presence.
- Create a framework for promoting the development of ITS professionals.

Many of these strategies are being met through current program activities. To complement existing activities, the program will implement the efforts listed below.

Training

- Expand the curriculum to incorporate cutting-edge foundational content on interoperability and integration, regional management and operations, and research initiatives. Deepen the curriculum to reflect more technical specialties in critical areas such as ITS Standards, systems engineering, transit, and CVO.
- Update the ITS Curriculum Guide to reflect the evolving nature of ITS careers.
- Review existing classroom courses to determine which can be transformed into a self-guided learning format, either as web-based courses or as easy-to-follow presentations.
- Continue to grow T3 webinars.
- Develop a web-based version of the ITS Foundation Course for the broader ITS audience.

[37] ITS PCB Program Plan, May 2006. Available at *www.pcb.its.dot.gov.*

- Promote blended learning for a more interactive distance learning environment for critical ITS topics.

Education

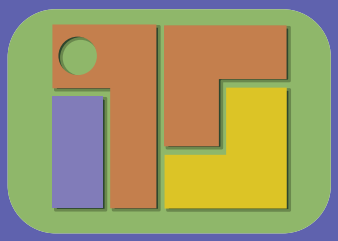
- Develop a strategy to identify and possibly leverage the resources and opportunities in ITS learning associated with universities and colleges.

Technical Assistance

- Develop a new critical resource—the ITS Solutions Center—that integrates the ITS PCB learning resources into an online, accessible tool. The ITS Solutions Center will provide synthesized learning to ITS professionals around the Nation just-in-time, on-the-job.
- Integrate the P2P Program with the ITS Solutions Center and ITS T3 sessions to decrease the time between the need for technical assistance and its delivery to a wide audience.
- Incorporate into the ITS Solutions Center information from the ITS Program Assessment Program's knowledge resources for decision-makers on costs, benefits, lessons learned, and deployment statistics.
- Incorporate changes in technology and practice into subject areas for which technical assistance contacts are available.
- Redesign the P2P Program to provide more effective just-in-time information through a broader, updated set of peers with linkages to experts through professional organizations and a set of interim steps to build learning incrementally.

The ITS Solutions Center. Much of the transformation of the ITS PCB Program business model relies on modifying existing learning materials for use in targeted, timely technical assistance. A new resource under development is the ITS Solutions Center, an online tool for providing just-in-time learning. The ITS Solutions Center will be the vehicle for easy access to the program's web-based learning, classroom-based materials, best practices, lessons learned, and targeted technical assistance.

The ITS Solutions Center is being created in response to demand expressed by ITS practitioners around the Nation. The combination of the ITS Solutions Center with other program resources—the ITS P2P Program, the ITS PCB curriculum, and the ITS T3 Program—will create a powerful synergy for continuous self-paced learning.



ITS Curriculum

- Update the ITS Curriculum based on a new continuous needs assessment process.
- Develop new ITS curricula-critical learning areas such as ITS Transit, ITS CVO, ITS Standards, ITS and Systems Engineering, and others based upon need.
- Link the ITS Curriculum Guide to the ITS Solutions Center.

Local PCB Programs

- Create business model templates to encourage creation of more local ITS PCB programs.

6.D ITS Program Assessment

The only source of knowledge is experience.

– Albert Einstein

6.D.1 Description of the Program

Continuous success in ITS deployment is based on the ability to provide critical information to decision-makers—State and local executives, transportation planners, ITS designers and developers, and transportation operations and maintenance units. The ITS Program Assessment Program conducts activities in two primary and critical areas:

- Providing an understanding of the value, effectiveness, and impact of ITS through the evaluation of project deployments around the Nation.
- Collecting and providing knowledge, information, and feedback critical to ensuring progress toward the vision of integrated ITS and to achieving ITS deployment goals.

6.D.2 Accomplishments to Date

Key activities of the program include:

- Independent Evaluations
- Deployment Statistics
- Knowledge Resource Development

6.D.2.1 Independent Evaluations

The program is responsible for conducting independent evaluations of State- and local-based ITS programs, deployments, and field operational tests (FOTs). Evaluators will review new ITS technologies, systems, and processes against hypotheses and metrics for performance. The result will be data on project effectiveness, costs, benefits, and consumer acceptance. The evaluation allows for the development of lessons learned on implementation and institutional issues. It also allows the program to develop important documentation on these issues. In measuring project effectiveness, the ITS Program Assessment Program has used the Government Performance and Results Act[38] as guidance to set metrics for measuring the impact of ITS on the Nation and to gauge the ITS program's effectiveness in meeting the Department's transportation goals.

6.D.2.2 ITS Deployment Statistics

As part of monitoring the effectiveness of the ITS program, the Program Assessment Program tracks key indicators of deployment around the Nation. Since 1996, the program has tracked data on how much ITS is deployed, how much is integrated, and the variations by metropolitan and rural areas. This is an important element of ITS Program Assessment since

[38] See *http://www.whitehouse.gov/omb/mgmt-gpra/index.html* for details on this Act.

deployment is an indirect measure of effectiveness of the ITS program. Information regarding deployment activities has provided feedback on progress of the program that can help stakeholders establish strategies for continued market growth. Understanding the rate of ITS deployment in various metropolitan areas has developed insights for the ITS program, which have led to program changes, redefinition of goals, and maintenance of current program direction, all in response to meeting stakeholder needs. For example, metropolitan areas that are lagging in deployment can be identified and targeted for action to stimulate deployment. Application areas that are not being deployed widely can also be identified and the ITS program can adjust its activities, such as by increasing outreach.

To date, the ITS Program Assessment team has completed evaluations for:

- 46 Field Operational Tests / 6 active
- 4 ISTEA Metropolitan Model Deployment Initiatives / None active
- 3 TEA-21 Model Deployments / 2 active
- 33 Integration Program Evaluations / 16 active
- 395 Integration Program Self-evaluations (monitor/support) / 327 active
- 1 Major ITS Initiative / 1 active
- 2 Exploratory Initiatives / 2 active

The national ITS Deployment Statistics Survey was first conducted in 1997. It measures ITS deployment against Department goals set in 1996. As data was collected, its purpose evolved to be an important source of information for State and local decision-makers on what is deployed in comparable cities and how well it works. Industry finds this data useful to forecast how markets for new technologies are developing. Compiling statistics has since evolved into a state-of-the-practice activity, allowing the following:

- Federal staff can learn more about ITS deployment in particular program areas (such as freeways, arterials, transit, or public safety) or geographic areas (metropolitan areas and States).
- Federal, State, and local elected officials with authority to allocate funds to ITS deployments can find decision-making support information.
- State and local transportation officials interested in learning more about how other agencies have deployed ITS can find comparison information to help in their own deployment.
- ITS vendors doing market analyses will find cost-benefit information.
- Journalists and researchers looking for empirical data on ITS deployment and members of the general public can learn more about ITS.

Deployment statistics are captured on:

ITS Infrastructure:

- Arterial Management Systems
- Freeway Management Systems
- Transit Management Systems
- Incident Management Systems
- Emergency Management Systems
- Electronic Payment Systems
- Traveler Information
- Information Management
- Crash Prevention and Safety
- Roadway Operations and Maintenance
- Road Weather Management
- Commercial Vehicle Operations
- Intermodal Freight

Intelligent Vehicles:

- Collision Avoidance Systems
- Driver Assistance Systems
- Collision Notification Systems

Survey data is posted in the ITS Deployment Statistics website at *http://www.itsdeployment.its.dot.gov/.*[39] The survey data has allowed the program to develop a collection of information about ITS within each State. Information can be found at *http://www.itsoverview.its.dot.gov/ITSInMyState.asp,* which has become a focal point for sharing intrastate ITS information.

[39] Results from a limited 2005 update will be posted in the summer of 2006.

6.D.2.3 Knowledge Resource Development

The Program Assessment Program plays a pivotal role in providing critical information to decision-makers as to why ITS is an appropriate choice as part of their transportation network. Information from the evaluations on costs and benefits feeds into the development of decision support tools in the form of online databases and reports. The ITS databases and websites that provide information are:

- **ITS Benefits Database:** This database contains information about the impact of ITS projects on the operation of surface transport in the areas of safety, efficiency, mobility, productivity, environment, and customer satisfaction, as reported in print and online sources.
- **ITS Costs Database:** This database contains unit cost estimates for more than 200 ITS technologies as well as system costs for sample ITS deployments. Unit costs are the costs associated with an individual ITS element; system costs summaries are examples of ITS projects that have been deployed.
- **ITS Lessons Learned Database:** This database provides the ITS professional community with quick and easy access to lessons learned from the experiences of stakeholders in their planning, deployment, operations, maintenance, and evaluation of ITS. The database provides all ITS stakeholders with convenient access to lessons learned knowledge so that they can make informed decisions.
- **Applications Overview:** This website is a one-stop source of information on over 100 specific ITS technologies. Information provided includes technology definitions; benefits; costs, deployment statistics; lessons learned; available evaluation documents; related ITS initiatives; available resources; and State-specific information.
- **Integration of Planning Tool and Costs and Benefits Databases:** The ITS Deployment Analysis System (IDAS) is a tool developed by the ITS program to assist State, regional, and local planners in estimating the costs and benefits of ITS investments during the transportation planning process. The ITS Program Assessment Program integrated its databases for costs and benefits into IDAS so that planners can use the most up-to-date information when running their analyses.

Important documents that have aided decision-making are:

- **ITS/Operations Resource Guide**:[40] This guide is a comprehensive listing of over 400 documents, videos, websites, training courses, software tools, and Department points of contact related to innovative transportation strategies such as ITS. The printed version is updated annually and the online version is updated semiannually.
- **ITS Benefits Special Studies Series:** These include brochures, crosscutting studies, case studies, guides on implementation, and technical reports.

The program also tracks the information needs of State and local decision-makers to ensure that they are appropriately identified and satisfied. Over the years, the need for information has evolved from a desire for basic awareness and understanding to a need for tailored, synthesized "how-to" information. The ITS Program Assessment Program is currently designing new approaches to deliver this higher level of responsiveness.

6.D.3 Five-Year Horizon

The ITS Program Assessment Program will continue to provide evaluations, statistics, knowledge resource development, and ad hoc policy studies as program gaps reveal themselves and new products are needed. The program will maintain the databases and websites to ensure that they are continually up to date for decision-makers.

Over the next five years, there will be new challenges. The program is designing a programmatic approach to meet these challenges. As the ITS community matures in its awareness and understanding of ITS, users of the program's materials have requested a higher level of synthesis to help in solving their problems. The program's initial "push" of information on ITS is turning into a "pull" by users whose needs have changed.

[40] Available at *http://www.resourceguide.its.dot.gov/.*

Program staff have recognized that basic lessons learned, data on costs and benefits, and technology overviews provide a solid foundation for understanding why to deploy ITS. Users are now interested in a deeper sense of how to deploy ITS and are looking to the program to provide insight into state-of-the-practice stories about what comparable cities and States are doing. In response to these needs, the ITS Program Assessment Program is pursuing the activities listed below.

Evaluations

- Complete evaluations that are underway.
- Choose new evaluations selectively, based on whether a test site offers unique characteristics in deploying ITS or whether results will produce new insights into ITS effectiveness.

Deployment Statistics

- Continue to collect data on deployment and integration around the Nation.
- Publish information and promote widespread dissemination.

Continuation of Knowledge Resources

- Evolve the program's materials to reflect state-of-the-practice results for users. The program is planning to implement a data collection effort to create a new baseline of users' needs and then to explore how the program's materials can be reoriented and tailored to provide more effective information for decision-makers. Additionally, program staff are reviewing how a synthesis of their databases and studies can provide more in-depth policy answers. An important planned outcome will be a greater focus on multijurisdictional and multistate cooperation.
- Tailor the program's materials to meet the needs of the planning community. Many of the program's products are oriented toward decision-makers and the engineers who focus on system operations. User feedback has revealed that transportation planners approach ITS problem-solving differently. In making their decisions, planners look at the overall system problem and impact and find solutions. ITS may be only one of those solutions. For example, using the Applications Overview, transportation engineers might identify dynamic message signs for providing real-time traffic information to drivers. Planners, in contrast, want the materials to help them understand how ITS will reduce congestion along a particular corridor. The program will reorient existing materials to address these needs.
- Use the program's materials to help decision-makers frame the transportation problem facing them. Many decision-makers have stated that they want the program's resources to help them scope out the breadth and depth of their problem to ensure that ITS investment is an appropriate solution. Program staff are reviewing plans to provide comparative information on transportation problems using existing statistical data, the ITS in Your State stories, and other materials. For example, for a local decision-maker trying to understand whether a particular ITS safety system might be useful in reducing accidents, it would be helpful to compare local statistics with those of other States and cities to see whether the problem was the same size, to determine whether these States and cities had deployed the ITS system (and if so, to examine the results), and to learn about alternative solutions.

6.D.4 International Activities

The ITS Program Assessment Program has been an active participant in key forums that facilitate the exchange of information and practices on important indicators of success in ITS. In 2002, it played a primary role in establishing the International Benefits, Evaluations, and Costs (IBEC) working group. This forum allows for an international exchange on information and techniques used to evaluate the costs and benefits of ITS throughout the world. IBEC's membership now exceeds 300 ITS professionals from over 30 countries.

6.E ITS Outreach

Through clear communications and outreach activities, the ITS program creates widespread awareness of the benefits of ITS. Used in combination, these activities create a transfer mechanism for knowledge and technology, cutting-edge research results, and deployment support assistance to State and local agencies.

6.E.1 Description of the Program

The ITS Outreach Program plays a critical role in ensuring that the American public has easy access to information on ITS. It is responsible for providing a consistent message on ITS, printing and distributing key research findings, disseminating information and products from the other ITS programs as well as products that it creates, and representing the ITS program at national conferences and meetings.

The ITS Outreach Program created and maintains a critical library of resources as well as the ITS program's website. The website provides an organized portal to the rest of the ITS programs: it publishes information on key events in ITS, highlighting a new lesson learned and benefit for each month. It describes the major research initiatives and provides updates on their progress. It contains a consolidated listing of all of the technical assistance resources as well as knowledge and decision-making resources. Finally, it has links to partners in other Department modes that support the activities and programs in ITS.

6.E.2 Accomplishments to Date

Key activities in the program include:

- Disseminating and maintaining up-to-date information on ITS.
- Providing coordinated Department publicity on major initiatives in support of Department policy and events.
- Maintaining the ITS JPO website.

6.E.2.1 Information Dissemination

The Outreach Program informs transportation practitioners and decision-makers about the benefits of ITS so that they can make informed decisions about ITS deployment. It also gives them the technical support needed to deploy ITS through:

- **ITS Cooperative Deployment Network (ICDN):** In 1998, the ITS Outreach Program, in cooperation with public- and private-sector professional associations, launched a shared electronic newsletter to disseminate up-to-date information on ITS research and deployment activities. In addition to a website, an ICDN newsletter was mailed twice weekly to nearly 10,000 subscribers. The ICDN provided a means for the industry to find information on the latest developments in the fast-changing ITS world. In 2005, the ICDN broadened and evolved into the newsletter of the National Transportation Operations Coalition (NTOC), which is committed to improving transportation safety and mobility through transportation management and operations, supported by ITS.

- **ITS Electronic Library (EDL):** In 1999, the ITS Outreach Program unveiled its publicly accessible online collection of ITS research and technical assistance documents for projects undertaken with support from the Department. Today, the collection has 1,800 documents and is among America's most comprehensive libraries of ITS documents.

6.E.2.2 Publicity and Conference Support

The Outreach Program works closely with the Department's Office of Public Affairs to provide publicity on releases of ITS products, results, and findings. Additionally, the Outreach Program arranges conference support at major events. A few of these events are described below:

- ***511*—America's Traveler Information Telephone Number:** In 2000, the FCC approved the Department's petition for assignment of a three-digit telephone number for local travel information. Traveling to national transportation conferences, the Outreach Program publicizes the *511* program, its potential benefits, and the availability of Federal grants for implementation. It coordinated a major press event in 2001 when the first *511* call was made. Today, *511* is available to one-third of Americans, with new deployments every month.
- **National Intelligent Vehicle Initiative Meeting and Demonstration:** In 2003, the Department convened the National Intelligent Vehicle Initiative Meeting and Demonstration to generate national interest in crash avoidance technologies. It was attended by more than 200 participants. A highlight of the meeting was a demonstration of the first "intelligent intersection" test site in McLean, Virginia. Scores of national and regional news organizations attended the demonstration. Today, crash avoidance technologies are deployed in many commercial and private vehicles in the United States.
- **Support for American Interests at International Venues.** In 2004, the ITS Outreach Program, in partnership with ITS America, helped to sponsor the first-ever American Pavilion at the ITS World Congress. The American Pavilion became the centerpiece of the U.S. presence at the Congress, offering demonstrations, displays, and discussions of America's ITS activities. This Pavilion provided support for American interests that had not existed before. Building on the 2004 success, the ITS Outreach Program again supported an American Pavilion at the 2006 ITS World Congress in England.

6.E.2.3 ITS JPO Website

The Outreach Program maintains oversight for the ITS program's website and publishes new information as it becomes available. Notable activities include:

- **ITS Website Serves as Portal to ITS Deployment Support and as Key Link to New Initiatives:** In the 1990s, "paper" was the key information medium for the Federal ITS program. As the ITS website and electronic library grew in the 2000s, it became clear that information about ITS could be more economically and broadly disseminated via its website. In the current decade, the ITS program produces few printed documents, relying instead on its website as its principal means of information distribution. Each day, there are more than 7,100 website visits. This figure far exceeds the number of individuals that the Outreach Program could otherwise reach.
- **ITS Reorganization Supported by Major New Website Redesign, Fact Sheet Development, and ITS Product "Branding":** In 2005, following the Department's 2004 ITS research reorganization, the ITS Outreach Program designed a new website reflecting the reorganization and simplifying access to deployment support. Fact sheets and other "branded" outreach products supporting the ITS program's safety, mobility, and productivity values were developed. In the first 12 months since the redesign, website usage more than doubled, from 90,000 page views per month to 221,300.

6.E.3 Five-Year Horizon

The ITS Outreach Program recognizes that broad dissemination of information is key to successful ITS deployments. In the next five years, the program will address the challenges of:

- Increasing public access to ITS deployment support information through the ITS website and electronic library, printed material distributed at national conferences, and presentations and speeches at key national industry meetings.

- Increasing public awareness of ITS benefits and deployment resources so that more ITS is deployed.
- Implementing new usability and technological improvements for the ITS website and EDL to ensure the broadest possible dissemination of ITS information and products necessary to improve transportation in the U.S.

Major activities for the next five years are listed below.

Information Dissemination

- Disseminate the ITS/Operations Resource Guide and other program assessment publications (including the biennial Benefits, Costs, Lessons Learned Update) through the ITS EDL, website notices, the NTOC newsletter, national and international conferences, and mail.
- Post new ITS research findings in the EDL. Advertise new contents on the ITS website front page, through the NTOC newsletter, and at national conferences and meetings.

Publicity and Conference Support

- Transportation Research Board
- ITS America annual meeting
- ITS World Congress meeting
- CTIA Wireless annual conference
- Institute of Transportation Engineers annual meeting
- American Public Transportation Association

ITS Program Website

- Post dual-format documents with updated URLs.
- Improve Google search engine instituted for electronic library.
- Develop major ITS initiative webpages as new initiatives are undertaken.
- Continuously review performance measures (and take action, if necessary) to ascertain “market penetration” and expansion.
- Conduct major redesign of the ITS website and implement new technology to improve user navigation, expand user base, and present the current nature of the ITS program.

7. Ongoing Research Programs and SAFETEA-LU Programmatic Activities

The ITS program is composed primarily of the nine major initiatives and the ITS Deployment Support Programs. However, ITS research and development activities include other important efforts that should be noted, such as TEA-21 legacy programs and SAFETEA-LU mandated programs.

Legacy programs are research programs that were initiated during TEA-21 and are on a path toward completion or forming a foundation for other research efforts. These include:

- National *511*
- Wireless Enhanced 9-1-1 (WE9-1-1)
- Commercial Vehicle Information Systems and Networks (CVISN)
- Surface Transportation Security and Reliability Information System Model Deployment (*i*Florida Program)

SAFETEA-LU mandated three specific research programs:

- A rural interstate corridor communications study (Section 5507)
- A program for road weather research and development (Section 5308)
- A multistate corridor operations and management effort, specifically directed at the I-95 Corridor Coalition (Section 5211(b))

This chapter presents a description of each program or research effort, its status and accomplishments to date, and the five-year horizon.

7.A Ongoing Research Programs

To facilitate the transfer of research into deployment and to fill the gaps with technology assistance to State and local areas, the ITS program continues to support four key programs that were initiated before the recent program restructuring. These ongoing efforts represent critical areas that are national in scope and have significant policy implications. The programs are:

- National *511*
- Wireless Enhanced 9-1-1 (WE9-1-1)
- Commercial Vehicle Information Systems and Networks (CVISN)
- Surface Transportation Security and Reliability Information System Model Deployment (*i*Florida Program)

7.A.1 The National 511 Program

The implementation of *511* continues to be a success. *511* is easy to remember and provides a direct service to its users by bringing ITS, traffic and incident management, public transportation, and weather information together under one umbrella. Where it has been implemented, it has helped local and interstate travelers and shippers to avoid delays and save time.

7.A.1.1 Description of the Program

In 1999, the U.S. DOT envisioned establishing a uniform abbreviated dialing code to provide travelers with a simple, easy to remember, and useful telephone number for multimodal travel information. Numerous sources of information for travelers already existed, each having its own ten-digit telephone number. The casual user rarely knew these numbers, and often there were multiple numbers for one metropolitan area or State. At one point, there were over 300 different telephone numbers providing travel information in the United States. A 1999 test drive from Washington, D.C., to New York City required 11 different numbers to access travel information.

Under TEA-21, the ITS program worked with the FCC to designate a public number for traveler information. On July 21, 2000, the FCC designated *511* as the single travel information telephone number available to States and local jurisdictions across the country. *511* is an easy-to-remember telephone number, available nationwide. It provides current information about travel conditions, allowing travelers to make better choices with regard to time, transportation mode, and route. It is important to note that there are no Federal requirements or mandates to implement *511*.

Mindful of both the opportunity and the challenge that implementing *511* presents, the ITS program and AASHTO established the *511* Deployment Coalition in conjunction with many other organizations, including the American Public Transportation Association and ITS America. The goal of the *511* Deployment Coalition is "the timely establishment of a national *511* traveler information service that is sustainable and provides value to users."[41] The intent is to implement *511* nationally using a bottom-up information-sharing approach along with a cooperative dialogue through the national associations.

The ITS program works in partnership with the FHWA and FTA to support and facilitate the planning and technical and institutional establishment of *511* traveler information services within each State. The ITS program also explores the synergies with other programs and the major initiatives. For example, through the *Clarus* Initiative, *511* could connect with weather reporting systems, or, through the Road Weather Research Program, *511* information could be incorporated with maintenance data on road composition and road treatment. SAFETEA-LU validated the direction of the *511* Program and required further progress in creating multijurisdictional interoperability and comprehensive websites for users.

[41] *511* Deployment Coalition. 2005. *Implementation and Operations Guidelines for 511 Services, Final Draft Version 3.0.* Available at *http://www.deploy511.org/docs/511%20Chicago2005/511%20Guidelines%20Version%203.0%20%20FINAL%20*DRAFT.pdf.

Subtitle B, Section1201(a)(1): CONGESTION RELIEF

Section 1201 directs the establishment, in all States, of real-time incident reporting systems and interoperability between State systems. These systems form the foundation, in most cases, for a quality 511 service:

(1) IN GENERAL.—The Secretary shall establish a real-time system management information program to provide, in all States, the capability to monitor, in real-time, the traffic and travel conditions of the major highways of the United States and to share that information to improve the security of the surface transportation system, to address congestion problems, to support improved response to weather events and surface transportation incidents, and to facilitate national and regional highway traveler information.

(2) PURPOSES.—The purposes of the real-time system management information program are to—

(A) establish, in all States, a system of basic real-time information for managing and operating the surface transportation system;

(B) identify longer range real-time highway and transit monitoring needs and develop plans and strategies for meeting such needs; and

(C) provide the capability and means to share that data with State and local governments and the traveling public.

Section 5306(b)(3)(B): RESEARCH AND DEVELOPMENT

Section 5306 directs that priority be placed on activities:

(B) ensuring that a national, interoperable 5–1–1 system, along with a national traffic information system that includes a user-friendly, comprehensive website, is fully implemented for use by travelers throughout the United States by September 30, 2010;

7.A.1.2 Status and Accomplishments to Date

As of April 2006, 28 services were operational in all or part of 23 States, making the *511* service available to over 93 million Americans, or 32 percent of the Nation's population. Forty-four States and the District of Columbia are planning or implementing systems with assistance from the ITS program. In addition to these States, five metropolitan areas—San Francisco, Cincinnati, Tampa, Orlando, and the southeast Florida region—have active *511* systems that provide tailored traffic information. By 2006, half of the country is expected to have access to *511*. The goal for 2010 is to have *511* services available nationwide. Figure 7.1 shows *511* deployment to date.

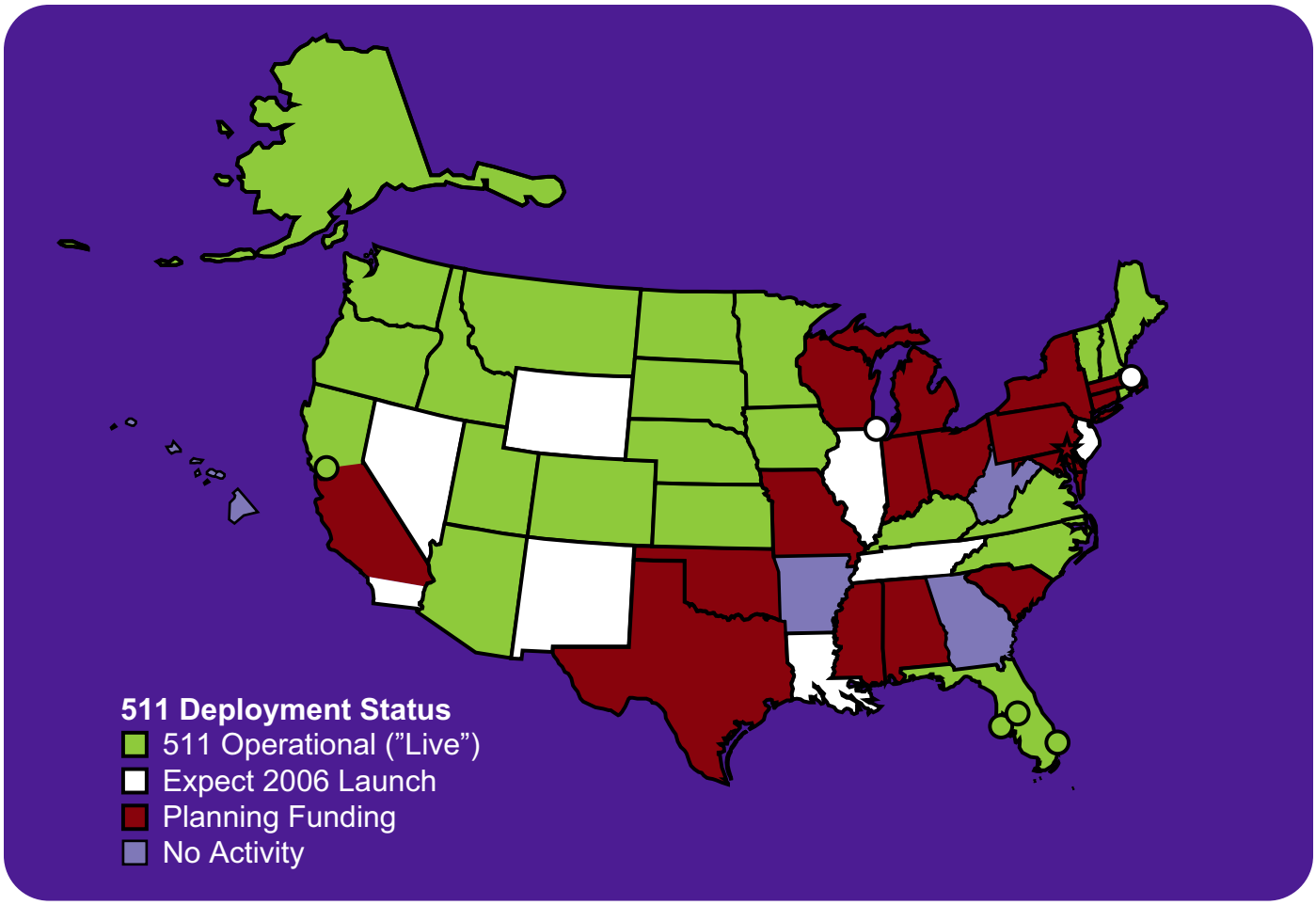


Figure 7.1: Nationwide *511* Deployments as of Summer 2006[42]

The ITS program's *511* efforts have tracked closely with the stages of the *511* Deployment Coalition's National Plan. Activities include:[43]

- **Planning:** Provide planning assistance grants to States and agencies to facilitate the development of a deployment plan. To date, 44 States and the District of Columbia have received *511* planning assistance funding, and 37 States and the District of Columbia have completed their planning efforts.
- **Implementation:** Deliver technical assistance to facilitate implementation and achieve nationwide deployment by 2010.
- **Monitoring Usage of the System:** In September 2005, over 1.1 million calls were made to *511*; in April 2006, the total number of calls reached 50 million.
- **Service Enhancement, Service Evaluations, and Performance Monitoring:** In 2002, Arizona was selected in a national competition to demonstrate and upgrade the State's existing *511* service. The *511* Model Deployment provided for a wide range of enhancements to the existing service, including the addition of several new categories of information and significant redesign of the user interface. In 2005, an independent evaluation of the Model Deployment was conducted. The overall result of the evaluation indicated that the Model Deployment was successful in providing a dramatic improvement in Arizona's original *511* service. Usage increased dramatically, and approximately 70 percent of surveyed callers indicated they were satisfied with information content.[44] Using the ITS program's approach, several other

[42] *511* Deployment Coalition. 2006. *511 National Progress Report.* Available at *http://www.deploy511.org/docs/511%20National%20Progress%20Report%202006.pdf.*

[43] More detail on these stages can be found in the *511 National Progress Report.*

[44] Batelle Memorial Institute and University of Arizona. 2005. *511 Model Deployment Evaluation Final Report.* Prepared for the FHWA. Available at *www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/14248.htm.*

States have launched evaluations and enhancements. Evaluating the usefulness of *511* has been an important way for States to understand how the system is serving its intended customers. Tracking user awareness of *511*, especially how users learned about it, is aiding deployers in understanding the effectiveness of marketing campaigns.

- **Training and Outreach:** Provide training and outreach to States and utility companies throughout their planning processes.
- **Branding and Marketing:** Once a *511* service has been deployed, successful marketing is key to making potential users aware of the service and continuing to attract new customers. Public agencies must often create innovative ways to market their services. In-kind media sharing and partnerships with transportation and tourist-related private companies are just some of the methods that deployers use to promote *511*.

7.A.1.3 Five-Year Horizon

The ITS program will continue to work in partnership with the *511* Deployment Coalition to facilitate implementation and encourage all States and regions to deploy *511* as soon as possible. Primary to these efforts will be the technical assistance and guidance required by States, regions, cities, utility companies, and agencies for *511* implementation. Success stories and lessons learned will be documented. In July 2006, the third national *511* conference was held, aimed at regions still planning deployments and those looking to improve the effectiveness of existing services.

The ITS program will continue to monitor technical and business developments to aid implementers in taking full advantage of the evolving technologies to offer better services and obtain a better return on public investment. The program will maintain current implementation and operating guidelines for *511* services, with an increased focus on web and alert services, to assist and encourage service consistency and to reinforce the view that *511* is the Nation's focal point for high-quality government-provided traveler information.

The ITS program will also research challenges that remain to *511* implementation and opportunities to enhance services through evolving technologies. Key areas of focus are:

- **Interoperability Using Voice-over-Internet Protocol (VoIP):** New technologies, such as VoIP, are adding new layers of complexity to the process of ensuring proper call routing for *511* services. VoIP presents challenges compared to traditional telephone networks because calls do not go through traditional telecommunications switches, where call routing programming is typically enabled. Further, Internet-Protocol (IP) phones can be moved from location to location and plugged into a user's computer without the "network" knowing where the caller is, which makes routing the call to the proper *511* service virtually impossible. As VoIP services are integrated with other forms of wireless technologies, callers will be able to operate a VoIP phone as though it were a cellular phone, allowing even greater mobility. Nationally, the FCC has placed a high priority on addressing these issues through Wireless Enhanced 9-1-1 services. The *511* Deployment Coalition has initiated direct conversations with leading VoIP service providers to determine how best to support *511* call routing. The ITS program will continue to support these efforts through research, funding, and technical assistance.
- **Digital Convergence:** The old model of voice-based content being provided solely over a phone or radio and data- and image-based content being provided only over a computer or television is rapidly disappearing. Mobile phones can now receive and display podcasts, and computer networks can now handle phone traffic as easily as and less expensively than traditional voice networks. The lines between phone, computer, television, and radio are blurring rapidly. For *511* to continue to build its position as the Nation's access point for transportation information, *511* services cannot focus only on serving the traditional telephone call. With support from the ITS program and the *511* Deployment Coalition, several agencies have begun down the path of broadening *511* beyond just the phone call. This convergence may very well bring new opportunities for creative public-private business models for *511* branded services.
- **Content versus Ease of Use:** An issue that will continue to face both legacy deployers and new deployers is the increasing amount of data available to traveler information systems. Each day, transportation agencies

are improving their ability to generate information on the status of the transportation system. However, the telephone-user interface is not yet designed to carry large amounts of data in an easily accessible manner. *511* deployers must consider:

- How to add elements such as congestion, speed, and travel data to their services without overwhelming the caller.
- How to include multimodal information while keeping the user interface simple and intuitive.
- How to balance content with simplicity.

The ITS program will continue to support the *511* Deployment Coalition in researching these issues and providing solutions. Continuing ITS program activities supporting *511* will form the basis for working toward meeting the SAFETEA-LU goal for the ITS program to ensure that a national, interoperable *511* system, along with a national traffic management information system that includes a user-friendly, comprehensive website, is fully implemented for use by travelers throughout the U.S.

Evidence of Impact and Effectiveness

- The winter of 2005 saw Oregon DOT's *511* service break its previous single-day call volume record of 43,078 calls, set during a January 2004 winter storm. A single-day usage record of 47,289 calls was set on December 30, 2005, due to a massive storm in the State. Entire roadways were covered by mudslides, shutting down major corridors throughout the affected region.

- In September 2005, the Virginia *511* service's ability to deliver Amber Alert information was put to the test. After a Statewide Amber Alert was issued, motorists were directed via VDOT's dynamic message signs to "Dial *511*." Between 5:00 a.m. and 12:00 p.m., the interactive voice response system handled a total of 26,832 calls, an average of 3,671 calls per hour.

- In July 2005, a series of forest fires ravaged the suburbs of Phoenix and surrounding cities. Living in one of the first States to deploy *511*, Arizona's citizens were well versed in the benefits of using *511*, and call volume shot up to over 160,000 calls during that month.

- Winter 2005 saw record-breaking usage of *511* in the States of Kansas, Montana, Nebraska, North Dakota, and South Dakota. During a single storm in November 2005, these States—which share a telephony infrastructure to support individual State *511* systems—received over 330,000 phone calls. Kansas's *511* set a new daily call record with 36,308 calls on November 28, 2005.

- During a late-winter storm on March 21, 2006, Nebraska's *511* broke its daily call record when it received 94,370 calls. South Dakota's *511* set a new daily call record with 30,293 calls on March 19, 2006. During that same day, all of the Upper Plains States again received over 330,000 calls—a total of nearly 700,000 call-minutes. During both of these storms, even though call volumes resulted in multiple State systems accessing overflow lines, no callers received busy signals.

7.A.2 The Wireless Enhanced 9-1-1 Project (WE9-1-1)

Work done by the ITS program and its industry and public-sector partners on the WE9-1-1 Initiative created the technical and institutional framework for the current NG9-1-1 Initiative. The WE9-1-1 Initiative provided 9-1-1 systems with the capability to locate wireless callers; the NG9-1-1 Initiative will further improve 9-1-1 service by allowing communication from a variety of devices and through a variety of media.

7.A.2.1 Description of the Project

In 2006, the ITS program completed work supporting the implementation of Wireless Enhanced 9-1-1 (WE9-1-1) services. Currently, 98 percent of America's population can be located quickly when making emergency calls from residential landline phones. However, more than one-third of 9-1-1 calls are now placed from wireless phones, and up to one-half of these calls cannot be delivered within the enhanced 9-1-1 system because of lack of accurate location information. This is a particular problem when cellular 9-1-1 callers report crashes, since the callers are often not able to determine and report their precise location. As former Secretary of Transportation Norman Mineta noted in a 2002 interview:

> *Events of September 11 highlight the need to be able to quickly and precisely locate people when they make 9-1-1 calls on cellular phones. When people are injured, response time is critical in determining survivability, and bringing experts together like this will help expedite deployment of wireless E9-1-1.*[45]

The Department has a long history of promoting and supporting 9-1-1 as the Nation's official emergency access telephone number. Former Secretary Mineta launched the WE9-1-1 Initiative in April 2002 to accelerate the availability of this emergency service. Through the Secretary's WE9-1-1 Initiative, the Department developed a Priority Action Plan, created technical assistance products for public safety answering points (PSAP), and conducted a technology innovation roundtable that fostered the creation of the NG9-1-1 Initiative. Deployment is complex; locating wireless callers requires new technologies as well as changes in the processes for handling and responding to emergency calls.

Deployment consists of two steps. Phase I requires carriers, upon appropriate request from a local PSAP, to be able to report the telephone number of a wireless 9-1-1 caller and the location of the antenna that received the call. With this information, the PSAP operator is able to call the caller back if the call is disconnected. Knowing the location of the cell-phone tower transmitting the call allows the WE9-1-1 system to direct the call to the appropriate PSAP.

Wireless Phase II requires the wireless carrier to more precisely locate the caller by providing latitude and longitude information—known as automatic location identification (ALI)—to the dispatcher. Two technologies exist to provide the necessary Phase II data—handset-based and network-based. Handset-based technology requires that existing cell phones be capable of providing ALI, which may require replacing older models. Network-based

[45] U.S. Department of Transportation Press Release FHWA 7-02, April 8, 2002. Available at *http://www.fhwa.dot.gov/pressroom/fhwa0207.htm.*

technologies—such as PDAs or wireless-enabled laptops—work with all existing wireless phones but can be less accurate.

Wireless Phase I also provides the contingency service in the event that Phase II fails. Phase I development creates a migration path to Phase II infrastructure and establishes relationships with all parties involved.

Priority Action Plan: The ITS program convened key stakeholder representatives from the public-safety, communications, and State and local government communities to formulate and initiate actions to accelerate WE9-1-1 availability. Stakeholder groups formed under this initiative include a Steering Council and a Working Group. In 2003, the WE9-1-1 Steering Council forwarded a Priority Action Plan to the Secretary of Transportation, highlighting six urgent priorities:

- Establish support for statewide coordination of WE9-1-1 technology and identify contact people within each State for each stakeholder group.
- Help convene stakeholders in appropriate 9-1-1 regions to facilitate more comprehensive, coordinated implementation of wireless location technologies.
- Examine cost recovery and funding issues at the State level.
- Initiate a knowledge transfer and outreach program to educate PSAPs, wireless carriers, and the public about wireless location issues.
- Develop a coordinated deployment strategy encompassing both rural and urban areas.
- Implement a model location program.

These actions are directed at 9-1-1 stakeholders at large. As such, the Department does not "own" these actions; rather, it is one of many organizations working to accelerate WE9-1-1 deployment. Specifically, the Department's WE9-1-1 Initiative conducted a Wireless Implementation Program that delivered technical assistance, guidance, and training to accelerate PSAP readiness for WE9-1-1. Efforts included:

- **Wireless Implementation Program:** The ITS Public Safety Program provided funding for the Wireless Implementation Program. The program was led by the National Emergency Number Association (NENA) in partnership with U.S. DOT, the Association of Public-Safety Communications Officials, and the National Association of State 9-1-1 Administrators. This program produced a clearinghouse of model documents and reference information for PSAPs, educational materials and regional forums, and a detailed national database of WE9-1-1 implementation status.
- **Technology Innovation:** In late 2002, the Department sponsored a 9-1-1 Technology Innovation Forum that engaged information technology experts in a reexamination of WE9-1-1 technological approaches. This formed the basis for the NG9-1-1 Initiative and for current stakeholder activities to implement IP-based solutions for emergency call delivery.

7.A.2.2 Current Status and Accomplishments to Date

Progress on implementing WE9-1-1 has been significant, as illustrated in the Wireless Deployment Profile (WDP).[46] The WDP is a four-year picture of the status of implementation at the State and county levels. The initial WDP was based on a detailed survey in 2002 of all 3,141 counties in the U.S. to determine readiness for and deployment of WE9-1-1 services. The information is updated regularly based on carrier filings with FCC. A detailed follow-up survey was completed in May 2006.

From a handful of PSAPs serving as trial sites in late 2001 and early 2002, Phase II (delivery of caller's location) is now available to almost 75 percent of the U.S. population. In 2001, there were few wireless 9-1-1 calls with caller location. Now, four years into the Department's initiative, there will be 40 to 60 million wireless calls with location provided.[47] Despite this success, work remains to be done.

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[46] NENA/U.S. DOT. See *http://www.nena9-1-1.org/pages/ContentList.asp?CTID=6* for details.

[47] Estimate calculated from NENA-DOT projected wireless implementation percentages and CTIA 9-1-1 call volume estimates, both of which are included elsewhere in this report. The range is offered because of uncertainty over the penetration of location-capable handsets among some providers.

The Wireless Deployment Profile: 2002-2006 County Implementation

	Phase I	Phase II
Fall 2002	37 percent	9 percent
Spring 2006	81 percent	62 percent
Population Served		
Spring 2006	86 percent	74 percent

Figure 7.2 shows the percentage of counties per state that were WE9-1-1–capable as of spring 2006.

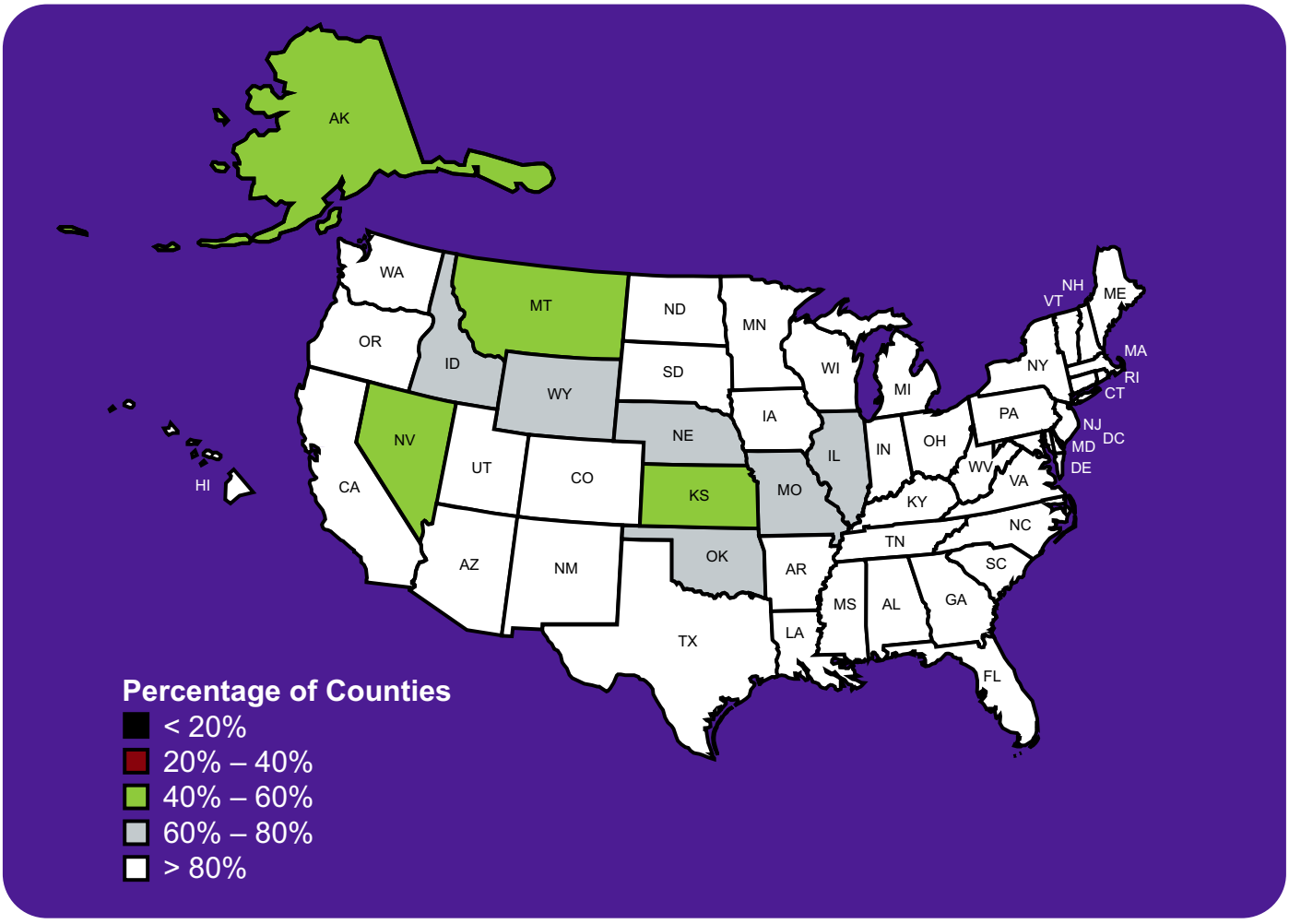

Figure 7.2: Percentage of Counties with Wireless E9-1-1 Capability, Spring 2006

In November 2003, the Government Accountability Office (GAO) commented on the FCC and DOT activities in WE9-1-1. The GAO recommended that "DOT work with State-level E9-1-1 officials, the National Emergency Numbers Association (NENA), and other public safety groups to determine which public safety answering points will need to have their equipment upgraded."[48] The Department concurred with GAO's conclusion. The survey and results noted above were used to address the GAO recommendation.

Public Law 108-494,[49] enacted in late 2004, directed NHTSA and the National Telecommunications and Information Administration (NTIA) to establish a joint grant program to assist with the implementation and operation of 9-1-1 services. Under this legislation, NHTSA and NTIA must create an E9-1-1 Implementation Coordination Office, establish a joint program to facilitate coordination and communication, and provide 9-1-1 matching grants to eligible entities.

With the completion of the ITS-funded WE9-1-1 Initiative, NHTSA has continued efforts to facilitate the deployment of WE9-1-1 services. Under programs that address Emergency Medical Services, NHTSA continues to provide technical assistance to States and national organizations to achieve the goals of the national EMS Agenda for the Future, including WE9-1-1. Additionally, the NHTSA-managed Mayday/9-1-1 FOT demonstrating the benefits of integrating telematics and automated collision notification with the 9-1-1 system was completed. ITS program activities provide the foundation for the NHTSA-NTIA program.

7.A.2.3 Five-Year Horizon

Work under the WE9-1-1 project was completed in 2006. However, trends in telecommunications mobility and convergence have put the Nation's 9-1-1 system at a crossroads. Based on decades-old technology, it cannot handle the text, data, images, and video that are increasingly common in personal communications. Each introduction of a new access technology, such as wireless, or expansion of system functions, such as location determination, has required significant engineering and system modifications. The 9-1-1 system cannot realistically be revamped for each new communications technology; the system itself must be redesigned to be "plug-and-play." The partnership efforts and results from the WE9-1-1 project have created the foundation for the NG9-1-1 Initiative, which is addressing this issue.

While the WE9-1-1 Initiative's goal was to ensure that emergency calls from cellular phones are identifiable and locatable, the NG9-1-1 Initiative recognizes that future calls will originate from a much wider range of technologies, including text messaging, WiFi phones, and portable computers. Building from the institutional and technological foundation established under the WE9-1-1 Initiative, the NG9-1-1 Initiative will ensure that all forms of communication are capable of reaching PSAPs with the proper identification and location information.

The ITS program will continue to support the Department in furthering the WE9-1-1 efforts. Improving 9-1-1 service by ensuring that calls placed from the roadway are located accurately, expanding access to 9-1-1 service to devices other than telephones, and making data from crash sites available to PSAPs are all expected to improve response times to crashes as well as the quality of information available to PSAPs and trauma centers. This will directly address the SAFETEA-LU goal of reducing rural emergency response times by an average of 10 minutes. It will also make improving communication between emergency care providers and trauma centers a research and development priority.

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[48] GAO. 2003. *Uneven Implementation of Wireless Enhanced 911 Raises Prospect of Piecemeal Availability for Years to Come.* Available at *http://www.gao.gov/new.items/d0455.pdf#search=%22fcc%202003%20report%20on%20wireless%20enhanced%20911%20service%22.*

[49] *ENHANCE 911 Act of 2004.* Available at *http://thomas.loc.gov/cgi-bin/query/z?c108:H.R.5419.*

7.A.3 The Commercial Vehicle Information Systems and Networks (CVISN) Deployment Program

CVISN expedites coordinated deployment of ITS to promote safety, enhance productivity and efficiency, and reduce operating costs in commercial vehicle operations. States have deployed all or part of the core capabilities associated with safety information exchange, interstate credentials administration, and roadside electronic screening functions.

7.A.3.1 Description of the Program

The CVISN Deployment Program, created in 1994 and continued under TEA-21 and SAFETEA-LU, provides a framework to enable government, industry, and other parties to exchange safety and credential information and to conduct business transactions electronically using standards and available communications infrastructure. In TEA-21 Section 5209(a), Congress specified that:

… the U.S. DOT shall carry out a comprehensive program to deploy intelligent transportation systems that improve safety and productivity of commercial vehicles and drivers, while reducing costs of commercial vehicle operations and regulatory requirements.

In Section 5209(b-c), Congress put forth the objectives for CVISN to:

> *… focus on advancing technological capabilities and promoting the deployment of ITS applications to commercial vehicle operations, including commercial vehicle, commercial driver, and carrier-specific information systems and networks. Priority areas for projects are those that encourage multi-state cooperation and corridor development; improve the safety of commercial vehicle operations; increase the efficiency of regulatory inspection processes to reduce administrative burdens; improve the efficiency of enforcement efforts; advance electronic processing of registration, driver licensing and fuel tax information, inspection and crash data; promote communication of information among the States; and enhance safe passage of commercial vehicles across international borders.*

In SAFETEA-LU, Congress continues the primary intent of the CVISN program and redirects the authority and responsibility for CVISN to FMCSA. Section 4126 of SAFETEA-LU replaces 5209 of TEA-21 and states:

SEC. 4126. COMMERCIAL VEHICLE INFORMATION SYSTEMS AND NETWORKS DEPLOYMENT

(a) IN GENERAL.—The Secretary shall carry out a commercial vehicle information systems and networks program to—

(1) improve the safety and productivity of commercial vehicles and drivers; and

(2) reduce costs associated with commercial vehicle operations and Federal and State commercial vehicle regulatory requirements.

SEC. 4126. COMMERCIAL VEHICLE INFORMATION SYSTEMS AND NETWORKS DEPLOYMENT (continued)

(b) PURPOSE.—The program shall advance the technological capability and promote the deployment of intelligent transportation system applications for commercial vehicle operations, including commercial vehicle, commercial driver, and carrier-specific information systems and networks.

(c) CORE DEPLOYMENT GRANTS.—

(1) IN GENERAL.—The Secretary shall make grants to eligible States for the core deployment of commercial vehicle information systems and networks.

(2) AMOUNT OF GRANTS.—The maximum aggregate amount the Secretary may grant to a State for the core deployment of commercial vehicle information systems and networks under this subsection and sections 5001(a)(5) and 5001(a)(6) of the Transportation Equity Act for the 21st Century (112 Stat. 420) may not exceed $2,500,000.

7.A.3.2 Current Status and Accomplishments to Date

The ITS program, in partnership with FMCSA and in cooperation with all States, other Federal agencies, and the motor carrier industry, continues to move toward the goal of nationwide deployment of the CVISN core capabilities. These core capabilities fall into three program areas:

- Exchange of motor carrier safety information between Federal, State, and industry partners.
- Electronic roadside screening of trucks for compliance with safety and weight regulations.
- Automated application and issuance of commercial vehicle registrations, fuel taxes, and other credentials.

Over the years, the CVISN Deployment Program had provided support to States and their partners in all of these areas.

As of June 2006, FMCSA had certified 14 states[50] as having completed the deployment of core CVISN capabilities. In addition, 28 states are in the process of deploying core CVISN capabilities, with the majority having made significant progress on their safety and roadside capabilities. Figure 7.3 illustrates this progress. Other accomplishments include:

- Forty-nine states and the District of Columbia have completed a CVO Business Plan.
- Forty-three states have completed the CVISN workshop series.
- Forty-two states have completed a CVISN Top-Level Design and CVISN Program Plan, with documents approved by FMCSA.
- The remaining nine states and the District of Columbia are developing plans and designs for their CVISN deployment activities.
- Fifty states and the District of Columbia have deployed the ASPEN automated inspection software or an equivalent.
- Thirty-four states have deployed electronic screening systems.
- Twenty-four states have deployed a Commercial Vehicle Information Exchange Window (CVIEW) and are sharing data with the national Safety and Fitness Electronic Records (SAFER) system.

7.A.3.3 Five-Year Horizon

Under SAFETEA-LU, each State will be eligible for $2.5 million of core CVISN deployment funds, including funds received under TEA-21. States that complete core CVISN deployment prior to reaching their limit may use the Federal grant money for expanded CVISN capabilities. Upon completing the deployment of core CVISN capabilities, a State becomes eligible to receive an additional $1 million to fund expanded CVISN capabilities.

[50] The 14 states are Arizona, Colorado, Connecticut, Idaho, Kentucky, Nebraska, Maryland, Montana, New Mexico, Ohio, Tennessee, Virginia, Washington, and Wisconsin.

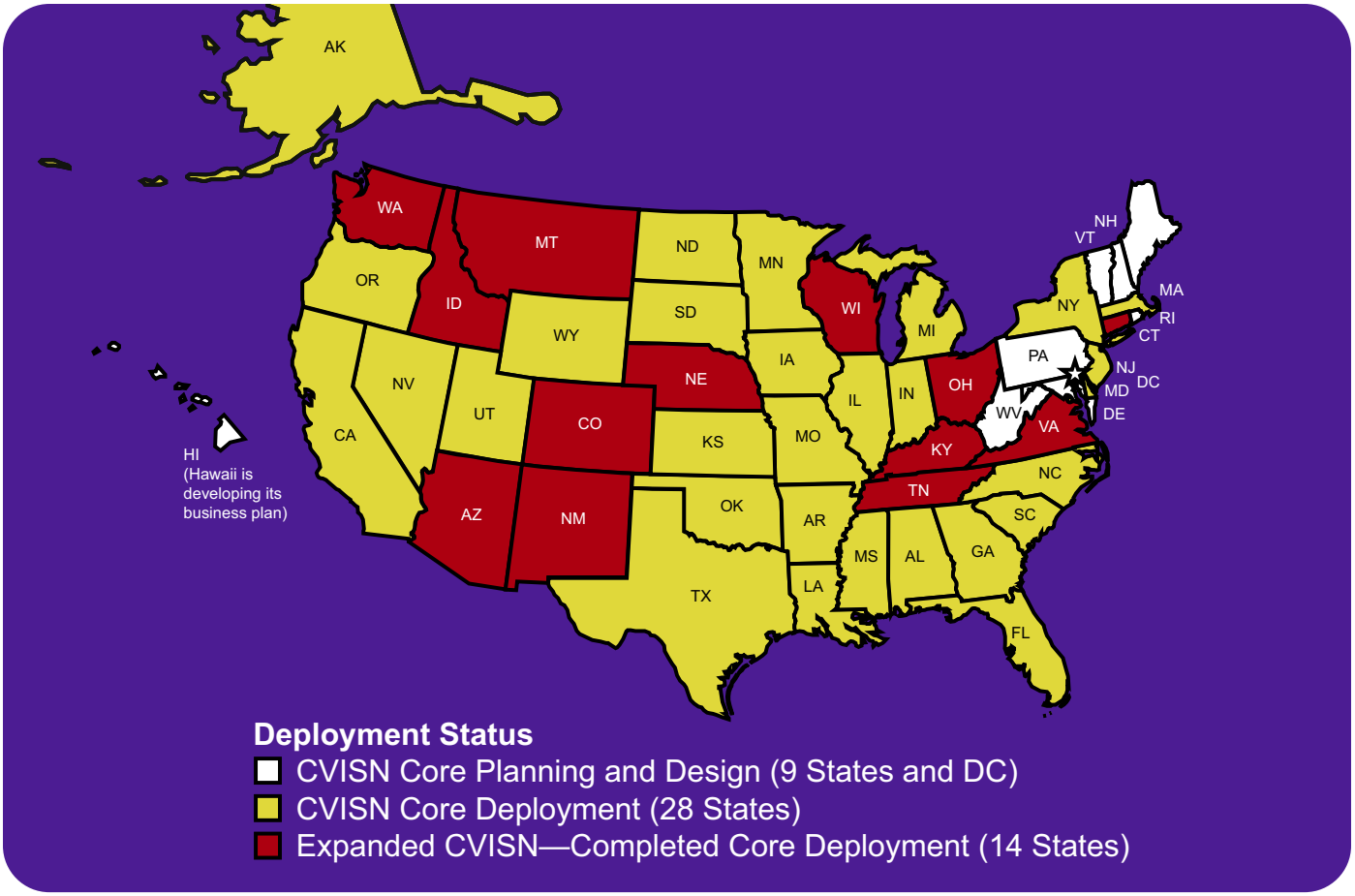


Figure 7.3: CVISN Deployment Status as of Summer 2006[51]

As authorized by SAFETEA-LU, FMCSA has developed a National CVISN Program Management Plan and grant application process for the core and expanded CVISN funding. The grant application process was implemented for FY 2006.

In addition to the continuation of the CVISN deployment grant program, SAFETEA-LU established an "expanded CVISN" program for the Department (see text box on following page). "Expanded CVISN" includes capabilities beyond the core services currently offered. The next phase of the CVISN program will allow the Department to work with industry and State partners to define the capabilities for expanded CVISN. Candidate capabilities include:

- **Driver Information Sharing.** Partners would establish, maintain, and provide controlled access to "snapshots" of driver information and use them for enforcement, licensing, hiring, and other processes that require information about drivers. Jurisdictions would improve the access of enforcement agencies and carriers to driver information in order to better target high-risk drivers.
- **Enhanced Safety Information Sharing and Data Quality.** Partners would establish measures for data timeliness, accuracy, and integrity, especially for those data elements used in determining safety ratings or making decisions. Partners would regularly check data used in CVISN processes for quality, purge stale data, and correct errors. Federal and State agencies would enhance carriers' ability to review safety-related data in a timely manner.
- **Smart Roadside.** Roadside personnel would have improved, integrated access to data stored in Federal and multistate systems such as the Safety and Fitness Electronic Records (SAFER) System, the Motor Carrier Management Information System (MCMIS), and Commercial Driver's License (CDL) data

[51] FMCSA. Available at *http://cvisn.fmcsa.dot.gov/Documents/Document_Nav_Frame_Page_states.shtml*.

systems. Jurisdictions also would expand the deployment and capabilities of virtual or remote sites to increase the effectiveness of enforcement.

- **Expanded E-Credentialing.** Jurisdictions would improve access to current and accurate credentials information for authorized stakeholders; reduce complexity and redundancy for users by offering access to multiple credentials from a single source; and increase the kinds of e-credentials that are available, such as oversize/overweight and hazardous materials permits.

Under expanded CVISN, FMCSA is prioritizing research into the Driver Information Sharing capability, based on a need for a national architecture to support the sharing of commercial vehicle driver data. This research is expected to have a significant impact on commercial vehicle safety, given that high-risk drivers are involved in a disproportionate number of crashes. FMCSA is focusing on this area because no other FMCSA program was designed to improve the sharing of information across jurisdictions. In conjunction with this focus area, FMCSA is developing a new program to address the Smart Roadside capabilities.

The expanded CVISN program is also being coordinated with other major FMCSA initiatives, including COMPASS and the Comprehensive Safety Analysis 2010 project. Additionally, the Department will ensure that expanded CVISN is integrated with other programs such as the CDL initiative, the Performance and Registration Information Systems Management (PRISM) initiative, work on border crossings, and safety data quality improvement projects.

SECTION 4126: COMMERCIAL VEHICLE INFORMATION SYSTEMS AND NETWORKS DEPLOYMENT

(d) EXPANDED DEPLOYMENT GRANTS.—

(1) IN GENERAL.—For each fiscal year, from the funds remaining after the Secretary has made grants under subsection (c), the Secretary may make grants to each eligible State, upon request, for the expanded deployment of commercial vehicle information systems and networks.

(2) ELIGIBILITY.—Each State that has completed the core deployment of commercial vehicle information systems and networks in such State is eligible for an expanded deployment grant under this subsection.

(3) AMOUNT OF GRANTS.—Each fiscal year, the Secretary may distribute funds available for expanded deployment grants equally among the eligible States, but not to exceed $1,000,000 per State.

(4) USE OF FUNDS.—A State may use funds from a grant under this subsection only for the expanded deployment of commercial vehicle information systems and networks.

(e) ELIGIBILITY.—To be eligible for a grant under this section, a State—

(1) shall have a commercial vehicle information systems and networks program plan approved by the Secretary that describes the various systems and networks at the State level that need to be refined, revised, upgraded, or built to accomplish deployment of core capabilities;

(2) shall certify to the Secretary that its commercial vehicle information systems and networks deployment activities, including hardware procurement, software and system development, and infrastructure modifications—

(A) are consistent with the national intelligent transportation systems and commercial vehicle information systems and networks architectures and available standards; and

(B) promote interoperability and efficiency to the extent practicable; and

(3) shall agree to execute interoperability tests developed by the Federal Motor Carrier Safety Administration to verify that its systems conform with the national intelligent transportation systems architecture, applicable standards, and protocols for commercial vehicle information systems and networks.

7.A.4 The Surface Transportation Security and Reliability Information System Model Deployment — "The iFlorida Program"

*i*Florida will develop one of the most comprehensive information infrastructures—or infostructure—that will enhance the operational, security, and informational capacity of Florida's transportation system.

7.A.4.1 Description of the Program

In March 2003, the Florida Department of Transportation (FDOT) was selected to participate in an innovative model deployment with the ITS program. The goal is to build a comprehensive, regional information infrastructure (hence the designation "*i*Florida") to demonstrate the wide variety of operational functions that are enabled or enhanced by a surface transportation security and reliability information system.

The model deployment will use state-of-the-art practices and innovative approaches for collecting, processing, disseminating, sharing, and archiving transportation information. Existing infrastructure will be augmented to fill gaps, and overall coverage will be enhanced with new sensors, increased data rates, and increased coverage density. Existing institutional arrangements will be expanded to facilitate operational functionality and integration.

The *i*Florida model deployment addresses nine components of a regional system:

- Metropolitan area data and information systems.
- Statewide reporting systems.
- Security of critical infrastructure.
- Nonmetropolitan evacuation.
- Weather response.
- Multimodal traveler information.
- Data availability.
- Locally defined components for the evacuation of attractions and special events.
- A national evaluation to examine the benefits and costs.

The *i*Florida model deployment will provide the ITS program with an opportunity to showcase some of the most advanced benefits of integrated ITS. Specifically, the *i*Florida model will help to assess:

- The effects of travel time information on traffic demand.
- The impact on cost and operations of less versus more coverage.
- Which innovative techniques prove most useful for operational strategies; for example, the use of toll tags to determine real-time link speeds or travel times.

- The data quality challenges and how they are best overcome.
- Data use.
- The benefits of comprehensive surveillance.
- The effectiveness of a comprehensive information infrastructure, such as *i*Florida, at improving transportation system operations.

Figure 7.4 shows the geographic layout of the *i*Florida system.

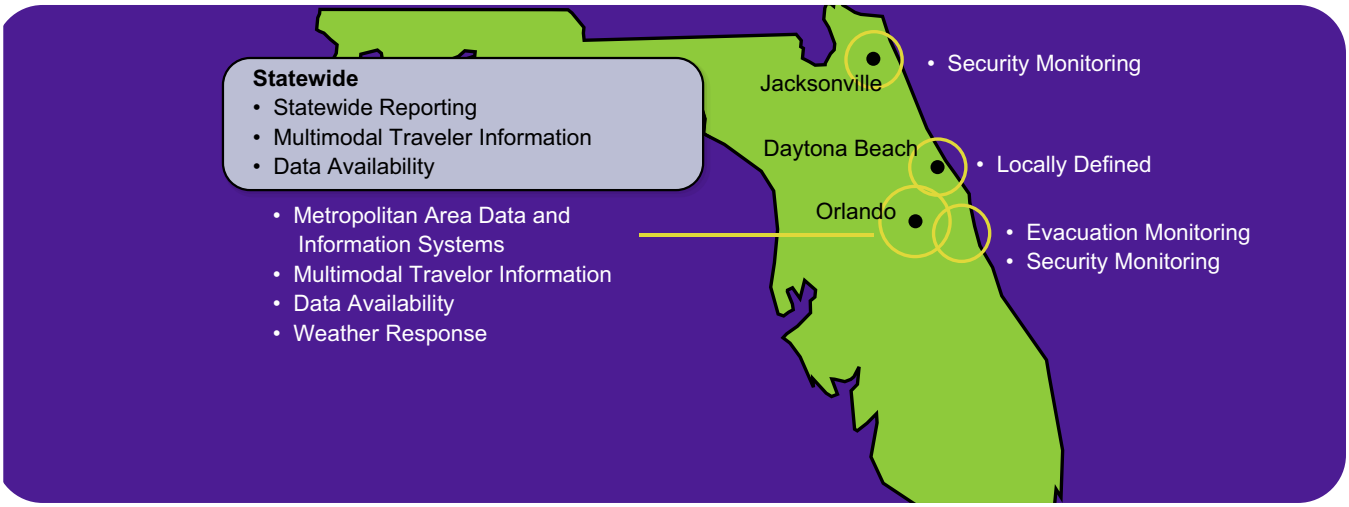


Figure 7.4: *i*Florida Model Deployment[52]

7.A.4.2 Current Status and Accomplishments to Date

The *i*Florida Program has three phases of activities. The first two phases—planning and deployment—are nearing completion. The final plan and design of the system were completed in early 2004. Installation of new system components began in 2003. During the deployment phase, many parts of the system were made operational, including the integration of data collection with the Orlando *511* system. In 2005, real-time travel information became available to travelers through the Florida *511* system.

7.A.4.3 Five-Year Horizon

In the fall of 2006, the ITS program will begin the third phase—evaluation. It is expected to be completed in August 2007. The primary elements of the evaluation include:[53]

- **Metropolitan Operations Evaluation:** This element will assess the operational use of the *i*Florida deployment in the Orlando region. The focus will be on traffic management activities at the District 5 Regional Traffic Management Center (D5 RTMC), activities at the Orlando Integrated Operations Center, the Brevard County Emergency Operations Center (EOC), and the LYNX Operations Center. Other transportation management centers will also be considered. Additional iFlorida projects that are specific to the Orlando area—for example, the Variable Speed Limit Trial and the Orlando Regional Transportation Network Reliability Analysis—will also be considered.
- **Statewide Operations Evaluation:** This element will assess operational uses of the *i*Florida Statewide data, specifically for the planned uses of the statewide data for traveler information and to support evacuations.

52 *http://www.iflorida.net/background.htm.*
53 SAIC. 2004. *iFlorida Model Deployment Evaluation Plan*. Submitted to the FHWA. Available at *http://www.iflorida.net/documents.htm.*

- **Weather Operations Evaluation:** This element will assess the operational uses of weather data. The currently planned uses are for traffic management at the D5 RTMC and for traveler information.
- **Evacuation Operations Evaluation:** This element will focus on the uses of the *i*Florida infrastructure to support evacuations. This will include use of the Orlando data to help decide if contra-flow is required and to monitor contra-flow (if it is used) of Statewide data to monitor evacuations at the State EOC, of *i*Florida data in the Hurricane Evacuation and Decision Support Utility Program (HEADS UP) being developed by the Florida Division of Emergency Management, and of traveler information to support evacuations.
- **Traveler Information Operations Evaluation:** This element will assess the *i*Florida *511* and website traveler information systems by examining usage, customer satisfaction, and the effectiveness of *i*Florida traveler information in helping users to make travel decisions.
- **Security Monitoring Evaluation:** This element of the evaluation will identify lessons learned during the five projects that make up the security monitoring component and will evaluate the operational use of the bridge security monitoring project.

Under the evacuation operations element, the State of Florida and the Department recognized an opportunity to use the Cape Canaveral evacuation route as a test corridor. State Route 528 is a designated evacuation route that connects the Cape and Brevard County with the Orlando area. This corridor offers a unique test case for a number of important transportation-related reasons:

- With the exiting of crowds gathered for Space Shuttle launches, the corridor offers a chance to test the instrumentation along the route, to test the route as an evacuation route, and to gather data on how real-time information affects transportation operations during high-demand times.
- The designation of the Cape as a high-security area imposes unique security issues for the community that affect transportation during evacuations. Real-time management strategies can be tested alongside security measures during high-demand times.
- The results of the evaluation along this corridor will supplement the development of strategies under the EMO Initiative.

Throughout the evaluation phase, the *i*Florida information infrastructure will be available to traffic managers at the Florida DOT so that residents and visitors will have access to real-time traffic and travel management information.

*i*Florida Program Partners

Public Agencies:

- Brevard County
- City of Daytona Beach
- City of Orlando
- Florida Highway Patrol, Troops D and G
- Florida Division of Emergency Management
- Greater Orlando Airport Authority
- LYNX
- METROPLAN
- OOCEA
- Orange County
- Seminole County
- Volusia County

Private Organizations:

- 3M
- Boeing Autometric
- Cambridge Systematics, Inc.
- International Speedway Corporation
- Meteorlogix
- PBS&J
- University of Central Florida's Advanced Transportation Systems Simulation
- University of North Florida

7.B New SAFETEA-LU Research

SAFETEA-LU provided specific direction on additional areas of research and development for the ITS program, including:

- Rural Interstate Corridor Communications Study (Section 5507)
- Road Weather Research and Development Program (Section 5308)
- Multistate Corridor Operations and Management, specifically the I-95 Corridor Coalition (Section 5211[b])

7.B.1 Rural Interstate Corridor Communications Study

Rural ITS is a critical component of transportation safety and access in remote areas. It depends on the deployment of ubiquitous, robust telecommunications systems for incident management, traveler information, and flexible access to transit, among other important medical and economic services.

7.B.1.1 Description of the Study

Section 5507 of SAFETEA-LU requires the Department to initiate a study of the applicability and potential benefits of the installation of fiber optic cable on three rural interstate corridors:

- Interstate 90 through rural Wisconsin, southern Minnesota, northern Iowa, and South Dakota
- Interstate 20 through Alabama, Mississippi, and northern Louisiana
- Interstate 91 through Vermont, New Hampshire, and Massachusetts

These corridors are shown in Figure 7.5.

Figure 7.5: Rural Communications Corridors

The interstate corridors could offer a valuable opportunity for the installation of fiber optic cables by the telecommunications industry to reach population centers while also supporting the transportation telecommunications needs of the States. To date, there has been little roadway fiber optic installation outside of major metropolitan areas. The first wave of fiber installation in the 1970s and 1980s was limited by a provision that utility installation was prohibited on the interstate system. In response, telecommunications companies were faced with the costly proposition of leasing or purchasing right of way (ROW) from railroads and other private landowners. The current nationwide system comprises a patchwork of fiber installations that serve specific communities.

In the late 1990s, the FHWA and AASHTO recognized the need for a communications capability along the Nation's roadways and supported an exception to the restrictions on utility installation along the transportation infrastructure ROW. With the restrictions lifted, States are now able to form partnerships with the telecommunications industry for fiber installation that will serve the needs of transportation system operators as well as the needs of its citizens for communications capability. For a State or a series of States along a corridor to consider such a partnership, it is essential that they understand their own telecommunications needs along the ROW, how this partnership could support the needs of rural communities along

SECTION 5507: RURAL INTERSTATE CORRIDOR COMMUNICATIONS STUDY

(a) STUDY.—The Secretary, in cooperation with the Secretary of Commerce, State departments of transportation, and other appropriate State, regional, and local officials, shall conduct a study on the feasibility of installing fiber optic cabling and wireless communication infrastructure along multi-State Interstate System route corridors for improved communications services to rural communities along such corridors.

(b) CONTENTS OF STUDY.—In conducting the study, the Secretary shall identify—

- *(1) impediments to installation of the infrastructure described in subsection (a) along multi-State Interstate System route corridors and to connecting such infrastructure to the rural communities along such corridors;*
- *(2) the effective geographic range of such infrastructure;*
- *(3) potential opportunities for the private sector to fund, wholly or partially, the installation of such infrastructure;*
- *(4) potential benefits fiber optic cabling and wireless communication infrastructure may provide to rural communities along such corridors, including the effects of the installation of such infrastructure on economic development, deployment of intelligent transportation systems technologies and applications, homeland security precaution and response, and education and health systems in those communities;*
- *(5) rural broadband access points for such infrastructure;*
- *(6) areas of environmental conflict with such installation;*
- *(7) real estate ownership issues relating to such installation;*
- *(8) preliminary design for placement of fiber optic cable and wireless towers;*
- *(9) monetary value of the rights-of-way necessary for such installation;*
- *(10) applicability and transferability of the benefits of such installation to other rural corridors; and*
- *(11) safety and other operational issues associated with the installation and maintenance of fiber optic cabling and wire infrastructure within Interstate System rights-of-way and other publicly owned rights-of-way.*

(c) CORRIDOR LOCATIONS.—The study required under subsection (a) shall be conducted for corridors along—

- *(1) Interstate Route 90 through rural Wisconsin, southern Minnesota, northern Iowa, and South Dakota;*
- *(2) Interstate Route 20 through Alabama, Mississippi, and northern Louisiana;*
- *(3) Interstate Route 91 through Vermont, New Hampshire, and Massachusetts; and*
- *(4) any other rural corridor the Secretary considers appropriate.*

(d) REPORT TO CONGRESS.—Not later than September 30, 2007, the Secretary shall submit to Congress a report on the results of the study, including any recommendations of the Secretary.

the corridor, and how best to accommodate the needs of the telecommunications industry while ensuring the continued safety and operation of the roadway.

7.B.1.2 Current Status and Accomplishments to Date

This study is the initial step of gaining insight into the issues and value
associated with specific rural corridors and into how State transportation agencies might benefit from the installation of fiber optic networks on
their ROW.
Each of the three corridors will be analyzed to consider important information related to:

- Safety and other operational issues associated with the installation and maintenance of the cable.
- Impediments to installation and to connecting this infrastructure to rural communities along the corridor.
- Environmental conflicts or real estate ownership issues.
- Access points necessary to serve rural communities and to support the installation of the VII infrastructure.
- Cost-benefit analysis for potential benefits, including the effects on economic development, homeland security, education, and health systems.
- Potential opportunities for private-sector partnerships.
- The extent of existing telecommunications capacity on the ROW along the corridor or parallel to it.
- Alternatives analysis, including the use of broadband wireless technology (for example, WiMax) to achieve coverage equivalant to fiber optics in rural areas.

Fiber optics installation along freeways is a critical and challenging topic for State and local transportation agencies. The installation decisions require collaboration and expertise around a host of complicated issues, including permitting and ROW access; multijurisdictional coordination; varying State and local legislation; telecommunications inventory, expertise, and engagement of companies; and project delivery.

The ITS program has developed a Fiber Optic Installation on Freeway Right-of-Way Workshop designed for both State DOT practitioners and telecommunications providers. Delivered by the ITS Professional Capacity Building Program, the workshop guides participants through the decision-making processes associated with project development, design, and approval. The workshop employs a scale model to illustrate how and why project concepts and principles work together. The goal is to broaden learning on:

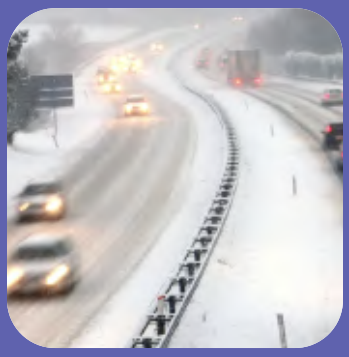
- The importance of shared resource agreements for installing fiber.
- The issues associated with creating and administering a shared resource project.
- The impacts of fiber installation on corridor quality.
- The methods of installation.
- The steps and their sequence in fiber optic installation, from project development through operations and maintenance.

Additional guidance is available through the Department's *Program Guide: Utility Relocation and Accommodation on Federal-Aid Highway Projects.*

7.B.1.3 Five-Year Horizon

The study began in the fall of 2006. The completion of the study and its results are expected to be delivered to Congress by September 30, 2007.

7.B.2 Road Weather Research and Development Program



Adverse weather conditions have a mojor impact on the safety and operation of our Nations's roads, from signalized arterials to Interstate highways. Weather affects driver behavior, vehicle performance, pavement friction, and roadway infrastructure.

In recognizing that weather has severe impacts on the transportation system, Congress included a requirement in SAFETEA-LU (Section 5308) to establish a Road Weather Research and Development Program.

Section 5308: Road Weather Research and Development Program

(a) ESTABLISHMENT.—The Secretary shall establish a road weather research and development program to–

(1) maximize use of available road weather information and technologies;

(2) expand road weather research and development efforts to enhance roadway safety, capacity, and efficiency while minimizing environmental impacts; and

(3) promote technology transfer of effective road weather scientific and technological advances.

(b) STAKEHOLDER INPUT.—In carrying out this section, the Secretary shall consult with the National Oceanic and Atmospheric Administration, the National Science Foundation, the American Association of State Highway and Transportation Officials, nonprofit organizations, and the private sector.

(c) CONTENTS.—The program established under this section shall solely carry out research and development called for in the National Research Council's report entitled `A Research Agenda for Improving Road Weather Services'. Such research and development includes—

(1) integrating existing observational networks and data management systems for road weather applications;

(2) improving weather modeling capabilities and forecast tools, such as the road surface and atmospheric interface;

(3) enhancing mechanisms for communicating road weather information to users, such as transportation officials and the public; and

Section 5308: Road Weather Research and Development Program (continued)

(4) integrating road weather technologies into an information infrastructure.

(d) ACTIVITIES.—In carrying out this section, the Secretary shall—

(1) enable efficient technology transfer;

(2) improve education and training of road weather information users, such as State and local transportation officials and private sector transportation contractors; and

(3) coordinate with transportation weather research programs in other modes, such as aviation.

The need for an expansion in road weather research is clear. As stated in a 2004 paper presented at the annual meeting of the Transportation Research Board:

> *Weather events such as precipitation, fog, high winds, high water, and extreme temperatures reduce roadway capacity. … As with any incident, managers must be able to predict or detect a weather event, assess the nature of the event (e.g., severity, impact area), and manage traffic under less-than-optimal conditions. To prevent weather-related congestion, and lessen the impact of unavoidable congestion, traffic managers need to understand how weather impacts roads and traffic, as well as the benefits of weather-responsive strategies. In spite of the ability to prepare for and manage such incidents, the field of weather-responsive traffic management is in its infancy.*[54]

7.B.2.1 Description of the Program

The ITS program is currently conducting research, developing new tools, and providing technology transfer and guidance under existing programs that address the requirements established in SAFETEA-LU for stakeholder input and activities.

7.B.2.2 Current Status and Accomplishments to Date

The Department has working partnerships with a wide range of organizations (including those listed in SAFETEA-LU) to provide substantive input to the road weather research efforts. Research is being pursued as follows:

- The *Clarus* Initiative is exploring how technologies help to mitigate weather impacts on roads through the development of data management systems and the integration of surface transportation-based weather observation networks.
- The Road Weather Program is:
  - Working on empirical models to study traffic flow and weather with the intent of integrating weather parameters and effects into existing traffic models like CORSIM.
  - Incorporating road weather information into technologies for traveler information dissemination. A prototype with the Missouri DOT to integrate *511* with a weather response system tool will assist transportation managers in tailoring information for route-specific delivery.
  - Incorporating road weather technologies into decision support systems for transportation managers.
  - Working with the VII Initiative to understand how to turn VII data into weather observations. For example, mobile probe vehicles measuring congestion could also utilize sensors to collect real-time weather data.

7.B.2.3 Five-Year Horizon

Over the next five years, the SAFETEA-LU requirements will serve as a catalyst to further integrate surface transportation weather and operations.

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[54] Pisano, Paul, and Lynette Goodwin. 2004. *Research Needs for Weather-Responsive Traffic Management.* Paper presented at the 2004 Transportation Research Board Annual Meeting. Available at *http://www.ops.fhwa.dot.gov/Weather/best_practices/WxRspTfcMgmtTRB2004.pdf.*

The additional resources will allow the Department to focus further on:

- Maximizing the use of information and technologies by providing leadership and direction for institutional change and technical advancement. As demand for more sophisticated traveler information products increases, the Department will have the resources to promulgate institutional changes among the transportation and meteorological communities. These changes will maximize local investments in integrated solutions that allow for use of common assets between transportation and meteorology and in turn will stimulate the building of new markets for private enterprise.
- Expanding efforts to enhance safety, capacity, and efficiency through an important partnership with the meteorological research community to develop new tools. This partnership has already produced the Maintenance Decision Support System (MDSS), a winter maintenance tool that provides information for advanced weather and road condition predictions and effective management of anti-icing resources. Ultimately, tools like this improve the safety of travelers while ensuring that the available capacity is maintained without compromising the environment through the overuse of roadway surface treatments. The MDSS represents only the first stage toward the development of integrated products that effectively harness weather information for efficient roadway operations.
- Promoting technology transfer of effective advances by providing generic specifications and requirements that advance the state of the practice across the transportation industry. By transferring new research products to industry, new marketplace products become available that enhance the performance of agencies in the application of weather information products and integrated solutions for transportation-specific weather prediction. The ITS program and FHWA's Road Weather Management Program are collectively pursuing a plan for industry outreach to address the needs of the private sector and the public sector alike.

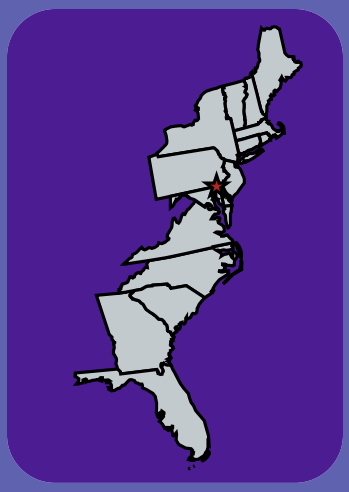
The resources provided by SAFETEA-LU will support these existing programmatic efforts and others in response to the demand for integrated solutions by the transportation and meteorological communities. The programs will also have opportunities to further leverage public-sector resources to build markets and improve private-sector services. These efforts ultimately will change the way that decisions are made, which will save lives, time, and money.

Technologies Are Available Today to Help Mitigate Weather Impacts on Roads

Road Weather Technologies fall into three categories:

- **Surveillance, Monitoring and Prediction Technologies,** which collect and transmit data on environmental conditions. These technologies include fixed environmental sensor stations (ESS), mobile sensing devices, and remote sensing systems that are installed on the transportation infrastructure and in vehicles or are a part of satellite systems. They measure atmospheric, pavement, and water level conditions. Over 2,400 systems are owned and operated by State transportation agencies.
- **Information Dissemination Technologies,** which allow transportation managers and information service providers to disseminate road weather information to travelers in order to influence their travel decisions—mode, route selection, departure time, vehicle type and equipment, driving behavior, and trip deferral. Technological solutions include activating flashing beacons atop static signs, posting warnings on DMS, and broadcasting messages via Highway Advisory Radio. Also, route-specific road condition reports and travel forecasts are fed into State agency websites and interactive telephone systems, including *511*. Road weather information can also be delivered via other dissemination technologies, such as PDAs, in-vehicle devices, and kiosks in rest areas.
- **Decision Support, Control, and Treatment Technologies,** which provide decision support to transportation managers and system operators. The MDSS, which integrates road weather information with rules of practice and resource data to help winter maintenance managers make road treatment decisions, is one such decision support technology.

7.B.3 I-95 Corridor Coalition



The I-95 Corridor Coalition

The Coalition comprises key decision-makers that have influenced or will influence the operation of the Corridor, including:

- State and Local Departments of Transportation
- Transportation Authorities
- Transit and Rail Agencies
- Port Authorities
- Motor Vehicle Agencies
- State Police/Law Enforcement
- U.S. Department of Transportation
- Intercity Passenger and Freight Transportation Providers
- Transportation Industry Associations

7.B.3.1 Description of the Coalition

The I-95 Corridor Coalition ("the Coalition") is an alliance of transportation agencies, toll authorities, and related organizations including law enforcement from Maine to Florida, with an affiliate member in New Brunswick, Canada. The Coalition has served as a model for multistate and multijurisdictional interagency cooperation and coordination for over a decade. It provides a forum for decision-makers to address transportation management and operations issues of common interest. This voluntary, consensus-driven organization enables its State, local, and regional member agencies to work together to improve transportation system performance far more than they could by working individually.

The Coalition began in the early 1990s as an informal group of transportation professionals working together to improve management of incidents that impacted travel across jurisdictional boundaries. In 1993, the Coalition was formally established to enhance transportation mobility, safety, and efficiency in the region. Under ISTEA and TEA-21, the Coalition received $64.7 million.

Over the years, the Coalition's program evolved from studying and testing ITS technologies to a broader perspective that embraced integrated deployments and coordinated operations. The Coalition's perspective evolved from a concentration on highways to one that encompasses all modes of travel and focuses on the efficient transfer of people and goods between modes. Facilitation of regional incident management for planning, coordination, and communication among transportation and public safety agencies in the corridor remains a key part of the Coalition's focus. Today, information management is the underpinning of seamless operations across jurisdictions and modes.

Section 5211 of SAFETEA-LU recognizes the importance of multistate cooperative agreements, coalitions, and other arrangements to promote regional cooperation, planning, and shared project implementation by continuing to fund the Coalition.

7.B.3.2 Current Status and Accomplishments to Date

Continuing Federal investment in the Coalition will help the Department to achieve its program goals related to safety, transportation security and emergency management, congestion management, freight management, equity, and convenience while advancing specific transportation management and operations initiatives throughout the East Coast. These initiatives comprise deployment of a traffic management and travel information infrastructure; deployment of related national standards; coordinated deployment of the national *511* travel information telephone number; CVISN deployment, including related security applications; compatible short-range communications applications; and integrated electronic payment methods and processes.

Section 5211(b): Multistate Corridor Operations and Management

(b) INTERSTATE ROUTE 95 CORRIDOR COALITION TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS.—The Secretary shall make grants under this subsection to States to continue intelligent transportation system management and operations in the Interstate Route 95 corridor coalition region initiated under the Intermodal Surface Transportation Efficiency Act of 1991 (Public Law 102-240).

The goals of the I-95 Corridor Coalition are to improve mobility for people and goods, enhance safety for all travelers, and improve the economic vitality of the region. The Coalition strives to add value for member organizations by leveraging resources, sharing information, and coordinating programs through three specific strategies:

- Learning and information sharing
  - Conduct forums and provide training on topics of critical importance.
  - Foster networking in support of sharing experiences and mutual education among members and partners.
- Information management
  - Provide easier access to information for system management and operation.
  - Provide a source of long-distance travel information for public dissemination.
  - Provide a source of information to support future investment decisions of the Coalition and its member agencies.
- Facilitating deployment across jurisdictions and modes
  - Promote multimodal and intermodal coordination.
  - Encourage interoperability among jurisdictions.
  - Foster standards adoption and other procedures that promote deployment.

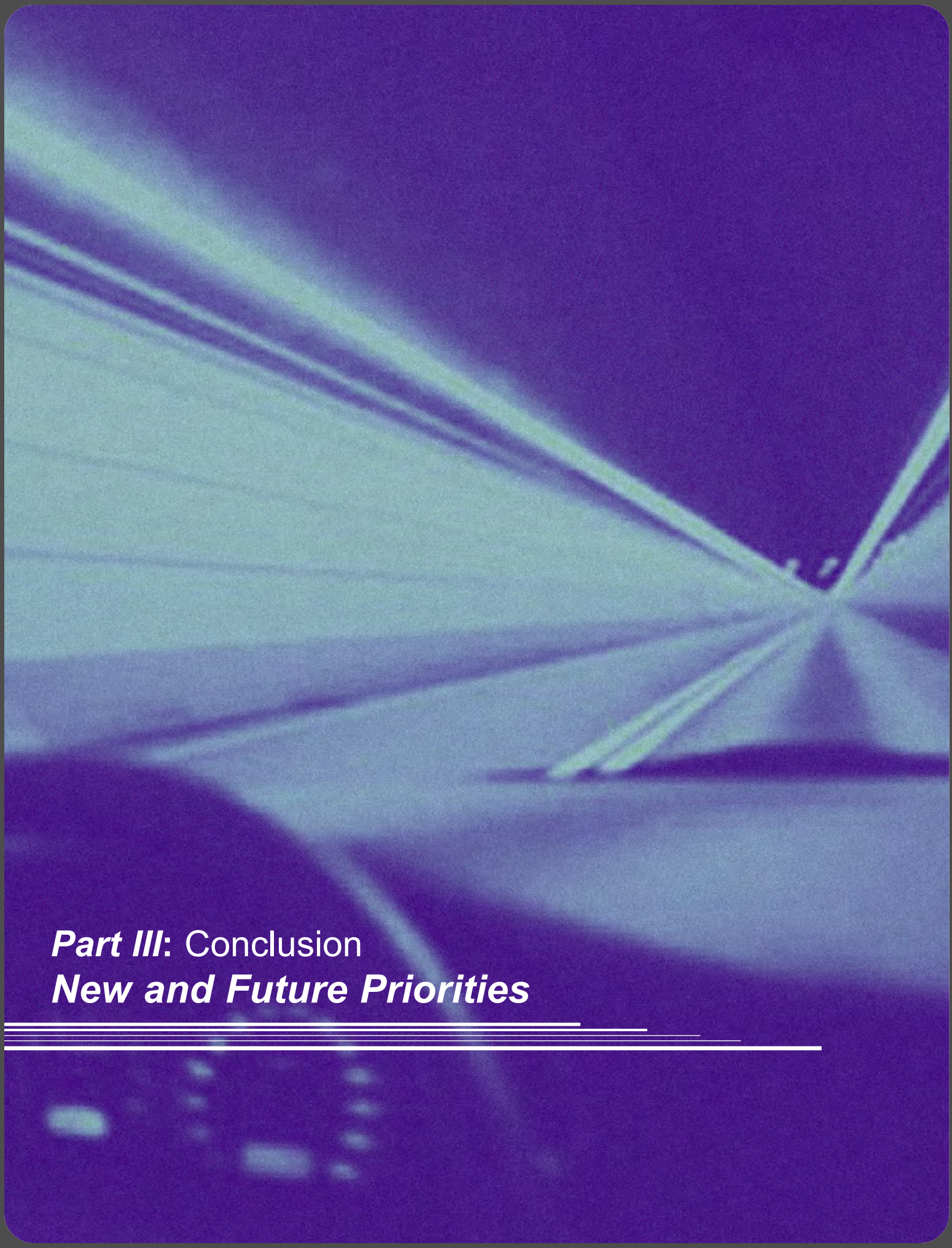
7.B.3.3 Five-Year Horizon

Over the next five years, the I-95 Corridor Coalition will continue to expand its focus on topics of growing regional and national concern, such as coordinated transportation system operations, integrated travel information for trips that cross jurisdictional and modal boundaries, intermodal freight movement security and efficiency, common electronic payment methods, and public safety and security. The Coalition will continue to evolve in directions that allow it to effectively serve the needs of its member agencies and the traveling public for seamless and effective transportation system management and operations across all modes of travel.

The ITS program anticipates working closely with the Coalition over the next five years. Within the next two years, the ITS program expects to have developed a coordinated plan with the Coalition to:

- Ensure a closer alignment of goals.
- Reduce redundancies.
- Identify and act upon opportunities.
- Leverage resources.

The Coalition anticipates a more active role in performing analyses of important regional transportation management and operations issues; in forging stronger ties with sister organizations, such as the regional organizations of AASHTO, the Coalition of Northeastern Governors, ITS America, and TRB; and in continuing its successful partnership with the FHWA and other modal agencies.



Part III: Conclusion
New and Future Priorities

8. New and Future Priorities

In setting the direction for the ITS program over the next five years, the Department has initiated a set of program activities that directly address the Congressional goals, purposes, and priorities set forth in SAFETEA-LU. The current program focuses on nine major initiatives and several deployment support programs. These activities also align with the Department's goals for safety, reduced congestion, and economic productivity, thus providing the Department with a focused means to advance technology applications for some of the most critical transportation problems facing the Nation. Additionally, this Program Plan represents a guiding vision for the Department. The activities described in this plan were formulated with input from stakeholders based on present-day needs. As such, the plan will guide the Department in addressing ITS needs of the Nation in the near term.

However, the Department recognizes that new challenges and priorities will emerge in the coming years that will require ITS to play an important role. The ITS program has the flexibility to address future high-priority issues as they emerge. For instance, in SAFETEA-LU, Congress provided the Department with a mandate to invest in technologies and systems that can aid in reducing congestion by 5 percent by 2010.

Section 5306 (b)(3)(a): Reduction in Congestion

(3) address traffic management, incident management, transit management, toll collection, traveler information, or highway operations systems with goals of—

(A) reducing metropolitan congestion by not less than 5 percent by 2010;

Shortly after the passage of SAFETEA-LU, former Secretary of Transportation Norman Mineta moved proactively to address escalating national congestion with the enactment of a new major initiative for the Department, the *National Strategy to Reduce Congestion on America's Transportation Network* (the "Congestion Initiative"). In September 2006, this emphasis on reducing congestion was reaffirmed in the Department's adoption of a new Strategic Goal on Reduced Congestion in its new Strategic Plan for 2006–2011. Using past research results and some of the products produced by the ITS program, the Department unveiled a set of proposed actions for aggressively confronting congestion within the next few years. These proposed actions are:

1. Relieve urban congestion.
2. Unleash private-sector investment resources.
3. Promote operational and technological improvements.
4. Establish a "Corridors of the Future" competition.
5. Target major freight bottlenecks and expand freight policy outreach.
6. Accelerate major aviation capacity projects and provide a future funding framework.

The Department has already taken steps to identify ways that the ITS program can address congestion. First, the ITS program has participated in important research that details the causal factors of congestion. Approximately half of the congestion experienced by travelers is what is known as recurring congestion, caused by excess demands that occur almost every day when road use exceeds existing

capacity. The other half is due to nonrecurring congestion, caused by temporary disruptions. The four main causes of nonrecurring congestion are traffic incidents (ranging from disabled vehicles to major crashes), work zones, weather, and special events. Nonrecurring events dramatically reduce available capacity and reliability of the entire transportation system. Travelers and shippers are especially sensitive to the unanticipated disruptions to tightly scheduled personal activities and manufacturing distribution procedures. Figure 8.1 shows the distribution of congestion-causing factors.

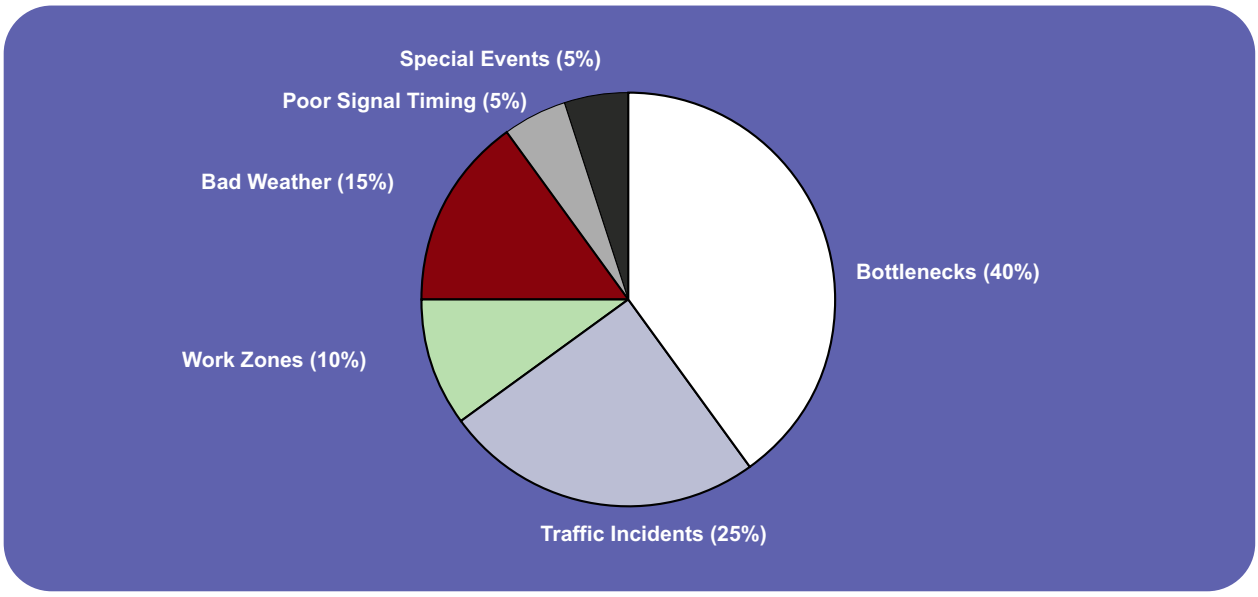


Figure 8.1: Causes of Congestion[55]

Second, the ITS program has inventoried its accomplishments—tools, strategies, technologies, and systems—to identify how ITS has provided benefits in the form of reduced congestion. Under ISTEA and TEA-21, the ITS program provided research and investment into:

- The establishment of advanced traffic management systems with a specific focus on traffic management centers in major urban areas.
- New modeling applications to understand the effects of ITS on mobility and congestion.
- The deployment of electronic toll collection systems to reduce congestion at toll plazas.
- The development and facilitated deployment of low-cost adaptive traffic signal control software that eliminates the need to retime signals.
- The development and testing of bus rapid transit technologies and systems that more efficiently utilize roadway and transit capacity.
- The development of incident management systems and strategies to reduce incident clearance time.
- The development of operational strategies for deploying ITS in response to congestion under varying conditions.

Third, four of the major ITS research initiatives are directly focused on producing results that have an impact on the different causes of congestion and that further the development of operational strategies and solutions for State and local agency managers. These initiatives are ICM, MSAA, *Clarus,* and EMO.

[55] FHWA. Available at *http://www.fhwa.dot.gov/congestion/congest2.htm.*

Through these initiatives, the ITS program is making progress on:

- New ways to manage congestion in urban corridors.
- More accurate and timely road weather information.
- Enhanced communication during emergencies, especially evacuations.
- Increased accessibility for the disabled and disadvantaged.
- Support for efficient movement of freight through ports and across borders.

Finally, the VII Initiative holds great promise in delivering:

- Decision-making access to vital real-time information on local congestion sources and levels.
- Improved decision-making by drivers and travelers regarding mode choice, time of departure, and choice of route.
- Optimization of existing capacity on the transportation networks.

Table 8.1 demonstrates where ITS has played a role and how it is currently providing solutions that can impact congestion.

Table 8.1: ITS Research/Programs/Initiatives in Support of the Department's Congestion Strategies

The Department's Six Strategies	ITS Research/Programs/Initiatives
(1) Bring solutions to cities to help relieve urban congestion, including: • Congestion pricing. • Bus rapid transit. • Telecommuting and flex scheduling. • Expedited completion of capacity projects.	The ITS program's research has aided in the development of: ✓**Electronic Fare Payment Systems (EFPS)** and has documented their benefits, costs, and challenges. The ITS program has tested and evaluated deployment of fare payment systems. It has documented the integration of EFPS with parking systems and transit systems and has developed standards for them. ✓**Bus Rapid Transit (BRT) technologies,** which were developed under the IVI research; strategies for BRT implementation are being developed under the ICM Initiative.
(2) Partner with the private sector to unleash the potential for new investment resources.	✓**The ITS program** has a rich history of public-private partnerships from which it has documented important lessons learned and best practices.

Table 8.1: ITS Research/Programs/Initiatives in Support of the Department's Congestion Strategies (continued)

The Department's Six Strategies	ITS Research/Programs/Initiatives
(3) Promote technological operational improvements that increase information dissemination and incident response capabilities, including: • Faster dissemination of real-time information from the private sector, *511*, wireless E9-1-1, wireless camera systems for ferries, trains, buses, and other sources. • Emphasis on addressing congestion in the ITS program. • Best practices for incident and intersection management, including adaptive intersections.	The ITS program has helped develop the state of the art in advanced traffic management systems and advanced traveler information systems, including: ✓Providing guidance on designing and staffing **transportation management centers** around the Nation. ✓Facilitating the development and deployment of the ***511* system**. ✓Researching the platform for **Wireless E9-1-1** and building from it to deliver the **NG9-1-1** system. ✓Developing **weather reporting systems** for transportation. ✓Researching the development of **incident management systems and strategies** and bringing the public safety community into the transportation strategies.
(4) Establish a "Corridors of the Future" competition that will select three to eight major corridors in need of long-term investment with a focus on accelerating the development of multistate, multiuse transportation financing and operational models.	The experiences along two important corridors will provide insight into operational models for the Department: ✓**The I-95 Corrridor Coalition** offers a set of multi-agency relationships and operational strategies as lessons learned and recommended practices. ✓**The *i*Florida Program** will provide insight into multiagency models for monitoring and managing metropolitan and rural corridors with varying degrees of instrumentation that allow for the use of *511*, weather data, real-time information on traffic and incidents, quicker incident response, and other systems developed under ITS.
(5) Target major freight bottlenecks and expand freight policy outreach, including: • A focus on Southern California's ports. • A dialogue with shippers and freight executives through DOT's National Freight Policy Framework. • A DHS-DOT border congestion team to prioritize operational and infrastructure improvements at the most congested border crossings.	✓Under the **EFM Initiative**, the ITS program has begun a dialogue with shippers and freight executives to address one aspect of freight delays—improving operational efficiency, productivity, and security by promoting electronic data exchanges along a supply chain "end-to-end," from the point of original consignment to final delivery. ✓Under the **National ITS Architecture Program**, the ITS program is addressing issues at border crossings that can lay the foundation for incorporating technologies that can play a key role in operational improvements. Previous research on the use of electronic freight credentialing systems suggests a significant decrease in delays at borders.
(6) Accelerate major aviation capacity projects and provide a future funding framework.	N/A

In moving forward to confront congestion, the Department envisions an expanded role for the ITS program through new activities that specifically address innovative concepts for reducing congestion, such as congestion pricing or new traffic control strategies. At this juncture, the Department is determining whether current ITS program activities can form the basis for advancing the Congestion Initiative or whether new activities will need to be formulated.

The Congestion Initiative is only one example of how a key issue might influence the future direction of the ITS program. As the current set of major initiatives comes to its logical conclusion, the ITS program expects to establish other initiatives that address critical surface transportation issues in congestion, safety, and economic productivity.

To address new priorities as they emerge, the Department has established a set of assessment metrics that will guide the investment and planning processes for all new proposed activities. These metrics will help the Department to measure the merits of proposed new initiatives by applying criteria to ensure that:

- The transportation problem's scope is clear, understandable, and aligned with one or more of the Department's priorities.
- The proposed resolution's impact and results:
  - Are quantifiable.
  - Have clear decision points and milestones.
  - Are presented with a market analysis and projected return on investment.
  - Address public and private stakeholders who will have long-term responsibility for implementation and market development.
- The investment adheres to the principles of:
  - The President's Management Agenda.
  - The Department Secretary's "Safer, Simpler, and Smarter" initiative.
  - Leveraging opportunities to integrate program, modal, and technological approaches.
  - Significantly engaging the private sector.
  - Providing effective bridges between conditions as they exist today and as they are envisioned.
  - Developing replicable and scalable results.
  - Ensuring a balanced ITS program portfolio with regard to the risk factors, technology maturity, delivery schedules, architecture compliance, and costs.

During the time period covered in this Program Plan, the ITS program will enter its twentieth year. Since its inception, it has delivered steady, solid progress and results for the Nation. Innovative applications have been developed across surface transportation modes to address traffic management and operations, public transportation, motor vehicle operations, weather, freight, public safety, vehicle safety, traveler information, and security.

SAFETEA-LU both validates the Department's direction in ITS and increases the focus on integration, mainstreaming, public-private partnerships, cooperative processes, and market expansion. With its recent reorganization, the ITS program is positioned to deliver the next generation of ITS through higher-risk/higher-reward research for the Nation. New, stronger internal processes guide investment, research processes, and portfolio growth. The ITS program will provide the Department with greater flexibility to evolve ITS in concert with critical market needs and new Departmental and Congressional priorities.

ITS is all about making the best, most efficient use of our existing network—fighting congestion by making the best use of what we have. We've made great strides these past fourteen years in advancing the development and deployment of ITS technologies such as traffic management systems, advanced signal control, electronic toll collection, automated collision notification, and traveler information systems. Now ITS is ready to take a significant leap forward through the deployment of vehicle to vehicle to roadside communication. This is the promise of vehicle infrastructure integration or VII. Through the VII initiative we have the opportunity to significantly improve safety by deploying advanced crash avoidance systems where vehicles and infrastructure work cooperatively to protect travelers. VII also allows us to manage and operate the transportation network through wireless connections, giving system operators the ability to quickly respond to disruptions … and users real-time travel conditions on major roadways.[56]

Rick Capka, FHWA Administrator, 12th ITS World Congress on Intelligent Transportation
Opening Plenary Session, November 7, 2005
Moscone Convention Center, San Francisco, California

[56] Available at *www.its.dot.gov/press/rickcapka.htm.*

Table A.1: Congressional Goals, Section 5303(a)

Goal	Major Initiatives and Other Activities	Deployment Support Activities
(1) Enhancement of surface transportation efficiency and facilitation of intermodalism and international trade to enable existing facilities to meet a significant portion of future transportation needs, including public access to employment, goods and services, and to reduce regulatory, financial, and other transaction costs to public agencies and system users.	X	X
(2) Achievement of national transportation safety goals, including the enhancement of safe operation of motor vehicles and nonmotorized vehicles and improved emergency response to a crash, with a particular emphasis on decreasing the number and severity of collisions.	X	X
(3) Protection and enhancement of the natural environment and communities affected by surface transportation, with particular emphasis on assisting State and local governments to achieve national environmental goals.	X	X
(4) Accommodation of needs of all users of surface transportation systems, including operators of commercial motor vehicles, passenger motor vehicles, motorcycles, bicycles, and pedestrians, including individuals with disabilities.	X	
(5) Improvement of the Nation's ability to respond to security-related or other manmade emergencies and natural disasters and enhancement of national defense mobility.	X	X

Table A.2: Congressional Purposes, Section 5303(b)

Purposes	Major Initiatives and Other Activities	Deployment Support
(1) Expedite, in both metropolitan and rural areas, deployment and integration of intelligent transportation systems for consumers of passenger and freight transportation.	X	X
(2) Ensure that Federal, State, and local transportation officials have adequate knowledge of intelligent transportation systems for consideration in the transportation planning process.	X	X
(3) Improve regional cooperation and operations planning for effective intelligent transportation system deployment.	X	X
(4) Promote the innovative use of private resources.	X	X
(5) Facilitate, in cooperation with the motor vehicle industry, the introduction of vehicle-based safety enhancing systems.	X	
(6) Support the application of intelligent transportation systems that increase the safety and efficiency of commercial motor vehicle operations.	X	
(7) Develop a workforce capable of developing, operating, and maintaining intelligent transportation systems.	X	X
(8) Provide continuing support for operations and maintenance of intelligent transportation systems.		X

Table A.3: Research and Development Priority Areas, Section 5306(b)

R&D Priority Areas	Major Initiatives and Other Activities	Deployment Support Activities
(1) Enhance mobility and productivity through improved traffic management, incident management, transit management, freight management, road weather management, toll collection, traveler information, or highway operations system and remote sensing products.	X	
(2) Utilize interdisciplinary approaches to develop traffic management strategies and tools to address multiple impacts of congestion concurrently.	X	
(3) Address traffic management, incident management, transit management, toll collection, traveler information, and highway operations systems with goals of:	X	
(a) Reducing metropolitan congestion by not less than 5 percent by 2010.	X	X
(b) Ensuring that a national, interoperable *511* system, along with a national traffic information system that includes a user-friendly, comprehensive website, is fully implemented for use by travelers throughout the United States by September 30, 2010.	X	X
(c) (i) Improving incident management response, particularly in rural areas, so that rural emergency response times are reduced by an average of 10 minutes.	X	
(ii) Improving communication between emergency care providers and trauma centers.	X	
(4) Incorporate research on the impact of environmental, weather, and natural conditions on intelligent transportation systems, including the effects of cold climates.		
(5) Enhance intermodal use of intelligent transportation systems for diverse groups, including emergency and health-related services.	X	
(6) Enhance safety through improved crash avoidance and protection, crash and other notification, commercial motor vehicle operations, and infrastructure-based or cooperative safety systems.	X	
(7) Facilitate the integration of intelligent infrastructure, vehicle, and control technologies.	X	

Appendix B: Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ACE	Automated Commercial Environment
AHS	Automated Highway System
AVL	Automated Vehicle Location
BRT	Bus Rapid Transit
CAD	Computer-Aided Dispatch
CAMP	Crash Avoidance Metrics Partnership
CAS	Collision Avoidance System
CCAM	Coordinating Council on Access and Mobility
CICAS	Cooperative Intersection Collision Avoidance Systems
CICAS-Gap	CICAS Gap Assist Systems
CICAS-V	CICAS Signal and Stop Sign Violation Warning System
Clarus	National Surface Transportation Weather Observing and Forecasting System
COMPASS	Creating Opportunities, Methods, and Processes to Secure Safety
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DHS	Department of Homeland Security
DMS	Dynamic Message Signs
DOJ	Department of Justice
DOT	Department of Transportation
DSRC	Dedicated Short-Range Communications
EDL	Electronic Document Library
EFM	Electronic Freight Management
EFPS	Electronic Fare Payment Systems
EMO	Evacuation Management and Operations
EMS	Emergency Management Systems
EOC	Emergency Operations Center
ES	Executive Summary
ESS	Environmental Sensor Station
FCC	Federal Communications Commission
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIH	Freight Information Highway
FMCSA	Federal Motor Carrier Safety Administration
FOT	Field Operational Test
FTA	Federal Transit Administration
FY	Fiscal Year
GM	General Motors
HEADS UP	Hurricane Evacuation and Decision Support Utility Program

IBEC	International Benefits, Evaluations, and Costs
ICDN	ITS Cooperative Deployment Network
ICC	Initiative Coordinating Committee
ICM	Integrated Corridor Management
IDAS	ITS Deployment Analysis System
IFTWG	Intermodal Freight Technology Working Group
IP	Internet Protocol
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITS	Intelligent Transportation Systems
ITS JPO	ITS Joint Program Office
ITS SPG	ITS Strategic Planning Group
IVBSS	Integrated Vehicle-Based Safety Systems
IVI	Intelligent Vehicle Initiative
JPO	Joint Program Office
MSAA	Mobility Services for All Americans
MUTCD	Manual on Uniform Traffic Control Devices
NENA	National Emergency Number Association
NG9-1-1	Next Generation 9-1-1
NHTSA	National Highway Traffic Safety Administration
NOAA	National Oceanic and Atmospheric Administration
NTOC	National Transportation Operations Coalition
P2P	Peer-to-Peer
PCB	Professional Capacity Building
PRISM	Performance and Registration Information Systems Management
PSAG	Public Safety Advisory Group
PSAP	Public Safety Answering Point
RITA	Research and Innovation Technology Administration
ROW	Right of Way
RWIS	Road Weather Information Systems
SAFER	Safety and Fitness Electronic Records System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SDO	Standards Development Organization
TEA-21	Transportation Equity Act for the 21st Century
TMC	Traffic Management Center
TMCC	Traveler Management Coordination Center
TRB	Transportation Research Board
U.S. DOT	United States Department of Transportation
UWR	United We Ride
VII	Vehicle Infrastructure Integration
VoIP	Voice-over-Internet Protocol
WE9-1-1	Wireless Enhanced 9-1-1

Appendix C: References

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