Illinois Statewide

Intelligent Transportation Systems (ITS) Strategic Plan

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DOCUMENT REVISION HISTORY

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1.0	August 2005	Initial release
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1 INTRODUCTION

Transportation in Illinois faces many challenges, including extensive and aging infrastructure, transportation demand, an aging population, suburban growth, rural accessibility, air quality, intermodal freight demand, and sustainable funding sources. To address these challenges, the Illinois Department of Transportation (IDOT) follows the goals prescribed by USDOT for statewide transportation planning:

- Support economic vitality
- Enhance integration and connectivity across modes
- Promote efficient system management and operation
- Emphasize the preservation of the existing transportation system
- Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation
- Environmental protection, energy conservation, improved quality of life, and consistency between transportation improvements, land use and economic development
- Increase accessibility and mobility of people and freight
- Enhance travel and tourism
- Increase security for motorized and nonmotorized users
- Increase safety for motorized and nonmotorized users

The strategic application of intelligent transportation system tools represents a range of approaches for IDOT and its partners to accomplish these goals.

1.1 DOCUMENT ORGANIZATION

The Illinois Statewide Intelligent Transportation Systems (ITS) Architecture and Strategic Plan consists of four primary components:

- Concept of Operations,
- Statewide and Regional ITS Architecture documents,
- Statewide and Regional RAD-IT Architecture databases, and
- Statewide ITS Strategic Plan.

This document presents the 2019 edition of the IDOT Statewide ITS Strategic Plan. An update of the initial Strategic Plan from 2006, this is a living document that will evolve as ITS projects are developed and deployed across the state. The remaining sections of the document are as follows:

- Section 1 – Introduction
- Section 2 – Program Goals and Objectives
- Section 3 – Statewide & Regional Architecture Overview
- Section 4 – Needs Identification and Prioritization
- Section 5 – Alternatives Analysis

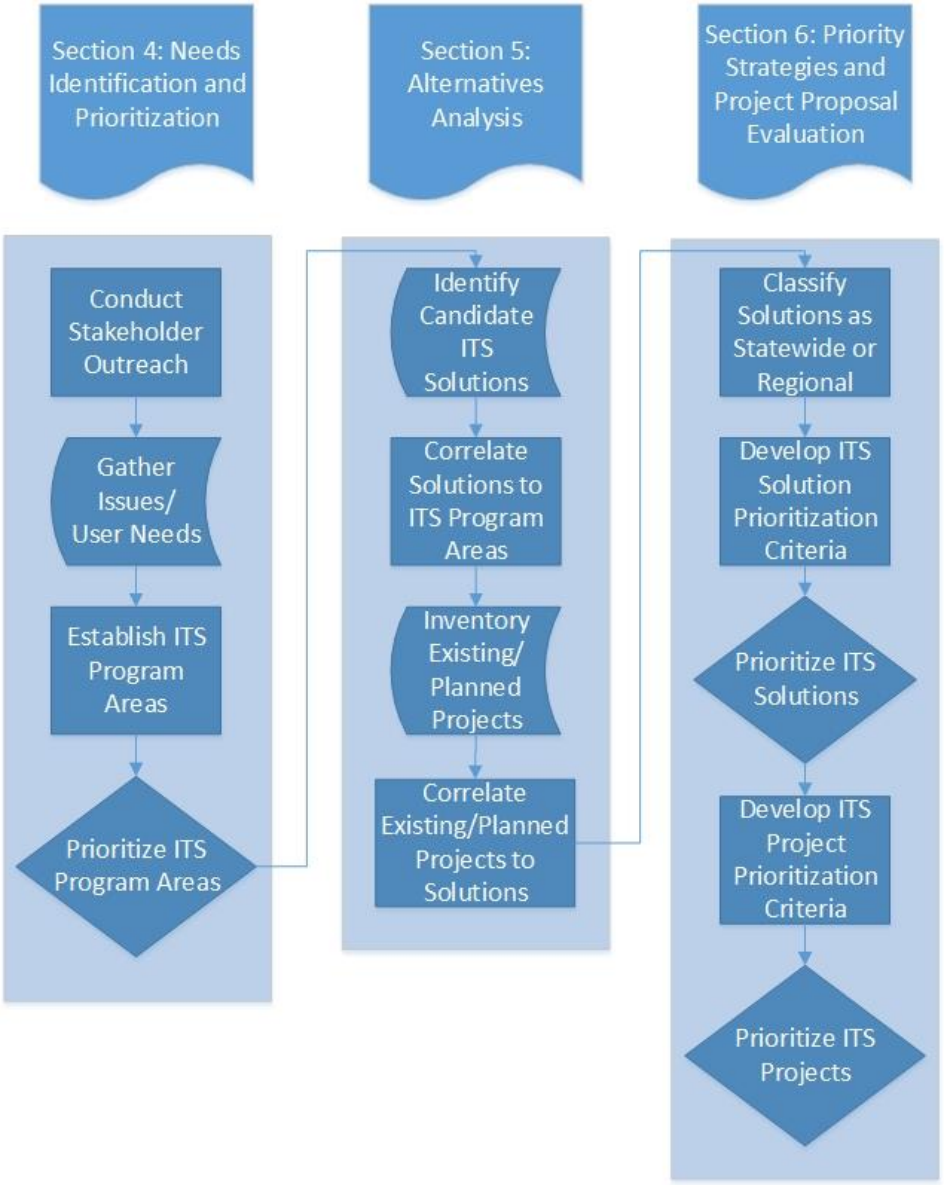

Figure 1-1 – Illinois Statewide ITS Strategic Plan Workflow

- Section 6 – Priority Strategies and Project Proposal Evaluation
- Section 7 – Transportation Systems Management and Operations
- Section 8 – Implementation Plan
- Section 9 – Operations and Maintenance
- Section 10 – Program Management

Sections 2 through 4 provide an overview of the current state of intelligent transportation systems in Illinois, including stakeholder needs identified through extensive outreach efforts across the state. Sections 5 and 6 focus on the identification, description, and prioritization of new ITS solutions to address the needs. Sections 7-10 provide recommendations for the identification, selection,

implementation, and ongoing operation and maintenance of ITS projects, including management of the state's ITS program.

As shown in Figure 1-1, this document provides traceability from the identified stakeholder needs to the recommended ITS projects. As described further in the identified sections, user needs have been grouped into ITS program areas, which are prioritized based on the importance applied to them during stakeholder outreach. Candidate ITS solutions, which represent general ITS tools and strategies, have been developed to align with the program areas. These ITS solutions are then prioritized to highlight those that are expected to provide the most benefit to travelers in Illinois. Lastly, specific ITS projects have been defined from the general ITS solution categories and prioritized based on various factors.

1.2 PURPOSE OF THE DOCUMENT

The Illinois Statewide Intelligent Transportation Systems Strategic Plan provides a performance-driven direction for the deployment of ITS on a statewide basis. The plan is a mechanism for the identification and prioritization of ITS projects within a single framework to promote maximum benefits from state and federal ITS funding. This document builds upon the groundwork defined by the Statewide Concept of Operations and statewide and regional ITS architecture process, as well as numerous studies performed by ITS stakeholders in Illinois. These include:

Transportation Improvement Plans/Programs

- Quad Cities: Davenport-Moline-Rock Island Urbanized Area, FFY 2018-21 Transportation Improvement Program (Bi-State Regional Commission)
- Champaign Urbana Transportation Improvement Program, FY 2019-2022 (Champaign-Urbana Urbanized Area Transportation Study, CUUATS)
- Danville Area Transportation Improvement Program, FY 2019-2022 (Danville Area Transportation Study, DATS)
- Decatur Urbanized Area FY 2017 – FY 2020 Transportation Improvement Program (Decatur Urbanized Area Transportation Study)
- FFY 2019-2022 Transportation Improvement Program for the Dubuque, Iowa, Illinois, and Wisconsin Urbanized Area (East Central Intergovernmental Association, ECIA)
- Transportation Improvement Program, Fiscal Years 2019 Through 2022, St. Louis Metropolitan Area (East-West Gateway Council of Governments, EWGCG)
- Kankakee County Transportation Improvement Program FY 2019 (Kankakee Area Transportation Study)
- Transportation Improvement Program, FY 2019-2023, Bloomington-Normal Urbanized Area (McLean County Regional Planning Commission)
- Rockford Transportation Improvement Program, Fiscal years 2017-2020 (Rockford Metropolitan Agency for Planning, RMAP)
- Springfield Transportation Improvement Program, Fiscal Years 2019-2022 (Springfield Area Transportation Study, SATS)
- Peoria Urbanized Area Transportation Improvement Program, Fiscal Years 2018-2021 (Tri-County Regional Planning Commission, TCRPC)
- Illinois Statewide Transportation Improvement Plan, FY 2018-2021 (IDOT)
- Illinois FY 2019 Proposed Highway Improvement Program (IDOT)

Illinois Strategic Plans/Business Plans

- Illinois Statewide ITS Strategic Plan, 2006
- Illinois Long Range Transportation Plan, 2017
- Illinois Strategic Highway Safety Plan, 2017
- Illinois Transit Plan, February 2018
- Illinois State Freight Plan, IDOT, October 2017
- 2017 Illinois State Rail Plan Update
- Dubuque Intelligent Transportation System Plan, City of Dubuque, 2009
- Northeastern Illinois Regional ITS Architecture, Version 3.0 (Chicago Metropolitan Area for Planning)
- USDOT's Intelligent Transportation Systems (ITS) ITS Strategic Plan 2015-2019

Other Studies

- Illinois Comprehensive Highway Safety Plan (IDOT)
- Illinois Statewide Mutual Aid Plan (Illinois Emergency Management Agency)
- Illinois Department of Natural Resources (DNR) Strategic Plan (Illinois DNR)
- Amber Alert Notification Plan (IDOT)
- Automated Vehicles 3.0, Preparing for the Future of Transportation (USDOT ITS Joint Program Office)

In addition to these documents, this Statewide ITS Strategic Plan utilizes stakeholder outreach conducted by the Project Team throughout the process to chart a course to make the systems and integration outlined in the Statewide Concept of Operations and ITS Architecture studies a reality.

1.3 OVERVIEW OF INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent transportation systems can be defined as "the *integrated* application of sensor, computer, electronics, communications and management strategies to provide traveler information to increase the *safety and efficiency* of the surface transportation system." Or, simply put, "People using technology in transportation to save time, lives, and money."

PEOPLE USING TECHNOLOGY IN TRANSPORTATION TO SAVE TIME, LIVES, AND MONEY.

Examples of "intelligent infrastructure" have become ubiquitous in Illinois: ramp meters, dynamic message signs, traffic cameras, open road tolling, electronic transit fare payment cards, and smartphone traveler information apps. Travelers now rely on these and many other intelligent transportation systems to make trips of varying distances and durations, often on multiple transportation modes.

As the 21st Century progresses, the focus of the ITS industry has expanded beyond the installation of roadside infrastructure to the vehicles themselves. The emergence of connected vehicles into the mainstream of automobile travel is now unfolding, bringing with it the ability to better understand and anticipate travel conditions, which is resulting in increased safety for all travelers. As vehicles become more connected they will transition from simply being traffic data points to becoming users of transportation data.

With more information being provided to the driver, more intelligence will be introduced into the vehicle itself. As described in the USDOT's *Automated Vehicles 3.0*, the future of transportation is poised to be one of automation, where humans will abdicate the role of driver and become directors of their travel. The effects of automated vehicles on society has become a popular focus of engineers, planners, sociologists, insurance providers, attorneys, and the government.

The utility and effectiveness of Illinois' intelligent infrastructure and its ability to support the emergence of connected and automated vehicles relies on management systems that oversee and administer the infrastructure. This includes traffic management centers that gather data from across the transportation network and apply it to make real-time decisions about incident and emergency response, traffic control, traveler information, and a host of other critical services.

Intelligent infrastructure produces a wealth of data that must be transmitted, processed, stored, and used to enable transportation management. This requires the establishment of data warehouses that interface with a wide range of data sources, applications, and users. Whether they are housed in a traditional traffic management facility or in the cloud, data warehouses serve as the central source for information and a connection point between transportation stakeholders.

For these intelligent transportation systems to be most effective, they must work together in an integrated manner. This integration component requires various wireline and wireless communications systems to support the exchange of data between management centers, personnel, vehicles, field devices, and the traveling public.

FOR INTELLIGENT TRANSPORTATION SYSTEMS TO BE MOST EFFECTIVE, THEY MUST WORK TOGETHER IN AN INTEGRATED MANNER

Before this level of integration can be realized and ITS can be deployed, transportation managers must identify a framework upon which ITS should be built. This framework should identify:

- ITS goals and objectives, a concept of how ITS will be operated;
- The various stakeholders and systems that are involved;
- The transportation services that partner agencies perform or plan to perform;
- Individual functional requirements for ITS, what the systems should provide to their users;
- Functional links between partner agencies and the data exchanged over those links;
- Applicable standards that apply to the exchange of information; and
- Any applicable or necessary agreements between partner agencies.

Acknowledging the need for this framework before deploying ITS, in 2001 the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) developed a rule/policy that requires regions that plan to deploy ITS to develop a regional ITS architecture in order to receive Federal funding for such projects. The Illinois Statewide ITS Architecture has been developed to provide a framework for the planning, deployment, and operation of ITS in Illinois.

Many groups are involved in the planning, design, deployment, and operation of ITS systems. These stakeholders include public officials, transportation planners and engineers, law enforcement, emergency management personnel, public/private transportation providers, civic groups, and the media and other information providers. Appendix A includes a comprehensive listing of ITS stakeholders in Illinois that participated in this effort. Each one plays a key role in the collection, processing, and distribution of transportation information to other partner agencies and the traveling public.

There are several proven benefits to the implementation of ITS systems. These benefits are typically measured by an increase in system capacity/throughput, cost savings, increased customer satisfaction, reductions in delay/travel time, reduced energy usage/environmental impacts, and improved safety. ITS projects often provide high return on investment, some with cost-to-benefit ratios of 20:1 or more. Performance measures for ITS are defined in Section 2.4.

1.4 NEED FOR AN ITS STRATEGIC PLAN

Many of the transportation improvement plans listed in Section 1.2 do not include references to ITS initiatives, but rather focus on traditional transportation projects, including road and bridge construction or transit. Others do include ITS, but only to a limited level. The listed ITS strategic plans cover other states, specific regions or corridors, or specific ITS programs in Illinois. This Illinois Statewide ITS Strategic Plan identifies the appropriate statewide ITS initiatives in these other documents, and then, based on extensive project outreach, expands upon these projects to outline a strategy to deploy ITS projects to meet the needs and requirements identified by stakeholders and defined in the Statewide ITS Architecture.

THIS PLAN SERVES AS A BASIS FOR BRINGING ITS PROJECTS TOGETHER IN AN INTEGRATED MANNER.

By documenting ITS initiatives across Illinois, this plan serves as a basis for bringing ITS projects together in an integrated manner. It identifies top-priority ITS projects that can be deployed in the short-term, "enabling" ITS projects that support other initiatives, and mid- and long-term ITS deployments that will build upon those ITS projects that precede them. This plan also documents an implementation strategy for making these projects a reality, which includes the identification of funding sources – both for initial deployment and ongoing operations and maintenance. This document concludes with recommendations for ITS program management that will guide the implementation and continuing planning of ITS in Illinois.

Furthermore, this Statewide ITS Strategic Plan contains recommendations for metropolitan planning organizations (MPO) and regional planning commissions (RPC) to create their own regional ITS strategic plans. These may be separate studies conducted at the regional level, or simply portions of regional transportation improvement plans or long-range transportation plans. Areas with an existing regional ITS architecture should be the first to consider developing and implementing these plans.

This ITS Strategic Plan is intended to provide the maximum benefit to end users by coordinating deployment priorities on a regional and statewide basis, leading to a more efficient, integrated transportation system.

1.5 BENEFITS OF AN ITS STRATEGIC PLAN

Based on the goals and objectives defined in Section 2, this ITS Strategic Plan provides guidance to ensure that, over time, ITS initiatives are incorporated into the transportation infrastructure and integrated with existing systems and with each other. By bringing together representatives from different transportation agencies across different transportation modes, this Strategic Plan documents the most pressing transportation needs from across the state, identifies and prioritizes potential ITS solutions to address these needs, and defines a series of ITS projects that will implement these solutions.

In addition, Section 7 of this document highlights the importance of Transportation Systems Management and Operations (TSMO), an integrated program designed to optimize the performance of the existing transportation network, and its role in identifying and prioritizing ITS initiatives. Section 8 defines an Implementation Plan that will guide the deployment of the identified ITS projects, from both the high-level statewide perspective and for those ITS project managers that will directly lead ITS deployment at the local level. Section 9 considers the impacts of the ITS project life cycle, in particular ongoing operations and management costs and resource needs.

Starting with the "Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users," or SAFETEA-LU in 2005 and continuing into the current Moving Ahead for Progress in the 21st Century (MAP-21) Act, and the related transportation act, Fixing America's Surface Transportation, or FAST Act, funding for ITS projects comes from the same sources as traditional transportation projects. By defining a comprehensive strategy for ITS deployment, this plan should serve as a resource for leveraging funding and help to identify when ITS can be deployed as part of, or in conjunction with, traditional transportation projects.

Lastly, this Strategic Plan outlines a recommended program management structure for ITS within IDOT. A multi-agency, multi-disciplinary approach to ITS is needed to lead the planning and deployment of ITS in the state and provide transportation stakeholders with a central source to help define, coordinate, and manage their ITS initiatives. This will help to optimize available resources and expertise within IDOT and its partner agencies.

Above all, this Illinois Statewide ITS Strategic Plan outlines a comprehensive direction for the future of ITS in Illinois. It will allow transportation stakeholders to be more aware of other related or similar initiatives as they plan, deploy, operate and maintain their own ITS projects. This will encourage integrated, interoperable systems and promote the sharing of information, and should also maximize available funding and leverage resources to the benefit of the traveling public in Illinois.

2 PROGRAM GOALS AND OBJECTIVES

2.1 VISION STATEMENT

The USDOT has stated that "projects have the greatest chance for success when they promote a shared vision." A long-term view of transportation needs and services underpins any vision for ITS deployments across the state. At its simplest, an integrated network of surface transportation information is based on monitoring, information management, system control, and optimization – in short, the creation of an integrated statewide network of transportation information shared between agencies and the traveling public.

The information to be gathered and managed includes real-time information on the physical state of the infrastructure; how it is being built, used, maintained, and secured; relevant road and weather conditions; driver expectations; and other information for system operators and users. At the highest level, the statewide vision for ITS in Illinois can be stated simply as…

Informed choices for improved operations using technology to provide safe, secure, and seamless services to the traveling public in real-time

This vision will be achieved within a flexible, adaptable, standards-based framework for the integration and coordination of transportation for both systems and operations. The transportation system should be managed and operated to provide end-to-end multi-modal passenger travel, regardless of traveler age, physical ability, or location. The system should be equally supportive of efficient intermodal freight transport.

The Statewide ITS Vision must support public policy and private sector decision makers so that future transportation will be secure, customer-oriented, performance-driven, responsive in times of crisis, institutionally innovative, and ready for the future of transportation - enabled by information that is derived from a fully integrated network of computing, communications, and sensor technologies. The Statewide ITS Vision is based on success in the following areas:

- Cost-Effectiveness
- Equitable Service
- Efficient System
- Information to User
- Low User Cost
- Minimum Travel Time
- No Surprise Delays
- Personal Security
- Positive Image
- Reliable Transportation
- Seamless Agency Coordination
- User Friendly
- Zero Crashes

2.2 GOALS AND OBJECTIVES

The goals and objectives of the ITS Strategic Plan are modeled after the goals and objectives developed for the Illinois *Long Range Transportation Plan* (LRTP), updated most recently in 2017. These goals and objectives will allow for the continued introduction of ITS technologies into the institutional and funding framework of surface transportation in the State of Illinois. These goals and objectives are:

Illinois LRTP Goals

- **Economy -** Improve Illinois' economy by providing transportation infrastructure that supports the efficient movement of people and goods.
- **Livability -** Enhance the quality of life across the state by ensuring that transportation investments advance local goals, provide multimodal options, and preserve the environment.
- **Mobility** - Support all modes of transportation to improve accessibility and safety by improving connections between all modes of transportation.
- **Resiliency** - Proactively assess, plan and invest in the state's transportation system to ensure that our infrastructure is prepared to sustain and recover from extreme events and other disruptions.
- **Stewardship -** Safeguard existing funding and increase revenues to support system maintenance, modernization, and strategic growth of Illinois' transportation system.

The objectives for the ITS Strategic Plan are defined by the various Program Areas described in Section 4.

The goals and objectives of the transportation system cannot be fully articulated without considering who will use, maintain, and expand the system. The evolving needs of these stakeholders, documented in Section 4, must guide any improvements to the transportation network. They include:

- The motoring public
- Public safety responders
- Transit riders
- Rural residents
- Tourists
- Infrastructure owners and operators
- Autonomous and connected vehicle industry
- Private industry partners
- Funding agencies
- Commercial vehicle operators
- Traffic Management Agencies
- Maintenance agencies
- Elected officials
- Intermodal planners
- Non-motorized travelers

2.3 OVERALL PROGRAM DIRECTION

In many ways, Illinois is the transportation center of America. Chicago has been the hub of the nation's rail system for nearly 160 years. Over 50 railroads currently traverse 9,982 miles of track in the state, providing links to all corners of the country.[1] O'Hare International Airport and the major commuter hub at Midway Airport make Chicago one of the busiest air destinations in the world. More than 107 public/private airports, with over 750 aviation facilities further emphasize the state's standing in aviation. Illinois also has over 1,095 miles of navigable waterways which link the Mississippi River (and the Gulf of Mexico) to the Great Lakes and beyond to the Atlantic Ocean.[2] To augment these other

[1] Wikipedia
[2] Illinois Transportation System Overview, IDOT

forms of freight shipping, thousands of commercial trucking companies are based in Illinois. These trucking companies, as well as the over 8.5 million registered drivers in Illinois,[3] provide a significant demand on the state's 147,005 miles of roadways. This road system includes over 2,100 miles of interstate highways, the third highest total of any state in the nation. Adding further complexity to the picture of Illinois' transportation infrastructure is the fact that vast portions of the state are not densely populated. In point of fact, approximately 66 percent of the state's roadways are classified as rural.[4]

With this enormous transportation infrastructure comes a multitude of challenges, all of which revolve around the safety, mobility, and economic viability of the transportation system. Illinois has been a pioneer in the use of ITS to address these challenges. What we today call ITS began in Illinois in the Chicago area as early as 1963 when IDOT's Traffic Systems Center (TSC) established one of the first real-time expressway surveillance and management systems in the world. The detectors, ramp meters, variable message signs, and highway advisory radio (HAR) systems have been operated continuously ever since.

Over the last 20 years, many of these technologies have been deployed outside of the Chicago area, first in metropolitan areas like the East St. Louis, Peoria-East Peoria, the Quad Cities, Rockford, Bloomington, Springfield, and most recently in Champaign-Urbana. ITS components have also been deployed in rural areas of the state, like smart work zones along Interstate routes in southern Illinois, rest area monitoring cameras, road weather information systems, and an array of commercial vehicle ITS applications across Illinois. By proving the viability and benefits of these systems, they have led to other planned ITS initiatives throughout the state, both in urban and rural settings. Many Illinois municipalities have applied technology and management strategies to improve the safety, capacity, and efficiency of the transportation system.

Section 5.3 provides a summary of major ITS planning initiatives in Illinois at a statewide, regional, and local level. These projects focus on a wide range of transportation fields, including transit, data management, traveler information, traffic management, highway-rail intersections, commercial vehicle operations, incident/emergency response, maintenance/construction management, and connected and automated vehicles. Planning for many of these projects has been carried out at the local or regional level, and some have involved the participation of several transportation agencies. As described in the Statewide Concept of Operations and summarized later in Section 3 of this document, the IDOT ITS Program Office provides the lead role for ITS planning and deployment in Illinois. This ITS Strategic Plan serves as a tool for the Program Office to plan statewide ITS initiatives with a wider, long-term perspective. In addition, recommendations in Section 10, Program Management, include additional transportation stakeholders' participation in the planning, programming, funding, and deployment of ITS projects.

2.4 PERFORMANCE MEASURES

Before deploying ITS, various performance measures are defined to evaluate the effectiveness of the ITS components once they are installed and operational. These performance measures often quantify the effect that ITS elements have on the transportation system, rather than the operation of the components themselves.

[3] Total Number of Licensed Drivers in the U.S. in 2017, by State, statista
[4] Statewide Vehicle Miles of Travel, IDOT, 2017

Successful implementation of the ITS Strategic Plan goals, as defined by the Illinois LRTP, will be embodied by the planning and programming of ITS projects that meet well-defined performance goals. IDOT is currently working with MPOs and transit agencies to establish and implement performance targets and to develop performance measures and data sources associated with MAP-21 and FAST Act performance goals covering the following areas: Safety, Infrastructure Condition, Congestion Reduction, System Reliability, Freight Movement and Economic Vitality, Environmental Sustainability, Reduced Project Delivery Delays.

The Federal Highway Administration (FHWA) has defined Transportation Performance Management goals that the Illinois LRTP has traced to its five overarching goals. The following subsections outline these performance goals that provide the basis for evaluating the performance of ITS components in the state of Illinois.

Safety

A specific goal of ITS components in Illinois is to improve transportation system safety by minimizing the occurrence of incidents, traffic deaths, and lowering incident response times. Several ITS components aim to minimize the occurrence of crashes and secondary crashes, speed the detection of incidents that do occur, and help to clear crashes more quickly. Typical measures of effectiveness used to quantify safety improvements include reductions in the overall crash rate, fatality crash rate, and injury crash rate (per miles traveled). To ensure that "before and after" comparisons of the safety impacts of ITS deployments are accurate, surrogate measures can be applied. These surrogate measures used include vehicle speeds (in relation to the posted limits), speed variability, or changes in the number of violations of traffic safety laws.

FHWA PERFORMANCE GOAL: *TO ACHIEVE A SIGNIFICANT REDUCTION IN TRAFFIC FATALITIES AND SERIOUS INJURIES ON ALL PUBLIC ROADS.*

RELATED IDOT LRTP GOALS:
LIVABILITY, MOBILITY, RESILIENCY, STEWARDSHIP

Infrastructure Condition

The goal of maintaining a highway infrastructure asset system in a state of good repair requires commitment from the agency to improve and maintain the pavement condition to support the continued mobility of people and goods throughout the state. This goal can also be supported by ITS technologies that help to measure the current state of infrastructure conditions. The National Reference for ITS Architecture provides an overview on how the monitoring of transportation infrastructure can be performed using various bridge sensors and infrastructure surveillance equipment to preclude an incident, control public access to impacted areas during and after an incident, or mitigate the impact of an incident to roadway and transportation infrastructure.

FHWA PERFORMANCE GOAL: *TO MAINTAIN THE HIGHWAY INFRASTRUCTURE ASSET SYSTEM IN A STATE OF GOOD REPAIR.*

RELATED IDOT LRTP GOALS:
MOBILITY, RESILIENCY, STEWARDSHIP

The condition of the transportation infrastructure is critical to ensuring the safe and efficient movement of people and goods throughout the state. Measures of effectiveness typically used to evaluate

infrastructure condition include bridge stress sensor reporting and crowd sourced pavement condition issues (e.g., potholes).

Congestion Reduction

A major goal of many ITS projects is the improvement of mobility by reducing delay and travel times. Measures of effectiveness typically used to evaluate mobility improvements include reductions in travel time delay and improvements in surrogate measures like the number of stops observed before and after an ITS deployment.

FHWA PERFORMANCE GOAL:
TO ACHIEVE A SIGNIFICANT REDUCTION IN CONGESTION ON THE NATIONAL HIGHWAY SYSTEM.

RELATED IDOT LRTP GOALS:
LIVABILITY, MOBILITY, RESILIENCY, STEWARDSHIP

Delay is measured in different ways depending on the transportation mode being analyzed. Delay of a system is typically measured in seconds or minutes of delay per vehicle. In addition, delay for users of the system may be measured in person-hours. Delay for freight shipments could be measured in time past scheduled arrival time of the shipment. Delay can also be measured by observing the number of stops experienced by drivers before and after a project is deployed or implemented.

System Reliability

Many ITS components seek to optimize the efficiency of the existing transportation system. This allows mobility and commerce needs to be met while reducing the need to construct or expand facilities. This is accomplished by increasing the effective capacity of the transportation system through ITS projects such as Managed Lanes that can improve the overall reliability of travel times along corridors.

FHWA PERFORMANCE GOAL:
TO IMPROVE THE EFFICIENCY OF THE SURFACE TRANSPORTATION SYSTEM.

RELATED IDOT LRTP GOALS:
LIVABILITY, MOBILITY, RESILIENCY, STEWARDSHIP

Effective capacity is defined as the "maximum potential rate at which persons or vehicles may traverse a link, node, or network under a representative composite of roadway conditions," including "weather, incidents, and variation in traffic demand patterns."[5] Capacity, as defined by the *Highway Capacity Manual*, is the "maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a given point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions."

While capacity is generally measured under typical conditions, i.e., good weather and pavement conditions with no incidents affecting the system, effective capacity can vary depending upon these conditions and the use of management and operational strategies. Throughput is defined as “the number of persons, goods, or vehicles traversing a roadway section or network per unit time.”[6] Increases in throughput are sometimes realizations of increases in effective capacity. Under certain conditions, it may reflect the maximum number of travelers that can be accommodated by a transportation system. Throughput is more easily measured than effective capacity and therefore can be

[5] USDOT, ITS Evaluation Guidelines – ITS Evaluation Resource Guide
[6] USDOT, ITS Evaluation Guidelines – ITS Evaluation Resource Guide

used as a surrogate measure when analyzing the performance of an ITS project as it relates to System Reliability.

One example of ITS technology that can increase vehicle throughput is Managed Lane deployments that allow general vehicles to utilize more of the roadway during conditions of heavy traffic congestion. Roadway shoulders can be opened to general traffic through DMS mounted over the shoulder lane and activated by traffic management agencies that monitor travel conditions along the corridor.

Travel time variability is defined as "the variability in overall travel time from an origin to a destination in the system, including any modal transfers or en-route stops."[7] This measure of effectiveness can also be applied to the movement of goods or people. Reducing the variability of travel time improves the reliability of arrival time estimates that travelers or companies use to make planning and scheduling decisions. By improving operations, improving incident response, and providing information on delays, ITS components can reduce the variability of travel time in transportation networks.

Freight Movement and Economic Vitality

ITS implementations can support the safe and efficient movement of freight and the overall economic vitality throughout the state. Some applications may save time in completing business or regulatory processes, enabling businesses to increase their economic efficiency. For public agencies in Illinois, ITS alternatives for transportation improvements may have lower acquisition costs and life cycle costs when compared to traditional transportation improvements. Other ITS applications enable the collection and synthesis of data that can translate into cost savings and performance improvements. Operational efficiencies and cost savings made possible by ITS implementation can help both public and private entities make the most productive use of their resources.

FHWA PERFORMANCE GOAL: *TO IMPROVE THE NATIONAL FREIGHT NETWORK, STRENGTHEN THE ABILITY OF RURAL COMMUNITIES TO ACCESS NATIONAL AND INTERNATIONAL TRADE MARKETS, AND SUPPORT REGIONAL ECONOMIC DEVELOPMENT.*

RELATED IDOT LRTP GOALS*: ECONOMY, MOBILITY, STEWARDSHIP*

Measure of effectiveness for this goal area can include an increased number of lifts at intermodal stations, increasing the availability of real-time truck parking availability information to assist commercial vehicle operators in meeting hours of service requirements, reduced hours of delay due to commercial vehicle traffic, increased freight tonnage, and an increased efficiency of truck parking at rest areas.

Environmental Sustainability

The air quality and energy impacts of ITS components are very important considerations, particularly for non-attainment areas. In most cases, environmental benefits of a given ITS project are hard to quantify and can only be estimated by the use of analysis and simulation. Problems related to regional measurement include the small impact of individual projects and large numbers of exogenous variables including weather, contributions from non-mobile sources, air pollution drifting into an area from other

[7] USDOT, ITS Evaluation Guidelines – ITS Evaluation Resource Guide

regions, as well as the time-evolving nature of ozone pollution. Small-scale environmental studies generally show that ITS projects have positive impacts on the environment, which result from smoother and more efficient traffic flow that ITS can help bring about, which can include a reduced number and duration of road closures due to heavy flooding. However, environmental impacts of travelers reacting to large-scale ITS deployment in the long term are not well understood.

Identified measures of effectiveness for this goal area are decreases in emission levels and energy consumption. Specific measures of effectiveness for emission levels and fuel use include:

- Emission levels (kilograms or tons of pollutants including carbon monoxide (CO), oxides of nitrogen (NOx), hydrocarbons (HC), and volatile organic compounds)
- Fuel use (gallons)
- Fuel economy (miles/gal)

FHWA PERFORMANCE GOAL: *TO ENHANCE THE PERFORMANCE OF THE TRANSPORTATION SYSTEM WHILE PROTECTING AND ENHANCING THE NATURAL ENVIRONMENT.*

RELATED IDOT LRTP GOALS*: LIVABILITY, MOBILITY, RESILIENCY, STEWARDSHIP*

Reduced Project Delivery Delays

ITS implementations can reduce operating costs and provide productivity improvements. Some applications may save time in completing business or regulatory processes, enabling businesses to increase their economic efficiency. For public agencies in Illinois, ITS alternatives for transportation improvements may have lower acquisition costs and life cycle costs when compared to traditional transportation improvements. Other ITS applications enable the collection and synthesis of data that can translate into cost savings and performance improvements. Operational efficiencies and cost savings made possible by ITS implementation can help both public and private entities make the most productive use of their resources. The measure of effectiveness for this goal area is cost savings as a result of implementing ITS.

FHWA PERFORMANCE GOAL: *TO REDUCE PROJECT COSTS, PROMOTE JOBS AND THE ECONOMY, AND EXPEDITE THE MOVEMENT OF PEOPLE AND GOODS BY ACCELERATING PROJECT COMPLETION.*

RELATED IDOT LRTP GOALS: *STEWARDSHIP*

3 STATEWIDE & REGIONAL ARCHITECTURE OVERVIEW

The Illinois Statewide Intelligent Transportation Systems (ITS) Strategic Plan uses the Statewide ITS Concept of Operations, the Statewide ITS Architecture, and regional ITS architectures to provide a roadmap for deployment and operations of enhanced transportation services across the state. The Concept of Operations reflects the current and anticipated transportation services from transportation stakeholders and identifies the organizational responsibilities of IDOT. The Statewide ITS Architecture identifies the current and planned technical framework for providing the transportation services described in the Concept of Operations.

3.1 ITS ARCHITECTURE

ITS Architecture provides the framework to efficiently use technology to solve transportation problems and to make better use of the existing infrastructure and resources. Architectures also bridge the gap between strategic planning for transportation management and operations for the ITS projects that implement those strategies.

The Federal Highway Administration (FHWA) final rule and Federal Transit Administration (FTA) policy on Intelligent Transportation Systems (ITS) Architecture and Standards, issued in 2001, requires ITS projects funded by the Highway Trust Fund and the Mass Transit Account conform to the National ITS Architecture (NITSA), now known as the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), as well as to USDOT-adopted ITS standards. In order to ensure federal compliance for the state of Illinois for ITS project development, implementation and funding, IDOT adopted Version 1.0 of the Statewide ITS Architecture and Strategic ITS Plan in 2005.

The software previously used to develop the Illinois Stateside ITS Architecture, Turbo Architecture®, has been replaced by the Regional Architecture Development tool (RAD-IT) . The new tool is designed with a user-friendly web interface, providing a wealth of resources and use cases. Beyond the web functionality, the tools for creating and maintaining ITS architectures were also overhauled. The RAD-IT tool is the software application that supports the development of regional and projects ITS architectures using ARC-IT as a starting point, as depicted in Figure 3-2.

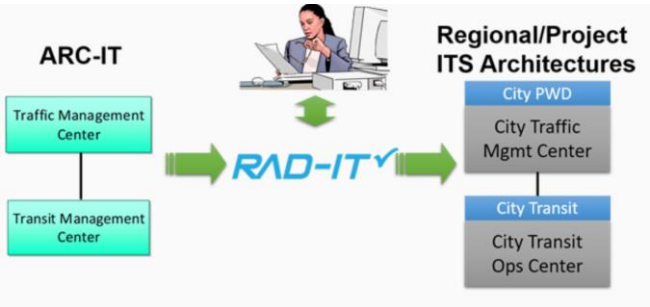

Figure 3-2 – ARC- IT and RAD-IT Architecture tools

The IDOT Statewide ITS Architecture defines functions and not technologies. The architecture helps to define how stakeholders, functions and systems relate to each other. The Project Team began the process to update the statewide architecture by reviewing the existing inventory of stakeholders, systems and services. Concurrently, a review of changes to the NITSA tools, related federal requirements, ITS best practices and associated resources was performed.

The NITSA service packages, formerly known as market packages, provide an accessible, service-oriented perspective to ARC-IT. They were also known as "applications" in the Connected Vehicle Reference Implementation Architecture (CVRIA), which has been integrated into ARC-IT. Service packages are implemented through projects (or program of projects) and in transportation planning, they are directly related to the ITS strategies used to accomplish regional goals and objectives.

Technologies that implement the functions in the architecture are enabled by individual projects discussed further in this Strategic ITS Plan Update.

3.2 STATEWIDE ITS CONCEPT OF OPERATIONS

Services from IDOT

The State of Illinois is a unique combination of urban and rural environments grouped into districts and regions. An IDOT region typically consists of two districts, except for the Chicago Metropolitan area where District 1 is a large enough to be designated as a region by itself. The specific description of each region as shown in Figure 3-3 Statewide ITS Regions is as follows:

- **IDOT Region 1**, located in northeastern Illinois, includes the Chicagoland region and the collar counties. This region is home to two of the nation's busiest airports, O'Hare and Midway. Both Interstate highways and tollways constitute the region's 28,060 centerline miles of roads.
- **IDOT Region 2** encompasses Districts 2 and 3. This region includes Rockford, the Quad Cities, the La Salle-Peru-Ottawa areas, and the Kankakee metropolitan area. This IDOT region is labeled as Rock River Valley and Commerce Corridors. About 29,683 centerline miles of roads span this region, including traffic operations along I-39, I-80, and I-88.
- **IDOT Region 3** spans north-central Illinois and includes IDOT's District 4 and District 5. This region encompasses 25,547 centerline miles of roads. The region's railroads move thousands of tons of freight and the growing airports serving the region include those in Peoria and Bloomington-Normal. Amtrak also provides service in Bloomington-Normal and Champaign-Urbana. This region includes Galesburg, Peoria, Bloomington-Normal, Champaign-Urbana, and Danville. This IDOT region is labeled as Great Rivers Country and University Trail.
- **IDOT Region 4** encompasses Districts 6 and 7 including Quincy, Jacksonville, Springfield, Decatur, Mattoon-Charleston area and Effingham. Located in central Illinois, the region is home to 36,208 miles of roadways and covers the widest portion of Illinois. This IDOT region is labeled as Capital West and Little Wabash and includes the I-70 corridor from Vandalia to the Indiana state line.
- **IDOT Region 5** encompasses Districts 8 and 9. This includes the Metro East St Louis area, Mt Vernon, Marion and Carbondale. The southernmost part of Illinois, this area is bordered on the south and west by the Mississippi and Ohio rivers. An estimated 25,844 centerline miles of roads traverse this region that includes Metro East and Little Egypt and the entire I-64 corridor.[8]

[8] IDOT Regions, IDOT website.

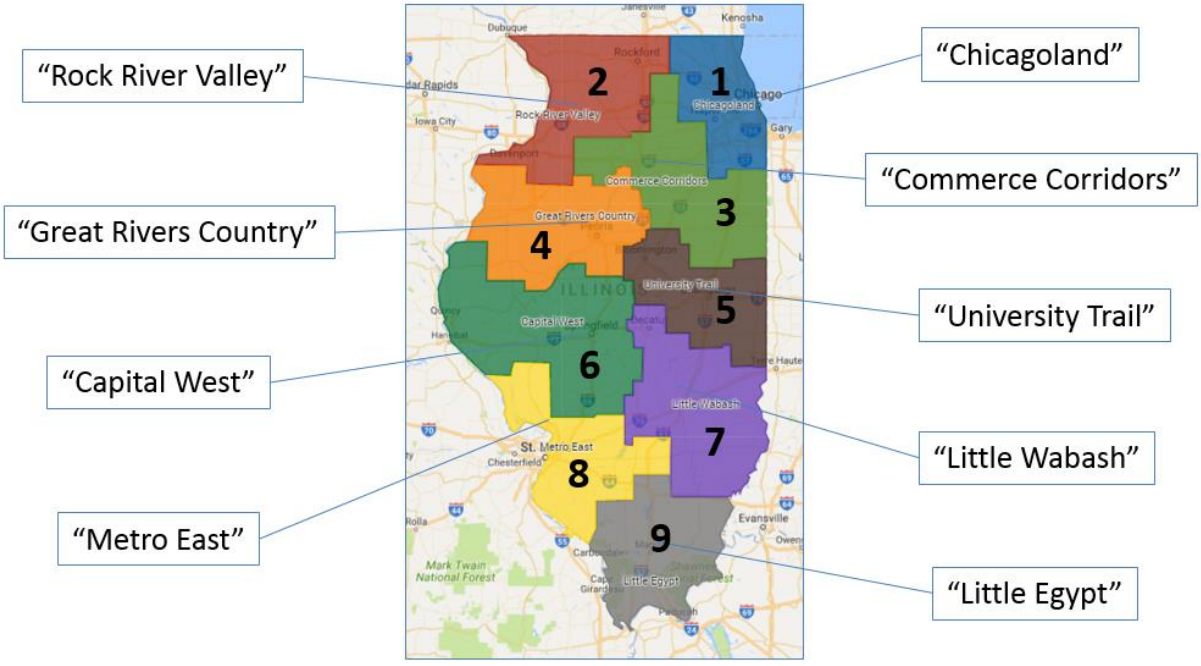

Figure 3-3 – Statewide ITS Regions

Current Statewide Services

IDOT has been active in the planning and deployment of ITS for many years including initiatives in cooperation with both local agencies and bordering states. Each IDOT region provides transportation services that implement the functions identified in the Statewide ITS Architecture. These functions are grouped into ITS "Service Packages" as defined by ARC-IT and reflect the unique characteristics of Illinois, as updated with the results from stakeholder outreach and data collection. Service packages enable transportation planners and decision makers to determine appropriate ITS services that satisfy local and statewide needs. A complete listing of ITS Service Packages applicable to Illinois can be found in Section 4 of the separately developed Statewide ITS Architecture Update document.

The Gateway Traveler Information System (GTIS) is the core system that facilitates the integration and interoperation of ITS for the center-to-center interface environment for Illinois, Indiana, Michigan, and Wisconsin and the Travel Midwest website. The public website regularly receives between 5-7 million visits per month and is the most visible product of the Gateway development efforts. The primary function of the Gateway system is to collect and distribute real-time information among the operating agencies. The GTIS has expanded over the last few years to include downstate Illinois in 2015, Iowa and Ohio in 2017, and Missouri in 2018.

For IDOT Region 1, ITS activities have largely been led by District 1 staff. District 1 partners with the Illinois State Toll Highway Authority (ISTHA) and the City of Chicago to provide real time traveler information on dynamic message signs (DMS) on tollways and highways throughout NE Illinois. District 1 also provides traffic management services on a 24/7 basis.

In IDOT Region 2, District 2 currently supports relaying weather information and cross-border coordination for DMS in the Quad Cities area and traffic management during I-90/39 alternate route

planning. District 3 supports display of travel times and shared DMS assisted by I-80 camera installations, as well as other DMS along I-39, I-55, and I-57. District 3 also has a working relationship with District 1 for dynamic message sign interoperability and messaging capabilities.

In IDOT Region 3, District 4 planned services include centralized traffic management capabilities and coordination for traffic signals by both the City of Peoria and IDOT. This region has expanded ITS planning, design, implementation, operations and maintenance activities over the past decade with management of the I-74 corridor. District 4 has integrated computer aided dispatching with local police. District 5 currently provides services that include road condition reporting and maintenance vehicle AVL alerts. Roadway Weather Information System (RWIS) is shared and viewed by IDOT and the Milestone video management software in use is scalable for future applications. District 4 provides traffic management services on a 24/7 basis and this capability has facilitated emergence of the operational concept where District 4 covers after-hours operations for the adjacent District 5.

IDOT Region 4 relies largely on Station One coverage, which also operates on a 24/7 basis, for after hours and coordination with ISP for incident and emergency management. There are ongoing efforts in District 7 to provide fiber optic communications between traffic management and law enforcement, as well as coverage on I-72 and cellular links with DMS. District 6 leverages ITS for Illinois State Fair special event planning, parking management and emergency operations and coordinated dispatching.

In IDOT Region 5, District 8 provides traffic management services on a 24/7 basis from its office in Collinsville and provides data collection and processing services, incident detection, verification, and response coordination. District 9 continues efforts for Smart Work Zone applications in coordination with FHWA and implementation of a centralized traffic management system on IL 13.

The ITS Program Office is responsible to manage ITS program activities that can be divided into four categories as shown below in Table 3-1 IDOT ITS Program Office Roles: policy, program management, ITS deployment, and operations. Further discussion of these services is contained in Section 10, Program Management.

Planned Services

Building upon the current statewide services noted above, the most significant planned services are the expansion of traffic management capabilities that will enhance the ability for IDOT Districts to support ITS operations throughout the state. Illustrated in Figures 3-4 and 3-5, these services are described in the Statewide ITS Concept of Operations, which leverages the existing Illinois ITS infrastructure. Each region provides transportation services, implementing the various functions represented by the NITSA Service Packages. The Service Packages included in the Statewide ITS Architecture update and updated Concept of Operations reflect the needs and associated planned services for Illinois' stakeholders. The updated list mirrors the RAD-IT packages which have changed significantly regarding the services that are bundled together instead of appearing as separate packages. For example, in the previous NITSA, Incident Management and Electronic Toll Collection were listed as separate packages. The current RAD-IT packages are more comprehensive including related services as shown by Traffic Management Service Package listed in Table 3-2.

Table 3-1 – IDOT ITS Program Office Roles

Policy	Program Management	ITS Deployment	Operations
Public Relations/ Legislative Issues	Project Programming	Systems Engineering Support	Training
Resource Sharing Coordination	ITS Architecture Development, Compliance & Maintenance	Technical Support to Regions/Local Governments	Performance Measures Tracking & Reporting
	Planning Coordination	Accounting/Funds Tracking	Technology Enhancements
	ITS Funding Allocation & Budgeting	ITS Standards Application	Operational Procedures Management
	Performance Measures Identification		
	ITS Standards Identification		
	Research & Development		

Consistent with the bundling of services, the updated Concept of Operations diagrams use icons to represent the entities, along with their respective services, functions, and requirements. The solid lines between icons represent the explicit protocols and procedures that the two entities use in performing operations and other communications that support operations. The Operational Concept supports the updated ITS Vision for Illinois that focuses on the exchange of real time transportation system data.

The originally adopted Illinois Statewide Architecture envisioned the formation of regional and district 'Hubs' to perform centralized Traffic Management operations for that region/district. Traveler Information, Commercial Vehicle Operations, and coordination with Regional Hubs and neighboring state departments of transportation are examples of Statewide functions for the Illinois Statewide Hub. The Illinois Statewide Hub also shares statewide transportation information with the Illinois State Police, transit operations, and public safety answering points (PSAPs)/emergency dispatch centers.

In the current technological environment, information hubs or centralized points of integration are still viable and often quite useful to bridge information from disparate systems. However, the ITS marketplace has shown a much stronger commitment to Application Protocol Interfaces (APIs) and use of standards to share data, meaning that software platforms for ITS data and command and control is generally easier than 15 years ago. Vendors are developing their products recognizing that integration of external data and/or devices are regularly required. Thus, in this architecture update, consideration of system-to-system without necessarily prescribing centralized processing hubs is an update. While Gateway TIS has been historically viewed as a Hub, in recent years, the capabilities as a traveler information provider and a true operations system in terms of incidents and particularly construction

events has been noteworthy. In terms, of Gateway functionality and the Concept of Operations at the Statewide and regional levels, the system serves traffic and incident management communication, traveler information, and data archiving services. Gateway also provides a level of system and data quality management services for the data sources in identifying system and information anomalies. As IDOT engages in TMC and ATMS assessment projects both in Northeastern Illinois and statewide, further updates to the role of the system are likely.

Figure 3-4 illustrates, at the highest level, an IDOT Station One Central Operations statewide concept of operations for ITS. While still a high-level concept, in addition to IDOT it includes a broader range of stakeholders such as MPOs/RPCs for Transportation Systems Management and Operations (TSMO) coordination, transit agencies, and law enforcement expected to exchange information through a typical Illinois Regional/District Hub.

Table 3-2 – RAD-IT Service Package Sample

RAD-IT Traffic Management (TM) - Service Packages		
Traffic Management	TM01	Infrastructure-Based Traffic Surveillance
	TM02	Vehicle-Based Traffic Surveillance
	TM03	Traffic Signal Control
	TM04	Connected Vehicle Traffic Signal System
	TM05	Traffic Metering
	TM06	Traffic Information Dissemination
	TM07	Regional Traffic Management
	TM08	Traffic Incident Management System
	TM09	Integrated Decision Support and Demand Management
	TM10	Electronic Toll Collection
	TM11	Road Use Charging
	TM12	Dynamic Roadway Warning
	TM13	Standard Railroad Grade Crossing
	TM14	Advanced Railroad Grade Crossing
	TM15	Railroad Operations Coordination
	TM16	Reversible Lane Management
	TM17	Speed Warning and Enforcement
	TM18	Drawbridge Management
	TM19	Roadway Closure Management
	TM22	Dynamic Lane Management and Shoulder Use

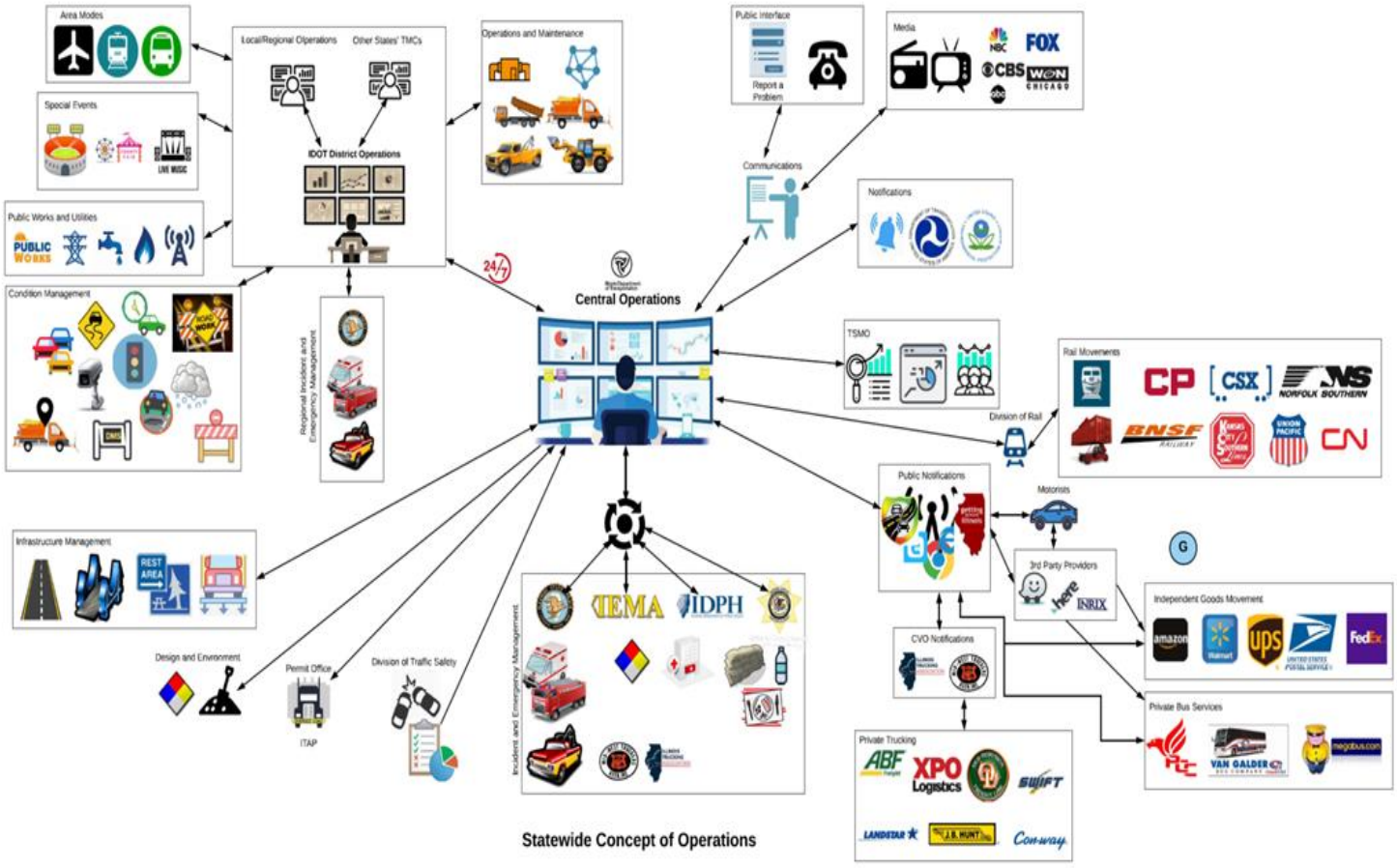

Figure 3-4 – Statewide Concept of Operations

Regional and district level entities provide safety, transit, and law enforcement information to the Illinois Statewide Hub. Figure 3-5 adds some representative details, including public and private sector stakeholders that are expected to exchange information through a typical District or Regional Communications center. Information exchange at a statewide level occurs, but the primary interactions occur at a regional or district level.

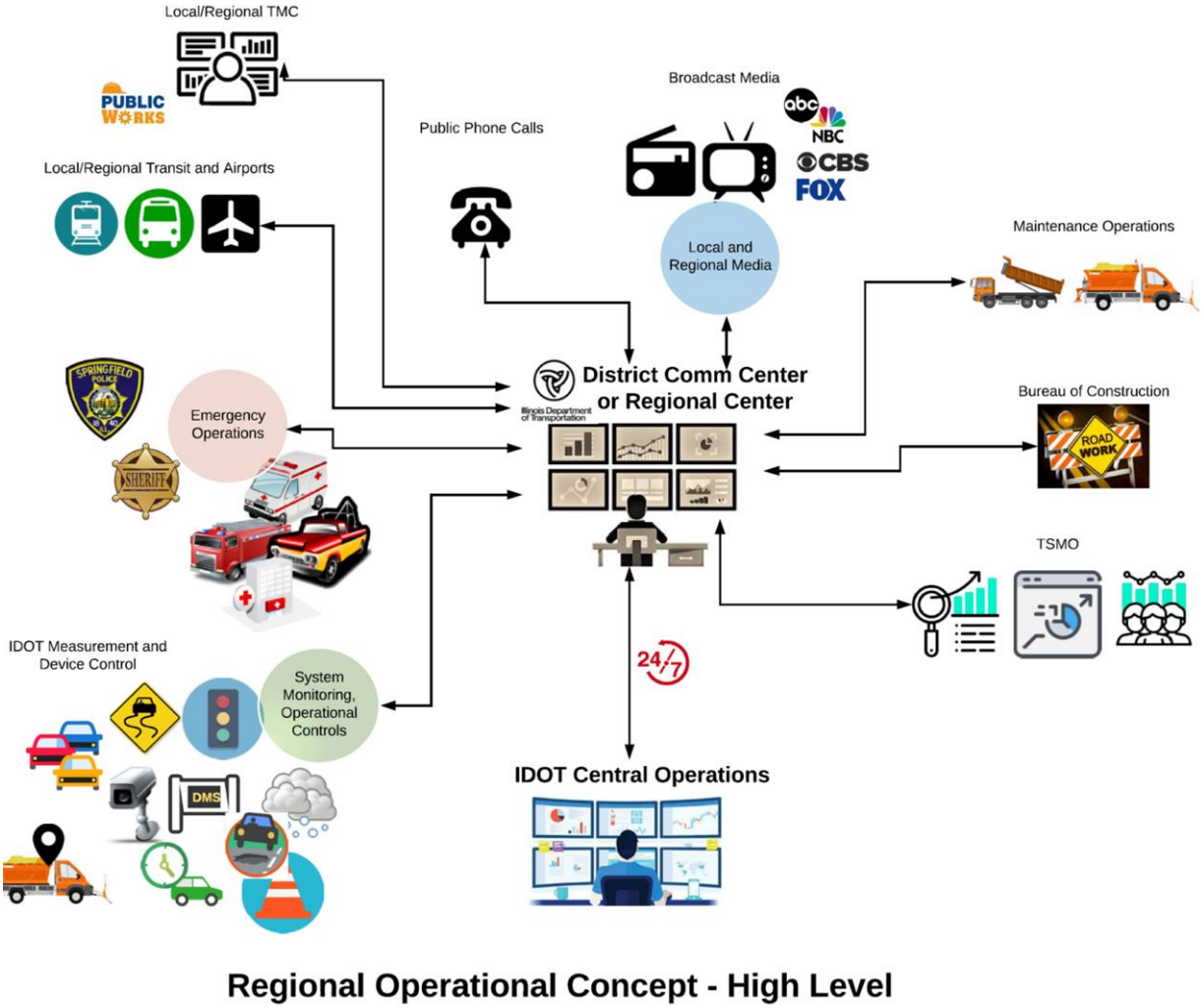

Figure 3-5 – Region/District Concept of Operations

This diagram is intended to focus within a district. The purpose of this next level of context is to show how entities relate to each other for regional and/or district operations. Each district communicates and shares information with the Illinois Statewide Hub, which shares that information with all regions that need that data. While each district and region are unique, Figure 3-5 can be applied as a template, explicitly showing the functions and services at the regional and/or district level. Any district/region may have all, some, or none of the entities shown.

3.3 STATEWIDE ITS ARCHITECTURE

The Statewide ITS Architecture update incorporates current transportation needs identified by stakeholders, the related functions and services and an overview of the updated Concept of Operations. Consistent with federal guidelines, a review of ITS Standards, Agreements and Architecture Maintenance are also addressed. A robust Stakeholder Outreach approach, utilizing various media and personal methods to involve stakeholders and collect the large amounts of data needed to update the existing

Illinois Statewide Architecture proved effective. Interactive workshops, surveys, webinars and interviews were all employed to inform and engage stakeholders. Section 4 of this ITS Strategic Plan update summarizes the resultant needs and program areas identified.

When looking at the statewide architecture entities, the specific (i.e., named) regional entities are addressed in the individual RITSAs, which encompass metropolitan areas (e.g., Chicago, St. Louis area) and large cities (e.g., Rockford, Peoria). Statewide functions such as traveler information, commercial vehicles operations, and emergency management reference specific entities because they are statewide in scope and all regions will need to interface to those entities. The Nomenclature Guide, Appendix F of the Statewide ITS Architecture Document can help identify the naming conventions related to entities in an individual project.

For example, the stakeholder group 'Regional Transit Providers' was mentioned above. There are many other transit agencies throughout the state, most of which function quite differently than the larger, regional providers. Table 3-3 below entitled, Stakeholder Groups for Transit Operations, shows the three stakeholder groups used as the template for statewide regional transit operations.

Table 3-3 – Statewide Template for Transit Operations

Stakeholder Group Name	Individual Stakeholders	Descriptions
City Transit Providers	CityLink, Connect Transit, CUMTD, DPTS, MCT, MetroLINK (Quad Cities), RMTD, SMTD	• Transit service in urban areas • Populations > 100k
Regional Transit Providers	CTA, RTA, METRA, Pace	• Regional and Rail Service providers • Service extends beyond metropolitan/regional/county borders
Rural Transportation Agencies	CIPT, DMT,GT, JCMTD, JDCT, Rides MTD, RVMMT, SCT, SMART, WCMTD	• Transit service in rural areas • Populations < 200k

The Illinois Statewide ITS Architecture is derived from the National ITS Architecture (NITSA) and has been tailored to meet the needs of transportation stakeholders at a statewide level. Figure 3-6 represents the top-level architecture interconnects diagram from the NITSA, showing all the subsystems and the basic communication channels between those subsystems.

As demand for transportation services continues to evolve, the Illinois Statewide ITS Strategic Plan, Concept of Operations, and Architecture will be updated to assure better integration and deployment. The Statewide ITS Architecture Maintenance Plan, Appendix G of the Statewide ITS Architecture Document, outlines recommended steps to keep the architecture in step with the evolution of ITS in Illinois. The iterative process described in the Architecture Maintenance Plan helps transportation agencies provide enhanced service with maximum re-use of current transportation investments. Further details about the Illinois Statewide ITS Architecture are contained in the separate Statewide ITS Architecture Update Document.

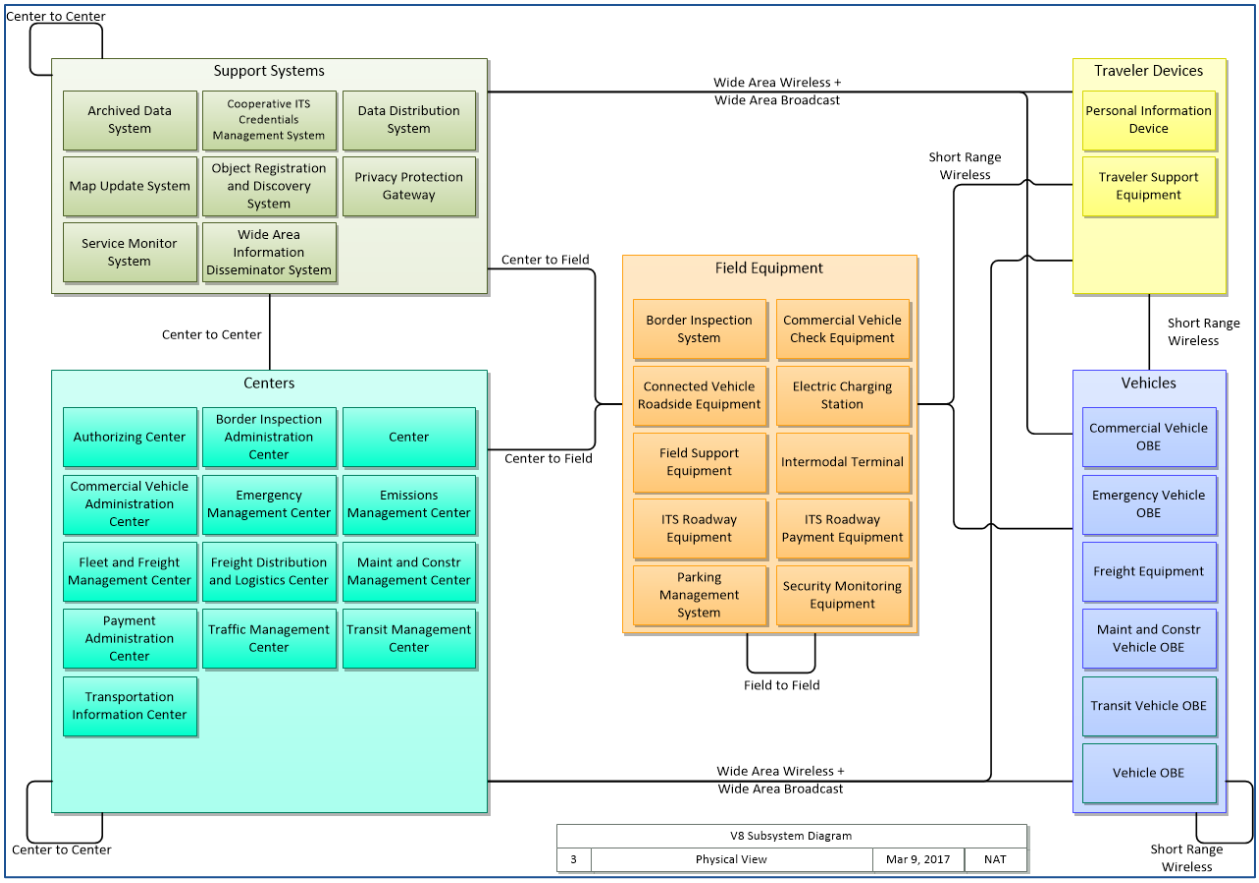

Figure 3-6 – ARC-IT Subsystem Interconnect Diagram

3.4 REGIONAL ITS ARCHITECTURES (RITSA)

While the Statewide ITS Architecture denotes Statewide/cross-regional functions, Regional ITS Architectures (RITSA) include more rural and smaller municipality functions and focus on unique local functions and is more specific at the local level. Statewide function examples include Emergency Incident Management and Smart Work Zones, while unique local functions may include integration of computer aided dispatching (CAD), actuated traffic signals and transit signal priority (TSP). The metropolitan areas listed in Table 3-4 were engaged in the RITSA development process.

When FHWA or FTA funds are to be used for project implementation, those projects must be included in the Transportation Improvement Plan (TIP), which is approved by the MPO or State. Furthermore, federally funded ITS projects must be included within a "regional" ITS Architecture. During interactive workshops held in cooperation with regional MPO/RPC Champions, emphasis was placed on aligning ITS project initiation and development with existing TIP and/or LRTP processes. Requirements of the TIP process are complimentary with ITS Planning for Operations strategies. The TIP must include project detail and specificity to demonstrate readiness once placed in the TIP. A lead agency or project sponsor with responsibility for implementation and funding are also identified during the planning process.

Table 3-4 – Regional ITS Architectures (RITSA) in Illinois

RITSA UPDATES	NEW RITSA DEVELOPMENT
Rockford	*Danville - remain in Statewide ITS Architecture*
DeKalb	Bloomington-Normal
Champaign - Urbana	Carbondale
Peoria	Decatur
Springfield	Kankakee

The IDOT ITS Program Office and the consultant team worked directly with regional champions to develop RITSA databases and also provided technical assistance to the ongoing development and update activities. As of June 2019, Danville remains included in the Statewide ITS Architecture until a regional ITS project architecture is warranted locally.

For the four new regional architectures listed in Table 3-4, an initial customization of the RAD-IT databases was provided for use in completing and updating the new architecture files. To achieve consistency among regions, the most common service packages were identified for inclusion in the regional architecture template as a guide for workshop discussions and to provide a baseline for newly developed RITSA. They include:

- Traveler Information Systems
- Smart Work Zone
- Construction/Roadwork Management
- Traffic Management - Incident Management
- Infrastructure Security

The IDOT Districts and MPOs are encouraged to take ownership for maintaining the RITSAs. The RITSA database files will be maintained by the Regional Champions and the IDOT ITS Program Office. The ITS Architecture Maintenance Plan Update in Appendix G of the Statewide ITS Architecture Update report describes the maintenance process.

4 NEEDS IDENTIFICATION AND PRIORITIZATION

4.1 PROJECT OUTREACH SUMMARY

Stakeholders and Regions

A wide and diverse group of stakeholders has participated in this Illinois Statewide Intelligent Transportation System (ITS) planning process to identify integration opportunities and ensure the legitimacy of these efforts. Beyond the essential state, city and county transportation agencies, the range of organizations with a potential stake in ITS within the state of Illinois includes incident and emergency responders, transportation system operators, public transit services, commercial vehicle entities, planning organizations, information service providers, University researchers, and local civic groups. More specifically, the following specific or types of organizations were invited to participate to gather information in the development of the statewide ITS architecture:

- Bordering State DOTs
- Bordering State Police
- Cities – Public Works
- Commercial Vehicle Operators
- Counties – Public Works
- County Sheriff Offices
- Emergency Service and Disaster Agencies (ESDA)
- Emergency Medical Services
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)
- Illinois DOT Central and District Offices
- Illinois Emergency Management Agency (IEMA)
- Illinois State Police
- Illinois State Toll Highway Authority
- Local, Regional Transit Agencies
- Local Fire and Law Enforcement Departments
- Metropolitan Planning Organizations (MPO)
- 911 Communications Centers (PSAPs)
- Regional Planning Commissions (RPC)
- Railroad Agencies
- Visitors and Convention Bureaus
- Illinois Universities

Not all of the invited agencies and organizations were involved equally, due to a variety of reasons that included the lack of availability of staff and resources. However, every effort was made to keep all identified stakeholders informed and involved. A complete listing of stakeholders invited to participate in the project is included in Appendix A.

For the purposes of developing the Statewide ITS Architecture and ITS Strategic Plan, this study divided the state of Illinois into nine ITS regions, based on both IDOT districts and MPO/RPC boundaries (see Figure 4-7). These regions determined the centralized locations where each of the statewide workshops were conducted.

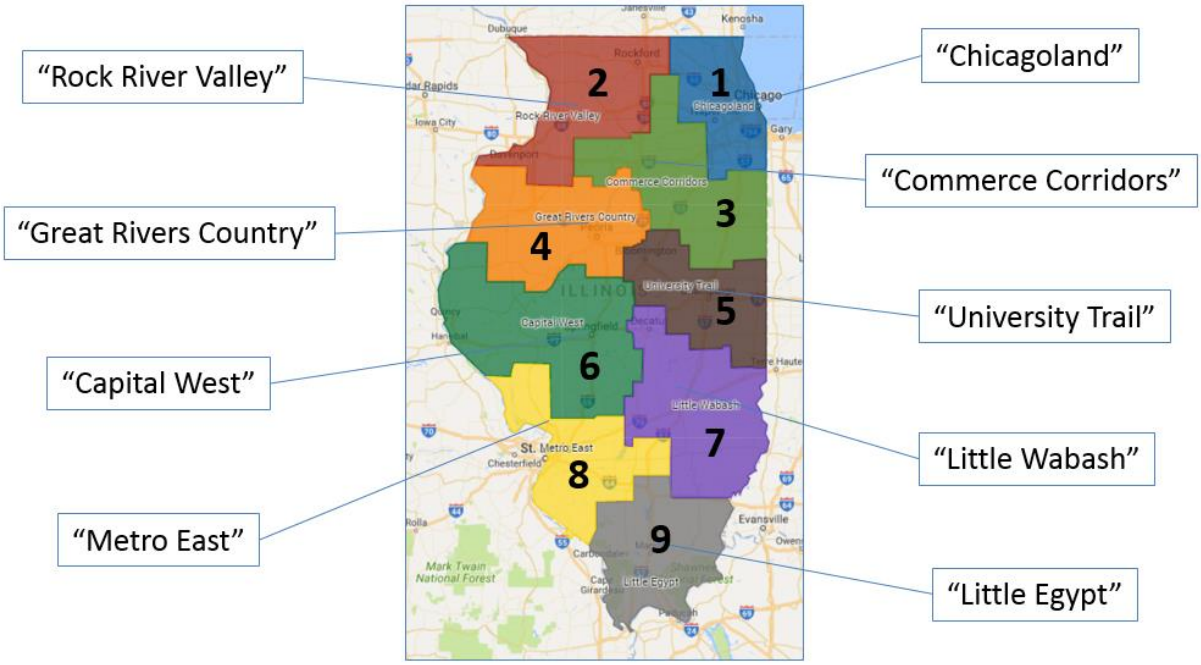

Figure 4-7 – Statewide ITS Regions

The FHWA Final Rule on ITS Architecture and Standards Conformity and parallel FTA Final Policy requires each region across the U.S. to establish and maintain a regional ITS architecture, in order to receive federal ITS funding. To meet this requirement, the Illinois Statewide ITS Architecture acted as a springboard for the development of regional ITS architectures in Champaign-Urbana, Dekalb, and Springfield in the mid-2000s, which were preceded by existing ITS architectures in Rockford, the Quad Cities, Peoria, and St. Louis (East Metro). As part of the current Statewide ITS Architecture update process, additional regional ITS architectures have been developed in Bloomington-Normal, Carbondale, Decatur, and Kankakee.

It should be noted that the Chicagoland Region in Northeastern Illinois had also previously developed an extensive regional ITS architecture that is currently being updated as part of its regular maintenance cycle. The Illinois Statewide ITS Architecture has been developed in coordination with the Northeastern Illinois Region.

Outreach Methods

All identified stakeholders were invited to help identify and discuss stakeholder ITS needs and requirements, as well as existing and planned ITS projects across the State of Illinois. The ITS planning and development process requires coordination with, and the cooperation of, multiple agencies. Several methods were used to gather input from the stakeholders. These methods included stakeholder workshops, stakeholder surveys, interviews, and the formation of both a project Steering Committee and Technical Committee.

Stakeholder Workshops

Multiple statewide ITS architecture, regional ITS architecture, and strategic plan workshops provided stakeholders with an introduction to, and an overview of, ITS. These workshops generated productive discussions on transportation needs and interagency communications. Workshops were conducted in all IDOT regions throughout the project as shown in Table 4-5. A collective total of 134 individual attendees provided valuable input and insight on their regional and statewide needs. Attendees of the statewide workshops for each region are identified in Appendix A. Building on the workshops, members of the project team continued to coordinate with regional ITS stakeholders to provide technical support toward regional architecture development.

Figure 4-8 - Stakeholder Workshop in Rock Falls

Stakeholder Surveys

To provide a framework for developing the Statewide ITS Architecture and the Strategic Plan as the baseline for the future direction of ITS initiatives in Illinois, online surveys were prepared and distributed to the identified stakeholders. The survey results gathered from stakeholders can be found in Appendix B. The survey results are also discussed in Section 4.2.

The surveys sought to gather information concerning perceived issues and needs related to the statewide and local transportation system, top priorities to mitigate these issues and needs, the functions or activities that each agency performs, the systems that each agency currently operates or plans to operate, and the information shared between the agencies. Multiple survey sections were provided to address issues specific to each type of organization or agency that would be receiving them:

- Top Issues/Services
- Your Organization/Agency
- Traveler Information
- Traffic Management and Operations
- Transit Operations
- Public Safety and Emergency Services
- Commercial Vehicle Operations
- Transportation and ITS Infrastructure

Interviews

To supplement the information collected from the stakeholder workshops and surveys, telephone interview follow-ups were conducted to clarify input from key stakeholders as well as to address any stakeholder questions. Additional telephone calls were made to key organizations, such as IDOT, transit agencies, emergency managers, and planning organizations. A sample template for the telephone interviews can be found in Appendix C.

Website

The project website, https://www.ilitsupdate.net, served as an important coordination and outreach tool during the development of the Strategic Plan and Architecture. The website allowed for dialogue

between stakeholders as well as an information clearinghouse of project-related materials. The website included a discussion board, updates, project documents, meeting dates and materials, and links to key resources such as the National Reference ITS Architecture and other project-related websites. The website also provided a central location for the posting of draft documents for the review by the Steering and Technical Committees. Applicable content from this project website will be transitioned to the IDOT website for ongoing reference and use.

Steering Committee

A strong and effective institutional framework that consists of representatives from partner agencies and other stakeholders is the key to successfully planning, operating and maintaining ITS deployments. The Steering Committee for this project provided multi-agency project support, guidance, and policy-level direction and ensured both participation by a wide variety of stakeholders and coordination with other related work in the state. Membership on the Steering Committee includes a cross-section of directors, managers and other senior staff with oversight responsibilities for ITS and operations. The Steering Committee's responsibilities included reviewing and providing feedback on ITS technologies and related documents throughout the development of the Statewide ITS Architecture and Strategic Plan. Steering Committee members are identified in Appendix A, and a listing of committee meeting dates can be found below in Table 4-5.

Technical Committee

The Technical Committee for this project also provided multi-agency project support and guidance, as well as technical direction during the ITS Architecture and Strategic Plan development. The committee consisted of those with direct responsibility for ITS within their organizations, including representatives from the IDOT District Offices (ITS Coordinators) and staff from the MPOs, as well as key local and regional agencies identified by the Steering Committee and project team. Technical Committee members are identified in Appendix A, and a listing of committee meeting dates are shown in Table 4-5. Some members of the Technical Committee also serve as champions for ITS in their regions, leading the development of regional ITS architectures listed above.

Table 4-5 – Project Meetings and Workshops

Meeting Name	Location	Date
Project Kick Off Meeting	Springfield	Sept. 21st, 2015
Joint Steering / Technical Committee Meeting	Springfield	September 14th, 2016
Region 1 Statewide ITS Architecture Workshop	Chicago	November 17th, 2016
Region 4 Statewide ITS Architecture Workshop	Peoria	December 6th, 2016
Region 6 Statewide ITS Architecture Workshop	Springfield	December 7th, 2016
Region 8 Statewide ITS Architecture Workshop	Collinsville	December 8th, 2016
Region 9 Statewide ITS Architecture Workshop	Carterville	December 13th, 2016
Region 7 Statewide ITS Architecture Workshop	Effingham	December 14th, 2016
Region 5 Statewide ITS Architecture Workshop	Champaign	December 15th, 2016
Region 3 Statewide ITS Architecture Workshop	Ottawa	January 31st, 2017
Region 2 Statewide ITS Architecture Workshop	Rock Falls	February 7th, 2017
Technical Committee Meeting	Springfield	May 12th, 2017
Champaign Regional ITS Architecture Workshop	Champaign	April 30th, 2018

Meeting Name	Location	Date
Peoria Regional ITS Architecture Workshop	Peoria	May 1st, 2018
Springfield Regional ITS Architecture Workshop	Springfield	May 2nd, 2018
Kankakee Regional ITS Architecture Workshop	Kankakee	May 10th, 2018
Carbondale Regional ITS Architecture Workshop	Carbondale	May 17th, 2018
Bloomington Regional ITS Architecture Workshop	Bloomington	May 18, 2018
Rockford Regional ITS Architecture Workshop	Rockford	May 31, 2018
DeKalb Regional ITS Architecture Workshop	DeKalb	June 8, 2018
District 2 Strategic ITS Plan Workshop	Rockford	September 18th, 2018
District 3 Strategic ITS Plan Workshop	Ottawa	September 19th, 2018
District 1 Strategic ITS Plan Workshop	Chicago	September 20th, 2018
District 6 Strategic ITS Plan Workshop	Springfield	October 2nd, 2018
District 4 Strategic ITS Plan Workshop	Peoria	October 2nd, 2018
District 7 Strategic ITS Plan Workshop	Effingham	October 3rd, 2018
District 5 Strategic ITS Plan Workshop	Champaign	October 4th, 2018
District 8 Strategic ITS Plan Workshop	Collinsville	October 30th, 2018
District 9 Strategic ITS Plan Workshop	Carterville	October 31st, 2018
Joint Steering / Technical Committee Meeting	Springfield	November 1st, 2018
Joint Steering / Technical Committee Meeting	Springfield	August 21st, 2019

4.2 OUTREACH RESULTS

Stakeholder Surveys

Stakeholder surveys were used to gather input on key statewide ITS needs, document existing and planned ITS infrastructure and identify the priority of various ITS projects throughout the state. The surveys were a key source of input for the development of the Statewide ITS Architecture and the ITS Strategic Plan.

Figure 4-9 summarizes the issues that the stakeholders characterized as their highest priorities. The highest-ranked issues with the local transportation network relate to interagency coordination, multimodal information, and ITS funding. Figure 4-10 presents an example survey response summary that shows the status of identified ITS projects and identifies the assigned priority of those ITS projects. At the ITS Strategic Plan workshops, the attendees were presented with a summary of the responses gathered and the summaries were used to guide discussion on the existing and planned ITS projects for each district.

After the ITS Strategic Plan workshops were completed, updates were made to the ITS project status and priority based on comments from workshop attendees. A final listing of all responses gathered from the nine IDOT district meetings are contained in Appendix B. Since the surveys asked respondents to rank predetermined issues and services and not create and rank their own list, the responses were intended to serve as a starting point for the further discussion of ITS needs and services at the individual stakeholder workshops.

Figure 4-9 – Top Local Transportation Network Issues

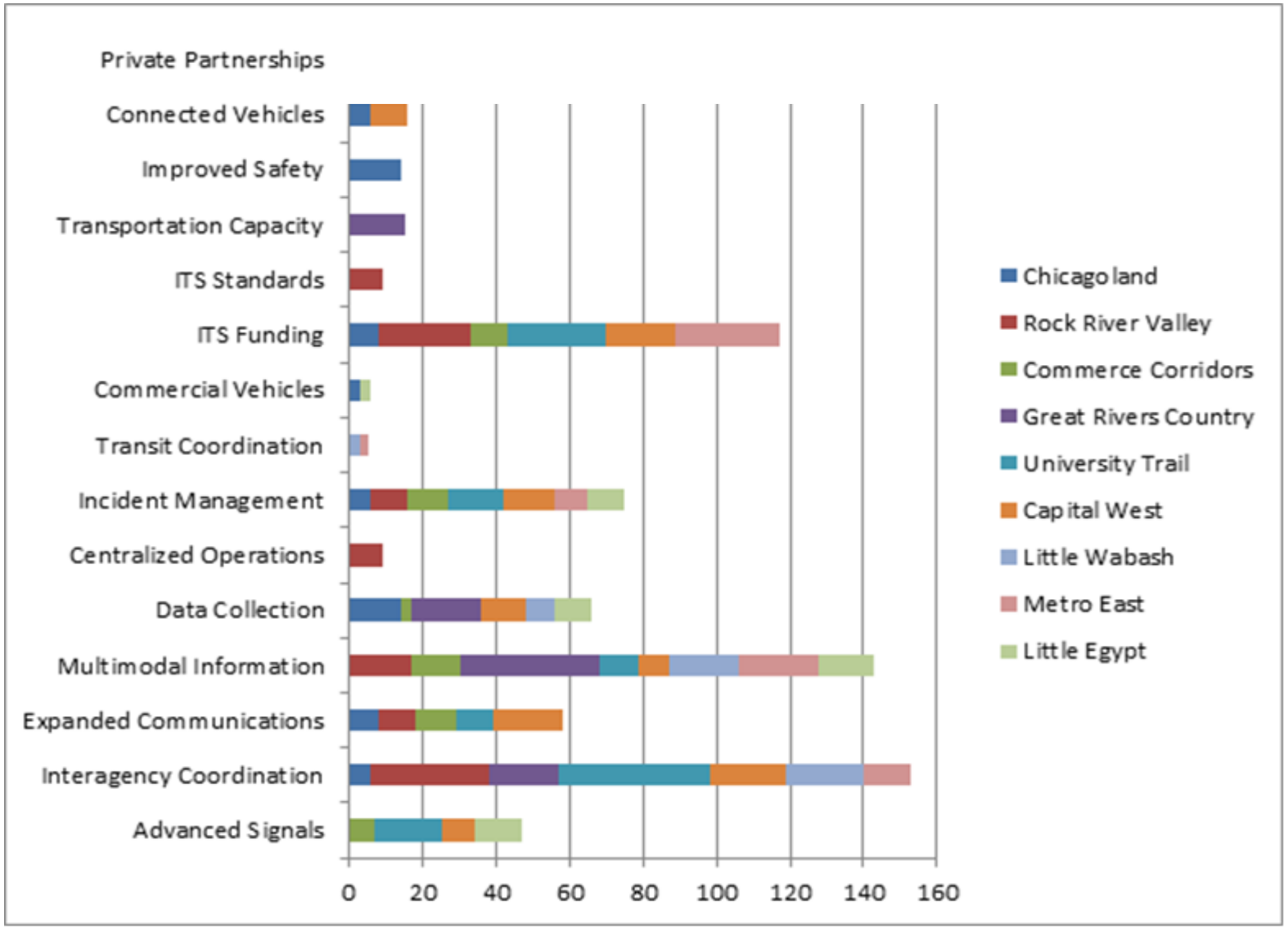

Figure 4-10 – Example Summary Page of Survey Responses on District 5 ITS Projects and Priorities

District 5 (University Trail) - Project Status and Priority
Priority points system: 3 points for "High" ; 2 points for "Medium" ; 1 point for "Low"

Project	Number of Responses – Project Status			Number of Responses – Project Priority			Total Priority Points	Additional Comments	Overall Rank
	Completed	Ongoing	Planned	High	Medium	Low			
Transit									
MCORE Project: Restructuring Campus Area Bus Routes, Stops, Access, Signals, etc. (BRT)	0	6	0	3	1	0	11		1
CUMTD StopWatch	1	1	0	0	1	0	2	This is a mass transit district project. I am not familiar with it. This project is for the provision of real-time bus departure times. The info is broadcast over an open API, our website, and at kiosks at bus stops.	5
Traffic Management									
Danville Area ITS (includes fiber expansion, CCTV cameras, DMS, and replace copper interconnects)	2	0	1	2	0	0	6		2
Bloomington-Normal ITS (includes fiber expansion and CCTV cameras)	2	1	0	2	0	0	6		2
Rantoul-Tuscola-Mahomet ITS (includes fiber optic installation, CCTV cameras and connections)	1	2	0	2	0	0	6		2
D5 Team Section Security								Install PTZ cameras at District 5 Team Sections. Requires fiber connection.	N/A
I-74 Champ/Verm PTZ Installation			1					Provide PTZ cameras along the I-74 corridor from Urbana to Danville. Fiber does not run along this section of I-74 so the high speed data connection is the major hurdle.	N/A
D5 Rest Area Video Upgrades			1					Replace outdated existing video recording system with up to date VMS, data recording, and integration into the District Milestone VMS. This will also require fiber connections to each of the rest areas.	N/A

Statewide Stakeholder Workshops

Each of the regions shown in Figure 4-7 participated in a region-wide workshop to identify statewide and regional transportation needs and to describe existing interagency communications. During the workshop, the Project Team provided project information to the participants, then identified top issues and priorities. The input was compiled and the entire group voted on the top issues and priorities by assigning point values to the identified needs. The results of the voting from each workshop are summarized in Appendix D.

Interviews

Individual telephone interviews were conducted to collect more detailed information from key stakeholders than was covered during the workshops or through the surveys. The interviews provided a valuable opportunity to clarify how transportation agencies operate and interoperate. The results of the telephone interviews are reflected in the details of the Statewide ITS Architecture, from the identification of individual ITS systems to the interconnections and data flows between them, and in Section 3 of this Strategic Plan.

Figure 4-11 – Needs Analysis Workflow

4.3 ITS PROGRAM AREAS

In order to address the specific issues and needs identified by stakeholders during project outreach, these needs have been organized into logical groups, or "program areas." These program areas correlate to many of the service packages included within the Illinois Statewide and Regional ITS Architectures (see Section 3).

Table 4-6 shows the program areas that were identified as being the most critical for Illinois based on the needs the stakeholders identified, as well as some of the ITS service packages that relate to each program area. It should be noted that some of the program areas do not correlate directly to a particular ITS service package. These program areas (Interagency Coordination, Improved Communications, Standardization, Outreach/Public Education, Asset Sharing and Control) are more overarching in nature and highlight the need for integration in the development and deployment of ITS. Furthermore, they are directly linked to the development and application of the Illinois Statewide and Regional ITS Architectures.

A detailed description of each program area follows below.

Traveler Information

This program highlights the need for timely, accurate, and useful information for the traveling public, including commercial vehicle operators, transit riders, motorists, cyclists, and pedestrians. Such information is useful to travelers before they embark on their trip, allowing them to make modal and routing decisions, during a trip to inform travelers of changing traffic conditions, and near the completion of a trip to help with travel services, like parking information and lodging reservations.

Table 4-6 – Identified ITS Program Areas

ITS Program Area	Related ITS Service Packages
Traveler Information	Broadcast Traveler Information (TI01), Personalized Traveler Information (TI02), Dynamic Route Guidance (TI03)
Traffic Management	Infrastructure-Based Traffic Surveillance (TM01), Traffic Signal Control (TM03), Regional Traffic Management (TM07)
Incident Management	Emergency Call-Taking and Dispatch (PS01)
Interagency Coordination	-
Improved Communications	-
Data Management	ITS Data Warehouse (DM01)
Commercial Vehicle Operations	Freight Administration (CVO02), Electronic Clearance (CVO03)
Transportation Safety	Transportation Infrastructure Protection (PS09)
Construction and Maintenance	Maintenance and Construction Vehicle and Equipment Tracking (MC01)
Transit	Transit Vehicle Tracking (PT01), Transit Traveler Information (PT08)
Standardization	-
System Security	Infrastructure-Based Traffic Surveillance (TM01)
Outreach/Public Education	-
Multi-Modal Coordination	Infrastructure-Provided Trip Planning and Route Guidance (TI04)
Asset Sharing and Control	-
Connected and Automated Vehicles	Curve Speed Warning (VS05), Stop Sign Gap Assist (VS06)

Traffic Management

Traffic flowing across a network of roads is complex, dynamic, and it is affected by many variables such as weather, special events, and time of day. Traffic managers need to continually monitor and measure the performance of the surface transportation system. As incidents arise, these managers need to have appropriate countermeasures to preserve the flow of traffic, both on interstate highways, state highways, county roads, and local streets.

Incident Management

State, county, and municipal agencies routinely handle incidents through their various resources such as police, fire, ambulance, and departments of public works. This program area emphasizes the need for improved incident management tools and techniques and better coordination between incident and traffic managers to bring about reduced time for incident detection, assessment, response, and clearance. For example, video images and weather information can be combined at emergency services dispatch centers to help determine the best response to an incident (i.e., the right people and equipment delivered at the proper times to the exact locations along the best route). Traffic managers can post messages to nearby message signs to warn users of traffic incidents or stopped traffic ahead.

Interagency Coordination

It is very common for one agency to collect and maintain information that would be of use to other agencies (e.g., construction schedules, evacuation plans, weather reports, special event plans). Needs identified in this program area include the integration of interagency information that can result in cost savings, improved access to useful data, and new services. The computer networks, databases, and

communication systems commonly used in ITS systems can facilitate much greater coordination between these agencies than ever before, and this can translate into fewer lives lost, reduced crash rates, less delay and higher returns on agency investments. This program area also addresses the need for interagency agreements to make this coordination possible.

Improved Communications

Communications is the common denominator for the exchange of information. This program area emphasizes the need for improved communications, both between management centers (center-to-center, or "C2C") and between centers and their assets (center-to-field, or "C2F"). Transportation managers need more reliable, more efficient, and more integrated means for C2C and C2F communications.

Data Management

It is evident from the amount of data discussed in the other program areas that data management is an important issue. This program area highlights the need for transportation agencies to be able to collect, store, process, purge, and mine the data that it collects so that it can be turned into useful information and more easily shared. This involves the combination or linkage of different agency databases.

Commercial Vehicle Operations

The number of trucks using roadway networks is increasing every year with no reduction in sight for the foreseeable future. These vehicles present significant challenges because their size degrades traffic flow and their weight can accelerate pavement and bridge deterioration. This program area emphasizes the need for monitoring commercial vehicle movements, identifying problem vehicles, notifying the carriers of their best options for movement within the metropolitan areas, and for dealing with the special concerns of hazardous cargo and oversize loads. Needs in this program area also include more efficient vehicle inspection, permitting, and credentialing.

Transportation Safety

Safety is a factor that must be incorporated into all transportation projects. This program area cites the need to improve the safety of travelers, including motorists, transit riders, cyclists, and pedestrians. Transportation managers need ways to identify high accident locations and determine ways to remedy unsafe conditions. Highway-rail intersections, in particular, provide unique safety challenges. For locations where safety is affected by weather conditions or animal movements, managers may need to dynamically monitor the environment before enacting a response. Furthermore, secondary crashes can be reduced through improved incident response and incident notification.

Construction and Maintenance

This program area covers problems associated with road and bridge construction as well as maintenance operations. Before roadwork is conducted, maintainers need tools to better track traffic loading so that pavement performance can be optimized. This can keep lane restrictions to a minimum. When work is needed, motorists need to know about problem areas and be able to determine alternate routes. Above all other issues in this program area, safety within the work zone – both for motorists and for workers – is paramount and should be continually improved and emphasized throughout Illinois. More specifically, construction can address the collection and sharing of construction-related road closure information with travelers and other road agencies. Maintenance can address the collection of

pavement condition information through crowdsourcing methods and make the information available to a larger group of stakeholders.

Transit

This program area identifies the need to make transit operations more efficient and convenient in both urban and rural areas. Transit managers need resources and additional tools to plan and track the movement of their vehicles to better maintain their schedules and provide reliable connections. Transit riders desire more information about transit system status.

Standardization

To achieve a high level of integration, it is imperative that all parties use compatible equipment and data protocols. This program area emphasizes the need for identifying and applying appropriate standards for use among transportation agencies. This will help to improve data sharing and shared asset control. Many of these standards are already established, and this is the primary reason for all projects to adhere to the Statewide or appropriate regional ITS architecture.

System Security

This program area emphasizes the need to continually improve transportation system security. Typical concerns include training and outfitting for preparedness, evacuation plans, hardening vulnerable targets and public areas, improving network security, and creating diverse communication systems that do not present a single point of failure.

Outreach/Public Education

Intelligent transportation systems offer many benefits to transportation managers and the traveling public. However, in many cases these benefits are not fully realized because potential system users are unaware of the tools at their disposal. This program area cites the need to emphasize ITS tools in Illinois, such as Travel Midwest, transit initiatives, and ITS applications for commercial vehicle fleet managers.

Multi-Modal Coordination

This program area highlights the need to coordinate the operation of different, complementary modes of transportation, including buses, light rail, intercity rail, and air. By providing seamless modal choices to the traveling public, transit becomes a more attractive option, thereby increasing the capacity of the transportation system.

Asset Sharing and Control

This program area expands upon the Interagency Coordination program area by citing the need for agencies to build common, integrated systems. Instead of just coordinating the interfaces and interaction between neighboring systems, this program area emphasizes opportunities to combine these systems and then establish the appropriate access rights for each member to access information or control remote devices, where feasible. This could include shared control of field devices, or a co-located management facility where multiple agencies reside at the same location to encourage coordination. Asset sharing has many advantages including lower costs per agency, instant compatibility, more powerful functions, simpler archiving, and lower maintenance costs.

Connected and Automated Vehicles

This program area reflects the rapidly emerging area of connected and automated vehicles within the transportation sector. The technologies included within this program area provide a starting point for transportation connectivity that will potentially enable countless applications that promote safety, mobility, and the environment. These applications allow for real-time communications between vehicles and roadside infrastructure that can enable numerous types of in-vehicle warnings to drivers based on their vehicle location, speed, and other characteristics. The applications can also allow for communications between vehicles to reduce the amount of vehicle collisions that occur along highways and at intersections, in turn reducing the amount of traffic-related fatalities and injuries resulting from vehicular crashes. Data provided by connected vehicle systems will also expand capabilities in many other program areas, like traffic management, traveler information, and multi-modal coordination.

4.4 PROGRAM AREA RELATION TO STATEWIDE ITS NEEDS

The outreach component of the Statewide ITS Architecture and Strategic Plan development is a critical step. A variety of techniques were used to obtain input from a representative cross-section of transportation stakeholders in Illinois, each of which provided valuable information about the issues and needs of the transportation system in the state.

The stakeholder surveys provide the regional or local perspective, while the stakeholder workshops were focused on interregional or statewide issues. As such, the needs identified in the surveys act as guidance for the topics discussed in person during the stakeholder workshops. In some cases, the priorities between the surveys and workshops may not align.

Taking into account the variety of outreach methodologies, participating stakeholders, and ensuing results, the program areas were related to the ranking of statewide ITS needs to observe which program areas relate to the highest statewide ITS needs. An initial ranking of statewide ITS needs was developed based on input gathered from stakeholders at the Statewide ITS Architecture workshops regarding needs that were voted on at those workshops.

Statewide ITS needs rankings from each workshop were created based on the votes, and an average value of each rank from each district was then calculated to determine the overall ranking of the statewide ITS needs. This ranking of statewide ITS needs based on stakeholder input was presented to the project steering committee for review and discussion. Additional input from the project steering committee was gathered on which statewide ITS needs could be viewed as related. For example, the statewide ITS need for an expanded communications infrastructure network helps to enable other statewide ITS needs to be satisfied, such as the advancement of a centralized traffic management system for traffic management.

Figure 4-12 presents a final summary ranking of the Statewide ITS Needs along with their relation to each of the program areas. This ordering of the statewide ITS needs will help to guide a future prioritization of statewide ITS projects and initiatives.

Figure 4-12 – Ranking of Statewide ITS Needs and Relation to ITS Program Areas

Rank	Statewide ITS Needs	Program Areas															
		Traveler Information	Traffic Management	Incident Management	Interagency Coordination	Improved Communications	Data Management	Commercial Vehicle Operations (CVO)	Transportation Safety	Construction & Maintenance	Transit	Standardization	System Security	Outreach / Public Education	Multi-modal Coordination	Asset Sharing and Control	Connected and Autonomous Vehicles
1	Enhanced interagency coordination and data sharing				X	X	X								X	X	
2	Enhanced data collection and monitoring capabilities for traffic management agencies		X														X
3	Expanded communications network infrastructure					X										X	
4	Additional funding for ITS deployment, operations, and maintenance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Enhanced multimodal mobility coordination and operations				X						X				X		
6	Enhanced incident management programs (includes construction and unplanned incidents)			X						X						X	
7	Centralized operations for 24/7 traffic management		X			X										X	
8	Preparations for connected vehicles													X			X
9	Stronger partnerships with private industry	X	X														X
10	Improved and expanded traveler information	X															
11	Improved safety through use of ITS		X	X					X	X							X
12	Statewide ITS standards and procurement options											X					
13	Improved commercial vehicle administration							X									
14	Advanced traffic signal systems		X		X												
15	Increased capacity of the transportation system		X														X

5 ALTERNATIVES ANALYSIS

5.1 PURPOSE OF ALTERNATIVES ANALYSIS

When addressing the needs identified by transportation stakeholders in Illinois, it is important to look at many different potential solutions to ensure an efficient and coordinated use of resources. While some solutions can be used to address a single identified area of need, other solutions can be used to address multiple needs, which can lead to significant cost savings. A thorough analysis of different alternatives helps to identify the solutions that provide the most benefit while addressing the highest priority problems.

For the purposes of this analysis, the following evaluation criteria were considered:

- What potential solutions can address the identified needs?
- How effectively will these solutions address the identified needs?
- Can some solutions address multiple needs?
- What are the potential benefits to the public as a result of implementing these solutions?
- What are the implementation and ongoing operations and maintenance costs associated with these solutions?
- What is the geographic scope of the solution?

Applying these criteria will ensure that Illinois ITS deployments are an efficient use of the state's resources and will provide a substantial benefit to travelers and residents at a reasonable cost.

The ITS Program Areas listed below in Table 5-1 were aligned with Statewide ITS Needs in Section 4. The following sections address potential solutions and how they relate to these Program Areas.

Table 5-7 Program Areas for Statewide ITS Strategic Plan

Program Area	Program Area
Traveler Information	Construction & Maintenance
Traffic Management	Transit
Incident Management	Standardization
Interagency Coordination	System Security
Improved Communications	Outreach
Data Management	Multi-modal Coordination
Commercial Vehicle Operations (CVO)	Asset Sharing and Control
Transportation Safety	Connected and Autonomous Vehicles

5.2 POTENTIAL ITS SOLUTIONS

Need vs. Solutions

Based on the needs brought forward by stakeholders, potential ITS solutions have been identified and examined to address those identified needs.

Figure 5-13 – Alternatives Analysis Workflow

Some solutions address multiple needs. For example, closed circuit television (CCTV) cameras can be deployed near work zones to support traffic management, at transit centers to provide transit security, or at bridges to monitor infrastructure. These systems can address more than one need at once or can be deployed to only focus on one need. This analysis examines where the solutions can be applied. Individual agencies responsible for implementing the solutions through ITS projects will need to determine the specific function(s) of the implemented solution.

While a single solution might address different needs, it might not address them equally. Some provide more benefits in a given program area while having less frequently realized benefits in another program area. For example, the potential solution identified as "In vehicle CVO Info" provides traveler information targeted at commercial vehicles, so it is primarily focused on the Traveler Information and Commercial Vehicle Operations program areas. Additionally, depending on what traveler information is broadcast, it could provide information regarding incidents, construction, or security events. The "In-vehicle CVO Info" ITS solution addresses these needs in a secondary manner, at a lower frequency or with less impact. The *Needs vs. Solutions* matrices in Table 5-2 below note whether a solution addresses a need in a primary (P) or secondary (S) manner. Some of the identified solutions are broken down into subsets for additional clarification, e.g., Advanced Railroad-Highway Interface Safety Technologies.

Based on the program areas identified during project outreach, the potential solutions contained in Table 5-2 were then identified as potential ways to address ITS stakeholder needs on a statewide or interregional level. These are the solutions that are developed further in this Statewide ITS Strategic Plan.

ITS Solution Descriptions

Appendix H contains descriptions of the potential ITS solutions being considered in this study for deployment in Illinois to address identified needs. The appendix includes potential benefits, estimated costs, the needs that each solution would address, and the geographic scope where each solution could be applied. These solution concepts have been found to provide a positive return on investment in previous deployments around the country. These are only concepts and estimates; exact functions and costs will be determined with specific projects that will be developed in subsequent sections of this document for top-ranked solution concepts.

Table 5-2 - Statewide Need (Program Area) vs. Solution Matrix

Potential Solutions	Traveler Information	Traffic Management	Incident Management	Interagency Coordination	Improved Communications	Data Management	Commercial Vehicle Operations	Transportation Safety	Construction & Maintenance	Transit	Standard-ization	System Security	Outreach / Public Education	Multi-Modal Coord-ination	Asset Sharing & Control	Connected and Automated Vehicles
Active Transit Station Signs	P									P				S		
Advanced Railroad-Highway Interface and Safety Technologies	P	P	P					P								
Advanced Railroad Highway Interface Technologies	P	P						P								
Emergency Vehicle Rail Crossing Safety Systems			P					P								
Automated Traffic Signal Performance Measures		P		S												
Automated Vehicle Deployments		S						S		S				S		P
Automatic Vehicle Location (AVL)	S		P						P	P						
Commercial Vehicle Enforcement / Inspection Technologies				S		P / S	P	S	S			S				
Automated Commercial Vehicle Inspection							P					S				
Commercial Vehicle Enforcement Systems				S		P	P	S								
Virtual Weigh Stations						S	P		S							
Connected Vehicle V2V and V2I Applications	P	P	S			P	P	S	S			S			S	P
In-vehicle CVO Info	P		S				P	S	S			S				P
In-vehicle Traffic Probes	S	P				P		S	S						S	P
Crash Investigation Systems			P					S								
Drones for Incident / Traffic Management		P	P					S	S							
Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion		P	P					S								
Enabling Backbone Communications Infrastructure	P	P		S	P	S					S				P	
Enhanced Communications Links to Field Devices		P	S		P	S				S	S				S	
High Volume Rest Area Truck Parking Management	P						P	S								
Illinois Statewide Transportation Information Network (ISTIN)	P	P			S	P					P					
Integrated Payment Systems										P				S		

Table 5-2 - Statewide Need (Program Area) vs. Solution Matrix

Potential Solutions	Traveler Information	Traffic Management	Incident Management	Interagency Coordination	Improved Communications	Data Management	Commercial Vehicle Operations	Transportation Safety	Construction & Maintenance	Transit	Standard-ization	System Security	Outreach / Public Education	Multi-Modal Coord-ination	Asset Sharing & Control	Connected and Automated Vehicles
Integrated Transportation Corridors		P						P			S					
Integration of Communications Channels			S	P	P						S	S			S	
ITS Data Collection Systems	P	P	S			S		S								
Localized Traffic Advisory Systems	S	P	P			S	S	P								S
Localized ITS Warning Systems	S	P	P			S	S	P								S
Traveler Information Systems	P	P	P			S	S	P								S
Managed Lanes		P														
Mobile Network Access	S	P	P			P			P	P		S			S	
Multimodal Travel Coordination										P				P	S	
Regional Communications Centers for Operations Interoperability	P	P	S	P	S	S					S				S	
Regional Paratransit Coordination				P						P	S				P	
Regional Traffic Signal Coordination		P	S	S												
Security Surveillance			P									P				
Smart Cities		S		P		P						S				
Statewide Comm. Center/Station One Upgrade	P	S	P	P	P	S						P			S	
Statewide ITS Teams	S	S	S	P		S		S		P	P	S	P	S	S	P
Third Party Traveler Information Applications	P					S										
Traffic Data Archive	P					P					P					
Traffic Signal Preemption / Priority		S	P	S			P			P					S	S
Traffic Signal System Upgrades		P						S								
Work Zone Enhancements	S	P	S	P		S	S	S	P	S			P	S	P	
Corridor Action Teams	S	P	S	P				S		S			P	S	P	

5.3 PAST, CONTINUING, AND PLANNED ILLINOIS ITS INITIATIVES

To maximize the benefit of some ITS solutions, they should be integrated with other systems that would enhance their effectiveness. Leveraging existing ITS deployments through this integration can provide data or connections to make implementations more effective. Using systems that are already in the ground can also keep costs more reasonable by reducing the amount of new equipment.

Based on surveys of transportation plans and projects in Illinois as well as stakeholder interviews, a listing of existing or planned projects in Illinois has been compiled. Table 5-3 takes a preliminary look at these existing ITS projects and suggests which ones have integration potential with the ITS solutions described in Section 5.2.

5.4 CONTINUING AND PLANNED ITS INITIATIVES IN NEIGHBORING STATES

In addition to coordinating activities within the state of Illinois, IDOT should also continue to coordinate with neighboring states on statewide initiatives or projects near borders. Illinois and neighboring states (Indiana, Wisconsin, Missouri, Iowa, and Kentucky) share priorities and are already working on similar ITS projects, such as the Travel Midwest traveler information system. This coordination can help plan for communications between systems in different states, reducing the cost of system compatibility and increasing the number of customers who can benefit from Illinois ITS projects.

The following sections outline initiatives and alliances that have the potential for coordinating efforts with Illinois. The Illinois Statewide ITS Architecture has been designed to be compatible with the ITS architectures of neighboring states following an inventory of those architectures by applying the ARC-IT framework.

Lake Michigan Interstate Gateway Alliance (LMIGA)

In 1993, USDOT identified the Gary-Chicago-Milwaukee Corridor (GCM) as an Intelligent Transportation System (ITS) Priority Corridor. Initial membership included a coalition of Illinois, Indiana, and Wisconsin transportation agencies and other interested parties. The primary focus of GCM was corridor planning and development of coordinated responses to traffic congestion. In late 2006, the focus of the GCM Corridor was reoriented towards interstate operations, and the name changed to reflect the new focus.

The new Lake Michigan Interstate Gateway Alliance (LMIGA) was born, with its corridor boundaries expanded to include southwest Michigan and the area east and south of Madison, Wisconsin. The total LMIGA coverage area includes 51 counties encompassing parts of four states (Wisconsin, Illinois, Indiana, and Michigan).

Today, LMIGA is a voluntary organization with member participation from the Wisconsin Department of Transportation, the Illinois Department of Transportation, the Indiana Department of Transportation; the Michigan Department of Transportation; the Illinois Tollway; the Skyway Concession Company, LLC; and the Indiana Toll Road Concession Company, LLC. The goal of LMIGA is to focus on operations within the region to ensure that traffic moves safely and efficiently. This goal is realized by interagency communication and coordination, improvement projects, training efforts, and region wide planning.

Table 5-3, Potential Existing Project and New Solution Integration

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Asset Sharing and Control	Fiber Connection Across State Boundaries	High-bandwidth communication links with adjacent state DOTs, e.g., MoDOT is scheduled to be re-established.	Enabling Backbone Communications Infrastructure	Enhanced Communication Links to Field Devices
Commercial Vehicle Operations	360 SmartView (Commercial Vehicle High Risk Identification) (Updated with PrePass)	An advanced safety e-screening solution that enables commercial vehicle enforcement officers to focus their resources on carriers most in need of intervention.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Automated License Plate Readers (ALPR) at Weigh Stations	Installation of ALPR systems at a weigh station in the region to promote commercial vehicle enforcement.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Expanded ITD Initiative	The expanded ITD (Innovative Technology Deployment) Program is now the Federal program that was formerly known as CVISN. This project is a key component of the FMCSA drive to improve commercial motor vehicle safety. This project would include truck routing studies for the region.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Intermodal Information and Statewide Routing Tool	Development of a central database containing information on bridge heights to properly route commercial vehicles through the area. This would support OS/OW routing of commercial vehicles in the region, which is difficult given differences in the permit processes for state and local permits.	Localized Traffic Advisory Systems	In-Vehicle CVO Info.
Commercial Vehicle Operations	International Fuel Tax Agreement (IFTA) Electronic Credentialing and Mandatory E-Filing	MiTAC system that enables automated electronic logging for commercial vehicle drivers. This system enables compliance with IFTA requirements for commercial vehicle drivers. System includes an in-vehicle tablet that provides truck drivers with proposed routes based on vehicle heights. System also helps trucking companies comply with federal mandates to utilize an Electronic Logging Device (ELD) for logging hours of service to minimize fatigued driving incidents.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	ITS for Intermodal Facilities	Includes the deployment of ITS devices at intermodal commercial facilities to improve the throughput of goods and services at the facilities. ITS technology can be implemented on commercial vehicles to increase communication with intermodal facility equipment. Cargo delivered at intermodal facilities can also be monitored in terms of delivery status at the facility.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Mobile Compliance Vehicle	Procurement of a mobile compliance vehicle to support commercial vehicle enforcement.	Commercial Vehicle Enforcement / Inspection Technologies	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Commercial Vehicle Operations	OSOW and Other Commercial Vehicle Permitting Systems/Process	IDOT has an ongoing Statewide Over-Size / Over-Weight (OSOW) system available online and known as Illinois Transportation Automated Permits (ITAP). System provides information to commercial vehicle operators on restrictions for travel and maps for OS/OW routes to be followed. Permits can be applied for through the site, and other real-time information ca be made available on the site as it pertains to impacted travel routes.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Portable Weigh Scales and Weigh-in-Motion	Illinois State Police (ISP) operates the portable weigh scales that are provided by IDOT for use in commercial vehicle enforcement. IDOT utilizes a Federal Motor Carrier Safety Administration program to procure weigh scale equipment for use by ISP. Alternatively, weigh-in-motion stations employ sensor and communication technologies to more effectively enforce weight restriction laws. These can be used to complement interstate weigh stations by improving weight enforcement capabilities on non-interstate routes throughout Illinois. By using weigh-in-motion scales in conjunction with highly focused enforcement strategies, enforcement personnel can screen more vehicles on more routes for excessively overweight trucks.	Commercial Vehicle Enforcement / Inspection Technologies	
Commercial Vehicle Operations	Regional Truck Delivery Management System	A centralized trucking dispatch center that would promote coordination of freight across the region.	Automated Vehicle Location	
Commercial Vehicle Operations	Truck Parking Management Systems (IDOT)	Project is modeled after a MAASTO-led initiative that will install cameras to measure real-time parking commercial vehicle parking space availability at IDOT rest areas and provide that information to truckers through a mobile application. Purpose is to provide truckers with information on where they can park for longer periods to be in compliance with hours of service requirements. Project will also include installation of kiosks at rest areas to provide traveler information.	High Volume Rest Area Truck Parking Management	In-Vehicle CVO Info.
Connected and Autonomous Vehicles	Develop Connected Vehicle Pilot (ISTHA, IDOT, Pace)	Led by Illinois Tollway, this project is to procure and deploy 11 DSRC units along the tollway for the purposes of data collection from DSRC-equipped vehicles. Data could be used for the purposes of travel time estimation or identifying locations of traffic congestion along the tollway. Data from DSRC units could also be shared with IDOT and Pace to allow for those agencies to disseminate traveler information and / or adjust transit operations as needed.	Connected Vehicle V-2-V and V-2-I Deployments	
Construction and Maintenance	Arterial Operation Centers	Includes the hardware, software, field devices and communication needed to implement network surveillance, traffic signal control, traffic information dissemination, and traffic incident management on arterials.	Regional Traffic Signal Coordination	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Construction and Maintenance	Drones for Incident Response	Planned project would utilize drones to provide video of the roadway network in response to planned lane closures and unplanned roadway incidents. Drones could be quickly deployable with Illinois State Police and local police departments responsible for deployment.	Drones for Incident / Traffic Management	
Construction and Maintenance	Smart Work Zones	Smart Work Zone technology can be built into the work zone contract and required of the contractor to provide speed detection for display of actual vehicle speeds in work zones. Other types of applications could also be requested where needed.	Work Zone Enhancements	
Construction and Maintenance	Work Zone Management - Statewide Integration	Improve work zone information dissemination in the region through information sharing with the IDOT Gateway. Would include provision of work zone information from transportation stakeholders (i.e., work zone contractors).	Work Zone Enhancements	
Data Management	"Array of Things" Project Data Integration	Application of data gathered by the Argonne National Laboratory's "Array of Things" sensor deployment to support traffic management.	Smart Cities	
Data Management	CAD Integration with Traffic Management	Integration of computer-aided dispatch (CAD) information for traffic operations. This project would allow IDOT to view roadway related incidents currently being handled by Illinois State Police (ISP) and other law enforcement agencies electronically. Fiber-optic cable connections would facilitate this sharing of information and video between agencies.	Regional Communications Centers for Operations Interoperability	
Data Management	Expansion of Public-Private Data	Expansion of an existing IDOT agreement with HERE as a private traffic data provider allows them to input real-time traffic data into the publicly accessible Illinois Gateway Traveler Information System (GTIS). The agreement would be modified to provide access to more traffic management agencies.	Third Party Traveler Information Applications	
Data Management	IDOT Maintenance Vehicle AVL System Deployment	Project that will upgrade maintenance vehicle communication equipment to be able to relay vehicle location in real time to a central management center to improve awareness of maintenance operations. Other data to be communicated to central software could include plow up / plow down status and material treatments. Based on a pilot project in IDOT District 5.	Automated Vehicle Location	
Data Management	Regional Transportation Data Archive	Regional archive that can receive transportation from the Gateway Traveler Information System for use by traffic management agencies.	Traffic Data Archive	
Data Management	Video Sharing with ISP	This project would allow Illinois State Police (ISP) and other law enforcement agencies to view live video from IDOT cameras. Fiber-optic cable connections would facilitate this sharing of information and video between agencies.	Security Surveillance	Regional Communications Centers for Operations Interoperability

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Improved Communications	Chicago Cellular Signal Interconnect	Includes the use of cellular modems for the purpose of data collection and archiving from traffic signal systems. Cellular modems could be used in locations where fiber-optic cable cannot be provided due to cost constraints.	Enhanced Communication Links to Field Devices	Traffic Data Archive
Improved Communications	Dedicated & Higher-Bandwidth Links between Agencies (Non-Centralized)	Ongoing efforts to expand the deployment fiber optic cable throughout the region to increase the bandwidth that allows for more users from other agencies to utilize the ATMS software package for information and video sharing purposes.	Enabling Backbone Communications Infrastructure	Enhanced Communication Links to Field Devices
Improved Communications	DoIT Smart State for ITS Projects	Refers to the Illinois DoIT (Department of Innovation and Technology) office deployment of fiber communications infrastructure to support ITS technologies, such as intelligent street lighting or centralized control of field-based ITS devices. DoIT supports state agencies in a turn-key type of operation with respect to communications infrastructure needs. This would include fiber cable deployments, connectivity to central offices, and other communications related needs.	Enabling Backbone Communications Infrastructure	Enhanced Communication Links to Field Devices
Improved Communications	Fiber Installation to Support ITS Expansion	Fiber optic cable installation to improve traffic signal coordination and connections with other ITS field devices operated/maintained by IDOT.	Enabling Backbone Communications Infrastructure	Enhanced Communication Links to Field Devices
Improved Communications	Public-Private Municipal Fiber Buildout	Linking of public facilities via fiber optic cable within a municipality to promote data sharing and interagency coordination. An example would be the Bi-state MPO in the Quad Cities area.	Enabling Backbone Communications Infrastructure	Enhanced Communication Links to Field Devices
Incident Management	AVL / CAD Systems for Emergency Vehicles	Installation of an AVL / CAD system for fire and police vehicles. Central software will be used for communications with the vehicles, though there are no current plans to communicate data with traffic management agencies.	Automated Vehicle Location	Regional Communications Centers for Operations Interoperability
Incident Management	Centralization of Alerts	Purpose would be to provide more traveler information, including AMBER Alerts for missing children and Endangered Missing Persons Advisories. Builds on efforts to centralize the messaging of the AMBER and Silver alerts as part Endangered Missing Person Advisories.	Regional Communications Centers for Operations Interoperability	
Incident Management	Combined & Electronic Dispatch	Ongoing project of combining dispatch centers to improve emergency response.	Regional Communications Centers for Operations Interoperability	Integration of Communication Channels
Incident Management	Emergency Vehicle Preemption (EVP) Deployment	Project refers to traffic signal pre-emption, otherwise known as Emergency Vehicle Pre-emption (EVP), which is in place in many areas of the state.	Traffic Signal Preemption / Priority	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Incident Management	Expansion of Expressway CCTV System (Cook County)	Includes CCTV camera replacements throughout IDOT District 1 to require CCTV cameras capable of license plate recognition for enforcement purposes. The new cameras will replace older cameras that do not have a high enough resolution for license plate recognition. Legislation was passed in May 2019 to support this expansion.	Security Surveillance	
Incident Management	Law Enforcement Radio System	Common microwave radio system for law enforcement is being upgraded, but it does not include all agencies, e.g., the St. Louis Area Regional Response System (STARRS).	Security Surveillance	
Incident Management	Red Alert System	Project to alerting cell phones within a geographic area for emergency management of flooding or other serious emergencies.	Localized Traffic Advisory Systems	
Incident Management	Special Event Traffic Management	Includes the use of ITS tools dedicated to planned special events, e.g., tracking databases similar to the work zone management project, alternate route applications, parking management systems.	Localized Traffic Advisory Systems	
Incident Management	Traffic Incident Management Training	Establishment of a training program that meets on a regular basis to conduct training, debrief incident response, conduct tabletop exercises, and develop a TIM training plan, e.g., TIMTAC.	Statewide ITS Teams	
Incident Management	Traffic Safety Teams	Establishment of Traffic Safety Teams to manage incidents, assess response (Iowa example).	Statewide ITS Teams	
Interagency Coordination	Fiber Links Between Transportation and Law Enforcement	Relates to the installation of fiber between IDOT communications/dispatch centers and nearby law enforcement agencies, e.g., city police and Illinois State Police. The fiber would allow for the sharing of CCTV camera video from IDOT offices with city police and ISP to improve emergency response to traffic incidents.	Enhanced Communication Links to Field Devices	Enabling Backbone Communications Infrastructure
Outreach / Public Education	Education about ITS	Development of outreach materials, videos, etc. to introduce ITS, describe benefits, and provide resources to the public.	Statewide ITS Teams	
Outreach / Public Education	ITS Resource Library	Creation of a centralized database of ITS specifications, standard drawings, documented costs and benefits, best practices documents, etc.	Statewide ITS Teams	
Traffic Management	Adaptive Traffic Control Signal Operations	Expansion of adaptive traffic control systems throughout the state. Systems have been deployed in District 1 and in Champaign. Springfield plans to implement system with traffic signal modernization efforts.	Traffic Signal System Upgrades	
Traffic Management	Alternate Route Traffic Management	Similar to integrated corridor management, this project would identify corridors that experience frequent traffic diversions and implement systems along the alternate routes to manage traffic. This could include detection systems, new traffic signal systems, and alternate route signing. Examples include IL Route 178 leading traffic through Starved Rock State Park.	Traffic Signal System Upgrades	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Traffic Management	Central Signal System Expansion	Expansion of municipal, e.g., DuPage County, central signal system to connect to signal systems for adjacent jurisdictions. Project will incorporate 170 signals into the existing signal management system operated by DuPage County. Related to the Regional Arterial TMC project listed below.	Regional Traffic Signal Coordination	
Traffic Management	Centralized CCTV Camera Monitoring and Control	Project to install pan-tilt-zoom (PTZ) cameras for monitoring and control, e.g., at the IDOT District 5 office, along I-74 between Urbana and Danville.	ITS Data Collection Systems	
Traffic Management	Centralized Traffic Signal Control for Municipalities	Installation of centralized traffic signal management software to support remote monitoring and control of municipal signal systems. Such systems should promote compatibility with other software/signal controllers to support regional signal control projects.	Regional Traffic Signal Coordination	
Traffic Management	District 1/District 3 Joint ITS Project along I-80 and I-55 Corridors	Includes one DMS on I-80 (EB I-80 near MM 102.1) and two DMS on I-55 (NB I-55 near MM 214, SB I-55 near MM 223), along with a number of CCTV cameras for traffic monitoring. Server in District 1 hosts the ATMS software responsible for communicating with the DMS. Also includes installation of 31 Bluetooth detectors along I-55/I-80 for traffic detection to understand where congestion is forming.	ITS Data Collection Systems	Regional Communications Centers for Operations Interoperability
Traffic Management	Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion	Project refers to the expansion of two similar emergency traffic assistance programs to cover additional areas of the state. IDOT's Chicago area Emergency Traffic Patrol (ETP) and Metro-East area Emergency Patrol Vehicle (EPV) programs, respectively, dispatch teams of emergency patrol vehicles and drivers to traffic disruptions and potential safety problems caused by accidents, disabled vehicles or hazardous debris. The primary objective of the ETP/EPV workers, also referred to as "Minutemen," is to respond to all disruptive incidents on the state's busiest urban expressway systems and to take immediate corrective action to safely restore normal traffic flow. Minutemen then execute help that motorists need when breakdowns or mishaps occur.	Emergency Traffic Patrol Expansion	
Traffic Management	Expansion of Lane Closure System	Lane closure system project geared towards lane closure based on events such as road construction. System would be integrated into the Travel Midwest site and information made available there for the public.	Managed Lanes	Localized Traffic Advisory Systems
Traffic Management	I-55 Project Managed Lanes	This project would add managed lanes from I-355 to the Dan Ryan. Because of the wide inside shoulder with full-depth pavement along part of the route, adding managed lanes can be relatively inexpensive, making it the most cost-effective congestion reduction project evaluated. IDOT currently anticipates adding two new lanes to assure travel time reliability.	Managed Lanes	Integrated Transportation Corridors

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Traffic Management	I-290 Project (IDOT) Integrated Corridor	Reconstruction of I-290 from Jane Byrne to Mannheim. ITS components may include traffic surveillance, traveler information, as well as a managed lane or congestion pricing on a managed lane. Integrated corridor components could also be incorporated along parallel arterial routes. Project is not funded at this time but has been identified in the CMAP ON TO 2050 plan.	Managed Lanes	Integrated Transportation Corridors
Traffic Management	Integrated Corridor Management (ICM)	Interconnect traffic signals, DMS, CCTV and potential vehicle-to-infrastructure technology communications and other applicable system components to support traffic management along key travel corridors.	Integrated Transportation Corridors	
Traffic Management	Interagency video sharing	Project to increase the amount of video shared between agencies that monitor CCTV cameras deployed along roadways. Project would allow multiple agencies to view roadway related incidents currently being responded to law enforcement and emergency management agencies . Fiber-optic cable connections between agencies can facilitate this sharing of video between agencies.	Security Surveillance	Regional Communications Centers for Operations Interoperability
Traffic Management	ITS Expert Resources	Identification of personnel with expertise in areas related to ITS, including computer programming, communications, and networking.	Traffic Signal System Upgrades	
Traffic Management	Managed Lanes (IDOT)	Several managed lanes projects have been identified in the CMAP ON TO 2050 plan. IDOT plans to implement managed lanes along several key interstates (i.e., I-55, I-290, I-80) to address traffic congestion. Management could include congestion pricing during periods of heavy congestion.	Managed Lanes	
Traffic Management	Multimodal Traffic Signal System Integration including Connected Vehicles	Integration of transit, e.g., Pace, buses with traffic signals to enable vehicle to infrastructure communication.	Connected Vehicle V-2-V and V-2-I Deployments	
Traffic Management	Rail Crossing Congestion Reduction	Project could include advanced warning systems, including pre-trip alerts, so motorists are aware of the pending train blockages	Advanced Railroad Highway Interface Technologies	
Traffic Management	Regional Arterial TMC	Development of regional arterial TMC for communicating with ITS equipment operated by counties and municipalities in IDOT District 1.	Regional Communications Centers for Operations Interoperability	Regional Traffic Signal Coordination
Traffic Management	Regional Traffic Signal Control for Municipalities	Establishment of links between municipal and IDOT traffic signal systems to support regional traffic signal control and monitoring within and across jurisdictions. Examples include IDOT District 2 linkages with Rockford, Quad Cities.	Regional Traffic Signal Coordination	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Traffic Management	Replacement of Obsolete Field Devices	Replacement of obsolete ITS field devices that serve traffic management, incident management, or traveler information purposes. Includes an ongoing project in District 2 to replace older DMS that were installed in 1999 to provide information to traffic approaching the aging I-74 bridge over the Mississippi River, as well as for traffic on I-80 and I-88.	Localized Traffic Advisory Systems	
Traffic Management	Rest Area Video Upgrades	Planned project to upgrade video recording systems at IDOT rest areas, including integration into existing video management software.	ITS Data Collection Systems	
Traffic Management	Smart Highway Deployments	Relates to the use of ITS technologies like traffic surveillance, road weather surveillance, communications infrastructure, DMS, incident detection, dynamic lane management and incident management systems along interstate routes. In particular, corridors like I-94 and US 41, which are parallel facilities. I-94 is operated by the Tollway, while US 41 is operated by IDOT, requiring high levels of cooperation and coordination to implement and operate the project.	Integrated Transportation Corridors	
Traffic Management	Smart Lighting	Smart Lighting systems can adjust the lighting along roadways based on a number of factors, such as environmental conditions or the presence of connected vehicles along roadways. Systems can also be managed and configured by traffic management centers.	Connected Vehicle V-2-V and V-2-I Deployments	
Traffic Management	Special Event Information/Reporting Systems	Improve special events information dissemination in the region through information sharing with the IDOT Gateway. Would include provision of information from non-traditional stakeholders (i.e., event promoters).	Localized Traffic Advisory Systems	
Traffic Management	Statewide Advanced Traffic Management System (ATMS)	Deployment and operation of a central IDOT ATMS to communicate with and control field ITS devices, potentially across IDOT district boundaries.	Regional Communications Centers for Operations Interoperability	
Traffic Management	Statewide Deployment of Additional ITS Field Devices	Additional ITS field devices can be deployed to serve traffic management, incident management, or traveler information purposes. Deployment can include dynamic message signs, CCTV cameras, and traffic detection equipment to expand the ITS coverage of existing metro areas. These projects should consider the inclusion of connected vehicle equipment as well.	Localized ITS Warning Systems	
Traffic Management	Traffic Signal Modernization	Ongoing projects to modernize traffic signal controllers in municipalities across the state.	Traffic Signal System Upgrades	
Traffic Management	Travel Time Detection Systems	Includes installation of detectors, e.g., Bluetooth, along interstate corridors to understand where congestion is forming, e.g., along I-55 and I-80.	ITS Data Collection Systems	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Transit	Automated Vehicle Location (AVL) Deployments for Transit Agencies (MCORE Project)	Ongoing larger project to improve transit operations in the Champaign-Urbana campus area for bus routes, stops, and signals. Phase 1 of the project has been completed and Phase 2 is ongoing with the deployment of a Routematch AVL system for automated routing of transit vehicles and improved transit fleet management.	Automated Vehicle Location	
Transit	Single Source Transit Service Call-Taking	Project is similar in nature to the Metro Call-A-Ride type of transit service call taking offered in the metro St. Louis area. Project would identify a single location to receive requests from customers with disabilities who qualify for Americans with Disabilities Act (ADA) paratransit services. Requests would then be arranged with the appropriate transit provider that could fulfill the requests.	Transit	Multi-modal Coordination
Transit	Real-Time Transit Information Signage	Project to expand the dissemination of real-time transit information in the region. RTA / CTA / Pace have deployed signage within District 1. MetroLINK in District 2 has ongoing project with the existing challenge of using the same vehicle radio for voice and data transmissions.	Active Transit Station Signs	
Transit	Rural Transit Information Applications	Project to develop smartphone-based applications for use by rural transit providers to disseminate information to passengers using fixed route or paratransit services.	Localized Traffic Advisory Systems	
Transit	Transit Signal Priority	TSP deployment was a planned project of a high priority for transit agencies, e.g., SMTD (Sangamon Mass Transit District). The potential may exist for the coordinated use of intersection-based system hardware that could potentially support both EVP and TSP operations.	Traffic Signal Preemption / Priority	
Transportation Safety	Crash Warning Systems	Planned project refers to an intelligent driver warning system based on information from Road Weather Information Systems and traffic counters (stopped/slowed traffic) and Computer Aided Dispatch data.	Localized Traffic Advisory Systems	
Transportation Safety	Intersection Collision Warning System (D-5)	ICWS systems enhance driver awareness of the traffic situation at the intersection by providing warnings through flashing beacons of vehicles entering the intersection. Drivers approaching the intersection on a major through road are given a warning when a vehicle has been detected as entering the intersection from the cross street. Also drivers waiting at the stop signs on the minor approaches are given a "crossing traffic" alert when approaching vehicles are detected along the major approach from either direction.	Localized Traffic Advisory Systems	
Transportation Safety	Pedestrian Safety Proximity and Intersection Detection	Includes Lake County DOT, Kane County DOT, and Pace as agencies to deploy vehicle / intersection-based sensors for detection of pedestrians in blind spots of transit vehicles.	Localized Traffic Advisory Systems	
Traveler Information	Downtown Parking Guidance Systems	Systems that gather parking availability data and relay it to motorists through dynamic signs, apps, and traveler information websites.	Localized Traffic Advisory Systems	

Program Area	Project Title	Project Description	Relation to ITS Solution Categories	
Traveler Information	Gateway Traveler Information System/Travel Midwest Website Enhancement	Includes enhancements to existing Gateway Traveler Information System, and could include the display of more ITS field devices in various IDOT Districts, as well as agreements with private data providers that could add traffic detection data and incident information to the system where IDOT does not have communications links to field based ITS devices.	Illinois Statewide Transportation Information Network	
Traveler Information	Rest Area Traveler Information	Project is to provide a video screen at IDOT rest areas showing travel information including weather, road conditions, and camera feeds along the corridor, e.g., in District 5.	Localized Traffic Advisory Systems	

The LMIGA ITS Priority Corridor Program operates through a comprehensive structure of work groups that meet periodically. LMIGA regional travel information, including current travel time, congestion, incident, construction, special event, and weather information is available on the Travel Midwest web site.

Gateway Traveler Information System

The Gateway Traveler Information System (GTIS) is the core system that facilitates the integration and interoperation of ITS within the region. The Gateway serves as an information hub for the center-to-center interface environment for Illinois, Indiana, Michigan, and Wisconsin and the Travel Midwest website. This website, available to the public, regularly receives between 5-7 million visits per month and is the most visible product of the Gateway development efforts. The primary function of the Gateway system is to collect and distribute real-time information among the operating agencies.

The GTIS has expanded at multiple points in time over the last few years to include downstate Illinois in 2015, Iowa and Ohio in 2017, and Missouri in 2018. These expansions are briefly described below:

- 2015 Downstate Illinois GTIS Expansion: Additional maps and Interstates for the state of Illinois added to Travel Midwest site, including several metro areas such as Bloomington/Normal, Champaign/Urbana, Effingham, Kankakee, Metro East St. Louis, Peoria and Springfield. The following interstates were added to the reports: I-24, I-64, I-70, I-72, I-155, I-164, I-172, I-255, I-270, I-465, and I-474. Dynamic message signs and closed circuit television cameras were displayed on the maps and reports. The goal of the Downstate Illinois Expansion was to make GTIS/Travel Midwest website serve as the foundation traveler information resource for the Illinois Department of Transportation website Getting Around Illinois.
- 2017 Iowa / Ohio GTIS Expansion: System expanded to cover I-80 from central Iowa to northwestern Ohio. Maps of Des Moines and Toledo were added. The following interstates in Iowa were added to reports: I-35, I-74, I-80, I-235, I-280, and I-380. The following interstates in Ohio were added to reports: I-75, I-80, I-90, I-280, I-475, US-23, and US-24.
- 2018 St. Louis, MO GTIS Expansion: System expanded to cover the St. Louis metropolitan area in Missouri. A map of St. Louis was added. The following interstates in Missouri were added to reports: I-44, I-55, I-64, I-70, I-170, I-255, and I-270.

Great Lakes Regional Transportation Operations Coalition (GLRTOC)

The Great Lakes Regional Transportation Operations Coalition (GLRTOC) includes transportation agencies responsible for operations on major transportation routes stretching from Minneapolis, Minnesota to Toronto, Ontario, Canada. The GLRTOC was formed in May 2010 with a core mission to collaborate on improving cross-regional transportation operations in support of regional economic competitiveness and improved quality of life. The major GLRTOC goals include incident management, improved freight operations, work zone coordination and regional coordinated traveler information. The three GLRTOC strategic focus areas include freight operations, reliability and mobility strategies, and traffic incident management/emergency transportation operations. GLRTOC has also established relationships with adjacent multistate

coalitions to enhance the use of technology and reliable operations and to provide the most efficient transportation network for mega-regions and the nation as a whole.[9]

One of the GLRTOC projects included expansion of the Gateway Traveler Information System (GTIS)/Travel Midwest website to cover the entire Interstate 94 corridor from Minneapolis, Minnesota to Detroit, Michigan. This expansion included all interstates in the Minneapolis/St. Paul and Detroit metropolitan areas in addition to providing coverage along Interstate 69 and Interstate 96 in Michigan. The goal of this project was to have automated GTIS connections with other major traffic management and operations centers in the GLRTOC area to display traveler information (travel times, speed, congestion, construction, incident, special event, and camera views, etc.). The GLRTOC meets on an as-needed basis to advanced efforts in support of the group's goals.

Additional GLRTOC projects include the Multistate Mobility Performance, Smart Work Zone Coordination, and Connected Centers projects. Project summaries and additional information can be found at: http://www.glrtoc.org/projects/.

Innovative Technology Deployment (ITD)

The Innovative Technology Deployment (ITD) Program (formerly known as Commercial Vehicle Information Systems and Networks or CVISN) is a key component of the Federal Motor Carrier Safety Administration's (FMCSA's) drive to improve commercial motor vehicle safety. The 2015 Fixing America's Surface Transportation Act (FAST Act) consolidated multiple FMCSA grant programs into the Motor Carrier Safety Assistance Program (MCSAP) and High Priority (HP) grant programs.

The MCSAP High Priority Grant Program now includes components of the previously separate Commercial Vehicle Information Systems and Networks (CVISN) Grant Program. The FAST Act has changed the name and funding structure of the CVISN Grant Program (now known as the ITD Grant Program), but many programmatic components remain the same. The FAST Act also increases focus on accountability, performance standards, efficiency, and effectiveness while reducing administrative burdens on FMCSA grantees.[10]

The states of Indiana, Michigan, and Wisconsin have attained an Expanded ITD status through the program. IDOT is ITD core compliant and will be eligible for Expanded ITD status after completing an ITD Program Plan/Top-Level Design (PP/TLD), which is currently in process. Together, these four states all perform PrePass Electronic Screening, upload commercial vehicle registration data into a federal SAFER database to support electronic screening, and support automated electronic processing of International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) credentials via web-based solutions.

State Level ITS Initiatives

Indiana: 511 Traveler Information System

The Federal Communications Commission designated 511 in July 2000 as the 3-digit telephone number to be used nationwide to provide traveler information. In doing so, the FCC noted that it expects the transportation industry to provide the traveling public with a quality service that has a degree of

[9] GLRTOC website, http://www.glrtoc.org/about.
[10] ITD website, https://www.fmcsa.dot.gov/information-systems/itd/innovative-technology-deployment-itd.

uniformity across the country.[11] The Indiana DOT implemented and operates a 511 traveler information system for the state known as TrafficWise. INDOT also provides information about road conditions, closures, and vehicle width/weight restrictions on its CARS 511 website.

Indiana: Borman Traffic Management Center

The first advanced traffic management system in Indiana was deployed in the northwestern portion of the state in 2001. The system covers 21 miles of the Borman Expressway (I-90/94) and Interstate 65. The Borman is a critical Interstate link carrying more than 180,000 vehicles per day with truck and commercial vehicle usage among the nation's highest.

Indiana: Indianapolis Traffic Management Center

The Traffic Management Center (TMC) for the Indianapolis metropolitan area is the focal point for ITS operations in the state, providing support to the Borman TMC and operating DMS at various locations in Indiana. The Indianapolis TMC is located at Indiana State Police Post 52 on the east side of Indianapolis. State Police dispatchers work in close proximity to the Traffic Management Center operators, making emergency response more timely and effective.

Indiana: Hoosier Helper - Motorist Assistance

The Hoosier Helper Program in Indiana assists motorists by clearing incidents on the road to quickly restore traffic flow. Incident management personnel help motorists by providing fuel, removing debris from the roadway, assisting in towing a vehicle, or offering other services. The Hoosier Helpers help to reduce incident related congestion and enhance motorist safety.

Illinois, Indiana, and Wisconsin recognized that many traffic incidents transcend jurisdictional boundaries and that intergovernmental coordination is essential in managing these events. The three states signed a Memorandum of Understanding to providing inter-jurisdictional cooperation for utilization of incident response resources of the state departments of transportation.

Indiana: State Emergency Management Agency Emergency Operations Center

The Indiana State Emergency Management Agency (SEMA) operates and maintains an emergency operations center (EOC) in Indianapolis. Staff at the center track and disseminate information from major disasters from a network of contact across the state. From this central post, SEMA can effectively coordinate response to disasters of varying size. Counties and some municipalities are included in the tracking and dissemination system so that actions can be coordinated for an organized response. Remote access to the agency's server is allowed through protected dial-up connections to allow remote operations by selected staff members. Seventeen counties have been given versions of the tracking software.

Indiana Toll Road

Beginning in 2002, INDOT deployed dynamic message signs (DMS) at strategic locations along the entire length of the Indiana Toll Road (I-80/90) to alert motorists about possible traffic hazards and conditions, including weather, accidents, congestion and construction. In recent years the Toll Road has begun implementing its own ITS equipment, including permanent DMS, vehicle detection, CCTV cameras,

[11] USDOT 511 Program, https://ops.fhwa.dot.gov/511/about511/history.htm.

wrong-way detection, weather sensors, fiber optic communication infrastructure, and a new traffic management center to act as the nerve center for operations across the Toll Road.

Indiana: Commercial Vehicle Operations

The Indiana DOT, in cooperation with the Indiana State Police Commercial Vehicle Enforcement Division (CVED), is working towards implementing a cost effective and customer focused commercial vehicle program in Indiana.

Indiana has developed an extensive Virtual Weigh Station program designed to better monitor the freeway system in Indiana utilizing ITS technology via wireless application. Reducing overweight commercial vehicles will significantly extend the life of the pavement, thereby allowing the Indiana DOT to utilize their funding more effectively.

Wisconsin: Traffic Management Center

The Wisconsin DOT's sophisticated freeway management system in southeastern Wisconsin is overseen from the WisDOT Statewide Traffic Management Center (TMC) in Milwaukee. WisDOT monitors all interstate and state highway routes using more than 320 system detector sites and more than over 400 CCTV cameras. Additionally, over 130 ramps have meters and 80 percent of the ramps have high occupancy vehicle or carpool bypass lanes. WisDOT also uses more than 150 DMS, 160 portable changeable message signs, 60 road weather stations, 13 active warning signs, 12 lane closure signs, 11 wrong-way detectors, 15 highway advisory radio sites, and 54 ramp gates. Wisconsin has also recently deployed truck parking information systems at targeted locations across the state.[12]

Wisconsin: Freeway Service Patrol Motorist Assistance

The Freeway Service Patrols are specially-equipped trucks in Wisconsin dedicated to handling and clearing incidents, especially collisions and disabled vehicles in Kenosha, Racine, Waukesha, and Dane counties. The patrols increase freeway safety, help reduce congestion, and increase freeway efficiency. Like the Hoosier Helpers, Freeway Service Patrols relocate disabled vehicles from the highway to safer areas, provide small amounts of fuel, handle minor repairs such as changing flat tires and taping hoses, call law enforcement officers to the scene of crashes, remove debris from the freeway and aid law officers and other responders by blocking lanes when necessary. The patrols will relocate a disabled vehicle from the freeway to safe location, or crash investigation site, where the motorist can contact a private towing service for further help.

Wisconsin 511 Traveler Information

Wisconsin provides 511 information to travelers through a telephone line, an interactive map, and social media. Travelers can create an account to receive customized travel alerts about their routes, including congestion, incidents, adverse weather impacts, and special events. WisDOT also offers specialized information for commercial vehicle drivers like permitting, oversize/overweight, and IRP/IFTA transactions.

[12] *Wisconsin Traffic Management Center Concept of Operations*, WisDOT, 2018.

Missouri: Gateway Guide

Gateway Guide is part of MoDOT's program designed to improve roadway efficiency and safety through a vast communications network. Aimed at reducing traffic congestion and disseminating traveler information, Gateway Guide utilizes a variety of state-of-the-art devices, including traffic detectors, dynamic message signs, and CCTV cameras, to provide motorists with all the tools and resources they need to effectively navigate in and around St. Louis.

The nerve center of Gateway Guide is the MoDOT District 6 TMC. IDOT and MoDOT are working to reestablish a direct link between the TMC and the IDOT District 8 Communication Center across the Mississippi River in Collinsville to better share data and coordinate efforts.

Missouri: Gateway Guide's Motorist Assist and Emergency Response Program

The Motorist Assist and Emergency Response patrols the St. Louis metro area interstates in search of lane obstructions caused by disabled vehicles, debris, and car crashes. They work hand in hand with local law enforcement and private towing agencies to keep traffic moving.

Motorist Assist operators can help change tires, provide fuel and perform other minor, short term repairs. If Motorist Assist cannot get an individual motorist moving again, they will provide a phone to call for additional help. They also help provide a safer situation for stalled motorists by providing a safe buffer with their truck and emergency flashing lights.[13]

Missouri: Traveler Information Map

Missouri hosts a statewide traveler information map that shows the latest road condition information and weather-related road conditions for metropolitan across the state. Missouri travelers also have the option of calling the State Highway Patrol for 24-hour winter road conditions on major routes or calling the MoDOT during regular office hours.

Iowa: PrePass Interstate Transportation Management

PrePass is intended to increase the efficiency of commercial motor carriers by allowing drivers with proven safety records to bypass open weigh stations. A transponder in a truck signals a receiver above the highway to determine if the truck may continue traveling. The system allows for concentration on the more high-risk motor carriers who are signaled to stop at the weigh station. PrePass is in use in 24 other states (including Illinois, Indiana, Missouri, and Wisconsin) and allows for more consistent traffic flow on our nation's roadway system.

[13] Gateway Guide website, http://mobile.gatewayguide.com/docs/about.html.

Iowa: 511 Traveler Information System

In 2002, Iowa led a joint effort with eight other states to obtain Federal funding to develop a 511 voice-enabled phone service for travelers. In addition to the 511 telephone line, the Iowa 511 traveler information includes a webpage, mobile apps, and social media, with specialized content for truckers, special events, and winter weather. The service is offered statewide in Iowa, and covers the interstate, U.S. routes, and portions of some state highways, with potential expansion to other roadways.

Iowa: Iowa DOT Statewide Communications Study and Plan Development

The Iowa DOT is conducting a study to address the dissemination of information within the state's transportation network to help determine how capital investments and enhancements should be made. The objective is to efficiently share information among all state agencies, local government, emergency management, public defense and the general public. This plan will help to provide the necessary officials with access to ITS information.

Kentucky: 511 Traveler Information System

Kentucky launched its 511 service in November, 2002. The system provides an interactive voice recognition service that provides callers with accurate, useful and timely traffic, travel and road weather information, 24/7. Callers can request specific information on major Kentucky roadways. Information on accidents, construction areas, weather conditions, and road closures allows motorists to make more informed choices for reaching their destination. The traffic and travel information is available by calling 511 or via the program website, which provides alerts from within the Kentucky Transportation Cabinet and from private data providers like Waze.

6 PRIORITY STRATEGIES AND PROJECT PROPOSAL EVALUATION

6.1 SOLUTION PRIORITIZATION CRITERIA

After generating a list of ITS solutions for Illinois in the Alternatives Analysis (Section 5), these solutions were prioritized to determine which ones had the most impact on the highest priority needs. Prioritization allows agencies to identify and implement those ITS solutions which can bring about the greatest benefit(s) with the limited resources that transportation agencies have available.

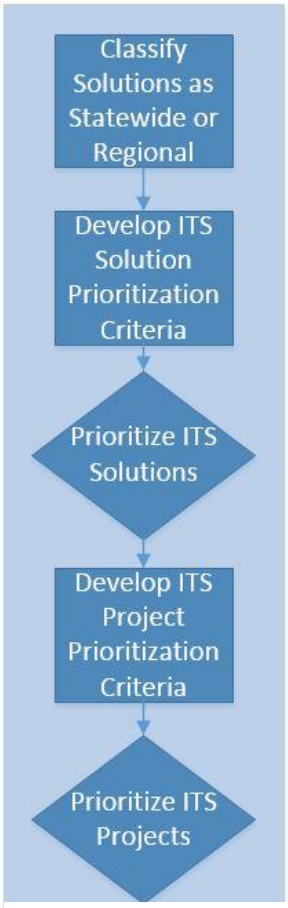

Figure 6-14 – Priority Strategies Workflow

The following list of questions was used for ITS solution prioritization:

- **What is the priority of the need(s) addressed?** Solutions that address several higher priority needs should rank higher than ones that address identified low priority needs. Using the results from Section 5, the rank of the identified needs that each solution primarily addressed was added together to determine the priority of the combined needs addressed.
- **Does the project offer the potential for a significant increase in safety, reduction in congestion, enhancement in the traveler experience, reduction in adverse environmental impacts, improvement in economic activity, and/or other benefits?** In addition to the priority of the need, the level of impact on a need or initiative was examined. Some solutions, while useful, have less of an impact than others. Those with a greater impact were favored.
- **Does the solution leverage existing systems?** As demonstrated in Table 5-3, there have been and continue to be substantial ITS investments in Illinois. Potential ITS solutions were examined to see it they would take advantage of these existing operating systems and enhance their utility.
- **Does the project support future systems and emerging technologies?** Technology is poised to play an even larger role in the transportation in the future. ITS solutions were assessed against their ability to enable forthcoming innovations.

6.2 RECOMMENDED ITS SOLUTIONS

By applying the prioritization criteria described above to all the ITS solutions listed in Section 6, a prioritized list of potential solutions was developed. The solutions were given scores ranging from 0 (least favorable) to 5 (most favorable) for each of the four prioritization criteria. These rankings were totaled, and the ITS solutions were arranged in descending order of total points as shown in Table 6-1.

Table 6-1 – ITS Solution Prioritization

Potential Solutions	Priority of Need	Significant Benefit	Leverage Existing Systems	Support Future Systems / Emerging Technologies	Total Points
ITS Data Collection Systems	3.8	3.8	3.0	3.0	**3.4**
Enabling Backbone Communications Infrastructure	2.5	3.8	3.8	3.5	**3.4**
Illinois Statewide Transportation Information Network (ISTIN)	2.5	3.5	3.8	3.8	**3.4**
Statewide Comm. Center/Station One Upgrade	2.5	3.3	3.3	3.8	**3.2**
Regional Communications Centers for Operations Interoperability	2.5	3.5	3.3	3.3	**3.1**
Smart Cities	1.8	3.3	3.3	3.8	**3.0**
Automated Traffic Signal Performance Measures	2.0	3.3	3.3	3.0	**2.9**
Statewide ITS Teams	1.5	3.3	3.0	3.8	**2.9**
Enhanced Communications Links to Field Devices	2.3	3.0	3.0	2.5	**2.7**
Integration of Communications Channels	2.0	3.0	3.3	2.3	**2.6**
Connected Vehicle V2V and V2I Applications	1.8	3.3	3.0	2.3	**2.6**
Traffic Data Archive	2.5	2.3	3.0	2.5	**2.6**
Mobile Network Access	2.0	2.5	2.8	2.5	**2.4**
Integrated Transportation Corridors	1.8	2.8	2.8	2.3	**2.4**
Work Zone Enhancements	2.0	3.3	2.5	1.5	**2.3**
Automated Vehicle Deployments	1.5	3.0	1.0	3.5	**2.3**
Drones for Incident / Traffic Management	1.5	2.8	2.5	2.3	**2.3**
Automatic Vehicle Location (AVL)	1.5	3.0	2.8	1.8	**2.3**
Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion	1.8	3.5	2.3	1.3	**2.2**
Integrated Payment Systems	1.0	3.0	2.8	2.0	**2.2**
Localized Traffic Advisory Systems	1.5	3.0	2.8	1.5	**2.2**
Regional Traffic Signal Coordination	1.5	3.0	2.0	2.3	**2.2**
Managed Lanes	1.5	2.5	2.3	2.0	**2.1**
Traffic Signal Preemption / Priority	2.0	2.3	2.0	2.0	**2.1**
Regional Paratransit Coordination	1.3	3.0	2.3	1.5	**2.0**

Potential Solutions	Priority of Need	Significant Benefit	Leverage Existing Systems	Support Future Systems / Emerging Technologies	Total Points
High Volume Rest Area Truck Parking Management	2.0	2.5	2.0	1.0	**1.9**
Third Party Traveler Information Applications	1.0	3.0	1.8	1.8	**1.9**
Traffic Signal System Upgrades	2.0	3.0	1.0	1.5	**1.9**
Crash Investigation Systems	1.5	2.8	1.5	1.5	**1.8**
Advanced Railroad-Highway Interface and Safety Technologies	1.5	1.8	1.8	2.0	**1.8**
Security Surveillance	1.5	2.0	1.5	1.3	**1.6**
Active Transit Station Signs	1.8	2.0	0.5	1.8	**1.5**
Commercial Vehicle Enforcement / Inspection Technologies	1.5	1.5	1.5	1.0	**1.4**

6.3 PROJECT ANALYSIS

Within the statewide ITS solution categories specified, eighty (80) project ideas were developed and categorized based on previous stakeholder feedback from surveys and through district workshops to review the proposed projects. Some solution categories contained a single project, while other solutions involved several potential ITS projects. Projects were only developed for solutions that were determined to have a statewide or interregional scope. While some projects are dependent on others and serve more of a supportive role than providing an end result, each project has a defined output that would accomplish or help accomplish the ITS solution strategy.

The list of projects is grouped by solution category below in Table 6-2. In addition, Appendix I contains detailed project descriptions for each ITS project. These descriptions include a summary of the program areas and ITS solutions addressed by each project, primary stakeholders, dependent projects/related efforts, and project status as determined through stakeholder feedback on the projects.

This Statewide ITS Strategic Plan is considered a “living document” and should be continually updated as emerging ITS technologies work their way into the mainstream. This effort will keep the State of Illinois well-poised to leverage these technologies to improve the safety and mobility of travelers.

Table 6-2 – Identified Statewide ITS Projects

No.	ITS Solution Category	Project Title	Project Description	Project Status
1	Active Transit Station Signs	Real-Time Transit Information Signage	Project to expand the dissemination of real-time transit information in the region. RTA / CTA / Pace have deployed signage within District 1. MetroLINK in District 2 has ongoing project with the existing challenge of using the same vehicle radio for voice and data transmissions.	Planned
2	Advanced Railroad Highway Interface Technologies	Rail Crossing Congestion Reduction	Project could include advanced warning systems, including pre-trip alerts, so motorists are aware of the pending train blockages	Planned
3	Commercial Vehicle Enforcement / Inspection Technologies	360 SmartView (Commercial Vehicle High Risk Identification) (Updated with PrePass)	An advanced safety e-screening solution that enables commercial vehicle enforcement officers to focus their resources on carriers most in need of intervention.	Planned
4		ITS for Intermodal Facilities	Includes the deployment of ITS devices at intermodal commercial facilities to improve the throughput of goods and services at the facilities. ITS technology can be implemented on commercial vehicles to increase communication with intermodal facility equipment. Cargo delivered at intermodal facilities can also be monitored in terms of delivery status at the facility.	Planned
5	Automated Vehicle Location	Regional Truck Delivery Management System	A centralized trucking dispatch center that would promote coordination of freight across the region.	Ongoing
6		IDOT Maintenance Vehicle AVL System Deployment	Project that will upgrade maintenance vehicle communication equipment to be able to relay vehicle location in real time to a central management center to improve awareness of maintenance operations. Other data to be communicated to central software could include plow up / plow down status and material treatments. Based on a pilot project in IDOT District 5.	Ongoing
7		AVL / CAD Systems for Emergency Vehicles	Installation of an AVL / CAD system for fire and police vehicles. Central software will be used for communications with the vehicles, though there are no current plans to communicate data with traffic management agencies.	Ongoing

No.	ITS Solution Category	Project Title	Project Description	Project Status
8	Automated Vehicle Location	Automated Vehicle Location (AVL) Deployments for Transit Agencies (MCORE Project)	Ongoing larger project to improve transit operations in the Champaign-Urbana campus area for bus routes, stops, and signals. Phase 1 of the project has been completed and Phase 2 is ongoing with the deployment of a Routematch AVL system for automated routing of transit vehicles and improved transit fleet management.	Ongoing
9	Commercial Vehicle Enforcement Systems / Inspection Technologies	Automated License Plate Readers (ALPR) at Weigh Stations	Installation of ALPR systems at a weigh station in the region to promote commercial vehicle enforcement.	Ongoing
10		Expanded ITD Initiative	The expanded ITD (Innovative Technology Deployment) Program is now the Federal program that was formerly known as CVISN. This project is a key component of the FMCSA drive to improve commercial motor vehicle safety. This project would include truck routing studies for the region.	Planned
11		International Fuel Tax Agreement (IFTA) Electronic Credentialing and Mandatory E-filing	MiTAC system that enables automated electronic logging for commercial vehicle drivers. This system enables compliance with IFTA requirements for commercial vehicle drivers. System includes an in-vehicle tablet that provides truck drivers with proposed routes based on vehicle heights. System also helps trucking companies comply with federal mandates to utilize an Electronic Logging Device (ELD) for logging hours of service to minimize fatigued driving incidents.	Ongoing
12		Mobile Compliance Vehicle	Procurement of a mobile compliance vehicle to support commercial vehicle enforcement.	Ongoing
13		OSOW and Other Commercial Vehicle Permitting Systems/Process	IDOT has an ongoing Statewide Over-Size / Over-Weight (OSOW) system available online and known as Illinois Transportation Automated Permits (ITAP). System provides information to commercial vehicle operators on restrictions for travel and maps for OS/OW routes to be followed. Permits can be applied for through the site, and other real-time information ca be made available on the site as it pertains to impacted travel routes.	Ongoing
14		Portable Weigh Scales and Weigh-in-Motion	Illinois State Police (ISP) operates the portable weigh scales that are provided by IDOT for use in commercial vehicle enforcement. IDOT utilizes a Federal Motor Carrier Safety Administration program to procure weigh scale equipment for use by ISP. Alternatively, weigh-in-motion stations employ sensor and communication technologies to more effectively enforce weight restriction laws. These can be used to complement interstate weigh stations by improving weight enforcement capabilities on non-interstate routes throughout Illinois. By using weigh-in-motion scales in conjunction with highly focused enforcement strategies, enforcement personnel can screen more vehicles on more routes for excessively overweight trucks.	Ongoing

No.	ITS Solution Category	Project Title	Project Description	Project Status
15	Regional Communications Centers for Operations Interoperability	CAD Integration with Traffic Management	Integration of computer-aided dispatch (CAD) information for traffic operations. This project would allow IDOT to view roadway related incidents currently being handled by Illinois State Police (ISP) and other law enforcement agencies electronically. Fiber-optic cable connections would facilitate this sharing of information and video between agencies.	Ongoing
16		Centralization of Alerts	Purpose would be to provide more traveler information, including AMBER Alerts for missing and endangered persons. Builds on efforts to centralize the messaging of the AMBER alerts.	Ongoing
17		Combined & Electronic Dispatch	Ongoing project of combining dispatch centers to improve emergency response.	Ongoing
18	Connected Vehicle V-2-V and V-2-I Deployments	Develop Connected Vehicle Pilot (ISTHA, IDOT, Pace)	Led by Illinois Tollway, this project is to procure and deploy 11 DSRC units along the tollway for the purposes of data collection from DSRC-equipped vehicles. Data could be used for the purposes of travel time estimation or identifying locations of traffic congestion along the tollway. Data from DSRC units could also be shared with IDOT and Pace to allow for those agencies to disseminate traveler information and / or adjust transit operations as needed.	Ongoing
19		Multimodal Traffic Signal System Integration including Connected Vehicles	Integration of transit, e.g., Pace, buses with traffic signals to enable vehicle to infrastructure communication.	Ongoing
20		Smart Lighting	Smart Lighting systems can adjust the lighting along roadways based on a number of factors, such as environmental conditions or the presence of connected vehicles along roadways. Systems can also be managed and configured by traffic management centers.	Planned
21	Drones for Incident / Traffic Management	Drones for Incident Response	Planned project would utilize drones to provide video of the roadway network in response to planned lane closures and unplanned roadway incidents. Drones could be quickly deployable with Illinois State Police and local police departments responsible for deployment.	Ongoing

No.	ITS Solution Category	Project Title	Project Description	Project Status
22	Emergency Traffic Patrol Expansion	Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion	Project refers to the expansion of two similar emergency traffic assistance programs to cover additional areas of the state. IDOT's Chicago area Emergency Traffic Patrol (ETP) and Metro-East area Emergency Patrol Vehicle (EPV) programs, respectively, dispatch teams of emergency patrol vehicles and drivers to traffic disruptions and potential safety problems caused by accidents, disabled vehicles or hazardous debris. The primary objective of the ETP/EPV workers, also referred to as "Minutemen," is to respond to all disruptive incidents on the state's busiest urban expressway systems and to take immediate corrective action to safely restore normal traffic flow. Minutemen then execute help that motorists need when breakdowns or mishaps occur.	Planned
23	Enabling Backbone Communications Infrastructure	Dedicated & Higher-Bandwidth Links between Agencies (Non-Centralized)	Ongoing efforts to expand the deployment fiber optic cable throughout the region to increase the bandwidth that allows for more users from other agencies to utilize the ATMS software package for information and video sharing purposes.	Ongoing
24		DoIT Smart State for ITS Projects	Refers to the Illinois DoIT (Department of Innovation and Technology) office deployment of fiber communications infrastructure that can be leveraged to support various functions, including links to ITS technologies, such as intelligent street lighting or centralized control of field-based ITS devices. DoIT supports state agencies in a turn-key type of operation with respect to communications infrastructure needs. This would include fiber cable deployments, connectivity to central offices, and other communications related needs.	Ongoing
25		Fiber Installation to Support ITS Expansion	Fiber optic cable installation to improve traffic signal coordination and connections with other ITS field devices operated/maintained by IDOT.	Ongoing
26		Public-Private Municipal Fiber Buildout	Linking of public facilities via fiber optic cable within a municipality to promote data sharing and interagency coordination. An example would be the Bi-state MPO in the Quad Cities area.	Ongoing
27	Enhanced Communication Links to Field Devices	Fiber Connection Across State Boundaries	High-bandwidth communication links with adjacent state DOTs, e.g. MoDOT is scheduled to be re-established.	Ongoing
28		Chicago Cellular Signal Interconnect	Includes the use of cellular modems for the purpose of data collection and archiving from traffic signal systems. Cellular modems could be used in locations where fiber-optic cable cannot be provided due to cost constraints.	Ongoing
29		Fiber Links Between Transportation and Law Enforcement	Relates to the installation of fiber between IDOT communications/dispatch centers and nearby law enforcement agencies, e.g., city police and Illinois State Police. The fiber would allow for the sharing of CCTV camera video from IDOT offices with city police and ISP to improve emergency response to traffic incidents.	Ongoing

No.	ITS Solution Category	Project Title	Project Description	Project Status
30	High Volume Rest Area Truck Parking Management	Truck Parking Management Systems (IDOT)	Project is modeled after a MAASTO-led initiative that will install cameras to measure real-time parking commercial vehicle parking space availability at IDOT rest areas and provide that information to truckers through a mobile application. Purpose is to provide truckers with information on where they can park for longer periods to be in compliance with hours of service requirements. Project will also include installation of kiosks at rest areas to provide traveler information.	Planned
31	Illinois Statewide Transportation Information Network	Gateway Traveler Information System/Travel Midwest Website Enhancement	Includes enhancements to existing Gateway Traveler Information System, and could include the display of more ITS field devices in various IDOT Districts, as well as agreements with private data providers that could add traffic detection data and incident information to the system where IDOT does not have communications links to field based ITS devices.	Ongoing
32	Integrated Transportation Corridors	Integrated Corridor Management (ICM)	Interconnect traffic signals, DMS, CCTV and potential vehicle-to-infrastructure technology communications and other applicable system components to support traffic management along key travel corridors.	Ongoing
33		Smart Highway Deployments	Relates to the use of ITS technologies like traffic surveillance, road weather surveillance, communications infrastructure, DMS, incident detection, dynamic lane management and incident management systems along interstate routes. In particular, corridors like I-94 and US 41, which are parallel facilities. I-94 is operated by the Tollway, while US 41 is operated by IDOT, requiring high levels of cooperation and coordination to implement and operate the project.	Planned
34	ITS Data Collection Systems	Centralized CCTV Camera Monitoring and Control	Project to install pan-tilt-zoom (PTZ) cameras for monitoring and control, e.g., at the IDOT District 5 office, along I-74 between Urbana and Danville.	Ongoing
35		District 1/District 3 Joint ITS Project along I-80 and I-55 Corridors	Includes one DMS on I-80 (EB I-80 near MM 102.1) and two DMS on I-55 (NB I-55 near MM 214, SB I-55 near MM 223), along with a number of CCTV cameras for traffic monitoring. Server in District 1 hosts the ATMS software responsible for communicating with the DMS. Also includes installation of 31 Bluetooth detectors along I-55/I-80 for traffic detection to understand where congestion is forming.	Ongoing
36		Rest Area Security Video Upgrades	Planned project to upgrade security video recording systems at IDOT rest areas, including integration into existing video management software, e.g., Milestone in IDOT District 5.	Planned
37		Travel Time Detection Systems	Includes installation of detectors, e.g., Bluetooth, along interstate corridors to understand where congestion is forming, e.g., along I-55 and I-80.	Planned

No.	ITS Solution Category	Project Title	Project Description	Project Status
38	Localized Traffic Advisory Systems	Red Alert System	Project to alerting cell phones within a geographic area for emergency management of flooding or other serious emergencies.	Planned
39		Replacement of Obsolete Field Devices	Replacement of obsolete ITS field devices that serve traffic management, incident management, or traveler information purposes. Includes an ongoing project in District 2 to replace older DMS that were installed in 1999 to provide information to traffic approaching the aging I-74 bridge over the Mississippi River, as well as for traffic on I-80 and I-88.	Ongoing
40		Statewide Deployment of Additional ITS Field Devices	Additional ITS field devices can be deployed to serve traffic management, incident management, or traveler information purposes. Deployment can include dynamic message signs, CCTV cameras, and traffic detection equipment to expand the ITS coverage of existing metro areas. These projects should consider the inclusion of connected vehicle equipment as well.	Planned
41		Crash Warning Systems	Planned project refers to an intelligent driver warning system based on information from Road Weather Information Systems and traffic counters (stopped/slowed traffic) and Computer Aided Dispatch data.	Ongoing
42	Localized Traffic Advisory Systems	Intersection Collision Warning System (D-5)	ICWS systems enhance driver awareness of the traffic situation at the intersection by providing warnings through flashing beacons of vehicles entering the intersection. Drivers approaching the intersection on a major through road are given a warning when a vehicle has been detected as entering the intersection from the cross street. Also drivers waiting at the stop signs on the minor approaches are given a "crossing traffic" alert when approaching vehicles are detected along the major approach from either direction.	Ongoing
43		Pedestrian Safety Proximity and Intersection Detection	Includes Lake County DOT, Kane County DOT, and Pace as agencies to deploy vehicle / intersection-based sensors for detection of pedestrians in blind spots of transit vehicles.	Ongoing
44	Managed Lanes	Expansion of Lane Closure System	Lane closure system project geared towards lane closure based on events such as road construction. System would be integrated into the Travel Midwest site and information made available there for the public.	Ongoing
45		I-55 Project Managed Lanes	This project would add managed lanes from I-355 to the Dan Ryan. Because of the wide inside shoulder with full-depth pavement along part of the route, adding managed lanes can be relatively inexpensive, making it the most cost-effective congestion reduction project evaluated. IDOT currently anticipates adding two new lanes to assure travel time reliability.	Ongoing

No.	ITS Solution Category	Project Title	Project Description	Project Status
46		I-290 Project (IDOT) Integrated Corridor	Reconstruction of I-290 from Jane Byrne to Mannheim. ITS components may include traffic surveillance, traveler information, as well as a managed lane or congestion pricing on a managed lane. Integrated corridor components could also be incorporated along parallel arterial routes. Project is not funded at this time but has been identified in the CMAP ON TO 2050 plan.	Ongoing
47		Managed Lanes (IDOT)	Several managed lanes projects have been identified in the CMAP ON TO 2050 plan. IDOT plans to implement managed lanes along several key interstates (i.e., I-55, I-290, I-80) to address traffic congestion. Management could include congestion pricing during periods of heavy congestion.	Ongoing
48	Regional Traffic Signal Coordination	Arterial Operation Centers	Includes the hardware, software, field devices and communication needed to implement network surveillance, traffic signal control, traffic information dissemination, and traffic incident management on arterials.	Planned
49		Central Signal System Expansion	Expansion of municipal, e.g., DuPage County, central signal system to connect to signal systems for adjacent jurisdictions. Project will incorporate 170 signals into the existing signal management system operated by DuPage County. Related to the Regional Arterial TMC project listed below.	Ongoing
50		Centralized Traffic Signal Control for Municipalities	Installation of centralized traffic signal management software to support remote monitoring and control of municipal signal systems. Such systems should promote compatibility with other software/signal controllers to support regional signal control projects.	Ongoing
51		Regional Traffic Signal Control for Municipalities	Establishment of links between municipal and IDOT traffic signal systems to support regional traffic signal control and monitoring within and across jurisdictions. Examples include IDOT District 2 linkages with Rockford, Quad Cities.	Planned
52	Security Surveillance	Video Sharing with ISP	This project would allow Illinois State Police (ISP) and other law enforcement agencies to view live video from IDOT cameras. Fiber-optic cable connections would facilitate this sharing of information and video between agencies.	Planned
53		Expansion of Expressway CCTV System (Cook County)	Includes CCTV camera replacements throughout IDOT District 1 to require CCTV cameras capable of license plate recognition for enforcement purposes. The new cameras will replace older cameras that do not have a high enough resolution for license plate recognition.	Planned
54		Law Enforcement Radio System	Common microwave radio system for law enforcement is being upgraded, but it does not include all agencies, e.g., the St. Louis Area Regional Response System (STARRS).	Planned

No.	ITS Solution Category	Project Title	Project Description	Project Status
55		Interagency video sharing	Project to increase the amount of video shared between agencies that monitor CCTV cameras deployed along roadways. Project would allow multiple agencies to view roadway related incidents currently being responded to law enforcement and emergency management agencies . Fiber-optic cable connections between agencies can facilitate this sharing of video between agencies.	Ongoing
56	Smart Cities	"Array of Things" Project Data Integration	Application of data gathered by the Argonne National Laboratory's "Array of Things" sensor deployment to support traffic management.	Ongoing
57	Statewide ITS Teams	Traffic Incident Management Training	Establishment of a training program that meets on a regular basis to conduct training, debrief incident response, conduct tabletop exercises, and develop a TIM training plan, e.g., TIMTAC.	Planned
58		Traffic Safety Teams	Establishment of Traffic Safety Teams to manage incidents, assess response (Iowa example).	Planned
59		Education about ITS	Working with the IDOT Office of Communications, development of outreach materials, videos, etc. to introduce ITS, describe benefits, and provide resources to the public.	Ongoing
60		ITS Resource Library	Creation of a centralized database of ITS specifications, standard drawings, documented costs and benefits, best practices documents, etc.	Planned
61	Third Party Traveler Information Applications	Expansion of Public-Private Data	Expansion of an existing IDOT agreement with HERE as a private traffic data provider allows them to input real-time traffic data into the publicly accessible Illinois Gateway Traveler Information System (GTIS). The agreement would be modified to provide access to more traffic management agencies.	Ongoing
62	Regional Communications Centers for Operations Interoperability	Regional Arterial TMC	Development of regional arterial TMC for communicating with ITS equipment operated by counties and municipalities in IDOT District 1.	Ongoing
63		Statewide Advanced Traffic Management System (ATMS)	Deployment and operation of a central IDOT ATMS to communicate with and control field ITS devices, potentially across IDOT district boundaries.	Planned
64	Traffic Data Archive	Regional Transportation Data Archive	Regional archive that can receive transportation from the Gateway Traveler Information System for use by traffic management agencies.	Ongoing
65	Traffic Signal Preemption / Priority	Emergency Vehicle Preemption (EVP) Deployment	Project refers to traffic signal pre-emption, otherwise known as Emergency Vehicle Pre-emption (EVP), which is in place in many areas of the state.	Planned
66		Transit Signal Priority	TSP deployment was a planned project of a high priority for transit agencies, e.g., SMTD (Sangamon Mass Transit District). The potential may exist for the coordinated use of intersection-based system hardware that could potentially support both EVP and TSP operations.	Planned

No.	ITS Solution Category	Project Title	Project Description	Project Status
67	Traffic Signal System Upgrades	Adaptive Traffic Control Signal Operations	Expansion of adaptive traffic control systems throughout the state. Systems have been deployed in District 1 and in Champaign. Springfield plans to implement system with traffic signal modernization efforts.	Planned
68		Alternate Route Traffic Management	Similar to integrated corridor management, this project would identify corridors that experience frequent traffic diversions and implement systems along the alternate routes to manage traffic. This could include detection systems, new traffic signal systems, and alternate route signing. Examples include IL Route 178 leading traffic through Starved Rock State Park.	Planned
69		ITS Expert Resources	Identification of personnel with expertise in areas related to ITS, including computer programming, communications, and networking.	Planned
70		Traffic Signal Modernization	Ongoing projects to modernize traffic signal controllers across the state.	Planned
71	Localized Traffic Advisory Systems	Intermodal Information and Statewide Routing Tool	Development of a central database containing information on bridge heights to properly route commercial vehicles through the area. This would support OS/OW routing of commercial vehicles in the region, which is difficult given differences in the permit processes for state and local permits.	Ongoing
72		Special Event Traffic Management	Includes the use of ITS tools dedicated to planned special events, e.g., tracking databases similar to the work zone management project, alternate route applications, parking management systems.	Planned
73		Special Event Information/Reporting Systems	Improve special events information dissemination in the region through information sharing with the IDOT Gateway. Would include provision of information from non-traditional stakeholders (i.e., event promoters).	Planned
74	Localized Traffic Advisory Systems	Rural Transit Information Applications	Project to develop smartphone-based applications for use by rural transit providers to disseminate information to passengers using fixed route or paratransit services.	Planned
75		Downtown Parking Guidance Systems	Systems that gather parking availability data and relay it to motorists through dynamic signs, apps, and traveler information websites.	Ongoing
76		Rest Area Traveler Information	Project is to provide a video screen at IDOT rest areas showing travel information including weather, road conditions, and camera feeds along the corridor.	Planned
77	Work Zone Enhancements	Smart Work Zones	Smart Work Zone technology can be built into the work zone contract and required of the contractor to provide speed detection for display of actual vehicle speeds in work zones. Other types of applications could also be requested where needed.	Planned
78		Work Zone Management - Statewide Integration	Improve work zone information dissemination in the region through information sharing with the IDOT Gateway. Would include provision of work zone information from transportation stakeholders (i.e., work zone contractors).	Planned

Project Prioritization

In order to determine which specific projects should be deployed first, a prioritization ranking was performed. The projects were analyzed by the following criteria to determine their priority:

Integration Opportunity

- **Where did the solution category for this project rank?** The previously developed solution scores (Table 6-1) show how well the general solutions address high priority needs in Illinois. Projects that are part of the ITS solutions that have significant impact on the highest priority needs should be given preference over those strategies with lower priority or a less significant impact.
- **Does the project serve to support other projects?** Some projects form the necessary foundation for other projects to be successful. For example, while there might not be an obvious consumable product from a communication link, the link is necessary to be able to share information between two locations.
- **Can elements of the project be "mainstreamed" by being incorporated in near-term construction plans?** Combining equipment deployment with construction is more cost efficient because work is already being done at the location. To realize these cost savings, deployment should be coordinated with upcoming construction projects in an area where ITS projects would be deployed.

Financial Integrity

- **Are resources readily available to implement?** Having funds designated for project deployment is an essential step. Often this funding is identified in the applicable regional transportation improvement plan and/or IDOT's Multi-Year Program, while Federal funding opportunities also exist. Projects that are included in agencies' programs or budgets are more likely to be deployed sooner than projects that are not yet programmed. It should be noted that IDOT will not allocate more than 20% of the State's annual ITS budget to any single district each year. For larger deployments, cost sharing becomes necessary.
- **Have resources been arranged for operations & maintenance?** Ongoing operations of deployed equipment is essential to a project's success. If there is not adequate funding to operate and maintain equipment or not enough staff to adequately operate it, the full benefits from a project will not be realized.
- **Does the project provide an acceptable return on investment (ROI)?** With limits on available resources, transportation agencies need to make sure they are using them wisely. Preference should be given to areas whose technology or policies can realize significant impact for the amount of funding spent, including those projects that generate revenue. This evaluation should consider the ROI and overall effectiveness of past projects implemented by the champion.
- **Are there opportunities for public/private partnerships (P3) to secure funding for deployment and operation and maintenance?** Private industry is well-positioned to help support transportation projects, including ITS implementations. P3 arrangements can provide the advantages of accelerated delivery, risk and cost sharing, and integration with other private initiatives.

Advancing Plan Objectives

- **Can the project be deployed in the near term to realize benefits sooner rather than later?** Projects that require long lead times for coordination or hardware/ software development and procurement will inhibit the ability for transportation agencies to

provide services in the near term. The identification of "early winners" may promote the benefits of ITS projects, leading to positive public perception and additional funding.

- **Has the project been identified through other studies as a key initiative?** A number of parallel studies have been conducted to identify key transportation initiatives in the near future. These studies include the Illinois State Transportation Plan, the Illinois Comprehensive Highway Safety Plan (CHSP), and the CVISN Program Plan. These studies have focused on a number of critical transportation issues, including congestion mitigation, traveler safety, and freight movement. By applying the results of these studies, the project ranking in this document will be more balanced with the overall needs of the state.
- **Does the project promote mobility for all transportation users?** Transportation projects should provide equitable service to all travelers regardless of their physical abilities. Projects that provide or increase mobility for all transportation users were favored.
- **Can the project overcome potential impediments to deployment or application?** ITS projects will need to observe applicable regulatory, policy, legal, and other requirements that may impede its deployment. The projects should also provide services that are not duplicated by private products or services.

Operational Efficiencies

- **Does the project use proven technology or a tested application of technology?** This criterion is a question of risk management. Proven technologies with widespread application are much easier to get funded, are more likely to be received well by the end users, and can be deployed more quickly, making a successful outcome more likely. This is not to say that cutting-edge, high-risk projects should not be considered, however. Projects using unproven applications can be included if they offer potential for dramatic improvements in service, lower costs, or provide other significant benefits. These are often deployed as pilot project to verify that the technology delivers the intended benefits before being expanded to larger geographic area.
- **Does the project promote interoperability between both legacy and proposed systems?** To enhance the application of ITS components across the state, ITS projects should deploy equipment that can be operated at the local and statewide level, both within single agencies (IDOT Central Office and District Offices) and between different agencies (traffic, emergency, transit, etc.).
- **Do the project's anticipated benefits apply to high travel modes/corridors and/or do they provide statewide or multi-regional coverage?** The scope of an ITS project affects the overall benefits that it would realize. Projects that are focused on areas that of high travel volume, address multiple modes of travel, and cover large areas should be favored.
- **Are performance measures available?** Once a project is deployed, it should be monitored to make sure it is effective and delivering expected results. Ideally, performance measures would be defined for each project to make sure it is effective. Easy, ready-to-measure criteria are preferable.

Using the above criteria, each project was given scores ranging from 0 (least favorable) to 5 (most favorable) for each of the fifteen project prioritization criteria. Acknowledging that some of the listed criteria are more critical than others, each of the above listed criteria was also weighted to emphasize high-priority issues:

High-priority Criteria (score multiplied by 5)

- Solution ranking
- Acceptable return on investment

- Identified as key initiative
- High travel corridors or statewide/regional coverage

Medium-priority Criteria (score multiplied by 2.5)

- Resources programmed/identified for implementation
- Resources available for O&M
- Implementation timeframe
- Mobility for all transportation users
- Promotes interoperability

The scores for each project were tabulated, and the resulting rankings were then normalized by dividing the cumulative point score by the number of criteria used to rank the project (since some criteria did not apply to certain projects). This process created an overall score range from 7.0 to 12.4, with higher scores indicating a higher priority.

The prioritized listing of statewide ITS projects can be found in Appendix I. This listing includes planned ITS projects as well ongoing ITS projects. A project is considered to be underway if:

- The project is being implemented as of the date of this document;
- The project is being designed as of the date of this document; or
- Funding has been identified for the project.

These ongoing projects have been included in this ITS Strategic Plan because they relate directly to projects proposed in the plan and help to underscore the ongoing nature of ITS planning and implementation.

7 TRANSPORTATIONS SYSTEMS MANAGEMENT AND OPERATIONS

Transportation Systems Management and Operations (TSMO) is an integrated program intended to optimize the performance of the existing transportation network by implementing multimodal transportation strategies and technologies to maximize capacity and improve the safety, security, and reliability of the transportation system. This section of the strategic plan focuses on the purpose of TSMO planning and its relationship to the ongoing identification, evaluation, deployment, and operation of ITS projects.

7.1 PURPOSE OF TSMO

TSMO refers to a set of strategies including intelligent transportation systems that focus on operational improvements that can maintain and restore the performance of the existing transportation system without the introduction of additional capacity. This involves comprehensive solutions that can be implemented at relatively low cost. The benefits of TSMO can include[14]:

- Improved quality of life
- Smoother and more reliable travel
- Improved safety
- Reduced congestion
- Reduced fuel consumption
- Improved air quality
- Increased economic vitality
- More efficient use of resources (facilities, staff, funding, etc.)

With road capacity largely built out in urban areas and transportation funding in limited supply, state and local transportation agencies and metropolitan planning organizations are turning to cost-effective, near-term TSMO solutions to address customer needs. FHWA has estimated that nationally about 40% of traffic congestion is due to insufficient capacity, which typically requires capital expansion.[15] Nonrecurring events such as incidents, construction, special events, weather conditions, and poor signal timing are responsible for a significant portion of traffic congestion and travel delays. Those are issues that do not require capital expansion. TSMO utilizes cost-effective and quick-to-implement transportation solutions like ITS that can complement and enhance traditional capital expansion projects for the approximately 60% of traffic congestion due to the nonrecurring events. Since TSMO solutions require lower capital investment, they are less expensive, less disruptive, and much faster to implement. Advancing TSMO has become a national movement spearheaded by FHWA and implemented with demonstrated success by peer states such as Colorado, Iowa, and Michigan.[16]

[14] USDOT FHWA TSMO website, https://ops.fhwa.dot.gov/tsmo/index.htm#q1.
[15] *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation*, USDOT FHWA, February, 2017.
[16] *Advancing TSMO: Making the Business Case for Institutional, Organizational, and Procedural Changes*, USDOT FHWA, December, 2018.

TSMO solutions involve a range of transportation operators and stakeholders, including those that have been involved in the development of this strategic plan like state departments of transportation, local communities, regional transit operators, and metropolitan planning organizations. Many TSMO strategies have a significant technology component. Projects identified in this strategic plan can facilitate the TSMO program planning for operations solutions to address regional congestion and operations. The timeframes of those projects (i.e., immediate-, medium- and long-term) can also assist in establishing the TSMO program funding plan.

7.2 IDOT TSMO EFFORTS TO-DATE

In 2018 IDOT participated in a TSMO workshop facilitated by the Federal Highway Administration. This workshop resulted in a series of TSMO guiding principles for the Department:

- Add an *operator* culture to complement IDOT's *builder* culture
- Observe constraints on adding new capacity
- Need to *operate* the existing network to its fullest service potential – "take back" capacity lost to congestion, incidents, construction, weather, poor signalization, etc.
- Apply TSMO to improve security, safety, capacity, and reliability

Next steps involve institutionalizing these principles and applying them in the projects defined through this strategic plan. This applies to many operational areas within the Department:

- Business processes – across all stages of project delivery
- Systems and technology – applying systems engineering and considering the interoperability of existing and new technology
- Performance measurement – gathering data, applying analytics, using the data in myriad ways
- Culture – foster technical understanding, leadership, outreach
- Organization/workforce – create an organizational structure and develop workforce capabilities
- Collaboration – forge partnerships with other levels of government, law enforcement, and the private sector

7.3 NEXT STEPS FOR TSMO IN ILLINOIS

The following are recommended next steps for advancing TMSO planning and implementation for Illinois:

- **Develop a TSMO Workforce.** Designate personnel within the Department to build a TSMO workforce to provide continuity in the development of the TSMO program and promote integration with other efforts.
- **Establish IDOT TSMO mission, vision, and strategic areas of focus.** This provides guidance and values to steer Illinois' development of an innovative and cohesive TSMO program.
- **Pursue development of a TSMO Program Plan** to organize and direct IDOT TSMO efforts.
- **Identify Actions for Implementation.** This provides actionable strategies and solutions for consideration to support IDOT's TSMO mission, vision and strategic focus areas.
- **Prioritize TSMO recommendations.** This will result in a series of priority recommendations for action that IDOT and partner agencies can implement first to advance IDOT's TSMO capability.

TSMO Workforce Development

To help build an operator culture within IDOT, the Department will need to refocus its efforts to develop, recruit, and retain professionals that bring knowledge, skills, and abilities (KSA) related to transportation technologies. Table 7-8 provides examples of the current and potential actions that transportation planners, traffic engineers, and ITS professionals can perform to integrate TSMO into planning, design, and operations.

Table 7-8 – Evolution of Transportation Positions to Integrate TSMO[17]

Job Title	Existing Description	Potential Roles and Responsibilities
Transportation Planner	• Develop long-range transportation plan • Allocate funding for transportation projects • Coordinate with other state and regional planning agencies	• Mainstream TSMO into the transportation planning process • Leverage data from ITS sources for transportation planning
Traffic Engineer	• Conduct traffic studies • Perform traffic signal optimization analyses • Operate and maintain traffic signals	• Apply data from ITS sources for design and operations • Leverage integrated corridor management techniques • Consider multimodal solutions • Advocate for TSMO applications during project planning
ITS Planner	• Identify, evaluate, and recommend ITS projects • Work with the IDOT ITS Program Office to secure funding	• Mainstream TSMO into the transportation planning process • Leverage data from ITS sources for transportation planning
ITS Design Engineer	• Design ITS projects or ITS elements in larger transportation projects • Apply the systems engineering process	• Consider multimodal solutions • Apply connected vehicle elements into ITS projects

As ITS projects have been deployed across the state, additional positions have been defined to better leverage these tools, primarily related to communications and software, e.g., communications specialists, network engineers. This process should continue, with lines of communication expanded to allow the unique KSAs from one district to be shared with others.

As described in the NCHRP *Transportation Systems Management and Operations Workforce Guidebook*, other emerging positions should be considered for Illinois to take advantage of the growing capabilities that ITS will offer. These roles are primarily focused on operations, and include:

- Connected and automated vehicles (CAV) manager
- Computer engineer
- Cyber security engineer
- Data scientist/statistician
- Integrated corridor manager
- Surface weather specialist
- Systems engineer
- TSMO manager
- Visualization specialist

[17] *Transportation Systems Management and Operations Workforce Guidebook*, NCHRP Project 20-07, March 2019.

These and other potential TSMO positions should be evaluated as part of the TSMO Program Plan process.

TSMO Mission, Vision, and Strategic Areas of Focus

A mission statement and vision will guide Illinois' TSMO program. Strategic areas of focus will grow from the mission and vision, providing a path for the development of TSMO solutions to address transportation challenges. These should be developed by TSMO personnel and organizational leadership, building on both IDOT's overall mission. This ITS Strategic Plan provides a basis for this step through the identification of transportation needs in Section 4 and the ITS vision statement in Section 2.

TSMO Program Plan

A TSMO Program Plan for Illinois should build upon the established mission, vision and strategic areas of focus and contain the following elements:[18]

Figure 7-15 – TSMO Program Plan Elements[5]

- Strategic: establishes the need for TSMO and defines goals and performance objectives with measures based on outcomes, considers financial resources
- Programmatic: establish business processes to implement TSMO activities, sets programmatic objectives with measures based on internal processes, consider staffing and resources, identify funding

[18] *Developing and Sustaining a Transportation Systems Management & Operations Mission for Your Organization*, USDOT FHWA, September 2017.

- Tactical: establish monitoring processes and data sources to assess objectives, develop near-term investment plan

Identify Actions for Implementation

The stakeholder group contained in Appendix A should serve as the source of potential TSMO actions, including the identification of ITS projects on a statewide level. Those stakeholders can also work with their local transportation partners to identify further ITS projects for consideration. Project concepts should be developed based on identified user needs. The needs and ITS program areas defined in Section 4 provide a basis for organizing these project concepts, including aligning them with performance measures. This mirrors the approach that has been applied in this strategic plan to develop the recommended list of ITS projects (Figure 7-16).

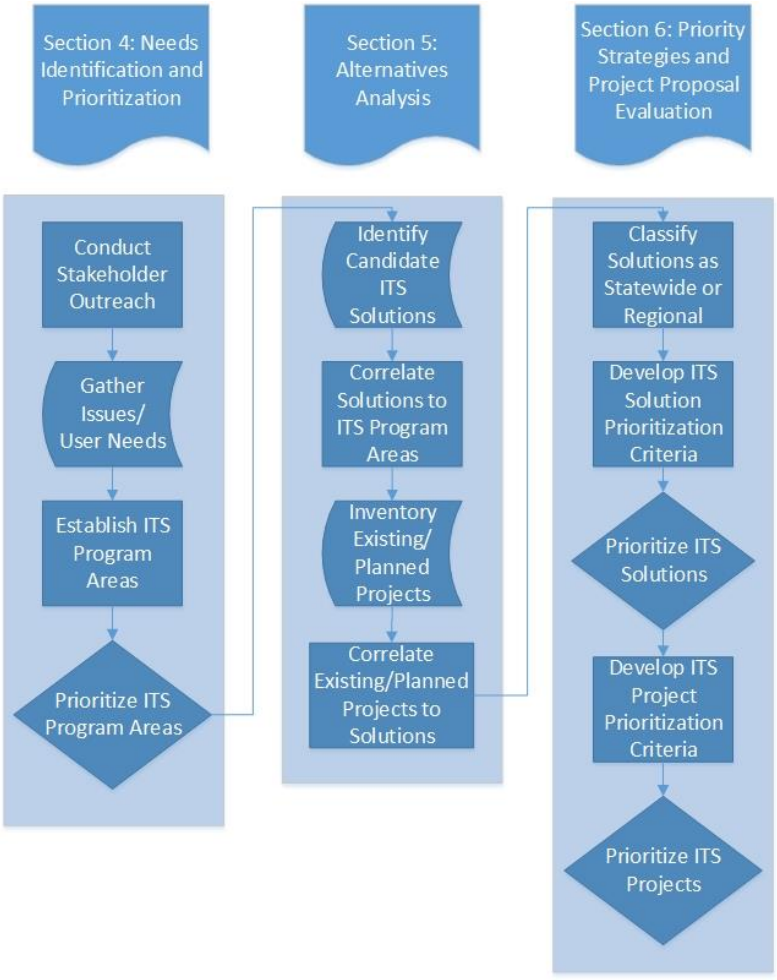

Figure 7-16 - Illinois Statewide ITS Strategic Plan Workflow

Prioritize Recommendations

The TSMO actions defined above will lead to the identification of new candidate ITS projects beyond those recommended in this Strategic Plan. These ITS projects will be competing against each other and with traditional transportation projects for available funding. With this in mind, a multi-step evaluation process should be applied toward potential ITS projects.

As described in Section 6.3, this Strategic Plan has applied a step-by-step process for comparing ITS projects against a series of established criteria that can be used to evaluate new ITS projects. This process applies fifteen (15) criteria related to 1) operational efficiencies and integration opportunity, 2) financial integrity, and 3) advancing plan objectives. Weights are given to certain criteria to emphasize their importance.

Some states have developed tools for the assessment of transportation projects. For example, Ohio's Traffic Operations Assessment Systems Tool (TOAST), a Microsoft Excel-based application, uses traffic data, crash rates, and other parameters to score potential improvement projects. The Texas Department of Transportation developed a Smart Work Zone System Go/No-Go Decision Tool to assess the effectiveness of various smart work zone tools based on the particular characteristics of a travel corridor. Building on these examples, IDOT can leverage the ITS project scoring spreadsheet developed through this strategic planning process to evaluate potential new ITS projects.

Benefit-Cost Analysis

A benefit-cost analysis can be used to provide an "apples to apples" comparison of ITS projects against traditional transportation projects. This step will often help to demonstrate the high value that ITS deployments offer at a relatively low cost.

While the exact types of costs and benefits will vary by project, the general areas below should be examined when determining which project, if any, should be moved forward to implementation. The results of the benefit/cost analysis can be used for both a traditional project and an ITS project to compare the effectiveness of the two projects. (A present worth cost comparison is recommended to compare projects with similar benefit cost ratios but have different life expectancies.) Example categories of costs include:

- Design (agency and consultant design labor costs, prototyping, surveys and inventory)
- Deployment (modification of existing equipment and facilities, new equipment costs, installation, integration, training, downtime costs during construction, utility setup charges)
- Operations and Maintenance (operating, maintenance labor, replacement parts, updates/enhancements, evaluation, configuration management, utility costs, specialized test equipment)

Example ITS project benefits include:

- Reduced Congestion (measured by hours saved X median hourly income rate)
- Improved Safety (measured by percentage reduction in accidents X current total number of accidents in area affected X average cost of fatal and non-fatal accidents as accepted by Illinois DOT)
- Increased Capacity (measured in terms of the effective increase in the number of vehicles or travelers per unit of time that pass through the facility)
- Air quality improvements (measured in pounds of each pollutant that are not introduced into the environment. This value is then converted into a societal cost savings in dollars.)
- Increased Life Span of Infrastructure (improvement/replacement cost X percentage increase in infrastructure life span)
- Security (measured in terms of the consequences of failure.) Comparison of security initiatives would not follow the typical benefit/cost ratio analysis process. Instead, it would be more of a risk

comparison between alternatives. Once alternative project approaches that have acceptable risks are identified, those projects could then be compared on a cost basis.

Though not comprehensive, these lists provide a good beginning for an individual ITS project cost-benefit analysis that can be compared against traditional transportation projects. The result of these steps will be a program of ITS projects that support the vision and goals identified through the ITS strategic planning process in support of the principles of Transportation Systems Management and Operations.

Project Selection

Once identified and prioritized, ITS projects can be selected for programming as funding is secured and as implementation opportunities come about.

Advancing TSMO capabilities in Illinois is critical as IDOT and its partners continue to deploy ITS technology and consider investments in emerging transportation technologies such as connected and automated vehicles. A robust TSMO program will help IDOT best leverage these technologies to the benefit of transportation system customers, including the traveling public, freight shippers, and communities.

8 IMPLEMENTATION PLAN

This section of the Illinois Statewide ITS Strategic Plan provides guidance for the coordinated deployment of the statewide high-priority ITS projects outlined in Section 6, as well as future ITS projects through the applications of Transportation Systems Management and Operations planning. This includes a roles and responsibilities and an overview of the process for implementing statewide, regional, and local ITS projects; a sequenced implementation plan with estimated costs; and additional deployment considerations for ITS projects. This implementation plan is "where the action is" with respect to ITS technology deployment in Illinois.

8.1 IMPLEMENTATION ROLES AND RESPONSIBILITIES

Before deploying ITS projects, it is important to define roles and responsibilities of the transportation agencies involved and how these projects should be brought into the planning and programming process. As depicted in , this implementation strategy involves three critical geographic and governmental areas for ITS deployment:

- The state of Illinois as a whole,
- The IDOT regions, and
- Local government agencies.

The statewide level of projects includes deployments encompassing the entire state and provides benefits from standardized deployment procedures throughout the state. An example would be the communications projects that are intended to join together the various regional information nodes to create an overall Illinois Statewide Transportation Information Network (ISTIN). Each individual deployment or project – whether managed through the IDOT Central Office or at the district level – is only one piece of the puzzle; to provide maximum benefit each project must be deployed in sequence to create this statewide network. The overall statewide information network is a critical component based solely on the number of projects that rely on its deployment. Therefore, sequencing of projects (Section 8.4) is a critical step in ITS project deployment.

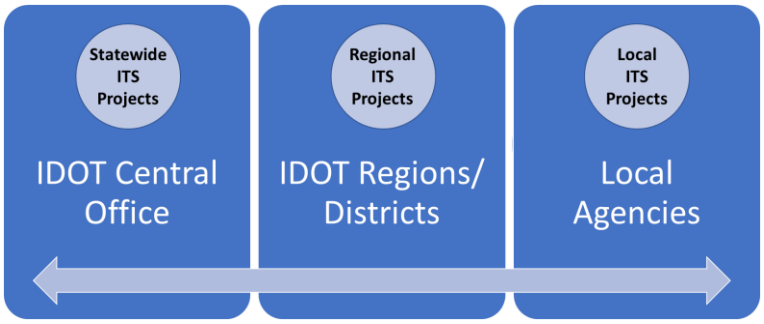

Figure 8-17 – ITS Program Implementation Plan

The second area for deployment involves the IDOT regions and districts. IDOT districts consist of an urban center or centers and rural areas. Urban centers typically have a regional ITS architecture in place which defines the exchange of pertinent ITS information between users (see Section 3). Rural areas rely on the Statewide ITS Architecture to serve the same purpose. Regardless, the IDOT district office becomes the conduit through which ITS is deployed on a regional basis. Both the statewide level of projects and the local government level of projects rely on the district office to coordinate statewide and local activities at a district level. In addition, the IDOT district may benefit from working together on deployment of ITS for interregional corridors.

Local government agencies are the third area of deployment. The coordination of local ITS initiatives is key to ensure the total benefits of a system are recognized. Given the nature of the ITS deployment, several projects may entail the coordination of multiple agencies and the sharing of resources in a collaborative manner. One example of such a situation would be the deployment of an interagency traffic signal system. Each agency may be responsible for the updating of their traffic signal equipment, while one agency may agree to operate the system during peak congestion periods to minimize overall staffing requirements. In this example, signal timing plans would be agreed to by all agencies involved and developed collaboratively.

These three major areas are critical to the overall implementation of intelligent transportation systems. Each area includes key implementation responsibilities that contribute to effectiveness of the ITS as a whole. The Statewide Concept of Operations and Statewide ITS Architecture are useful references for operational responsibilities, ITS services, and interfaces between agencies. This Implementation Plan focuses on responsibilities related to the actual implementation of projects and/or project management.

Table 8-9 summarizes the responsibilities of IDOT and other key stakeholders involved in the deployment of ITS. The implementation responsibilities are consistent with the statewide and regional project descriptions outlined in Section 6, as well as the responsibilities of the following IDOT offices:

- IDOT Office of Planning and Programming – develops plans and programs aimed at improving the state's transportation system. Includes the following bureaus:
  - Bureau of Planning
  - Bureau of Programming
  - Bureau of Innovative Project Delivery
- IDOT Office of Highways and Project Implementation – monitors district programs to ensure statewide uniformity of policy interpretation and compliance and to certify program coordination with federal, state and local agencies. Includes the following bureaus:
  - Bureau of Operations
  - Bureau of Safety Programs and Engineering
- IDOT Office of Intermodal Project Implementation – coordinates activities for amongst different transportation modes to provide safe, efficient, affordable, reliable, and coordinated transportation of people and goods through rail, mass transit, and related modes of transportation[19]

Additional transportation agencies are denoted under the Service Area Responsibility columns in Table 8-9. Section 10 outlines a number of multiagency ITS teams that involve these stakeholders in support of ITS project development, deployment, and operation.

[19] IDOT Organizational Structure, IDOT website.

Table 8-9 – ITS Implementation Responsibilities

ITS Solutions	Office of Planning and Programming	Office of Highways Project Implementation	Office of Intermodal Project Implementation	Service Delivery Responsibility			
				State	Regional	Local	Other
Active Transit Station Signs					X		X[1]
Advanced Railroad-Highway Interface and Safety Technologies	X	X	X		X	X	
Automated Traffic Signal Performance Measures	X	X		X	X	X	
Automated Vehicle Deployments	X	X		X	X	X	X[3]
Automatic Vehicle Location (AVL)				X	X		
Commercial Vehicle Enforcement / Inspection Technologies	X	X	X	X	X		
Connected Vehicle V2V and V2I Applications	X	X		X	X	X	X[3]
Crash Investigation Systems	X			X			X[2]
Drones for Incident / Traffic Management	X	X	X		X	X	X[3]
Emergency Traffic Patrol / Vehicle (ETPV) Expansion	X	X		X			
Enabling Backbone Communications Infrastructure	X	X		X[4]			
Enhanced Communications Links to Field Devices	X	X		X[4]	X	X	X[3]

ITS Solutions	Office of Planning and Programming	Office of Highways Project Implementation	Office of Intermodal Project Implementation	Service Delivery Responsibility			
				State	Regional	Local	Other
High Volume Rest Area Truck Parking Management		X		X[4]			X[3]
Illinois Statewide Transportation Information Network (ISTIN)	X	X		X			
Integrated Payment Systems	X	X	X	X		X	X[1,3]
Integrated Transportation Corridors	X	X	X		X		X[1]
Integration of Communications Channels	X	X		X[5]	X	X	X[1,2]
ITS Data Collection Systems	X	X	X	X	X	X	X[3]
Localized Traffic Advisory Systems	X	X					X[3]
Managed Lanes	X	X		X	X		X[1]
Mobile Network Access	X	X		X			
Regional Communications Centers for Operations Interoperability		X		X	X	X	X[1,2]
Regional Paratransit Coordination		X	X		X		X[1]
Regional Traffic Signal Coordination		X		X	X	X	X[1]
Security Surveillance	X	X	X	X	X	X	
Smart Cities	X	X	X	X[4]	X	X	X
Statewide Comm. Center/Station One Upgrade	X	X		X			
Statewide ITS Teams	X	X		X			

ITS Solutions	Office of Planning and Programming	Office of Highways Project Implementation	Office of Intermodal Project Implementation	Service Delivery Responsibility			
				State	Regional	Local	Other
Third Party Traveler Information Applications	X	X		X	X		
Traffic Data Archive	X	X		X	X		X[3]
Traffic Signal Preemption / Priority	X	X	X		X	X	X[1]
Traffic Signal System Upgrades		X			X	X	
Work Zone Enhancements		X		X	X	X	X[3]

"Other" Responsible Agencies footnotes:

[1] Transit Operators
[2] Emergency Responders
[3] Private Sector
[4] Department of Innovation and Technology (DoIT)
[5] Emergency Management

8.2 ITS PROJECT DELIVERY

Like most traditional transportation projects, ITS projects will go through a process for project delivery that includes 1) planning and programming, 2) design, 3) implementation, and 4) operations and maintenance. This subsection describes the manner in which ITS projects progress through the first three steps in the project delivery process.

Planning and Programming

The ITS projects identified in Section 6 are focused on providing benefits at a statewide level, but they will also improve transportation operations at the regional and local level since they involve varying degrees of deployment at the regional and local level. As such, it is important to identify ways to integrate ITS into the statewide, regional, and local transportation planning and programming process.

The Statewide ITS Architecture and the various regional ITS architectures in Illinois provide a starting point for defining the functionality and scope of a given ITS project. As individual ITS projects take shape, the architecture should be reviewed to ensure that an ITS project's functionality is included within the framework of the architecture. Once this is confirmed, the ITS architecture can be used to obtain project funding and to introduce the project into the appropriate transportation improvement plan.

The development of this Statewide ITS Strategic Plan has been led by the Illinois Department of Transportation, and IDOT will serve as the focal point for ITS planning and programming for statewide ITS projects and many regional/local projects. This will require coordination both within IDOT and between IDOT and the partner agencies identified in Table 8-9.

Once an ITS project is identified, it can be deployed as part of a larger improvement project (e.g., installation of vehicle detection as part of a roadway reconstruction project), or as a separate standalone project (e.g., transit smart card program). The following subsections discuss ways that ITS projects can be incorporated into both approaches.

Mainstreaming ITS Projects

Intelligent transportation systems should be considered as a potential application in all highway improvement projects. Typically, the earlier that ITS is considered in the development of a transportation improvement project, the greater the benefits ITS will provide. When ITS is introduced late in the process and time is of the essence, it can be over- or under-designed, it may miss out on potential integration opportunities, and it may create project budgetary issues. By defining the ITS design component early in the project's development, it becomes part of the overall highway improvement. This is referred to as "mainstreaming" ITS and is encouraged by the USDOT.

The IDOT project development process follows a phased approach as presented in Figure 8-18. Phase I encompasses the planning or preliminary design stage. This phase begins with project scoping and concludes with the creation of a Phase I report. This report describes the purpose and need of a given project, documents existing conditions, outlines a number of project alternatives, and provides recommendations for subsequent phases. Phase II represents the final design stage of a project. This second phase builds upon the findings in the Phase I report and finalizes the specific design parameters of the project. Phase III represents the construction stage of a project.

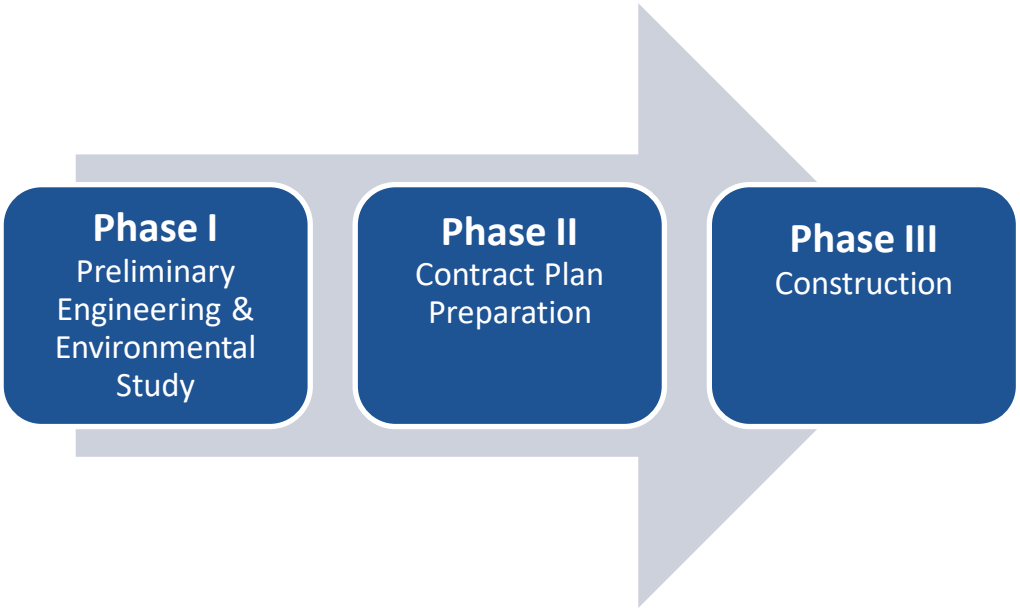

Figure 8-18 - IDOT Project Development Process

Sections 2 and 3 of the IDOT Bureau of Design and Environment (BDE) Manual define distinct Phase I "activities" for IDOT projects, with the total number of steps varying based on whether the project requires right-of-way acquisition, if it follows an existing roadway alignment, etc. ITS is not formally included in this process, but should be incorporated into the following activities (at a minimum):

- Scope Project – consider ITS at project conception
- Collect Data – identify existing ITS elements in the project area
- Analyze Existing Conditions – determine utility of existing ITS elements
- Initiate Early Coordination/Scoping – consider partner agencies that could augment or benefit from ITS in the project
- Determine Reasonable Corridors / Alignments – assess suitable ITS applications
- Conduct In-Depth Analysis of Reasonable Corridors / Alignments – further assess suitable ITS technologies/strategies
- Identify Recommended Corridor / Alignment – identify recommended ITS elements
- **ITS Concept Checklist*** – compile a checklist of ITS element recommendations to coincide with the Drainage Report, Geotechnical Report, Bridge Drawings, Environmental Documentation, and Preliminary Utility Review
- Develop Transportation Management Plan (TMP) – ITS elements should also be considered for application during the construction stage
- Set Pre-Final Geometry and Right-of-Way – incorporate ITS elements into preliminary design
- Prepare Draft Design Report – incorporate ITS elements into preliminary design
- Conduct Public Hearing/Meeting – introduce ITS elements to the traveling public
- Select Preferred Alignment – select ITS elements for Phase II design
- Prepare Final Design Report – document ITS recommendations
- Obtain Design Approval – obtain approval of preliminary ITS design

* Proposed new activity

Next, assuming that ITS elements are included in the Phase I recommendations, during the Phase II of the IDOT project development process, ITS should be included in the "Conduct Field Inspection" activity, with ITS Infrastructure and schematic sheets falling under the category of "Specialized Plans" in the Phase II Project Development Network[20], developed along with the standard roadway design, maintenance of traffic, structural, and landscaping plan sheets. This way all project designers would be aware of the inclusion of intelligent transportation systems of the project, allowing the design of all project components to be carried out in an integrated and coordinated manner.

During Phase III (construction), ITS tools would be applied to collect traffic data for traveler information and management purposes, monitor the work zone to detect incidents and enforce traffic laws, and provide traveler advisories to improve traveler safety.

Standalone ITS Projects

In the past, ITS projects have been considered as specialized initiatives and have often been developed without consideration of other transportation areas. However, since the passage of the SAFETEA-LU transportation reauthorization bill in 2005, ITS deployments have become more mainstreamed with the support and encouragement of the USDOT. While this promotes interoperability and improved coordination between different transportation disciplines and ITS, ITS project champions can be faced with the prospect of competing with traditional road and transit projects for available funding.

As stated in the Code of Federal Regulations, Part 940, "use of the National ITS Architecture to develop a regional ITS architecture, and the subsequent adherence of all ITS projects to that regional ITS architecture" is required before Highway Trust Funds can be applied towards an ITS project. As such, the Statewide ITS Architecture and various regional ITS architectures have been developed throughout Illinois to promote the fast and efficient collection, processing, and dissemination of transportation data to help users make "*informed choices for improved operations*." This is a critical step in the development of ITS projects. As ITS projects move towards implementation, the systems engineering process that was used to develop the ITS architectures continues.

This portion of the Implementation Plan is intended to serve as a guide for ITS project managers to help them deploy successful, integrated ITS projects. The implementation guidelines in this subsection follow the systems engineering approach, as required under CFR 940. First, it is important to define a few key terms:

- ITS project – any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture (now known as ARC-IT)[21]
- ITS project manager – one who oversees the planning, design, deployment, and/or operations and maintenance of ITS projects
- ITS project champion – one who facilitates the development of an ITS project, bringing together interested parties to help gain consensus and approval throughout the project cycle

[20] IDOT Bureau of Design and Environment Manual, Revised April 2019, IDOT website.
[21] 23 CFR Part 940.3

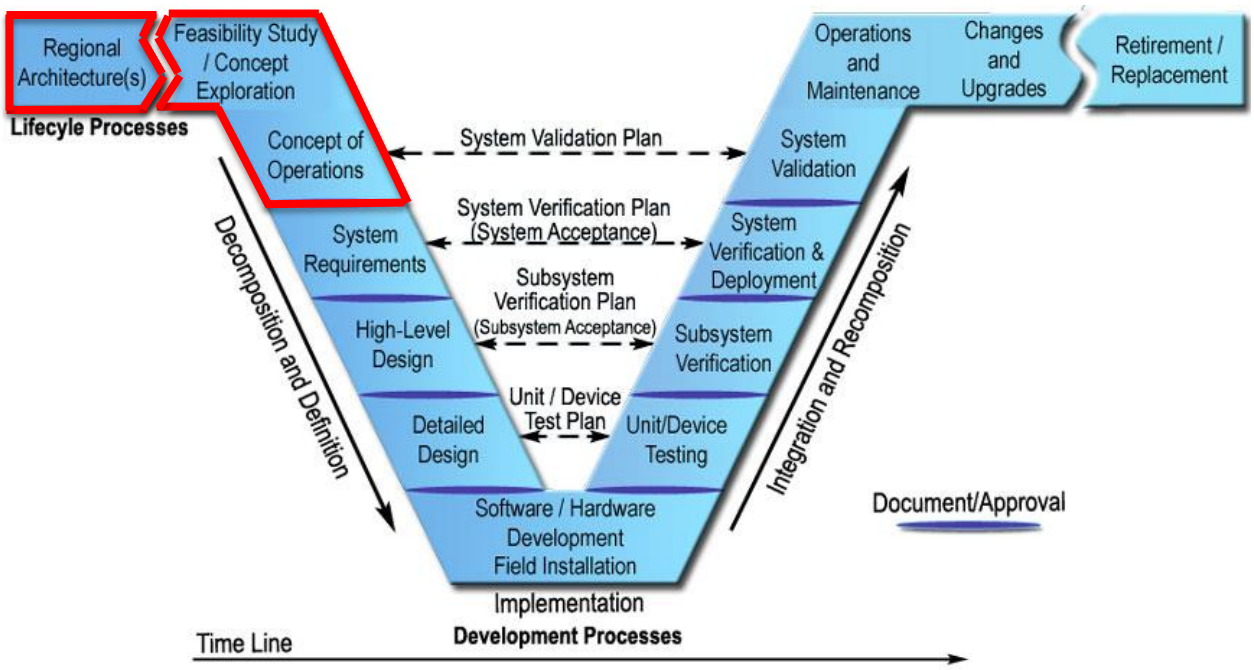

Figure 8-19 - V Diagram of Systems Engineering (with ITS Planning Steps Highlighted)

Based on the Systems Engineering Process (Figure 8-19), the following are the recommended steps for implementation of all ITS projects, but standalone ITS projects in particular:

1. ITS project manager should review the Illinois Statewide ITS Strategic Plan to identify candidate local ITS projects. These candidate projects should be compared against:

- Current local/regional transportation priorities,
- Potential deployment opportunities (e.g., planned roadway reconstruction project), and
- Regional operations and maintenance capabilities (e.g., staffing levels and skill sets, operations budget).

2. A project champion should be identified. This could be the ITS project manager, a Bureau Chief or Deputy Director/Regional Engineer, or any other IDOT or partner agency representative involved in the project. The champion should have a strong desire to see the project through and the ability to bring disparate parties together and facilitate its design and deployment. The deployed project would typically be managed by personnel in operations, which could be the project champion.

3. Identify a funding source(s) and get the ITS project incorporated into the regional transportation improvement plan (TIP) or statewide transportation improvement plan (STIP). These tasks can occur in either order, but both must take place to get the ITS project to Step 4. This step will most likely involve the metropolitan planning organization (MPO) or regional planning commission (RPC).

4. Initiate a systems engineering approach by identifying portions of the statewide and/or regional ITS architecture that apply to the ITS project. This includes the identification of applicable:

- Stakeholders,
- Subsystems and terminators,
- Service packages,
- Roles and responsibilities/concept of operations,
- Functional objects,
- Interconnects and architecture flows,
- ITS standards,
- Interagency agreements, and
- Related ITS projects

to create a project ITS architecture, if necessary. In many cases the applicable regional architecture will identify project elements, in which case a separate project architecture is not required. In some cases the regional architecture will only need to be slightly modified to identify the new project elements.

5. The ITS architecture components listed under Step 4 may need to be modified to fit the specific details of the ITS project. This will require a review of the roles and responsibilities to develop a project-specific concept of operations, the functional objects that can be used to develop project-specific functional requirements, and the identified ITS standards. Any appropriate architecture modifications should be incorporated back into the regional ITS architecture. Once this is complete, a conceptual design can be created. This conceptual design will build upon the functionality described by the architecture and will include implementation items, their locations, and costs.

6. Once the conceptual design has been approved, detailed design can begin. This involves the creation of a plans, specifications and estimates (PS&E) package and/or other procurement documents, as required. Data compiled in previous steps serves as the basis for the design. Information from the architecture such as functional requirements are critical to the design of the project and can be used as a basis for developing the specifications of the system. When complete, the PS&E package will be used as bid documents for potential implementers, and other procurement documents will be used if another method of implementation is used.

7. The next phase includes the implementation of the ITS project. Here, the ITS project manager must oversee the deployment and systems integration of ITS hardware/software to ensure that it adheres to the requirements set forth in Steps 4 and 5. As part of this step, the deployed ITS components will be tested to demonstrate that they meet the functional requirements, both as a single item and as part of a larger intelligent transportation system.

8. Next, the implemented components should be tested at the device level against the detailed project design, verified at the subsystem level against the high-level design and at the system level against the system requirements, and validated against key aspects of the concept of operations.

9. Once the ITS project is fully tested and implemented, it must be operated and maintained in order to fulfill its purpose. The roles and responsibilities contained in the concept of operations identify stakeholder responsibilities for the operations and maintenance of the ITS components and overall system. Operations and maintenance requirements for the identified statewide ITS projects are contained in Section 8.

8.3 STATE AND LOCAL PROCUREMENT PROCESS

The Illinois Procurement Code establishes the policies and procedures governing procurement for state agencies. For ITS professional and design services, there are two basic routes that ITS procurements can take, depending on the type of project:

Professional Services

When the ITS professional and design services fall under an established prequalification category, the procurement follows the IDOT polices for Engineering, Architectural & Professional Services. This is a qualifications-based selection process. The request for these services is advertised on the IDOT Professional Transportation Bulletin (PTB), available on the IDOT website.

For ITS professional and design services which do not fall under an established prequalification category, a request for proposals (RFP) process is followed. RFPs are developed under the supervision of IDOT Bureau of Business Services, with DoIT and/or CMS consultation as necessary during the RFP development.

Each of these procurement routes go through the RFP process for selection of a vendor, which applies the following steps before an agency can negotiate with a vendor:

1) Advertise RFP
2) Receive proposals
3) Administrative review of submitted proposals
4) Technical review of submitted proposals
5) Central Management Services (CMS) review (required only for IT technology, not services)
6) Selection committee review and recommendation
7) Price evaluation

The RFP process usually takes a 45-day advertising period followed by a two-month evaluation period starting from the date that all proposals are received. A database is used to track vendors that have delinquent debts to Illinois to identify vendors that are not qualified for Illinois contracts.

There are a number of issues that can slow the award of an RFP or signing of a contract:

- Number of legal departments involved – Review by agency or company legal departments can be a lengthy process. The more entities involved increases the number of legal departments that need to review documents.
- Required Forms – Not filling out forms required for procurement within the designated time period can delay the procurement process or even necessitate the process to start over.
- Identifying and securing funding – Funding that is identified at the beginning of the procurement process might sometimes be sidetracked for other purposes by the agency, causing a funding shortfall for the project.
- Number of requests to units – Many simultaneous requests for procurement review and approval by the unit will slow down the process significantly.

- Request for Information (RFI) - Involving an RFI prior to issuing an RFP to get a better idea of the work that will need to be accomplished in the project can add time to the project, though it can provide worthwhile information on what should be included in the RFP.

ITS Infrastructure

For procurement and deployment of ITS infrastructure and related technologies, the most common method of procurement is the public bidding of projects though the IDOT Contractor's Bulletin. This public bidding process is performed approximately seven times per year, and information on the letting schedule and bidding process is available on the IDOT Contractor's Bulletin webpage.

In addition to the above procurement methods, it may be possible to procure ITS equipment or services through an existing master contract. If the master contract includes appropriate scope and vendor qualifications, this may be the fastest, easiest way to procure goods or services for a project. Reviews are performed and agreements are already in place, so the RFP process is not required, reducing project implementation by months.

8.4 PROJECT SEQUENCING PLAN

Building upon the guidelines set forth in this Implementation Plan, this section describes a sequence of deployment for the statewide ITS projects defined in Section 6. Many of the statewide ITS projects are dependent on other current and planned projects. For instance, the deployment of fiber optic cable communications infrastructure within the state allows for the continued deployment and management of ITS field devices throughout the state, as well as enhanced interagency coordination within IDOT.

In addition, the amount of available funding for ITS projects is a key factor in sequencing. While several projects fall within the "High Priority" category, not all of these can be deployed, and the deployment of some high-cost ITS projects in a given fiscal year will limit the opportunities for additional ITS projects during that year. Section 8.5 of this Strategic Plan addresses options for funding ITS projects in greater detail.

With these considerations in mind, this Sequencing Plan will focus on the 28 "High Priority" statewide ITS projects identified in Section 6. Contained in Table 8-10, these high priority projects will be considered for deployment over the short-term (1-3 years), medium-term (4-6 years), and long term (7-10 years) timeframes. The remaining 25 medium and 28 low priority ITS projects outlined in Section 6 would be considered for deployment in the 10-year timeframe and beyond. These projects represent an ITS "toolbox" that can be applied as funding becomes available, related projects are completed, and deployment priorities are updated.

Deployment of all of the High Priority projects within the short term timeframe is not plausible under current ITS funding options. As such, a phased deployment schedule has been developed (Table 8-10) to spell out those ITS projects that are recommended for deployment in each of the term of ITS deployment along with estimated deployment costs. These ITS deployments can be coordinated with IDOT's letting schedule for calendar years 2019-2023, shown in Table 8-11.

Table 8-10 – High-priority ITS Project Deployment Schedule

Project Title	Deployment Sequencing and Estimated Deployment Costs (in thousands)						
	Short Term			Medium Term			Long Term
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7-10
DoIT Smart State for ITS Projects	$300	$300	$300	$300	$300	$300	$300
Fiber Links Between Transportation and Law Enforcement	$500	$500	$500	$500	$500	$500	$500
Fiber Installation to Support ITS Expansion	$1,000	$1,000	1,000	$1,000	$1,000	$1,000	$1,000
Fiber Connection Across State Boundaries	$100	$100	$100	$100	$100	$100	$100
Traffic Signal Modernization	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Statewide Deployment of Additional ITS Field Devices	$2,500	$2,500	$2,500	$5,000	$5,000	$5,000	$5,000
Replacement of Obsolete Field Devices	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Smart Work Zones	$500	$500	$500	$500	$500	$500	$500
Traffic Incident Management Training	$25						
Education about ITS	$10						
District 1/District 3 Joint ITS Project along I-80 and I-55 Corridors	$100						
Expansion of Public-Private Data	$100						
Gateway Traveler Information System/Travel Midwest Website Enhancement	$100	$100					
Dedicated & Higher-Bandwidth Links between Agencies (Non-Centralized)	$500	$500					
Central Signal System Expansion		$5,000	$5,000	$5,000			
Truck Parking Management Systems (IDOT)	$3,500	$3,500	$3,500				
IL 64 / IL 56 Smart Arterial Corridors	$2,500	$2,500	$2,500				
CAD Integration with Traffic Management	$400	$400	$400	$400	$400		
Centralized CCTV Camera Monitoring and Control		$1,750					
Smart Highway Deployments		$7,000	$7,000	$7,000		$3,000	
Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion		$500		$500			$500
Statewide Communications Center/Station One Upgrade		$6,250					
Statewide Advanced Traffic Management System (ATMS)			$2,500	$2,500			
I-55 Project Managed Lanes				$5,000	$5,000	$5,000	
I-290 Project (IDOT) Integrated Corridor				$3,000	$3,000	$3,000	
Regional Arterial TMC					$6,000		
Integrated Corridor Management (ICM)							$6,250
Managed Lanes (IDOT)							$5,000
Totals:	**$19,635**	**$39,900**	**$33,300**	**$38,300**	**$29,300**	**$25,900**	**$26,650**

Continual Projects: Years One through Ten

Several ITS projects listed within Table 8-10 will require a continual focus by IDOT throughout the course of ITS deployment to support additional ITS projects in future years. These projects focus on internal staff training, communications infrastructure to support ITS field components and future projects, as well as maintaining the operation of existing ITS components.

Communications infrastructure projects would establish center-to-field connections where necessary between IDOT district offices and ITS field devices, as well as the necessary center-to-center connections to enable the operation of a Statewide Advanced Transportation Management System (ATMS) in Years 3 and 4. This can include partnerships with the Department of Innovation & Technology (DoIT) to leverage its communications infrastructure for ITS devices, as well as potential links between transportation and law enforcement to support incident management activities.

Short Term Projects: Years One through Three

Short term projects include the upgrade of Station One for centralized monitoring of ITS field components throughout the state, as well as corridor based projects.

The upgrade of the Station One communications center within Year 2 would precede the deployment of a Statewide ATMS at a central IDOT office location. This would allow for 24/7 monitoring and control of all ITS field assets (DMS, CCTV, etc.) for IDOT districts in off hours when those districts cannot be present to respond to traffic incidents. Various districts have taken steps to deploy ATMS software and fiber from district offices to ITS field assets, which makes a Statewide ATMS effort more feasible.

This term would also include CAD integration with traffic management activities. Building upon agreements established between IDOT districts and law enforcement agencies in Districts 1 and 4, this would allow IDOT to view roadway related incidents currently being handled by Illinois State Police (ISP) and other law enforcement agencies electronically. Fiber-optic cable connections established within Years 1 and 2 would facilitate this sharing of information and video between these agencies.

Medium-Term Projects: Years Four through Six

Medium term projects include additional corridor based deployments throughout the state, such as Managed Lanes along the I-55 corridor and an I-290 Integrated transportation corridor.

Long Term: Years Seven through Ten

Long term ITS projects include additional managed lanes projects throughout the state similar to the I-55 managed lanes project, as well as Integrated Corridor Management (ICM) projects that can leverage ITS projects in areas such as the I-290 and parallel IL 64 and IL 56 arterial corridors.

Beyond Ten Years: Medium and Low-Priority Projects

During the subsequent 7-10 year period, IDOT and its partner agencies should continue to deploy ITS projects throughout the state as listed in Appendix I. Of the 54 ITS projects in the medium- and low-priority categories of the table, the following, at a minimum, are recommended for deployment:

- Travel Time Detection Systems
- Regional Traffic Signal Control for Municipalities
- Develop Connected Vehicle Pilot (ISTHA, IDOT, Pace)

- AVL / CAD Systems for Emergency Vehicles
- Emergency Vehicle Preemption (EVP) Deployment
- Video Sharing with ISP
- Multimodal Traffic Signal System Integration including Connected Vehicles
- IDOT Maintenance Vehicle AVL System Deployment
- Interagency video sharing

Transportation Bulletin	Pre-Qualification "Cut-Off"	Joint Venture "Cut-Off"	Request for Authorization to Bid and Affidavit of Availability "Cut-Off"	Letting Day
6/14/2019	6/21/2019	7/5/2019	7/9/2019	7/12/2019
6/28/2019	7/12/2019	7/26/2019	7/30/2019	8/2/2019
8/16/2019	8/30/2019	9/13/2019	9/17/2019	9/20/2019
10/4/2019	10/18/2019	11/1/2019	11/5/2019	11/8/2019
12/6/2019	12/27/2019	1/10/2020	1/14/2020	1/17/2020
1/31/2020	2/14/2020	2/28/2020	3/3/2020	3/6/2020
3/20/2020	4/3/2020	4/17/2020	4/21/2020	4/24/2020
5/8/2020	5/22/2020	6/5/2020	6/9/2020	6/12/2020
6/26/2020	7/10/2020	7/24/2020	7/28/2020	7/31/2020
8/14/2020	8/28/2020	9/11/2020	9/15/2020	9/18/2020
10/2/2020	10/16/2020	10/30/2020	11/3/2020	11/6/2020
12/4/2020	12/25/2020	1/8/2021	1/12/2021	1/15/2021
1/29/2021	2/12/2021	2/26/2021	3/2/2021	3/5/2021
3/19/2021	4/2/2021	4/16/2021	4/20/2021	4/23/2021
5/7/2021	5/21/2021	6/4/2021	6/8/2021	6/11/2021
6/25/2021	7/9/2021	7/23/2021	7/27/2021	7/30/2021
8/13/2021	8/27/2021	9/10/2021	9/14/2021	9/17/2021
10/1/2021	10/15/2021	10/29/2021	11/2/2021	11/5/2021
12/10/2021	12/31/2021	1/14/2022	1/18/2022	1/21/2022
2/4/2022	2/18/2022	3/4/2022	3/8/2022	3/11/2022
3/25/2022	4/8/2022	4/22/2022	4/26/2022	4/29/2022
5/13/2022	5/27/2022	6/10/2022	6/14/2022	6/17/2022
7/1/2022	7/15/2022	7/29/2022	8/2/2022	8/5/2022
8/19/2022	9/2/2022	9/16/2022	9/20/2022	9/23/2022
10/14/2022	10/28/2022	11/11/2022	11/15/2022	11/18/2022
12/9/2022	12/30/2022	1/13/2023	1/17/2023	1/20/2023
2/3/2023	2/17/2023	3/3/2023	3/7/2023	3/10/2023
3/24/2023	4/7/2023	4/21/2023	4/25/2023	4/28/2023
5/12/2023	5/26/2023	6/9/2023	6/13/2023	6/16/2023
6/30/2023	7/14/2023	7/28/2023	8/1/2023	8/4/2023
8/18/2023	9/1/2023	9/15/2023	9/19/2023	9/22/2023
10/13/2023	10/27/2023	11/10/2023	11/14/2023	11/17/2023

Table 8-11 – IDOT Letting Schedule, 2019-2023[22]

[22] IDOT Letting Schedule, IDOT website.

8.5 ITS PROJECT FUNDING

Delivery of the ITS projects identified in this Statewide ITS Strategic Plan hinges on the ability to secure sustainable funding. As outlined in the IDOT *Fiscal Year* (*FY) 2019-2024 Proposed Highway Improvement Program*, Federal funding through the current transportation authorization bill, the FAST Act, is expected to be the largest single source of funding for transportation projects through fiscal year 2024.[23] Passed in June of 2019, a new statewide infrastructure and transportation plan introduced increased revenues that will enhance the ability for Illinois to augment federal dollars with state and local funding.

Considering the influence of both federal and state funding to ITS projects, this subsection will discuss the various programs, grants, and other vehicles that can be used to fund ITS deployments.

Funding Environment

After several years of decline, transportation funding in Illinois has increased slightly at the federal, state, and local levels (Figure 8-21). The recently approved infrastructure and transportation plan should further strengthen funding levels. However, considering the backlog of transportation needs across the state, agencies must carefully choose what projects they pursue with an eye toward activities that derive the most benefit from the available resources. This Statewide ITS Strategic Plan is designed to highlight the ITS projects that are ready to deploy to provide the largest benefits to the traveling public.

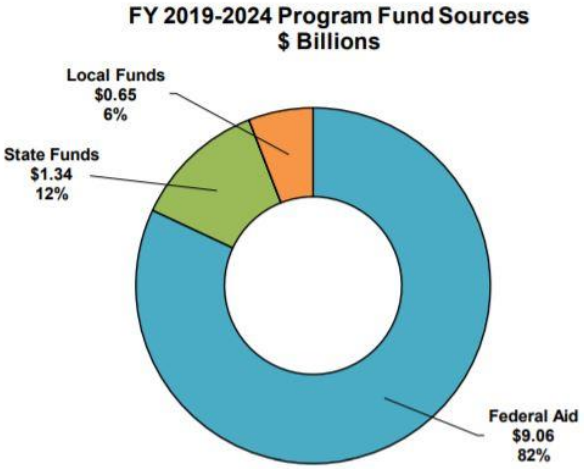

Figure 8-20 – IDOT Transportation Funding Sources, FY 2019-24

Federal funding often requires states to provide matching funds to access the federal funding source. This approach amplifies the buying power of state and local investment to deliver projects. Agencies should also be aware of different types of resources that can be used as matching funds, such as operations staffing hours or previously deployed systems or equipment that can be included as an "in-kind" match.

[23] *FY 2019-2024 Proposed Highway Improvement Program*, IDOT, spring, 2018.

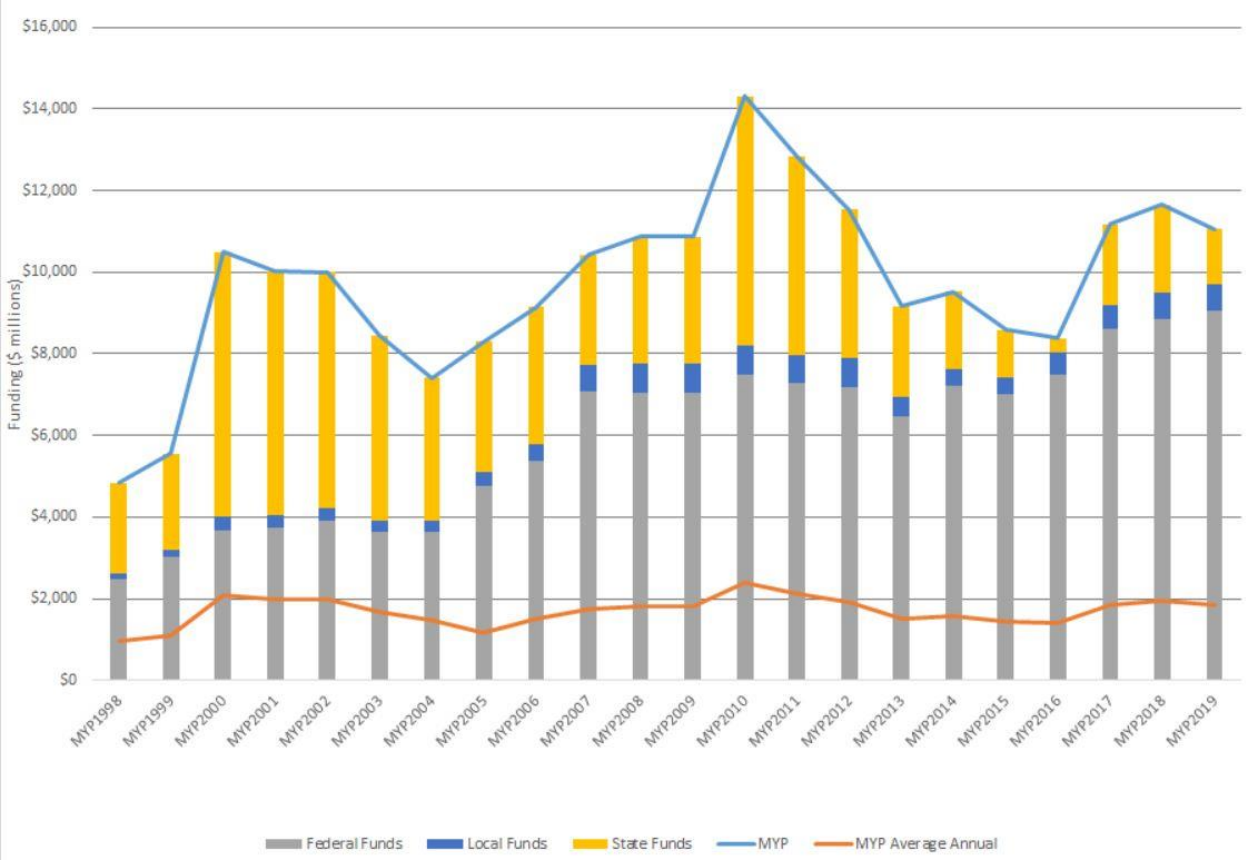

Figure 8-21 - IDOT Multiyear Program by Funding Source[24]

Federal Transportation Authorization Bills and Their Impact on ITS

SAFETEA-LU (2005)

The 2005 Transportation Reauthorization Act, known as the "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU), provided the largest amount of federal funding for highways, highway safety, and public transportation in the nation's history. SAFETEA-LU replaced the Transportation Equity Act for the 21st Century (TEA-21), authorized in 1998. The act made a significant impact on the resources available for transportation in general, and ITS in particular.[25]

SAFETEA-LU introduced several changes in the use of funding for ITS projects. One of the most significant changes was the discontinuation of dedicated funds for ITS deployment. After FY 2005, no monies were set aside for deploying specific ITS projects. However, money for highway construction or enhancements, such as from the National Highway System (NHS) Program, could be used to deploy ITS equipment if it addressed the goals of the funding program, such as reducing congestion or improving operations. While this eliminated the assurance of funding specifically set aside for ITS deployment, it created the opportunity to access a greater amount of funding, was used to help tie ITS to other projects the state was pursuing, and helped mainstream ITS with other state and agency initiatives. The ITS

[24] *For Illinois Roads, Needs Are Growing. Funding Isn't*. NPR Illinois, July 2018.
[25] *A Summary of Highway Provisions in SAFETEA-LU*, USDOT FHWA, August 2005.

Research program, established under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), was retained, as were several other programs that could be used to fund ITS solutions.

SAFETEA-LU required the development of a National ITS Program Plan, an ITS Advisory Committee, National ITS Architecture and Standards, Rural Interstate Corridor Communications Study, Road Weather Research and Development Program, and Multistate Corridor Operations and Management. Through initiatives like these, SAFETEA-LU confirmed the overwhelmingly positive return on investment that ITS deployments provide and contained provisions to embed ITS into the mainstream transportation planning and deployment processes, as well as to increase general awareness of improved operations brought about by the adoption of ITS applications.

MAP-21 (2012)

The Moving Ahead for Progress in the 21st Century (MAP-21) Act was signed into law in July 2012, providing funding for surface transportation programs for fiscal years 2013 and 2014. MAP-21 created a performance-based surface transportation program that built on many of the highway, transit, bike, and pedestrian programs and policies established in 1991 under the Intermodal Surface Transportation Efficiency Act (ISTEA). MAP-21 continued support for the ITS program by restoring the ITS research budget and establishing a Technology and Innovation Deployment Program.[26] MAP-21 changed the focus of ITS activities by directing the USDOT to encourage deployment of ITS technologies that will improve the performance of the national highway system.

FAST ACT (2015)

Most recently, the Fixing America's Surface Transportation (FAST) Act was signed into law in December 2015 for fiscal years 2016 through 2020. MAP-21 included provisions to help make the delivery of transportation projects more streamlined and timelier while still meeting the requirements for planning, public outreach and engagement, and environmental review processes. The FAST Act builds on the efforts of MAP-21 and FHWA's *Every Day Counts* program to continue the acceleration of the delivery of complex but vital transportation projects.[27]

The FAST Act authorizes a significant amount of funding for programs related to research, development, technology, and education. It also builds on MAP-21's transformation of the national transportation program to a performance and outcome-based program. The emphasis on performance management is intended to provide a means to more efficient investment of Federal transportation funds by focusing on national transportation goals, increasing the accountability and transparency of the Federal highway programs, and improving transportation investment decision making through performance-based planning and programming as DOTs incorporate performance goals, measures, and targets into the process of identifying needed transportation improvements and project selection. States will invest resources in projects to achieve individual targets that collectively will make progress toward national goals.

[26] *A Summary of Highway Provisions in MAP-21*, USDOT FHWA, July 2012.
[27] *A Summary of Highway Provisions in FAST Act*, USDOT FHWA, July 2016.

Potential Funding Sources

Federal and State Transportation Programs

A combination of federal and state funds is a likely scenario to pay for the implementation and operation of projects. Traditionally, federal funds have been used for deployment only. States have been required to provide their own operations resources. The transportation authorization bills beginning with SAFETEA-LU onwards have changed this scenario, allowing greater flexibility in how federal funds can be applied.

SAFETEA-LU and the subsequent transportation authorization bills, including the FAST Act, continued or established a number of programs which are applicable to the deployment or operation of ITS technologies. Programs such as the National Highway System (NHS) and Surface Transportation Program (STP) can be used to support ITS solutions. In addition to those broader programs, there are several specific programs from the FAST Act with potential to fund ITS projects:

- **Intelligent Transportation Systems (ITS) Program** – The ITS Program provides $100 million annually (FY2016-2020) for the research, development, and operational testing of ITS aimed at solving congestion and safety problems, improving operating efficiencies in transit and commercial vehicles, and reducing the environmental impact of growing travel demand (80% federal share).[28]
- **Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD)** – This program provides competitive grants for the development of model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment (50% federal share).[29]
- **Highway Research and Development (HRD) program** – The HRD Program funds strategic investment in research activities that address current and emerging highway transportation needs, including activities to improve highway safety; activities to reduce congestion, improve highway operations, and enhance freight productivity; and exploratory advanced research (80% federal share).[30]
- **Technology and Innovation Deployment Program (TIDP)** – The TIDP is focused on funding efforts to accelerate the implementation and delivery of new innovations and technologies that result from highway research and development to benefit all aspects of highway transportation (80% federal share).[31]
- **FASTLANE (Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies) grants** – The FAST Act establishes a discretionary competitive grant program of $4.5 billion over five years to provide financial assistance to nationally and regionally significant highway, rail, port, and intermodal freight and highway projects (maximum 60% federal share through this program).[32]
- **Nationally Significant Freight and Highway Projects (NSFHP) program** – The NSFHP provides competitive grants, known as Infrastructure for Rebuilding America (INFRA) grants, or credit

[28] FAST Act: Intelligent Transportation Systems Program website, USDOT FHWA, April 2016.
[29] FAST Act: Advanced Transportation and Congestion Management Technologies Deployment, USDOT FHWA, February 2016.
[30] FAST Act: Highway Research and Development website, USDOT FHWA, February 2016.
[31] FAST Act: Technology and Innovation Deployment Program website, USDOT FHWA, February 2016.
[32] FAST Act: FASTLANE Grants website, USDOT FHWA, February 2016.

assistance to nationally and regionally significant freight and highway projects (maximum 60% federal share through this program).[33]

- **Congestion Mitigation and Air Quality (CMAQ) Improvement Program** – The FAST Act continued the CMAQ Program, which promotes improved traffic flow and air quality by funding transportation projects and programs that reduce congestion and improve air quality to help meet the requirements of the Clean Air Act for areas that meet identified criteria.[34]
- **Highway Safety Improvement Program (HSIP)** – The HSIP promotes reduced traffic fatalities and serious injuries on urban and rural public roads including work zones.[35]
- **Railway/Highway Crossings** – The FAST Act authorized $1.3 billion over five years for this program, which promotes reductions in the number and severity of injuries at public highway-railroad crossings (90% federal share).[36]
- **Training and Education Program** – Funding for training, education, and workforce development activities that promote and support national transportation programs and activities.[37]

Federal funding from the FAST Act is usually distributed through IDOT, though funding from some programs is assigned directly to planning organizations or transit agencies. Local agencies should work with the IDOT Bureau of Local Roads or their metropolitan planning agency to determine what federal money is available for local projects.

For example, due to its positive impact on air quality, intelligent transportation systems can often leverage CMAQ funds for projects of varying sizes, from localized congestion reduction projects and the establishment of a regional arterial traffic management center. After an ITS project is identified, its potential environmental benefits can be quantified. A project champion would complete a CMAQ funding application that would capture this information for evaluation by CMAQ project selection committee of the local MPO.

The Federal Motor Carrier Safety Administration (FMCSA) offers additional funding opportunities through its Innovative Technology Deployment (ITD) Grant program. The program supports the deployment, operation, and maintenance aspects of the ITD program across the US.[38]

In June 2019, the State of Illinois passed its first capital plan with increased State funding in a decade, providing $33 billion in much-needed funding over the next six years for road, bridge, transit, cycling, and walking projects. The plan includes increases to several transportation-related fees a modernization of Illinois' motor fuel tax, which has not seen an update since 1990. The legislation doubles the gas tax from 19 cents to 38 cents per gallon and indexes the rate to inflation, a measure designed to make the revenue source more sustainable for transportation system needs into the future. These revenue streams will be dedicated to transportation projects, though it is as yet unclear what portion of these funds will be dedicated to ITS projects.

[33] FAST Act: Nationally Significant Freight and Highway Projects factsheet, USDOT FHWA.
[34] FAST Act: Congestion Mitigation and Air Quality Program website, USDOT FHWA, April 2019.
[35] FAST Act: Highway Safety Improvement Program website, USDOT FHWA, February 2016.
[36] FAST Act: Railway-Highway Crossings Program website, USDOT FHWA, February 2016.
[37] FAST Act: Training and Education website, USDOT FHWA, February 2016.
[38] FMCSA ITD Grant website, USDOT FMCSA, October 2016

Federal Grants

The principal purpose of an award of financial assistance is to transfer a thing of value from a federal agency to a recipient to carry out a public purpose of support or stimulation authorized by a law of the United States. A grant differs from a contract, which is used to acquire property or services for the Federal government's direct benefit or use. Federal grant information is available electronically at www.grants.gov.

Public/Private Partnerships (P3)

A public-private partnership (commonly called a P3) is a contractual agreement between a public agency and a private entity that allows for greater private sector participation in the delivery and financing of a project. P3 arrangements provide the public sector with a proven tool to accelerate infrastructure delivery and contain costs. P3s provide a role for the private sector in solving public challenges, provide a variety of contract structures and financing, and are performance-based and outcome-focused. P3 delivery methods commonly fall into the following categories: design-build (DB), operate-maintain (OM), design-build-operate-maintain (DBOM), design-build-finance (DBF), and design-build-finance-operate-maintain (DBFOM). Each method can offer advantages or disadvantages, depending on the specific project and parties involved. Every transportation project is different and may or may not benefit from innovative delivery methods such as P3s.

The state of Illinois passed the Public-Private Partnerships for Transportation Act in August of 2011. Several organizations have spoken out in support of the judicious use of P3s in Illinois, including Transportation for Illinois Coalition (TFIC); Chicago Metropolitan Agency for Planning (CMAP), the Chicago region's Metropolitan Planning Organization (MPO); and the Metropolitan Planning Council (MPC).

A number of projects outlined in this Illinois Statewide ITS Strategic Plan could potentially include a match of private funding, such as managed lanes projects on I-55 and elsewhere in the state, Truck Parking Management Systems, Dedicated & Higher-Bandwidth Links between Agencies, Fiber Installation to Support ITS Expansion, and Regional Arterial TMC. The State of Illinois could pursue private partners for these and other applicable projects that could provide goods or services like advertising time, equipment, or permission to place equipment on their property.

Federal Earmarks

Federal earmarks – formally known as congressionally-directed spending – have been banned since 2011. While funding formulas and eligibility rules continued to permit "soft" earmarks for several years, in MAP-21 Congress made changes that limited the ways to adjust funding levels or to direct to a particular recipient.[39]

In some instances, it is acceptable to build out planned ITS infrastructure as line items in construction or rehabilitation projects. These features often serve a dual purpose in that they can serve as traffic management tools during construction and then are left in place as permanent congestion management tools. This is allowed under the FAST Act funding and helps to mainstream ITS.

[39] *Transportation Spending Under an Earmark Ban*, Congressional Research Service, December 2018.

Transportation Security Funds

Transportation security funds are another opportunity for funding projects with security applications, such as surveillance cameras or communications devices. Transportation enhancements and ITS projects can address security concerns by detecting threats, maximizing the movement of people, goods, and services, and supporting response activities. Security funds could be available through the Department of Homeland Security, Department of Agriculture, or the Department of Energy, as well as other agencies.

8.6 LEGAL CONSIDERATIONS

There are a variety of issues involved in entering into an agreement/contract with different agencies for ITS projects. As new technologies and delivery systems have advanced, several potential legal hurdles may arise that have not been addressed in previous transportation projects. Many relate to computer software and traveler information distribution, though they have parallels with traditional physical improvements. These legal issues often arise after the initial deployment of a project and frequently deal with ownership of data, data processing, or operations. As outlined in the Systems Engineering Process, a concept of operations should be developed that covers the expected life span of the system. Language should also be included in an initial agreement with contractors, partners, or other agencies to address future maintenance, operations, improvements, and data sharing to ensure that the project will be able to evolve equitably.

Proprietary Software

Proprietary software is a term used to describe software in which the user does not control what it does or cannot study or edit the code, in contrast to free or open software. If a contractor is hired to develop software or pre-developed software is used, the original developer usually owns the rights to that code. Only that original developer is allowed to make changes to the code to modify the software, so if an agency wants any modifications or enhancements, they must work with the developer. This can leave the agency in a poor position to negotiate what it sees as a reasonable price for these changes. While a software package can be purchased at a low initial price, if there are no safeguards in the initial agreement, the cost can increase greatly with future modifications.

The best strategy is to address this in the initial agreement with the software developer, either allowing the agency to assume the rights to the software, including a warranty that covers future modification for a defined number of years, or by specifying a price or rate for the cost of future work on the software by the agency.

Open Source Software

Unlike proprietary software, open source software does allow the user control over the software and the code behind it. Some transportation agencies have deployed open source software as a means of advancing its use within the industry. For example, the Minnesota Department of Transportation (MnDOT) operates an advanced traffic management system known as Intelligent Roadway Information System (IRIS). It provides a platform for transportation agencies to manage traffic monitoring and control devices through an intuitive map-based interface. The user interface has been refined over many iterations through feedback from operators to streamline their workflow, and the software is free

to download for agencies that desire to use the software for traffic management purposes. [40] In addition to Minnesota, other state DOTs currently use IRIS as an open source software, including California, Nebraska, Wyoming, and Wisconsin.

The primary benefits to the use of open source software are significant cost savings from the need for purchasing software and licenses from specific vendors, as well as costs for ongoing support from the vendor. Other benefits include being able to adjust the interface used by operators based on their direct feedback. However, this does require an in-depth understanding of the source code behind the software, which would likely require dedicated internal agency IT staff to set up and support the use of the software by operators, as well as IT staff to respond to operational issues that may arise with the use of the software. It can be challenging for agencies to transition away from receiving dedicated software support from specific vendors that provided the software, to receiving internal IT support which would require experience with and knowledge of the software.

"No Compete" Clauses

Some private firms include language in their agreements that their software, system, or process cannot be used by a competing firm. While this might not seem like a major issue for a public agency, it can cause problems in partnering with private agencies or future plans to generate revenue for the agency. If information generated using the private firm's software ends up being sent to another private firm, even if it is through another public agency, the first firm could consider such action a violation of the agreement. This is usually not a problem if private entities receive the information in the same way the general public does, but it can become one if they have a direct line to the data source.

The best strategy is to address this in the initial agreement negotiations with the software developer by specifying where the information will go and whether it is used by any of those entities for profit. An agreement with the software developer may be able to be reached if a third party is passing along information to private entities, or the agency may need to filter the information before redistributing it to all or some of its contacts. Agencies should be aware of who receives the information or benefit from a project and how private firms relate to a project.

Interstate Coordination

Some projects benefit from or require coordination/integration with other jurisdictions or states. These arrangements can introduce an increased number of issues that must be addressed, as agencies will be operating under different state laws and regulations. To support this coordination, formal inter-agency agreements (IGAs) or memoranda of understanding (MOUs) may be necessary, especially for transferring funding between states, if personnel from one state do any work in the neighboring state, or if ownership/operations/maintenance responsibility is shared across jurisdictional boundaries. These agreements will detail what actions can or cannot be taken, ensure that these activities receive appropriate review from agencies' legal counsel, and provide a legal basis for the agencies' actions. Examples of activities near border areas that may need to be covered under these formal agreements include equipment maintenance, motorist assistance, equipment installation, and remote operation of a neighboring state's equipment.

It is important to make sure that the agreements an agency already has in place do not conflict with new agreements with another state, or existing agreements that the second state has in place. In addition,

[40] IRIS. https://mnit-rtmc.github.io/iris/index.html

some jurisdictions have different regulations and responsibilities. Even though the agency may share several areas of responsibility, they might not share all, such as maintenance. When coordinating between districts, it is important to ensure that the agencies and individuals who will be responsible for all aspects of the projects are clearly defined. This, also, should be outlined in a project concept of operations document.

In projects where both states will be providing funding, either for initial deployment and/or for operations and maintenance, it is critical to define how funding will be collected and distributed beforehand. Some state agencies can receive funding transfers from other states, while payments to others may be routed through the state's general funds, making it difficult to allocate money directly to a specific project. For Illinois, once in the General Fund, money is available to all Illinois agencies and the project must compete with other initiatives. Also, states may have different regulations on their procurement processes. By examining these issues early in an agreement and developing a strategy to use funding and procure equipment within both partners' regulatory framework, the project can avoid confusion and delays.

Connected and Automated Vehicles

As vehicle functionality advances to fully automated status, automated vehicle applications will transfer the driving responsibility from human to vehicle, shifting the source and depth of legal liability between drivers and vehicle manufacturers. Infrastructure managers will continue to face potential liability through the data sources that automated vehicles use, e.g., pavement markings, speed limit beacons. State and Federal laws will be needed to guide this transition.

In contrast, many connected vehicle applications are intended to improve a driver's performance by making them more aware of their circumstances and by preventing high risk behaviors, which should reduce legal claims.

Data Ownership and Use

Intelligent transportation systems, especially automated and connected vehicle applications, can produce a significant amount of data. Ownership of this data often resides with the equipment that collects it. For example, vehicle and environmental sensor data is housed with transportation agencies, while most private vehicle data (raw and processed) is owned by the auto/equipment manufacturers that gather it. Agreements will be needed to formalize the sharing and use of this data with transportation managers, research entities, and other stakeholders for whom the information is fundamental to realizing the safety, mobility, and environmental objectives of ITS solutions.

9 OPERATIONS AND MAINTENANCE

9.1 IMPACTS OF ITS PROJECT LIFE CYCLE

When considering the cost of an ITS project, it is important to consider its entire life cycle, in terms of both the ITS technologies and the effect those technologies will have on related infrastructure. Closer examination of life cycle costs provides a more accurate view of a project and minimizes the surprises from hidden costs, like upgrades. These variables can have a substantial impact on the bottom line. ITS projects should plan for these changes as much as possible by considering the life cycle of similar projects and equipment costs in the project budget.

Different projects require different levels of effort to operate and maintain. Some projects are fully automated and require relatively little maintenance once they are set up, while others, in particular software installations like advanced traffic management system (ATMS) deployment, require frequent updates and regular monitoring. Adequate consideration is needed for operation of a system like this that may include periodic updates and integration with other systems.

As described in Section 8.2, the general stages in the lifecycle of a project are planning and programming, design, implementation, and operations and maintenance. For ITS projects, a more detailed analysis is often needed. This expanded life cycle can be further broken down in the standard Systems Engineering Process phases, producing estimates of duration and cost for each phase. These steps include the following (see Figure 9-22):

1. Project Architecture
2. Feasibility Study/Concept Exploration
3. Concept of Operations
4. System Requirements
5. High Level Design
6. Detailed Design
7. Implementation
8. Integration and Testing
9. Subsystem Verification
10. System Verification
11. System Validation
12. Operations and Maintenance
13. Changes and Upgrades
14. Retirement/Replacement

In some cases the costs of dismantling the system after its useful life has passed can be significant and should also be included in the lifecycle cost estimate. This would include any salvage value that can be recovered.

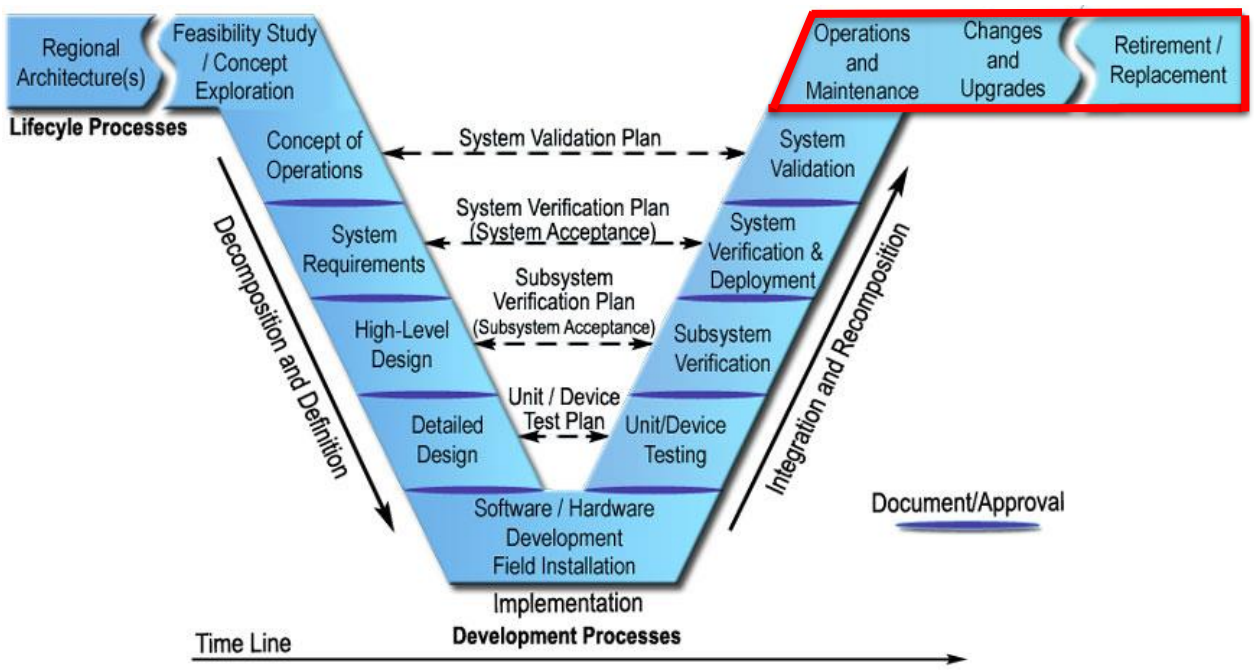

Figure 9-22 - V Diagram of Systems Engineering (with Operations and Maintenance Steps Highlighted)

Some things to consider when looking at life cycle cost include:

- **Useful equipment life** – Manufacturers should have an estimate for the durability of their equipment. This can be supplied during the design phase. It provides an estimate of how long the equipment should last under normal operating conditions. These estimates can also be acquired from other end users of the products, who may have a different perspective on the issue of longevity and durability.
- **Useful technology life** – It is critical to research whether technology will be outmoded or is likely to fall out of common use. While the technology for a project may be operational for a long time, if it is no longer commonly used in the future it may be harder to find replacement parts and upgrades. Addressing these concerns is essential at the time of deployment. While it is often hard to determine what technologies or software will be used in the future because of the rapidly changing nature of the field, it is still instructive to look at whether the market for the technology is developed, identify whether the technologies are compatible with other developed technologies, and whether there are competing types of technologies that may be more prevalent in the future.
- **Maintenance and replacement parts** – In order to maintain equipment, extra parts will often be used during the Operations & Maintenance phase. Contractors or manufacturers can supply the estimated number and cost of replacement parts necessary under the manufacturer's recommended equipment life during the design phase of a project. Additional estimates can also be acquired from other end users of the products.
- **Operator training** – When a project is deployed, the operations staff needs to be adequately trained to operate and maintain the equipment. The amount of this training varies with the complexity and robustness of the equipment. Training is often included in the Deployment/Implementation phase of a project. Further training may be necessary if there are significant enhancements to equipment or if employee turnover is expected during the useful life of the system. To be completely self-

sufficient, an agency may also want to consider purchasing reproducible training materials, "train-the-trainer" programs, and allocating resources for employees to join industry user groups relevant to the equipment.

- **Specialized equipment** – Some systems require specialized equipment to operate and this equipment may be harder to find or more expensive to replace in the operations & maintenance phase. Equipment may even be custom built and require special maintenance. The increased cost of specialized equipment, including maintenance, should be measured against the utility it provides. A specialized unit at a higher cost may be able to perform unique actions that justify the cost over a lower-priced unit.
- **Specialized expertise** – During the design phase, it should be determined whether specialized expertise is needed to deploy, operate, or maintain a system. The ability to install, integrate, or operate some systems may be beyond the experience of many contractors or agency personnel. If specialized expertise is needed, it can significantly increase the initial and/or on-going costs of a project.
- **Evaluation** – The operations and maintenance phase should include periodic tests to make sure that the system is working at an acceptable level and performing necessary functions.
- **Configuration management** - Configuration management is a process to ensure that only authorized changes are made to a system, and it provides an organized method for tracking changes and a detailed history to check and make sure that system upgrades are compatible with other integrated systems. Configuration management should be conducted over the entire life of an ITS project and factored into Operations & Maintenance costs. The configuration management process creates an environment where the details of a variety of complex systems can be efficiently managed. There are four main steps to the configuration management process:
  - Configuration Identification – the process of creating and maintaining documentation describing the Configuration Items in a system and determining the hierarchy of components of a system.
  - Change Control – managing changes to the configuration of a system by evaluating the overall impact of the change, tracking the progress of the alteration, and ensuring that the change is properly documented. This will ensure that any changes to the system are managed carefully and each change is uniquely identified to minimize confusion.
  - Configuration Status Accounting – this action records all relevant information about Configuration Items for the entire system. Each Item's documentation is updated with changes to ensure that the records accurately reflect the Item's current status.
  - Configuration Audits – a process to confirm that the documentation for all elements within the system is consistent with the Item's current state. This is a safety check to ensure that all procedures in the Configuration Management Plan are correctly followed. Any discrepancies between what is occurring and what needs to take place are documented and auditors provide suggestions for returning to compliance.

ITS projects can also affect the life cycle of more traditional transportation infrastructure. Systems that regulate use of infrastructure can reduce the amount of maintenance or repairs. For example, Virtual Weigh Stations that identify grossly overweight commercial vehicles can reduce the deterioration of roads and preserve pavement life. These impacts should be considered as benefits when selecting projects. While a project may require a large capital investment, it may be justified if it reduces infrastructure maintenance costs in addition to reducing congestion.

9.2 OPERATIONS AND MAINTENANCE PLANNING

TSMO is the foundation for operations and maintenance (O&M) planning, a critical component of ITS projects, especially in the case of ITS where new and complex technologies are being deployed. The O&M costs for ITS projects represents the life-cycle costs of implementing and operating the project. This is important for ITS projects since they typically incur a greater proportion of their costs in years after deployment to operate and maintain the system, and replace obsolete equipment, when compared to more traditional improvements. To promote the successful use of these technologies, consideration needs to be made for operations and maintenance aspects of ITS during the planning and implementation of projects.

The IDOT FY 2019-2024 Proposed Highway Improvement Program underscores the importance of O&M planning by emphasizing asset management, defined as "a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life cycle of the assets at a minimum practical cost."[41]

With an O&M plan, an organization has a process to help ensure that installed ITS elements are properly operated and maintained. Proper operation and routine maintenance can provide early detection of equipment problems, will better leverage equipment warranties, and may lower repair and replacement costs. More importantly, it may also help prevent equipment malfunctions and minimize system downtime. With a proper O&M plan along with required documentation, an organization may have an affirmative defense in the case of an equipment or system failure.

Having an O&M plan is also important in helping develop the long-term resource requirements for an ITS project, including the total cost and required full time equivalent (FTE) hours. Estimating the total cost of ITS improvements is more difficult compared to traditional infrastructure improvements. This is due to ITS improvements incurring a greater proportion of their costs as continuing operation and maintenance costs rather than up front capital costs. In addition, ITS equipment typically has a shorter anticipated useful lifespan compared with many traditional improvements and requires replacement as it reaches obsolescence. In some cases, replacement may mean the use of newer technologies or alternative data sources, like private crowd-sourced data in place of roadside detection systems.

Operations and maintenance planning should take place at the district level, i.e., with the personnel that will be responsible for the use of deployed ITS projects. The IDOT ITS Program Office can provide support with the planning and budgeting of ITS O&M, but the application of O&M will occur at the district level.

Project Operations Planning

A typical operations plan contains information on the proper operation of ITS systems and equipment. Operating parameters, once defined, are an important indicator whether a system or equipment is operating as designed. Examples of operating parameters may include the performance of vehicle detection systems so that they provide data meeting accuracy requirements. An operating parameter can be initially defined, and later modified, by the organization based on operations experience.

[41] *FY 2019-2024 Proposed Highway Improvement Program*, IDOT, spring, 2018.

An operations plan should contain an operations log that records operations parameters that are outside the defined limits. Operating parameters outside the operating limits are not generally a problem unless repeated and ignored.

Project Maintenance Planning

A typical maintenance plan contains information on the proper maintenance of ITS systems and equipment. This includes maintenance procedures to be performed and suggested frequency of routine maintenance. Examples of maintenance procedures may include inspections, cleanings, lubrications, adjustments, replacements, or recalibrations. A maintenance plan can initially be defined and modified later by the organization based on past maintenance experience.

For example, a maintenance plan for a dynamic message sign deployment may include information detailing inspection and routine maintenance procedures including frequency by which they are to be performed. A maintenance plan should contain a maintenance log that records both routine and non-routine maintenance on an ITS system or equipment.

9.3 ITS PROJECT COSTS AND RESOURCE ESTIMATES

O&M costs consist of two components: 1) equipment maintenance costs (such has equipment replacements, upgrades, etc.), and 2) FTE costs. Developing an O&M cost estimate requires defining the annual equipment maintenance cost and the required person-hours to perform the maintenance tasks. Part of defining the person-hours requirements includes developing a general position description that outlines the required skill sets to perform the necessary tasks. It is important to remember that new equipment typically has a warranty against malfunctions within the first year(s) of operation. The warranty helps reduce the overall O&M cost of equipment during the warranty period.

Skill Set Definitions

Included below is a list of skills sets required for different aspects of ITS systems and equipment O&M. Skill sets include advanced knowledge in the following areas:

- Computer administration: includes, but is not limited to, computer system administration, computer security setup and maintenance, hardware installation and configuration
- Local Area Network (LAN) administration: includes, but is not limited to, LAN systems administration, LAN security setup and maintenance, hardware installation and maintenance
- Electric power: includes, but is not limited to, electric power systems
- Fiber optics: includes, but is not limited to, fiber optic cable installation and maintenance
- ITS standards: includes, but is not limited to, familiarity of current and developing ITS standards
- Marketing: includes, but is not limited to, public outreach techniques and tools

From the list of defined skill sets, specific ITS O&M job positions can be defined. They include:

- Computer systems administrator
- Communications engineer
- Field engineer
- Marketing coordinator
- Training coordinator

High Priority Project O&M Costs

Below is a compilation of the identified high priority statewide ITS projects and an estimated O&M cost, including an estimated resource requirements for each deployment of a listed project. This involves full-time employees (FTEs), hardware, software, and other related costs. These values are presented as annual costs for the use and upkeep of elements included in each high-priority project, i.e., after the capital expenditure to obtain equipment associated with the project.

Project Title	**Truck Parking Management Systems (IDOT)**
Brief description	Project is modeled after a MAASTO-led initiative that will install cameras to measure real-time parking commercial vehicle parking space availability at IDOT rest areas and provide that information to truckers through a mobile application. Purpose is to provide truckers with information on where they can park for longer periods to be in compliance with hours of service requirements. Project will also include installation of kiosks at rest areas to provide traveler information.
Position description	Computer systems administrator
Estimated FTE	0.1
Estimated O&M costs	$35,000 per year for operations and maintenance. This assumes $15,000 for operations and $10,000 for system maintenance and upgrades.

Project Title	**Smart Work Zones**
Brief description	Smart Work Zone technology can be built into the work zone contract and required of the contractor to provide speed detection for display of actual vehicle speeds in work zones. Other types of applications could also be requested where needed.
Position description	Field engineer
Estimated FTE	0.1
Estimated O&M costs	$10,000 per year.

Project Title	**CAD Integration with Traffic Management**
Brief description	Integration of computer-aided dispatch (CAD) information for traffic operations. This project would allow IDOT to view roadway related incidents currently being handled by Illinois State Police (ISP) and other law enforcement agencies electronically. Fiber-optic cable connections would facilitate this sharing of information and video between agencies.
Position description	Computer system administrator / communications engineer
Estimated FTE	0.1
Estimated O&M costs	$25,000 per year for operations and maintenance. This assumes $15,000 for operations staff and $10,000 for system maintenance and performing integration functions as well as hardware and software upgrades.

Project Title	**DoIT (Department of Innovation and Technology) Smart State for ITS Projects**
Brief description	Refers to the partnership between Illinois DoIT and IDOT to leverage DoIT's fiber communications infrastructure to support ITS technologies, such as intelligent street lighting or centralized control of field-based ITS devices. DoIT supports state agencies in a turn-key type of operation with respect to communications infrastructure needs. This would include fiber cable deployments, connectivity to central offices, and other communications related needs.
Position description	Communications engineer
Estimated FTE	0.25
Estimated O&M costs	$25,000 for annual project coordination with DoIT on ITS projects.

Project Title	**Dedicated & Higher-Bandwidth Links between Agencies (Non-Centralized)**
Brief description	Ongoing efforts to expand the deployment fiber optic cable throughout the region to increase the bandwidth that allows for more users from other agencies to utilize the ATMS software package for information and video sharing purposes.
Position description	Communications engineer
Estimated FTE	0.25
Estimated O&M costs	$35,000 per year for operations and maintenance. This assumes $25,000 for operations staff and $10,000 for system maintenance and upgrades.

Project Title	**Fiber Installation to Support ITS Expansion**
Brief description	Fiber optic cable installation to improve traffic signal coordination and connections with other ITS field devices operated/maintained by IDOT.
Position description	Communications engineer
Estimated FTE	0.1
Estimated O&M costs	$15,000 per year for the operations and maintenance. This work includes maintaining the fiber communication links and performing integration functions as well as any hardware and software upgrades.

Project Title	**Traffic Incident Management Training**
Brief description	Establishment of a training program that meets on a regular basis to conduct training, debrief incident response, conduct tabletop exercises, and develop a TIM training plan, e.g., TIMTAC.
Position description	Training coordinator
Estimated FTE	0.25
Estimated O&M costs	$25,000 per year for incident management training exercises.

Project Title	**Expansion of Public-Private Data**
Brief description	Expanded use and procurement of IDOT agreements with private traffic data providers allows them to input real-time traffic data into the publicly accessible Illinois Gateway Traveler Information System (GTIS). The agreement would provide access to more traffic management agencies.
Position description	Computer systems administrator / Communications engineer
Estimated FTE	0.25
Estimated O&M costs	$25,000 per year for IDOT personnel for agreement administration costs .

Project Title	**Fiber Links Between Transportation and Law Enforcement**
Brief description	Relates to the installation of fiber between IDOT communications centers and nearby law enforcement agencies, e.g., city police and Illinois State Police. The fiber would allow for the sharing of CCTV camera video from IDOT offices with city police and ISP to improve emergency response to traffic incidents.
Position description	Communications engineer
Estimated FTE	0.1
Estimated O&M costs	$15,000 per year for the operations and maintenance. This work includes maintaining the fiber communication links and performing integration functions as well as any hardware and software upgrades.

Project Title	**Education about ITS**
Brief description	Development of outreach materials, videos, etc. to introduce ITS, describe benefits, and provide resources to the public.
Position description	Marketing coordinator
Estimated FTE	0.1
Estimated O&M costs	$10,000 per year for development of outreach materials to introduce ITS, describe benefits, and provide resources to the public.

Project Title	**Fiber Connection Across State Boundaries**
Brief description	High-bandwidth communication links with adjacent state DOTs, e.g. MoDOT, is scheduled to be re-established.
Position description	Field engineer / communications engineer
Estimated FTE	0.25
Estimated O&M costs	$25,000 per year for operations and maintenance of fiber connections across state boundaries

Project Title	**Emergency Traffic Patrol / Emergency Patrol Vehicle (ETP/EPV) Expansion**
Brief description	Project refers to the expansion of two similar emergency traffic assistance programs to cover additional areas of the state. IDOT's Chicago area Emergency Traffic Patrol (ETP) and Metro-East area Emergency Patrol Vehicle (EPV) programs, respectively, dispatch teams of emergency patrol vehicles and drivers to traffic disruptions and potential safety problems caused by accidents, disabled vehicles or hazardous debris. The primary objective of the ETP/EPV workers, also referred to as "Minutemen," is to respond to all disruptive incidents on the state's busiest urban expressway systems and to

	take immediate corrective action to safely restore normal traffic flow. Minutemen then execute help that motorists need when breakdowns or mishaps occur.
Position description	Highway maintainer (with special training)
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for vehicle maintenance.

Project Title	**Integrated Corridor Management (ICM)**
Brief description	Interconnect traffic signals, DMS, CCTV and potential vehicle-to-infrastructure technology communications and other applicable system components to support traffic management along key travel corridors.
Position description	Communications engineer
Estimated FTE	0.5
Estimated O&M costs	$125,000 per year for operations and maintenance. This assumes $50,000 per year for IDOT operations staff, $50,000 per year for additional agency operations staff (transit agencies), and $25,000 per year for corridor maintenance and upgrades.

Project Title	**Smart Highway Deployments**
Brief description	Relates to the use of ITS technologies like traffic surveillance, road weather surveillance, communications infrastructure, DMS, incident detection, dynamic lane management and incident management systems along interstate routes. In particular, corridors like I-94 and US 41, which are parallel facilities. I-94 is operated by the Tollway, while US 41 is operated by IDOT, requiring high levels of cooperation and coordination to implement and operate the project.
Position description	Communications engineer
Estimated FTE	0.5
Estimated O&M costs	$75,000 per year for operations and maintenance. This assumes $50,000 per year for operations staff and $25,000 per year for corridor maintenance and upgrades.

Project Title	**District 1/District 3 Joint ITS Project along I-80 and I-55 Corridors**
Brief description	Includes one DMS on I-80 (EB I-80 near MM 102.1) and two DMS on I-55 (NB I-55 near MM 214, SB I-55 near MM 223), along with a number of CCTV cameras for traffic monitoring. Server in District 1 hosts the ATMS software responsible for communicating with the DMS. Also includes installation of 31 Bluetooth detectors along I-55/I-80 for traffic detection to understand where congestion is forming.
Position description	Field engineer
Estimated FTE	0.1
Estimated O&M costs	$20,000 per year for the operations and maintenance. This assumes $10,000 per year for operations staff and $10,000 per year for equipment maintenance and upgrades.

Project Title	**Centralized CCTV Camera Monitoring and Control**
Brief description	Project to install pan-tilt-zoom (PTZ) cameras for monitoring and control, e.g., at the IDOT District 5 office, along I-74 between Urbana and Danville.
Position description	Field engineer
Estimated FTE	0.25
Estimated O&M costs	$35,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $10,000 per year for equipment maintenance and upgrades.

Project Title	**Gateway Traveler Information System/Travel Midwest Website Enhancement**
Brief description	Includes enhancements to existing Gateway Traveler Information System, and could include the display of more ITS field devices in various IDOT Districts, as well as agreements with private data providers that could add traffic detection data and incident information to the system where IDOT does not have communications links to field based ITS devices.
Position description	Computer systems administrator / Communications engineer
Estimated FTE	0.1
Estimated O&M costs	$10,000 per year for the maintenance of the enhancement to the Gateway Traveler Information System.

Project Title	**Statewide Deployment of Additional ITS Field Devices**
Brief description	Additional ITS field devices can be deployed to serve traffic management, incident management, or traveler information purposes. Deployment can include dynamic message signs, CCTV cameras, and traffic detection equipment to expand the ITS coverage of existing metro areas. These projects should consider the inclusion of connected vehicle equipment as well.
Position description	Field engineer
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**Replacement of Obsolete Field Devices**
Brief description	Replacement of obsolete ITS field devices that serve traffic management, incident management, or traveler information purposes. Includes an ongoing project in District 2 to replace older DMS that were installed in 1999 to provide information to traffic approaching the aging I-74 bridge over the Mississippi River, as well as for traffic on I-80 and I-88.
Position description	Field engineer
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**I-55 Project Managed Lanes**
Brief description	This project would add managed lanes from I-355 to the Dan Ryan. Because of the wide inside shoulder with full-depth pavement along part of the route, adding managed lanes can be relatively inexpensive, making it the most cost-effective congestion reduction project evaluated. IDOT currently anticipates adding two new lanes to assure travel time reliability.
Position description	Field engineer / computer systems administrator
Estimated FTE	0.5
Estimated O&M costs	$100,000 per year for the operations and maintenance. This assumes $50,000 per year for operations staff and $50,000 per year for equipment maintenance and upgrades.

Project Title	**IL 64 / IL 56 Smart Arterial Corridors**
Brief description	Relates to IL Highways 64 and 56, which are parallel facilities to the I-290 corridor. ITS technologies, including traffic surveillance, road weather surveillance, communications infrastructure, DMS, incident detection, dynamic lane management and incident management systems would be deployed to support the project.
Position description	Field engineer / computer systems administrator
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**I-290 Project (IDOT) Integrated Corridor**
Brief description	Reconstruction of I-290 from Jane Byrne to Mannheim. ITS components may include traffic surveillance, traveler information, as well as a managed lane or congestion pricing on a managed lane. Integrated corridor components could also be incorporated along parallel arterial routes. Project is not funded at this time but has been identified in the CMAP ON TO 2050 plan.
Position description	Field engineer / computer systems administrator
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**Managed Lanes (IDOT)**
Brief description	Several managed lanes projects have been identified in the CMAP ON TO 2050 plan. IDOT plans to implement managed lanes along several key interstates (i.e., I-55, I-290, I-80) to address traffic congestion. Management could include congestion pricing during periods of heavy congestion.
Position description	Field engineer / computer systems administrator
Estimated FTE	0.5

Estimated O&M costs	$100,000 per year for the operations and maintenance. This assumes $50,000 per year for operations staff and $50,000 per year for equipment maintenance and upgrades.

Project Title	**Central Signal System Expansion**
Brief description	Expansion of municipal, e.g., DuPage County, central signal system to connect to signal systems for adjacent jurisdictions. Project will incorporate 170 signals into the existing signal management system operated by DuPage County. Related to the Regional Arterial TMC project listed below.
Position description	Field engineer / communications engineer
Estimated FTE	0.25
Estimated O&M costs	$40,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $15,000 per year for system maintenance and upgrades.

Project Title	**Statewide Communications Center/Station One Upgrade**
Brief description	Upgrades of IDOT's existing emergency radio/phone service, Station One, can be implemented to have it serve as a Central Office Communications Center. Data from a statewide traveler information system would be available for viewing at the center. The center would also be connected with the State Emergency Operations Center (SEOC) to provide transportation information and support in case of emergencies. Additional communication devices can be used to make the Station One system more robust and ensure that it operates at peek effectiveness.
Position description	Field engineer / computer systems administrator
Estimated FTE	1
Estimated O&M costs	$125,000 per year for the operations and maintenance. This assumes $100,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**Statewide Advanced Traffic Management System (ATMS)**
Brief description	Deployment and operation of a central IDOT ATMS to communicate with and control field ITS devices, potentially across IDOT district boundaries.
Position description	Field engineer / computer systems administrator
Estimated FTE	1
Estimated O&M costs	$125,000 per year for the operations and maintenance. This assumes $100,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Project Title	**Regional Arterial TMC**
Brief description	Development of regional arterial TMC for communicating with traffic signal and ITS equipment operated by counties and municipalities in IDOT District 1.
Position description	Field engineer / computer systems administrator
Estimated FTE	4

Estimated O&M costs	$500,000 per year for the operations and maintenance. This assumes $400,000 per year for operations staff and $100,000 per year for system maintenance and upgrades.

Project Title	**Traffic Signal Modernization**
Brief description	Ongoing projects to modernize traffic signal controllers in municipalities across the state.
Position description	Field engineer
Estimated FTE	0.25
Estimated O&M costs	$50,000 per year for the operations and maintenance. This assumes $25,000 per year for operations staff and $25,000 per year for equipment maintenance and upgrades.

Table 9-12 summarizes the O&M costs and resource requirements for these high priority ITS projects. All O&M costs are in 2019 dollars and reflect the total cost to operate and maintain a particular project deployment. Note that the O&M costs repeat every year after the initial deployment of the project and continue as long as the system or equipment is in operation.

Table 9-12 – High Priority ITS Project Operations & Maintenance Costs

Project	Estimated FTE*	Estimated O & M Costs (thousands)*							Total Years 1-10
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7-10	
Truck Parking Management Systems (IDOT)	0.1		$35	$35	$35	$35	$35	$35	**$315**
Smart Work Zones	0.1		$10	$10	$10	$10	$10	$10	**$90**
CAD Integration with Traffic Management	0.1		$35	$35	$35	$35	$35	$35	**$315**
DoIT Smart State for ITS Projects	0.25		$25	$25	$25	$25	$25	$25	**$225**
Dedicated & Higher-Bandwidth Links between Agencies (Non-Centralized)	0.25		$35	$35	$35	$35	$35	$35	**$315**
Fiber Installation to Support ITS Expansion	0.1		$15	$15	$15	$15	$15	$15	**$135**
Traffic Incident Management Training	0.25		$25	$25	$25	$25	$25	$25	**$225**
Expansion of Public-Private Data	0.25		$25	$25	$25	$25	$25	$25	**$225**
Fiber Links Between Transportation and Law Enforcement	0.1		$15	$15	$15	$15	$15	$15	**$135**
Education about ITS	0.1		$10	$10	$10	$10	$10	$10	**$90**
Fiber Connection Across State Boundaries	0.25		$25	$25	$25	$25	$25	$25	**$225**
Emergency Traffic Patrol / Vehicle (ETPV) Expansion	0.25			$50	$50	$50	$50	$50	**$400**
Integrated Corridor Management (ICM)	0.5							$125	**$500**
Smart Highway Deployments	0.5			$75	$75	$75	$75	$75	**$600**
District 1/District 3 Joint ITS Project along I-80 and I-55 Corridors	0.1		$20	$20	$20	$20	$20	$20	**$180**
Centralized CCTV Camera Monitoring and Control	0.25			$35	$35	$35	$35	$35	**$280**
Gateway Traveler Information System/Travel Midwest Website Enhancement	0.1		$10	$10	$10	$10	$10	$10	**$90**
Statewide Deployment of Additional ITS Field Devices	0.25		$50	$50	$50	$50	$50	$50	**$450**
Replacement of Obsolete Field Devices	0.25		$50	$50	$50	$50	$50	$50	**$450**
I-55 Project Managed Lanes	0.5					$100	$100	$100	**$600**
IL 64 / IL 56 Smart Arterial Corridors	0.25		$50	$50	$50	$50	$50	$50	**$450**
I-290 Project (IDOT) Integrated Corridor	0.25					$50	$50	$50	**$300**
Managed Lanes (IDOT)	0.5							$100	**$400**
Central Signal System Expansion	0.25			$40	$40	$40	$40	$40	**$320**
Statewide Communications Center/Station One Upgrade	1			$125	$125	$125	$125	$125	**$1,000**
Statewide Advanced Traffic Management System (ATMS)	1				$125	$125	$125	$125	**$875**
Regional Arterial TMC	4						$500	$500	**$2,500**
Traffic Signal Modernization	0.25		$50	$50	$50	$50	$50	$50	**$450**
Totals:	**12.05**	**$0**	**$485**	**$810**	**$935**	**$1,085**	**$1,585**	**$1,810**	

* FTE estimate per deployment

10 PROGRAM MANAGEMENT

10.1 ITS PROGRAM MANAGEMENT SERVICES

ITS program management represents the administrative functions associated with the planning, design, deployment, operations, and maintenance of ITS. ITS program management services are provided on four levels: Policy, Program Planning, Deployment, and Operations. Each of these levels is critical to providing successful ITS solutions.

To be successful, the Program Manager needs to play a key role in all aspects of ITS project delivery, including working with management at IDOT to make and act upon key strategic decisions that advance the program's goals. This often relates to how a budget is established and allocated, limitations placed on staff oversight and responsibility, and being involved when key decisions are made that affect their ability to perform the work.

ITS Program Management Services in Illinois

IDOT ITS activities and programs were initiated in the 1960s with the establishment of ramp metering, reversible lanes, and the Emergency Traffic Patrol (ETP). The ITSPO was formed in 1991 to plan, design, and deploy the ADVANCE Project. ADVANCE (Advanced Driver and Vehicle Advisory Navigation Concept) was a public-private partnership that began in 1991 as a major test of a dynamic route guidance system in the Chicago northwestern suburbs. The ADVANCE Project combined real-time two-way electronic communication, GPS positioning, CD-ROM map storage and database retrieval to provide drivers with continuously updated navigational directions. The project objective was to supply motorists with route guidance and real-time traffic information to help them avoid congestion and improve the quality of their trip.

Later activities including the multi-state Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor Program and its successor Lake Michigan Interstate Gateway Alliance (LMIGA) were federally funded efforts to improve traveler information and interstate operations coordination that were consultant supported. Over time and with the reduction of federal fund support, public agency members of the coalition took on management of these later initiatives.

Historically, IDOT ITS program management functions have resided in the IDOT ITS Program Office (ITSPO), which is part of IDOT Central Office. The ITSPO recently shifted from the Office of Planning & Programming, Bureau of Planning to the Office of Highways Project Implementation, Bureau of Operations. This departmental transition underscores the Department's focus on delivering operational benefits of ITS.

IDOT should ensure that ITS program management is woven into the fabric of its entire project development process. This includes institutionalizing ITS into operations and maintenance to provide

the necessary long-term resources. IDOT also should be proactive in working as a partner with metropolitan planning organizations (MPO) and regional planning commissions (RPCs) throughout the state to address regional, as well as statewide, ITS needs in the development of the Statewide TIP.

As other states have recently done, Illinois has also established an initiative focused on the continued development and deployment of connected and automated vehicles within the state. Known as Autonomous Illinois, the initiative is a combination of state agencies and community partners working to create a new state of mobility through serving as a national leader in the development and use of connected and automated vehicles (CAV).[42] Some states have taken the step of integrating the ITS and CAV approaches under one department in an integrated manner, while other states have separate leadership efforts for the deployment ITS and CAV technologies.

States that are recognized as national leaders in both ITS and related CAV technologies have integrated these efforts into their program development process and provide sufficient funds for operations and maintenance. They also have established a structure whereby ITS is always considered as an option in the development of solutions, given that ITS solutions often offer an impressive benefit-to-cost ratio.

The following subsections describe the service levels that an ITS Program Manager needs to provide, with the tasks involved in each level described in greater detail. Table 10-1 provides a high-level overview of policy, program management, ITS deployment, and operations items to be considered.

Table 10-13 - IDOT ITS Program Office Roles

Policy	Program Management	ITS Deployment	Operations
Public Relations/ Legislative Issues	Project Programming	Systems Engineering Support	Training
Resource Sharing Coordination	ITS Architecture Development, Compliance & Maintenance	Technical Support to Regions/Local Governments	Performance Measures Tracking & Reporting
	Planning Coordination	Accounting/Funds Tracking	Technology Enhancements
	ITS Funding Allocation & Budgeting	ITS Standards Application	Operational Procedures Management
	Performance Measures Identification		
	ITS Standards Identification		
	Research & Development		

[42] http://www.idot.illinois.gov/autonomous

Policy Level

Before ITS projects can be developed and deployed, there must be a suitable political and fiscal environment in place in support of ITS. Such an environment is created at the policy level and the Program Manager should be involved. The following services are included:

- **Public Relations/Legislative Issues** – before ITS and/or CAV solutions can be applied, lawmakers and the traveling public must understand the benefits and costs of ITS and support the funding of ITS projects.
- **Resource Sharing Coordination** – as the focal point for ITS in Illinois, the IDOT ITSPO should assist transportation stakeholders in coordinating the sharing of ITS resources between different agencies.

Program Planning Level

Once ITS funding has been made available, the ITS Program Manager must oversee its application towards meeting identified ITS needs. The following services comprise the program planning level and represent the primary tasks of the statewide ITS program:

- **Project Programming** – the ITSPO is responsible for adding funded projects to the ITS program.
- **ITS Architecture Development, Compliance & Maintenance** – having overseen development and updating of the Illinois Statewide ITS Architecture, the IDOT ITS Program Office will continue to oversee its application and will be responsible for ongoing maintenance of the architecture to ensure that it remains current.
- **Planning Coordination** – considering its important role in the identification of ITS project funding, the IDOT ITSPO is uniquely suited to provide coordination of ITS projects on a statewide and regional level. Metropolitan planning organizations (MPOs) and regional planning commissions (RPCs) that have played a key role in the ITS architecture and strategic planning process should support ITS project planning coordination at the local level.
- **ITS Funding Allocation & Budgeting**– ITS funding, whether federal, state, local, or a combination thereof, needs to be identified (see Section 8) and directed towards ITS initiatives. Identified ITS funding should be applied effectively towards ITS research, planning, deployment, operations, and maintenance.
- **Performance Measures Identification** – assistance in the development of project-level ITS performance measures.
- **ITS Standards Identification** – as ITS standards evolve both nationally and statewide, the IDOT ITSPO should monitor their progress and provide guidance in their application on statewide and regional ITS projects.
- **Research & Development (R&D)** – Illinois has been a pioneer in the application of ITS, and a strong research and development program will allow the state to continue to discover or adapt new ITS applications for the benefit of motorists in Illinois.

Deployment Level

Once ITS projects have been defined and funded, the ITS Program Manager provides assistance to ITS project managers during deployment and beyond through the following services:

- **Systems Engineering Support** – as described throughout this ITS Strategic Plan, the Systems Engineering Process offers a proven approach for delivering successful technology projects. The ITS

Program Office should serve as a resource for the application of systems engineering for ITS projects at the statewide, regional, and local level.

- **Technical Support to Regions/Local Governments** – the IDOT ITSPO should serve as a technical resource to IDOT districts/regions and local governments during deployment.
- **Accounting/Funds Tracking** – during project implementation, ITS funds should be monitored to ensure that they are being applied properly.
- **ITS Standards Application** – the IDOT ITSPO can play a role in the testing and verification of ITS standards applied during project deployment.

Operations Level

With its shift to the Bureau of Traffic Operations, the ITS Program Office should provide support to the use and upkeep of ITS deployments.

- **Training** – the operation and maintenance of ITS components (both at the statewide and regional level) requires ongoing guidance and training to achieve ITS goals.
- **Performance Measures Tracking** – by applying the ITS performance measures defined during project scoping, the IDOT ITSPO should monitor the results of the project to record the benefits provided by ITS.
- **Technology Enhancements** – the IDOT ITSPO should seek ways to continually improve the capabilities of ITS in Illinois by supporting the implementation of recommendations developed through research and development.
- **Operational Procedures Management** – as a technology-based field, ITS is constantly changing, which will require ongoing evaluation and revision of operational procedures.

10.2 PROGRAM MANAGEMENT CONSIDERATIONS

IDOT manages the ITS Program with assistance and project-level outsourcing of the private sector. These include ITS technical research and planning studies, as well as traveler information systems. There are pros and cons of outsourcing ITS functions. The non-traditional ITS needs related to staffing and technical skills can often be better met by the private sector. This includes greater flexibility in setting hours of operations and an industry competitive salary structure for the specialized skill sets required. Another benefit can be with the procurement and upgrading of hardware and software, which have a much shorter life-cycle than items typically procured or constructed by state DOTs. The private sector normally has a faster procurement process and less “red tape.”

The potential risks that IDOT would assume through the outsourcing elements of ITS support and services generally relate to a situation of non-performance by the private entity. There is a potential for delays in providing timely services such as traveler information should there be unsatisfactory performance. Should there need to be a change in the private operator due to non-performance, it is possible that there could be an interruption in service, for which the Department would be held accountable.

10.3 REPRESENTATIVE ITS PROGRAM MANAGEMENT EXAMPLES

The following subsections provide representative examples of successful ITS programs in other states and highlight effective program management techniques that potentially could be used in Illinois.

Florida

The ITS program in Florida mirrors the decentralized structure of the Florida Department of Transportation (FDOT). The FDOT ITS program is organized under the Division of Transportation System Management and Operations (TSMO) and endeavors "to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities."[43] The program is divided into six areas:

1. Connected Vehicle -- The recently developed Connected Vehicle initiative uses leading edge technologies to quickly identify roadway hazards and alert drivers. Among others, these technologies include wireless communications, vehicle sensors, and GPS navigation.
2. Management/Deployments – oversees the design, procurement, and deployment of ITS projects including 511 Traveler Information, updates/maintains the ITS Strategic Plan, develops ITS standards, and provides technical assistance to Florida Department of Transportation (FDOT) districts.
3. ITS Communications – guides deployment of backbone communications infrastructure for ITS use and manages the Statewide ITS Wide Area Network (WAN) to support ITS deployments.
4. ITS Software and Architecture – Manages the SunGuide® software system for freeway and incident management, and also updates and maintains the Statewide ITS Architecture.
5. Statewide Arterial Management Program (STAMP) – Provide guidance to DOT districts and local agencies that may be considering adaptive signal control technologies.
6. Managed Lanes – Advocates for the delivery express lane projects throughout the state. FDOT Central Office in partnership with Florida Turnpike Enterprise (FTE) is initiating the development of an Express Lanes Manual that will provide requirements for Districts that implement Express Lane Projects in their districts.

Each of these areas combine to provide guidance in ITS planning, deployments, operations, and maintenance in key travel corridors across the state.

Virginia

Like Florida, the Virginia DOT's (VDOT) ITS technologies are implemented under the VDOT Operations Program with the goal of implementing "a robust and reliable transportation system that keeps users informed and supports multi-modal options."[44]

VDOT has five Transportation Operations Centers (TOCs) that cover all areas of the state by monitoring traffic and travel conditions, dispatching personnel to respond to incidents and events, coordinating traffic information, coordinating traffic signal operations, and guiding travelers to make informed choices about when and how they travel.

VDOT has also recently developed a Connected and Automated Vehicle program to guide the department in the deployment and sustainment of related CAV technologies and initiatives. VDOT has also developed a CAV program plan in 2017 to provide a strategic roadmap to guide VDOT in the deployment of CAV technologies as they evolve over the coming years. [45]

[43] https://www.fdot.gov/traffic/ITS/TSMO.shtm
[44] https://www.virginiadot.org/business/operations_program.asp
[45] https://www.virginiadot.org/programs/resources/cav/Release_Final_VDOT_CAV_Program_Plan_Fall_2017.pdf

10.4 RECOMMENDED IDOT ITS PROGRAM MANAGEMENT STRUCTURE

A number of transportation agencies and organizations, both within and outside of IDOT, have a stake in intelligent transportation systems. Many of them have been actively involved in the development of this Statewide ITS Strategic Plan. Some of these groups are focused on specific ITS applications, such as transit or commercial vehicle operations, while some groups concentrate their efforts on specific geographic locations, such as corridor action teams and metropolitan planning organizations.

To coordinate the efforts of these groups, this subsection defines a recommended program management structure for ITS at IDOT. This structure involves ITS groups at the statewide, regional, and local levels working together to identify transportation issues and develop and implement appropriate ITS solutions.

ITS Oversight Committee

IDOT's ITS program should be under the guidance of a statewide ITS Oversight Committee comprised of IDOT staff. This committee would be responsible for determining the overall policy direction of ITS in Illinois under the overall policy-level direction of the Secretary of Transportation. This statewide committee should consist of senior-level IDOT personnel representing the following offices or bureaus:

- Bureau of Information Processing (located in the Office of Finance and Administration)
- Bureau of Operations (located in the Office of Highways Project Implementation)
- Bureau of Safety Programs and Engineering (located in the Office of Highways Project Implementation)
- Office of Communications
- Office of Legislative Affairs
- Office of Planning & Programming

ITS Program Manager

As the head of the IDOT ITS Program Office, the ITS Program Manager would gather input from the ITS Oversight Committee and be responsible for carrying out their recommendations for the ITS program, including overseeing and facilitating ITS policy, program planning, deployment, and operations for IDOT per the recommendations of the ITS Strategic Plan.

The ITSPO would coordinate with the following teams: ITS Planning & Deployment (IPD) Team; ITS Operations Team; a Connected and Automated Vehicle (CAV) Group; and an Innovative Technology Deployment (ITD) Steering Committee (see below). Each team could also have one or more ad hoc subgroups to carry out specific responsibilities.

Leadership for each team could be provided by a single member or could be established on a rotating basis, allowing different members of each team to provide direction in turn.

ITS Planning & Deployment (IPD) Team

The ITS Planning & Deployment Team would be responsible for continuing the program planning process set forth by this ITS Strategic Plan: identifying and prioritizing ITS needs, developing and evaluating

potential ITS projects, and fostering high-priority projects through the programming process. Formed from the Technical Committee that supported development of this ITS Strategic Plan, this team would also focus on the delivery of ITS projects through the cooperative evaluation of ITS technologies and strategies, the development of statewide ITS standards and design conventions, asset management, and the sharing of lessons learned from ITS project delivery. Regular meetings of the ITS Planning & Deployment Team would involve demonstrations and other training events.

This team would consist of representatives from the IDOT Central Office as well as from regions across the state. Given their role in the administration of federal funds, it could help with coordination if IDOT elects to include representation from one or more metropolitan planning organizations/regional planning commissions, at a minimum one or more IDOT MPO liaison(s). This team should consist of the following central office and regional/district-level personnel:

- Bureau of Information Processing representatives
- Bureau of Operations representatives
- IDOT District Bureau of Local Roads representatives
- IDOT District Programming Engineers
- IDOT Office of Planning & Programming representatives
- ITD Steering Committee representative
- ITS representatives from Districts 1-9
- ITS Program Office representative
- Metropolitan planning organization/regional planning commission liaisons

ITS Operations Team

The ITS Operations Team would consist of regional representatives from across the state that use ITS tools to achieve the operational goals of the ITS program. The ITS Operations Team is intended to be a forum for front-line operations personnel to coordinate activities related to major incidents and special events, the sharing of traveler information, severe weather response, and other disruptions to the transportation network. This could include tabletop exercises, training, incident debrief sessions, and other efforts that promote improved operations.

In addition, this group should consider the operation, maintenance, and expansion of the Illinois Statewide Transportation Information Network (ISTIN). As described in Appendix H, ISTIN will provide transportation data to traffic managers and operators across the state. To ensure successful deployment and operation of the network, the ITS Operations Team should address a number of ongoing tasks:

- Development of configuration management (CM) Guidelines and CM training
- Development of statewide data standards and statewide information systems training
- IDOT Central Office and inter-regional ITS asset management and control
- ComCenter/TMC functionality transfer
- ISTIN Expansion to new districts, partner agencies, and adjacent states
- ISTIN system upgrades

This team should consist of the following personnel:

- Bureau of Information Processing representatives
- Bureau of Operations representatives
- ComCenter representatives from all IDOT districts that manage ITS assets
- IDOT winter operations staff
- Illinois Department of Innovation and Technology (DoIT)
- Illinois State Police
- Illinois Tollway
- ITD Steering Committee representative
- ITS Coordinators from Districts 1-9
- ITS Program Office representative
- Station One Manager

Connected and Automated Vehicle (CAV) Team

As noted above, Autonomous Illinois has been established to serve as a multiagency organization focused on the development and use of connected and automated vehicles in Illinois. To support these efforts, a CAV Group was formed to provide a technical perspective on the evolving application of CAV technologies and how they can best be translated into the travel environment in Illinois. Following the lead of states like Florida and Virginia, this group supports efforts to develop a roadmap for CAV applications, identify and participate in CAV test pilots, and other related initiatives. The IDOT ITS Program Office provides a support function to the CAV Team.

Innovative Technology Deployment (ITD) Steering Committee

The ITD Steering Committee is an existing interagency group that supports IDOT as it establishes a new expanded ITD Program, formerly known as the Commercial Vehicle Information Systems and Networks (CVISN) Program. In the near-term, this involves participation in IDOT's efforts to develop an ITD Program Plan/Top-Level Design (PP/TLD) Document. The PP/TLD will identify requirements and provide a top-level design of the hardware, software, networks that support the ITD Program. Once the PP/TLD is in place, the ITD Steering Committee will focus on overall program management, system architecture, and project funding.

This steering committee consists of representatives from the following agencies:

- IDOT Bureau of Information Processing
- IDOT Bureau of Operations
- IDOT ITS Program Office
- IDOT Traffic Safety
- Illinois Commerce Commission
- Illinois Department of Revenue
- Illinois Secretary of State
- Illinois State Police

Project teams would be established to support the implementation of ITD projects that the team prioritizes for implementation.

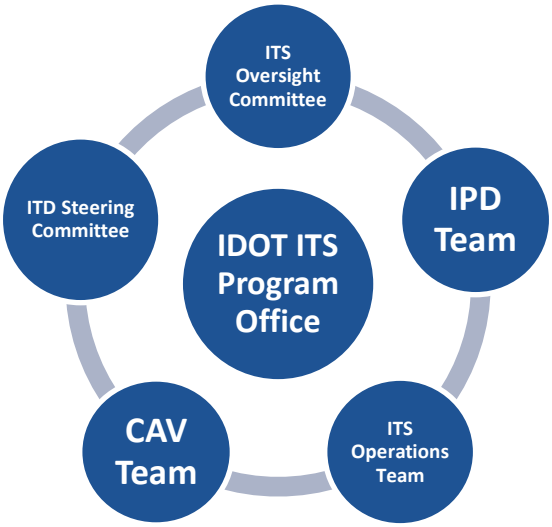

Figure 10-23 – Illinois ITS Program Management Teams

10.5 POTENTIAL PARTNERSHIPS

In addition to public-private partnerships discussed in Section 8.5, IDOT could benefit by tapping the expertise and perspective of outside organizations, including those of which IDOT and/or its staff are members. These could include colleges/universities, professional societies, and any other organizations with a focus on ITS.

The University of Illinois at Urbana-Champaign (UIUC) has performed regional and statewide ITS assessments in the past and is a valuable resource for ITS initiatives. UIUC houses the Illinois Center for Transportation (ICT), which has identified traffic operations & roadside maintenance research as one of its missions. Additionally, Northwestern University, the University of Illinois Chicago, and Southern Illinois University at Edwardsville are also supporting ITS research and test deployments, e.g., traveler information, connected and automated vehicles.

ITS Midwest is the regional chapter of ITS America, a national organization of public and private sector organizations that promotes the use of intelligent transportation systems to improve the safety, security, and efficiency of the transportation system. Covering the states of Illinois, Indiana, Kentucky, and Ohio, ITS Midwest can help transportation agencies across the state at the policy level to promote ITS in the public and with elected officials. These outreach activities could be done through media events, training sessions, publications and public presentations on the benefits of ITS from a local, regional and national perspective.