2017 Update

Flint Hills Intelligent Transportation Systems Architecture

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1.0 Executive Summary

1.1 Introduction

The Flint Hills Regional Intelligent Transportation Systems (ITS) Architecture is a roadmap for the deployment and integration of ITS in the Flint Hills Metropolitan Planning Organization (FHMPO) planning area for the next ten years. The FHMPO planning area, defined as the region in this Architecture, geographically covers portions of Riley County, Geary County, and Pottawatomie County in Kansas. The Flint Hills Regional ITS Architecture provides a framework for institutional agreements and technical integration of ITS implementation projects in the region. It supports effective and efficient deployment of transportation and ITS projects that address the transportation problems and needs in the region.

1.2 Purpose

The purpose of the Flint Hills Regional ITS Architecture is to illustrate and document the integration of regional ITS systems to allow planning and deployment to occur in an organized and coordinated process. The Architecture helps guide the planning, implementation, and integration of ITS devices deployed and managed by multiple types of agencies that provide transportation services within the region.

The Architecture helps to accomplish the following objectives for ITS deployment in the region:

- Facilitate stakeholder coordination in ITS planning, deployment and operations;
- Reflect the current state of ITS planning and deployment within the region;
- Provide high-level planning for enhancing regional transportation systems using current and future ITS technologies; and
- Conform with the National ITS Architecture and FHWA Final Rule 940 and FTA Final Policy on ITS Architecture and Standards.

1.3 Flint Hills Regional ITS Architecture

The Flint Hills Regional ITS Architecture describes coordination of overall system operations by defining interfaces between equipment and systems which have been or will be deployed by different organizational or operating agencies in the region. The Architecture identifies the current ITS deployment and how these systems interact and integrate with each other. It also builds on the existing systems, addressing the additional components deemed necessary to grow the ITS systems within the region over the next 10 years to accommodate specific needs and issues of stakeholders.

A high-level interconnect diagram for the Flint Hills Regional ITS Architecture, often referred to as a "sausage diagram" as shown below, illustrates the architecture subsystems and primary types of interconnections (or communications) between these subsystems. The sausage diagram was customized to reflect the systems of the Flint Hills Regional ITS Architecture. The shaded areas indicate the functions and services that do not exist or are not currently planned in the region.

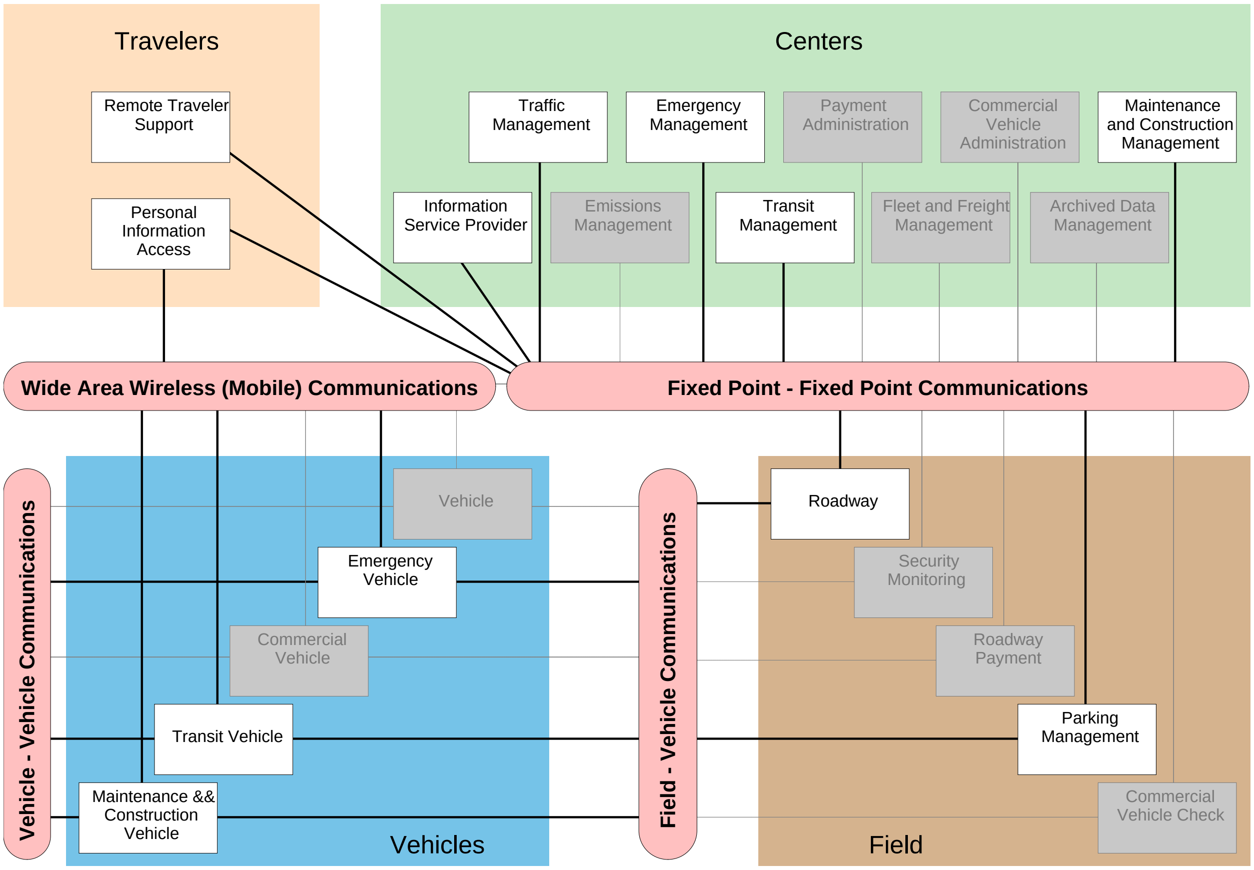


Figure 1: Flint Hills Regional ITS Architecture High-Level Interconnect Diagram

1.4 Applicable ITS Standards

ITS standards are fundamental to the establishment of an open ITS environment that achieves the goals originally envisioned by the United States Department of Transportation (USDOT). Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. Standards can be thought of as the glue that holds the various pieces of architecture together. They define how the communications within an ITS environment take place. Fifty (50) ITS standards were identified as standards supporting current and future ITS applications in the region.

It is important that stakeholders are aware of the importance of ITS standards, especially with respect to cost, risk, and interoperability issues both within the region and when connecting with other ITS architecture regions. These standards can save money in the long run, ensuring that various devices and systems are compatible.

1.5 Recommended ITS Projects and Implementation Sequencing

The Flint Hills Regional ITS Architecture identifies a list of ITS projects for consideration and a recommended sequence for implementation. The project implementation sequence is based on a combination of two factors:

1. **Prioritization of projects based on existing conditions and stakeholder needs.** ITS projects were prioritized to reflect a deployment path (sequence) of stakeholder needs. As technology, funding opportunities, and requirements continue to evolve, it is expected that stakeholders will reevaluate and reprioritize projects periodically.

2. **Project dependencies, based on how successive ITS projects can build upon one another.** Project dependencies influence the project sequencing. It is beneficial to identify the information and functional dependencies between projects.

1.6 Documentation of ITS Architecture

The Flint Hills Regional ITS Architecture is documented in the following four forms:

1. This report (Flint Hills Regional ITS Architecture Report): This report provides a technical-oriented summary regarding various aspects of the Architecture.
2. Architecture website: The architecture website provides detailed architecture outputs in an organized web environment.
3. Turbo Architecture Database: The database prepared using the Turbo Architecture version 7.1, a software tool developed by FHWA for developing ITS architectures.
4. Turbo Architecture Report: This report is a detailed report generated using the Turbo Architecture software and the database for the Regional ITS Architecture.

1.7 Architecture Maintenance

By its nature, an ITS architecture is not a static set of outputs. The Flint Hills Regional ITS Architecture is a living document and should be modified as plans and priorities change, ITS projects are implemented, and ITS needs and services evolve in the region. An architecture maintenance plan is developed as a separate document to address the needs for maintenance and updates. The FHMPO will be responsible for housing and maintaining the ITS Architecture. The architecture maintenance plan also recommends that an ITS Committee be established to oversee all ITS activities in the region, including architecture maintenance. The ITS Committee will consist of regional stakeholders who have implemented or are interested in implementing ITS. The architecture maintenance plan outlines the steps for making changes to the architecture.

2.0 Regional ITS Architecture Overview

An ITS architecture describes the "big picture" for ITS deployment in terms of individual components (i.e. subsystems) that will perform the functions necessary to deliver the desired needs. It describes what is to be deployed but not how those systems are to be deployed. An ITS architecture defines the components and subsystems that must interface with each other, the functions to be performed by those subsystems, and the flow of data between these subsystems.

The region covered by the Flint Hills Regional ITS Architecture is the entire FHMPO planning area. As illustrated in Figure 2, the FHMPO planning area covers portions of Riley County, Geary County and Pottawatomie County, including four municipalities and Fort Riley Military Installation.

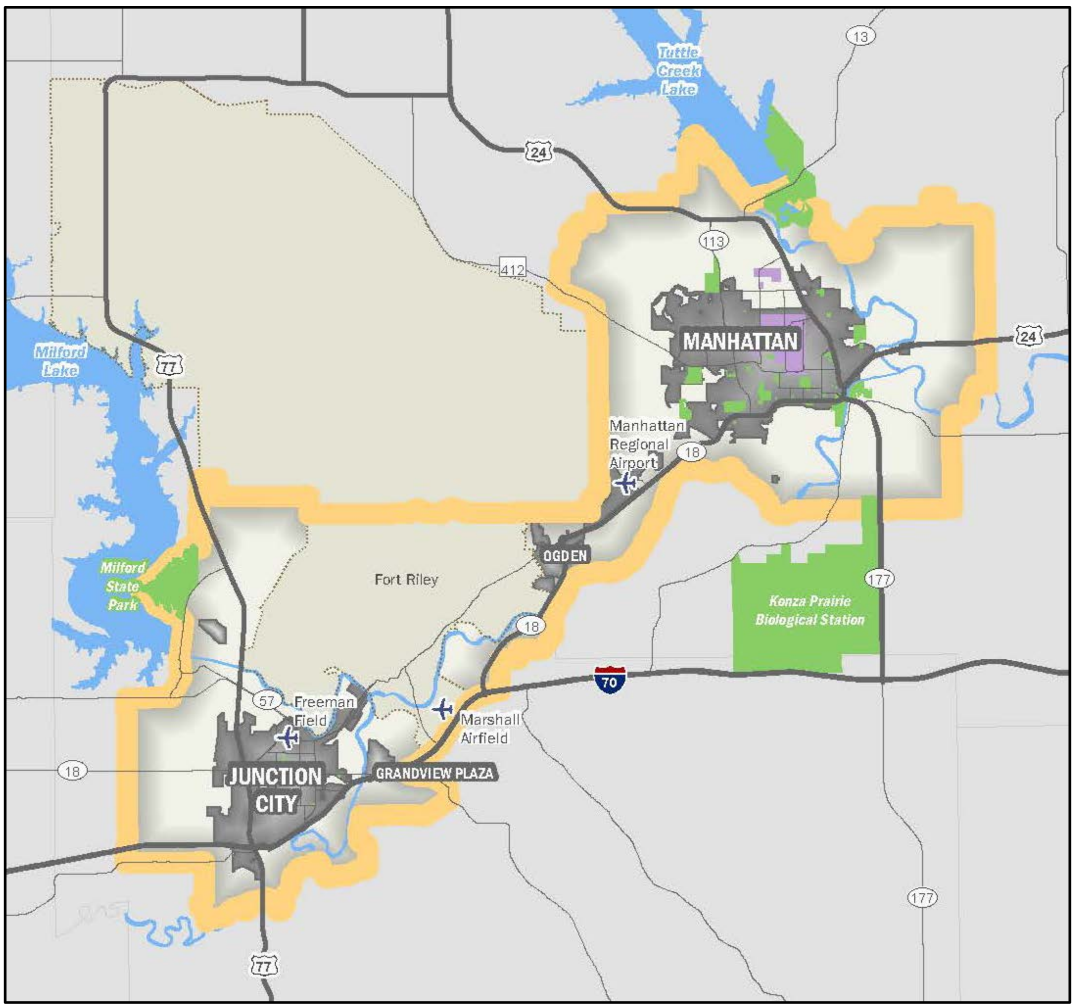


Figure 2: FHMPO Planning Boundary Map

The Flint Hills Regional ITS Architecture is an open and integrated ITS architecture that is compliant with the Federal Highway Administration (FHWA) Final Rule and Federal Transit Administration (FTA) Policy on

ITS Architecture and Standards. The Architecture has been developed through a cooperative effort by the transportation, transit, law enforcement, emergency management, commercial vehicle and freight management agencies. It represents a shared vision of how each agency's systems work together by sharing information and resources to enhance transportation safety, efficiency, capacity, mobility, reliability, and security. The collaboration and information sharing among transportation stakeholders in the region helps illustrate integration options and gain consensus on systematic and cost-effective implementation of ITS technologies and systems in the region.

2.1 Architecture Development Process

The National ITS Architecture is a tool to guide the development of regional ITS architectures. It is a common framework that guides agencies in establishing ITS interoperability and helps them choose the most appropriate strategies for processing transportation information, implementing and integrating ITS components and systems, and improving operations. The Flint Hills Regional ITS Architecture is a specific application of the framework specified in the National ITS Architecture, tailored to the needs of the transportation stakeholders in the Flint Hills region.

The process used to develop the Flint Hills Regional ITS Architecture is illustrated in Figure 3. This figure shows six general steps in the "life-cycle" of an ITS architecture. In the first four steps, the ITS architecture components are developed. These components are used and maintained in steps 5 and 6. The development process begins with basic scope definition and team building and moves through increasingly detailed steps, culminating in specific architecture outputs and documents that will guide the implementation of the ITS architecture.

The key to the ITS architecture development process is to identify stakeholder needs, identify ITS projects to address those needs, and define project sequencing. The project definition outlines the project concepts and the associated details including project title, stakeholder, project scope, costs, benefits and the service packages defined in the Flint Hills Regional ITS Architecture. The project sequencing provides an approximate timeframe in which an ITS project may be implemented based on the understanding of the projects, project dependencies of the project, as well as other existing or planned ITS systems.

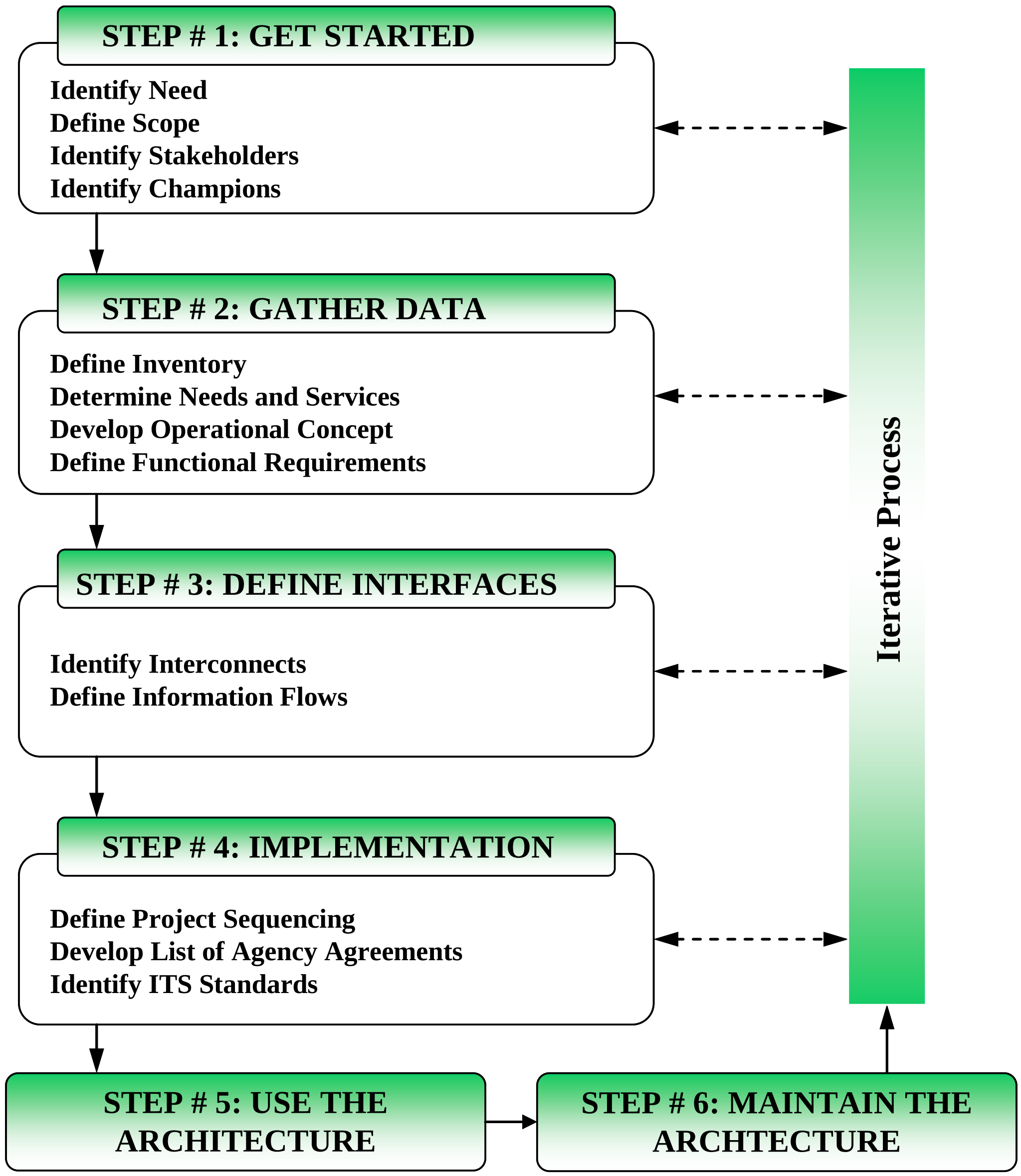


Figure 3: ITS Architecture Development Process

2.2 Systems Engineering

"Systems Engineering" is a phrase used to describe a cyclical process of planning, designing, implementing, testing, operating, and maintaining an ITS system. Essentially, this process covers the entire useful life of the system. Systems engineering is a multi-step process that requires agencies to ask critical questions about how the technical aspects of the system will work together. This is often overlooked in complex systems. Figure 4 graphically illustrates the systems engineering process in what is often referred to as the "Vee" diagram. The purpose of a "V" in the diagram is to show how the final deliverables relate back to the early decisions (the right side relates directly back to the left side). This prevents surprises once the system is delivered. For example, while a system is being designed the various functions are documented as requirements. Then, when the system is being built, these same functional requirements are compared to what was actually delivered.

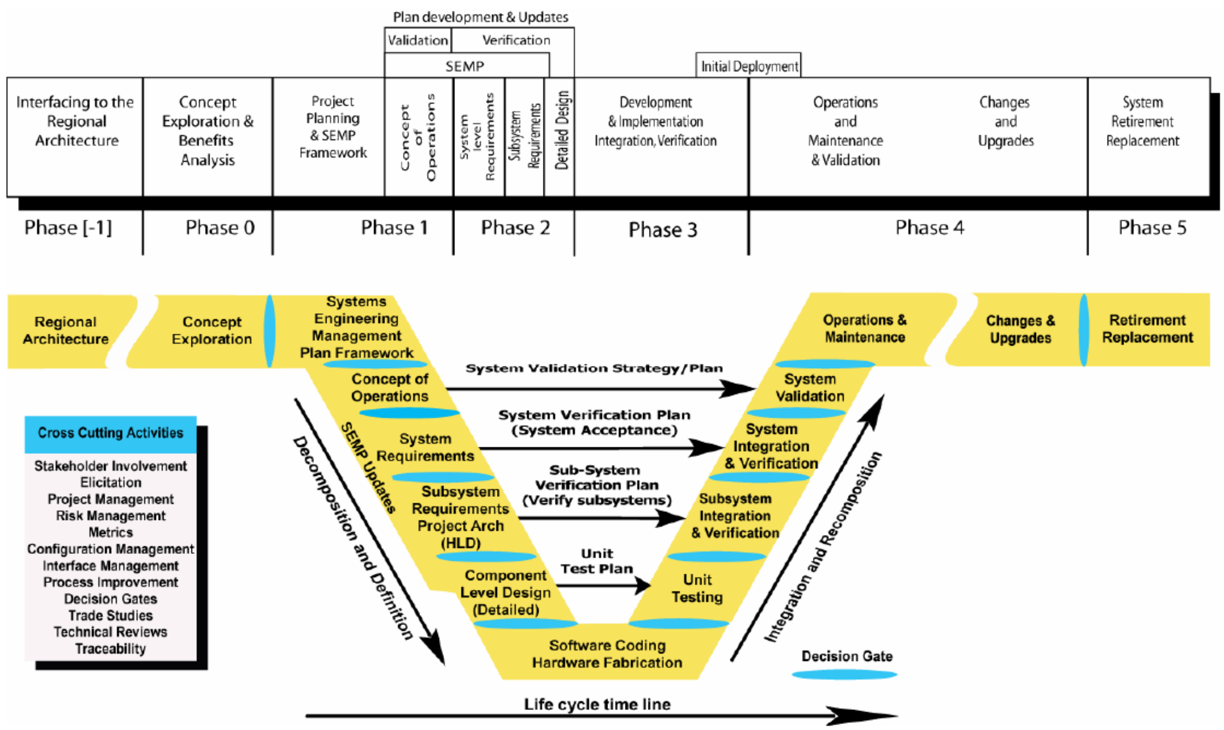


Figure 4: Systems Engineering V-Diagram

The systems engineering process shows how each step of the process builds on the previous one and is reliant on a system of back-checking to ensure that the project is being designed and constructed based on its originally intended purpose. Systems engineering is a risk management tool that sets expectations and then verifies that those expectations are met. It also enables a change management system so that unexpected issues can be incorporated into the process.

2.3 FHWA and FTA Requirements on ITS Architectures

FHWA Rule 940 (http://ops.fhwa.dot.gov/its_arch_imp/docs/20010108.pdf) provides policies and procedures for implementing Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA–21), Public Law 105–178, 112 Stat. 457, pertaining to conformance with the National ITS Architecture and Standards. The rule states, in part, that the final design of all ITS projects funded with Highway Trust Funds must accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. This ITS Architecture and Standards Rule/Policy continues under subsequent federal transportation legislation (i.e. SAFETEA-LU and MAP-21).

For federally funded ITS projects, several steps need to be followed as part of the systems engineering analysis and Rule 940 requirements. Rule 940 states that the systems engineering analysis shall include, at a minimum:

- Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS architecture)
- Identification of participating agencies roles and responsibilities
- Definitions of high-level functional requirements for ITS systems and devices
- Analysis of alternative system configurations and technology options to meet requirements
- Procurement options
- Identification of applicable ITS standards and testing procedures
- Procedures and resources necessary for operations and management of the system

The rule requirements are applicable for all ITS projects funded through the Highway Trust Fund account. Conformity with the Rule 940 requirements is required for both routine and non-routine projects. However, with routine projects, the effort and the scope of systems engineering analysis should be minimal. For non-routine projects, the scale of the systems engineering analysis depends on the scope of the project.

While the use of the architecture and the systems engineering approach is mandatory for federally funded projects, project developers are encouraged to use this approach for any ITS project using state or local funds, especially for projects that integrate with other systems in the region.

3.0 Stakeholder Involvement

Stakeholders are commonly considered to be those who own or operate ITS systems in the region, as well as those who have an interest in regional transportation issues. Stakeholders provide crucial input regarding the region's transportation investments and ITS deployments; therefore, stakeholder participation and coordination is critical to the success of the ITS architecture development.

The Flint Hills Regional ITS Architecture includes a wide range of stakeholders. Key stakeholders were identified early in the architecture development process and include the following:

- Blue Township Fire Department
- City of Grandview Plaza
- City of Junction City Engineering
- City of Junction City Fire Department
- City of Junction City Police Department
- City of Junction City Public Works
- City of Manhattan Fire Department
- City of Manhattan Public Works
- City of Ogden
- Flint Hills Area Transportation Agency (FHATA)
- FHMPO
- FHWA
- Fort Riley Emergency Management
- Fort Riley Fire Department
- Fort Riley Police
- Fort Riley Network Enterprise Center
- Fort Riley Public Works
- FTA
- Geary County Emergency Management
- Geary County Public Works
- Geary County Rural Fire Department
- Geary County Sheriff's Department
- Kansas Division of Emergency Management
- Kansas DOT (KDOT)
- Kansas Highway Patrol (KHP)
- Kansas Homeland Security
- Kansas State University
- Pottawatomie County Emergency Management
- Pottawatomie County Public Works
- Pottawatomie County Sheriff's Department
- Riley County Emergency Management
- Riley County Emergency Medical Services
- Riley County Fire Department
- Riley County Police Department
- Riley County Public Works
- U.S. Department of Homeland Security

Information on current and potential ITS deployment was gathered through a large stakeholder meeting held in December 2014. Prior to the meeting, surveys were distributed to stakeholders to solicit input on a wide range of local/regional issues, problems and needs; define the inventory of ITS elements in the region; along with details about how information exchanges occur between those elements. Future and potential ITS projects were also identified through the surveys obtained from stakeholders. Stakeholders were asked to rank on 43 issues and needs across seven categories in the survey. The seven categories were:

- Information for Travelers

- Travel and Traffic Management on Arterials
- Travel and Traffic Management on Freeways and Expressways
- Public Transportation
- Security and Incident Response
- Commercial Vehicle Operations
- Others

Top ranked issues and needs identified through this survey process were:

- Recurring congestion during rush hours
- Congestion due to special events
- Incident identification
- Interagency coordination and communication during incidents and emergencies
- Lack of communications in less populated areas
- Lack of traveler information
- Notification of major crashes to travelers
- Provide up-to-date information to travelers
- Transit vehicle tracking
- Transit on-time performance
- Transit schedule and route information
- Real-time transit information

In addition, stakeholders expressed the desire to continue expanding ITS in the region, particularly in the area of traffic management to assist in congestion reduction and in expanding communications capability to facilitate interoperability and interagency communication. The idea of a joint regional traffic operation between Manhattan and Junction City also received support from the regional stakeholders. The need for data storage and management was discussed, and stakeholders felt further discussion would be needed in the future in order to identify plans and steps to move forward.

In May 2015, stakeholders were again invited to attend a second stakeholder meeting to review the list of potential ITS projects identified during this planning process. Stakeholders were also asked to verify project validity, identify additional projects, and discuss implementation timeline and strategies.

4.0 Regional ITS Architecture Components

This section describes the key components of the Flint Hills Regional ITS Architecture. The Flint Hills Regional ITS Architecture was developed based on the National ITS Architecture Version 7.1 through the use of Turbo Architecture Software Version 7.1.

4.1 Inventory

The inventory of the Flint Hills Regional ITS Architecture contains the existing and future elements of ITS technology within the region. An inventory of ITS elements was identified through a survey and meetings with the regional stakeholders, as well as review of the City of Manhattan's ITS architecture developed by the Manhattan Public Works Department staff.

ITS elements within the inventory represent the range of ITS devices and systems. Figure 5 displays the four types of inventory elements that can exist within an ITS Architecture (represented by the four colored boxes). ITS elements can exist:

- On vehicles (i.e. fire trucks, police cars, snow plows, etc.)
- In the field (i.e. traffic signals, cameras, etc.)
- At a center (i.e. traffic management centers, 911 dispatch centers, emergency operations centers, etc.)
- In the hands of travelers (i.e. computers, smartphones, etc.)

The technical functions that each of these elements perform are defined by the National ITS Architecture as subsystems, also illustrated in Figure 5.

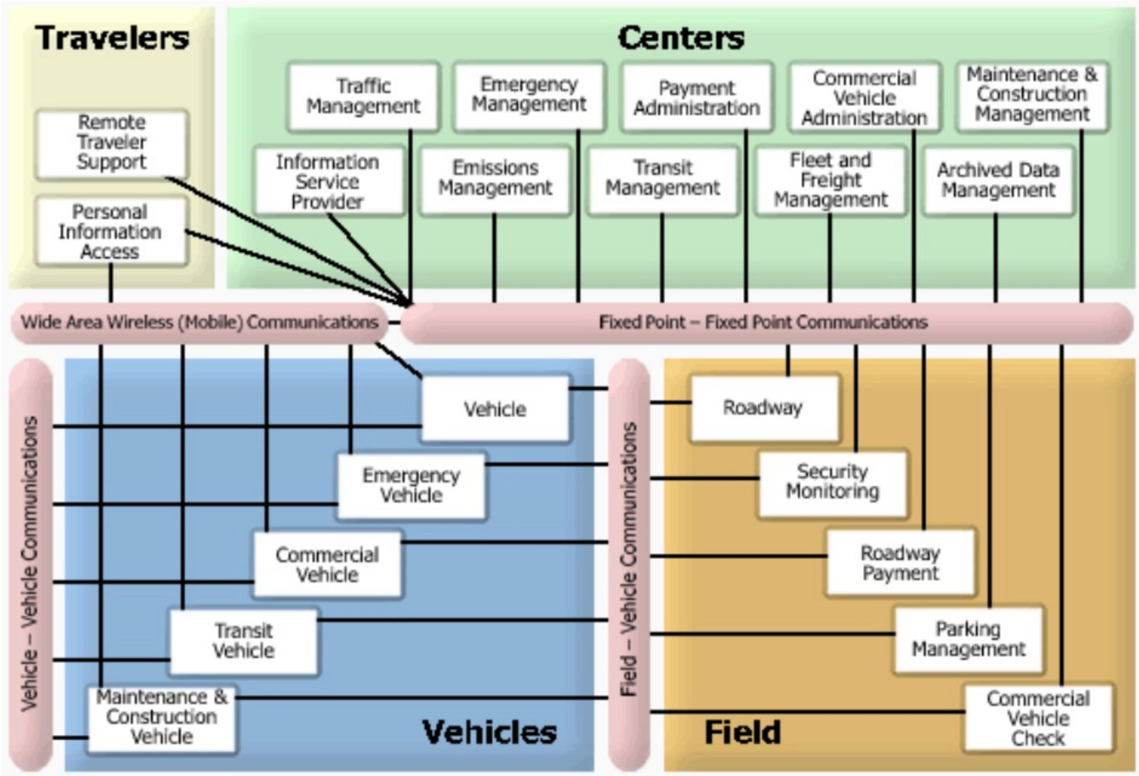


Figure 5: National ITS Architecture Subsystems and Interconnections

In addition to subsystem elements, there are additional elements added to the inventory defined by the National ITS Architecture as “Terminators”. These represent the people, systems, and general environment that interface with the subsystem elements. Terminators typically represent the beginning or end of a flow of information in the ITS Architecture. No technical or functional requirements are assigned to terminators because they are the points outside the system boundaries where the architecture “plugs in” to the outside world.

A listing of ITS elements in the Flint Hills Region is presented in Table 1. Each ITS element is documented at a high level by the associated stakeholder(s), its status (e.g. existing or planned), and a brief description for each element in the ITS inventory.

Table 1: Flint Hills Regional ITS Elements

Stakeholder	Element Name	Element Description	Element Status
Blue Township Fire Department	Blue Township Fire Department	This element represents the Blue Township Fire Department. It is a Volunteer Fire Department serving the area of Blue Township in Eastern Manhattan, KS. Pottawatomie County District 5.	Existing
Blue Township Fire Department	Blue Township Fire Department Vehicles	This element represents the vehicles operated by the Blue Township Fire Department.	Existing
City of Junction City	Junction City Emergency Vehicles	This element represents all emergency vehicles in Junction City, including police vehicles, fire trucks, ambulances, and other EMS vehicles. Police vehicles have InTouch AVL equipment installed in 14 vehicles to allow for central monitoring of vehicle locations.	Existing
City of Junction City Engineering	Junction City Engineering Department	Junction City Engineering Department provides engineering services including; Airport Operations, Construction Criteria & Specifications, Current Bids/Proposals, Engineering Permits, Pavement Management, Resources, Storm Water Management, and Traffic and Right-of-way.	Existing
City of Junction City Fire Department	Junction City Fire Department	The Junction City Fire Department provides joint fire and EMS operations. The department provides fire protection throughout the city limits. The EMS coverage is for all of Geary County.	Existing
City of Junction City Police Department	Junction City Police / 911 Center	Junction City 911 Center is the public safety answering point for all of Geary County.	Existing
City of Junction City Public Works	Junction City CCTV Cameras	This element represents future CCTV cameras in Junction City for traffic monitoring purpose.	Planned
City of Junction City Public Works	Junction City Dynamic Message Signs	This element represents future dynamic message signs for Junction City.	Planned
City of Junction City Public Works	Junction City Maintenance and Construction Vehicles	This element represents Junction City's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows. InTouch AVL equipment is installed on these vehicles to allow for central monitoring of vehicle locations.	Existing
City of Junction City Public Works	Junction City Public Works Department	The Junction City Public Works Department provides services including: street maintenance, snow and ice removal, storm water collection, fleet maintenance, water distribution, sanitary sewer collection, and sanitation collection.	Existing
City of Junction City Public Works	Junction City Traffic Detection Equipment	The element represents the City of Junction City's traffic detection equipment. Junction City is currently looking at installing video detection systems.	Planned
City of Junction City Public Works	Junction City Traffic Signals	This element represents traffic signals owned and operated by Junction City. Traffic signals are not currently centrally monitored or controlled.	Existing

Stakeholder	Element Name	Element Description	Element Status
City of Junction City Public Works	Traffic Signal Interconnects and Upgrades	The current loop system was replaced with a new video camera system to control traffic movements, along with a wireless communication system.	Existing (2017)
City of Manhattan	Manhattan Emergency Vehicles	This element represents all emergency vehicles in Manhattan, including police vehicles, fire trucks, ambulances, and other EMS vehicles. Fire trucks utilize Emergency Vehicle Pre-emption (EVP) equipment to pre-empt signals during emergencies within the City of Manhattan. The Manhattan Fire Department currently has VHF radio communications on all of its emergency vehicles. The Fire Department also plans to have MDTs in each of its first out responding apparatus by the end of 2015. This will include AVL/GPS equipment to allow for tracking in dispatch.	Existing
City of Manhattan Fire Department	Manhattan Fire Department	Manhattan Fire Department provides fire protection and emergency medical services in Manhattan.	Existing
City of Manhattan Fire Department	MFD Digital Information Boards	Installed TVs in all apparatus floors that identify address locations, map of incident area, and street closings.	Existing (2017)
City of Manhattan Fire Department	Manhattan Fire Vehicles—Wireless router	Wireless router in the battalion chief vehicle to allow multiple devices to connect to the internet while in-route to a call (iPad for mapping with Active 911, which receives information from Spillman CAD), as well as on scene electronic resources.	Existing (2017)
City of Manhattan Fire Department	Manhattan Fire Station #1 Fiber	Fiber connection between Station #1 and City Hall that integrates with KSU and Manhattan's ITS architecture.	Existing (2017)
City of Manhattan Fire Department	Manhattan Fire Vehicles—iPads and Active 911	iPads installed in all primary response vehicles and using the Active 911 application. Active 911 receives information from Spillman CAD including mapping the address.	Existing (2017)
City of Manhattan Public Works	Manhattan Bicycle Detection System	This element represents a future bicycle detection system at signalized intersections that will improve safety and reduce bicycle-vehicle collisions.	Planned
City of Manhattan Public Works	Manhattan Bluetooth Readers	Manhattan has installed 15 Bluetooth readers, and the associate reporting software and sever, to provide travel time and speed reporting along principal arterials and minor arterials within the city and western-Pottawatomie County. See Figure 6 for a map of the locations.	Existing (2017)
City of Manhattan Public Works	Manhattan CCTV Cameras	This element represents the pan-tilt-zoom (PTZ) traffic cameras owned and operated by the City of Manhattan.	Existing (2017)
City of Manhattan Public Works	Manhattan Dynamic Message Signs	This element represents future permanent dynamic message signs for the City of Manhattan. The City of Manhattan is considering installing dynamic message signs, as well as speed and count stations and fiber optic cable along K-18 from the K-18/K-113 interchange to the K-18 and I-70 interchange.	Planned

Stakeholder	Element Name	Element Description	Element Status
City of Manhattan Public Works	Manhattan GIS Mapping Service	This element represents the GIS section within the City of Manhattan Engineering Division.	Existing
City of Manhattan Public Works	Manhattan Maintenance and Construction Vehicles	This element represents Manhattan's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows. Manhattan plans to install MDTs by the end of 2015 and also has plans to use on-board GPS devices as an AVL/Computer Aided Dispatch system as well.	Existing
City of Manhattan Public Works	Manhattan Portable Changeable Message Signs	This element represents Manhattan's portable changeable message signs. Those signs are used for special event traffic management, work zone traffic management, and potentially for providing travel time information. The signs are programmed and controlled locally. Future enhancements may include adding communications capabilities to allow signs to be remotely accessed and controlled by the Manhattan Traffic Operations Facility.	Existing
City of Manhattan Public Works	Manhattan RWIS Stations (Installed)	The City of Manhattan currently has one RWIS station located on K-18. An additional station has been purchased and is awaiting site selection and installation.	Existing (2017)
City of Manhattan Public Works	Manhattan RWIS Stations	Three additional RWIS monitoring stations on the North, East, and West arterials surrounding the city, as well as the wireless or fiber links for communications, are being considered.	Planned
City of Manhattan Public Works	Manhattan Street Division Office	Manhattan Street Division provides a wide variety of services essential to the public including repair and maintenance of city streets and alleyways, sweeping, brush and limb collection if necessary, and salting of city streets, as well as snow and ice removal during the winter months.	Existing
City of Manhattan Public Works	Manhattan Traffic Detection Equipment	The element represents the City of Manhattan's traffic detection equipment, including loop detectors and fixed camera video detection.	Existing
City of Manhattan Public Works	Manhattan Traffic Information Website	City of Manhattan's traffic information website providing current street closures, detours, snow and ice maintenance routes, and traffic camera images.	Existing
City of Manhattan Public Works	Manhattan Traffic Operations Facility	The Manhattan Traffic Operations Facility (MTOF) is the traffic operations center as well as the traffic maintenance facility for the City of Manhattan. It monitors and controls City owned CCTV cameras, traffic signals, and RWIS station(s).	Existing
City of Manhattan Public Works	Manhattan Traffic Signals	This element represents the City of Manhattan traffic signal system and other roadside equipment used for traffic control and management. The system include traffic signals, controllers, loop detectors, video detection, and other signal operation equipment used for the control and management of traffic at	Existing

Stakeholder	Element Name	Element Description	Element Status
		intersections. Emergency vehicle signal preemption capability exists at many intersections.	
FHATA	FHATA Dispatch Center	This element represents the FHATA Control/Dispatch Center. A new CAD/AVL system is being procured through KDOT to replace the current system in 2015. The new CAD system along with a new management system will enable real-time monitoring of bus trips to enhance performance.	Existing
FHATA	FHATA Real-Time Signs	Signs at transit stops providing real-time bus arrival/departure information. FHATA envisions installing such signs at key stops in the long term.	Planned
FHATA	FHATA Vehicles	This element represents transit vehicles operated by FHATA. A new AVL system is being procured through KDOT to replace the current system in 2015. New vehicle cameras will be installed in FY 2016. Tablets will be installed on board to provide real time monitoring of vehicles and trips and provide information to drivers.	Existing
Fort Riley	Fort Riley Emergency Management	Fort Riley Emergency Management Program synchronizes EM Plan with on & off post partners, runs Community Awareness Campaign (Ready Army), manages Army compliant Exercise Program, serves as interface to staff jurisdictional requests for Military Assistance (not Mutual Aid), and serves as interface for requests for Defense Support of Civil Authorities (DSCA).	Existing
Fort Riley	Fort Riley Emergency Services	This element represents the Fort Riley Directorate of Emergency Services. It provides continuous holistic emergency services to the Fort Riley military community in order to ensure the installation is safe and secure.	Existing
Fort Riley	Fort Riley Fire Department	Fort Riley Fire Department protects the lives, property, and environment of the Soldiers and citizens of the Fort Riley Community. The department responds to any natural and man-made disasters, provides emergency medical care, and reinforces education through prevention while being a proactive community partner in the Flint Hills Region.	Existing
Fort Riley	Fort Riley Police Department	This element represents the 97th Military Police Battalion. The 97th Military Police Battalion conducts continuous Law and Order operations in support of the Fort Riley military community. It deploys worldwide to conduct Military Police operations in support of the U.S. Army Forces Command.	Existing
Fort Riley	Fort Riley Public Works	The Fort Riley Public Works is comprised of 6 Divisions: Business Operations Division; Engineering Services Division; Environmental Division; RCI / Housing Services Office; Master Planning Division; and Operations & Maintenance Center.	Existing
Geary County Emergency Management	Geary County Emergency Operations Center	This element represents the Geary County Emergency Operations Center (EOC). The EOC is responsible for communications and coordination of local, regional and State resources during a disaster or large scale incident.	Existing

Stakeholder	Element Name	Element Description	Element Status
Geary County Public Works	Geary County Maintenance and Construction Vehicles	This element represents Geary County's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows. Vehicles have radio communications.	Existing
Geary County Public Works	Geary County Public Works	Geary County Public Works Department consists of six divisions: Road and Bridge, Traffic Control/Sign Shop, Rural Water District #2, Sewer District #4, Solid Waste Transfer Station, Building Maintenance, and Noxious Weed. The Road and Bridge Division provides roadway, bridge, ditch and culvert maintenance and installation; snow removal; roadside mowing; and maintenance of motorgraders, sandspreader/plow trucks and mowers. The Traffic Control/Sign Shop fabricates, installs and maintains all County roadside markers, street signs and traffic control signs.	Existing
Geary County Rural Fire Department	Geary County Emergency Vehicles	This element represents all emergency services vehicles in Geary County, including sheriff vehicles, fire trucks, and emergency management vehicles. Vehicles have radio communications, and some sheriff's vehicles have mobile data terminals (MDT). Vehicles utilize sound-based Emergency Vehicle Pre-emption through use of vehicle sirens.	Existing
Geary County Rural Fire Department	Geary County Rural Fire Department	Geary County Rural Fire Department handles calls throughout Geary County with the exception of the Southeast area of the County which is handled by the Alta Vista Rural Fire Department and the Dwight Fire District. The department operates 15 trucks out of 9 stations located throughout Geary County and relies on volunteers to operate the trucks.	Existing
Geary County Sheriff	Geary County Sheriff Department	Geary County Sheriff's Department includes four divisions: Corrections, Investigations, K-9 Unit, and Patrol. Patrol Division provides emergency law enforcement services, traffic enforcement, accident investigation, criminal investigation and reporting, crime prevention and detection, and response to other emergencies.	Existing
Kansas Division of Emergency Management	Kansas State Emergency Operations Center	The State Emergency Operations Center (SEOC) gathers, processes, and reports emergency situation intelligence to aid in State policy and decision making; support local communities as they direct and control disaster emergency response operations; and account for the State’s response support costs. In non-disaster conditions, the SEOC is maintained in an operational status that facilitates a timely response to rapidly evolving emergencies. The SEOC's ability to exchange critical disaster information is achieved through diverse and redundant communications technologies.	Existing

Stakeholder	Element Name	Element Description	Element Status
Kansas DOT	KDOT KanDrive Website and 511 Phone Traveler Information System	The KanDrive Website provides real time travel information including weather-related road conditions and construction/maintenance work zones and detours as well as camera snapshots and active messages on electronic signs. The information covers each of the six KDOT districts and the Kansas City, Topeka, and Wichita metropolitan areas. Road conditions, camera snapshots and sign messages for the Kansas Turnpike are also provided. Links to the Kansas AMBER Alert website and traveler information from surrounding states and other sources are also provided on the website. The 511 phone system provides road condition and construction/maintenance work zones and detours via a touch tone menu. The 511 phone system can be accessed by calling 511 or 1-866-511-KDOT (5368).	Existing
Kansas DOT	KDOT CCTV Cameras	This element represents the CCTV cameras in the Flint Hills Region. Currently there are six cameras: - One camera on I-70 at Junction City Exit 299 (a PTZ camera) - One camera on I-70 at Junction City MP 298 (a static camera mounted on an RWIS station) - One camera on I-70 at Junction City Exit 301 (a PTZ camera) - One camera on I-70 at exit 313 (K-177 in Geary County, a PTZ camera) - One camera on I-70 at exit 315 (Deep Creek in Geary County, a PTZ camera) - One camera on I-70 at MP 302 viewing only the WB DMS at MP 302 (a static camera) KDOT is also in the process of adding cameras at the following locations: - One camera at the RWIS site on Kansas River Viaduct on K-18 (K-177) in Manhattan - One camera on I-70 at exit 328 (K-99) in Wabaunsee County	Existing
Kansas DOT	KDOT District 1 Office	KDOT District 1 is responsible for construction and maintenance activities for 17 counties in Northeast Kansas, including Riley and Pottawatomie Counties. These responsibilities include providing snow and ice removal on state highways that are housed in this district. KDOT District 1 Office is located in Topeka.	Existing
Kansas DOT	KDOT District 2 Office	KDOT District 2 is responsible for construction and maintenance activities for 16 counties in North Central Kansas, including Geary County. These responsibilities include providing snow and ice removal on state highways that are housed in this district. KDOT District 2 Office is located in Salina.	Existing
Kansas DOT	KDOT Dynamic Message Signs	The element represents both permanent and portable dynamic message signs owned and operated by KDOT.	Existing

Stakeholder	Element Name	Element Description	Element Status
		KDOT has three dynamic message signs along I-70 in the region. The locations of the signs are: - I-70 WB at Milford Lake Rd MP 291 - I-70 EB at Junction City MP 302 - I-70 WB at Junction City MP 301 - I-70 WB at exit 315 (Deep Creek)	
Kansas DOT	KDOT KanRoad	KanRoad is internet-based software that allows multiple users, primarily KDOT and KTA personnel, to enter information about construction work zones, maintenance work zones, detours, weather-related road conditions and other hazards into a reporting system. Data gathered by the KanRoad is then provided to the KDOT Internet website (KanDrive.org) and the 511 phone system for public use.	Existing
Kansas DOT	KDOT Maintenance and Construction Vehicles	This element represents KDOT's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows.	Existing
Kansas DOT	KDOT RWIS Central Server	Weather-related information is transmitted by a combination of land lines, cell phones, radios and Local Area- or Wide-Area-Networks (LAN/WAN) from weather stations to KDOT RWIS Central Server located in Topeka. The information is presented both on an Intranet-based Website for KDOT use as well as a KDOT Internet site for the public.	Existing
Kansas DOT	KDOT RWIS Stations	This element represents KDOT owned Road Weather Information System (RWIS) stations in the Flint Hills Region. Currently there are two KDOT RWIS stations in the region, one in Manhattan and another in Junction City. KDOT owns and operates 43 RWIS stations located throughout the state. The KDOT RWIS also leverages other Kansas RWIS assets by integrating information from 10 additional weather stations owned by the Kansas Turnpike Authority (KTA). It uses sensors both mounted in the road surface as well as mounted away from the road to determine pavement temperature, subsurface temperature, ambient air temperature, wind speed, wind direction, pavement wet/dry, precipitation, and relative humidity.	Existing
Kansas DOT	KDOT Statewide TOC	KDOT Statewide TOC is a virtual TOC with a PC-based software application that communicates with a central server in Topeka to allow for the control of electronic signs and cameras and has reporting capabilities based on gathered data. The Statewide TOC allows for immediate and real-time transportation system operation from both the local level at KDOT District and Area offices and a statewide level in Topeka headquarters or Kansas City Scout to notify travelers of incidents and construction activities through messages on electronic signs. Users can have access to the	Existing

Stakeholder	Element Name	Element Description	Element Status
		application through any KDOT networked computer with the appropriate software capability.	
Kansas Highway Patrol	KHP Communications Center	This element represents the Statewide center for KHP communications for Highway Patrol operations. This statewide central call taking and dispatching center receives incident/emergency calls from travelers who dial *47 (HP) or the listed KHP telephone number. The center also receives calls related to state highway incidents and emergencies which are transferred by county 911 centers. The center dispatches a full range of emergency medical, towing and other incident response personnel. The KHP Communications Center is located in Salina.	Existing
Kansas Highway Patrol	KHP Troop C	KHP Troop C consists of 18 counties in north central-Kansas. Its headquarters share the former Marymount College campus in Salina with the Training Academy (Troop J), and some of its members assist with training. Troop C's pilots and aircraft often assist with surveillance, searches, traffic enforcement, and transportation.	Existing
Kansas Highway Patrol	KHP Troop C Vehicles	This element represents Kansas Highway Patrol Troop C vehicles.	Existing
Kansas Homeland Security	Kansas Homeland Security	Kansas Homeland Security, within the Adjutant General's Department, coordinates statewide activities pertaining to the prevention of and protection from terrorist-related events. This involves all aspects of prevention/mitigation, protection/preparedness, response and recovery.	Existing
Kansas State University	K-State Athletics Department	K-State Athletics Department represents the key special event sponsor who schedules and manages major events on K-State campus that may impact travel on roadways and transit.	Existing
Kansas State University	K-State Parking Services	K-State Parking Services provide parking information and services to University students, faculty, staff and visitors. It also manages the University parking facilities.	Planned
Kansas State University	K-State Police Department	K-State Police Department is the law enforcement agency responsible for safety and security of the Kansas State University campus.	Existing
Kansas State University	K-State Traffic Operations Lab	K-State Department of Civil Engineering plans to establish a Traffic Operations Lab on campus to study traffic operations within the region.	Planned
Media	Media Outlets	This element represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media. Traffic and travel advisory information collected by ITS is provided to this element. It is also a source for traffic flow information, incident and special event information, and other events which may have implications for the transportation system.	Existing

Stakeholder	Element Name	Element Description	Element Status
Neighboring Cities and Counties	Neighboring 911 Centers	This element represents public safety answering points in neighboring cities and counties.	Existing
Neighboring Cities and Counties	Neighboring County Emergency Operations Centers	This element represents the emergency operations centers (EOCs) in neighboring counties.	Existing
NOAA	National Weather Service	The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life.	Existing
Pottawatomie County	Pottawatomie County Emergency Vehicles	This element represents public safety (sheriff, fire, EMS) vehicles in Pottawatomie County.	Existing
Pottawatomie County Emergency Management	Pottawatomie County Emergency Operations Center	This element represents the Pottawatomie County Emergency Operations Center (EOC). The EOC is responsible for communications and coordination of local, regional and State resources during a disaster or large scale incident.	Existing
Pottawatomie County Public Works	Pottawatomie County Maintenance and Construction Vehicles	This element represents Pottawatomie County's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows. Most vehicles have radio communications and 55 vehicles utilize InTouch Automated Vehicle Location (AVL) equipment to allow for central monitoring of vehicle locations.	Existing
Pottawatomie County Public Works	Pottawatomie County Public Works	Pottawatomie County Public Works Department is comprised of five divisions: Road and Bridge, Environmental Health, Solid Waste, Utilities, and Facilities. The Road & Bridge Division is responsible for maintenance of roads, bridges and drainage structures, and snow removal. Most vehicles have radio communications and automated vehicle location (AVL).	Existing
Pottawatomie County Sheriff	Pottawatomie County Sheriff Office / 911 Center	Pottawatomie County Sheriff's Department includes five divisions: Communications, Detention, Investigations, Patrol, and Special Programs. The Communications Division is responsible for relaying information between the public and the Sheriff's Office. It includes the Dispatch Center. The Patrol Division conducts preventive patrols, responds to calls for service, investigates criminal complaints, directs and controls traffic, and maintains public order.	Existing
Riley County	Riley County Emergency Vehicles	This element represents police vehicles, fire trucks and EMS vehicles in Riley County. Vehicles utilize various VHF and cross band repeater systems to communicate with other EM responders. All Riley County police vehicles use VHF radios and about half of the vehicles have a Mobile Data Terminal (MDT) that is also equipped with an AVL feature.	Existing

Stakeholder	Element Name	Element Description	Element Status
Riley County Emergency Management	Riley County Emergency Operations Center	This element represents the Riley County Emergency Operations Center (EOC). The EOC is responsible for communications and coordination of local, regional and State resources during a disaster or large scale incident.	Existing
Riley County Emergency Management	Riley County Mobile Emergency Command Post	Used for on scene command and control of emergency responders. It has multi band radio capability and satellite broadband.	Existing
Riley County Fire Department	Riley County Fire Department	Riley County Fire Department (District #1) provides fire services to all unincorporated areas of Riley County and provides first responder level medical services in cooperation with Riley County EMS.	Existing
Riley County Police Department	Riley County 911 Center	Riley County 911 Center is the public safety answering point for both Riley County and City of Manhattan. The center is responsible for emergency response and emergency vehicle dispatch.	Existing
Riley County Public Works	Riley County Maintenance and Construction Vehicles	This element represents Riley County's vehicles and equipment for roadway maintenance and construction purposes, including heavy equipment, trucks, supervisory vehicles, and snow plows. Vehicles utilize various VHF and cross band repeater systems to communicate with others.	Existing
Riley County Public Works	Riley County Public Works	Riley County Public Works Department consists of six divisions: Engineering & Construction, Operations, Fleet, Solid Waste, Facilities, and Utilities. Major functions include: construction and maintenance of roadway infrastructure, installation and maintenance of traffic signs, traffic studies, maintenance of county vehicles and equipment, and facilities repairs and maintenance.	Existing
Travelers	Pedestrians	This terminator provides input (e.g. a request for right of way at an intersection) from a specialized form of the Traveler who is not using any type of vehicle (including bicycles) as a form of transport. Pedestrians may comprise those on foot and those in wheelchairs.	Planned
Travelers	Drivers	This terminator represents the human entity that operates a licensed vehicle on the roadway. Included are operators of private, Transit, Commercial, and Emergency vehicles where the data being sent or received is not particular to the type of vehicle. Thus this terminator originates driver requests and receives driver information that reflects the interactions which might be useful to all drivers, regardless of vehicle classification. The Driver terminator is the operator of the Basic Vehicle terminator. Information and interactions which are unique to drivers of a specific vehicle type (e.g., fleet interactions with transit, commercial, or emergency vehicle drivers) are covered separately.	Existing
Travelers	Personal Computing Devices	This element represents devices that have the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, over multiple types of	Existing

Stakeholder	Element Name	Element Description	Element Status
		electronic media. This includes computers, smartphones, tablets, etc.	
Travelers	Travelers	This element represents travelers using various modes of transportation in the region.	Existing

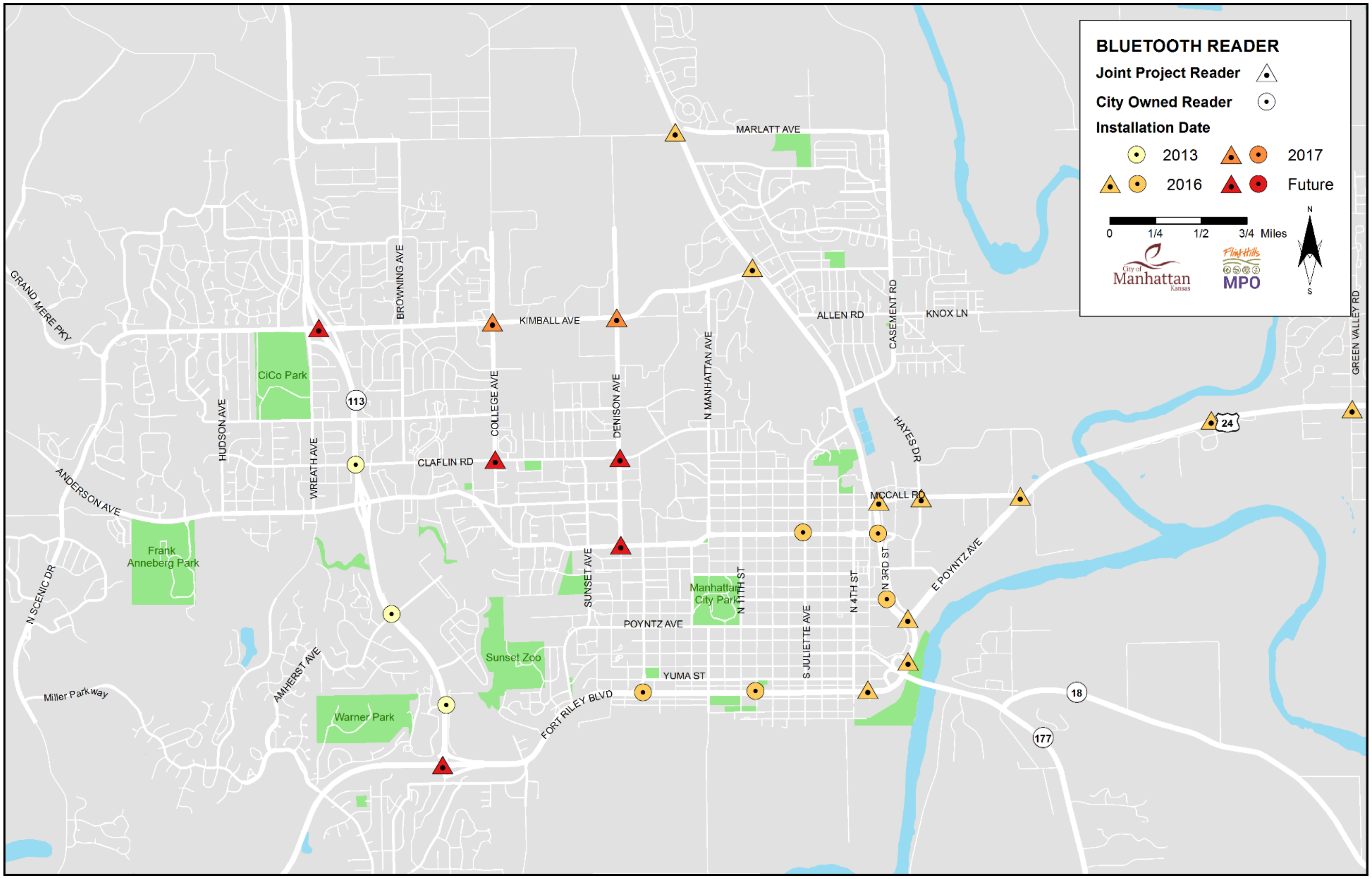
Communications that support ITS in the region includes both wireline and wireless communications. The City of Manhattan uses a variety of communications media for ITS, including wide area network (WAN) wireless, fiber optic, local area network (LAN), and leased communications.

KDOT has a statewide fiber optic network for the ITS communications backbone. The network extends fiber and conduit along I-70, from Kansas City to the Colorado state line, then runs south from Salina to Wichita, and then on to the Oklahoma state line.

KDOT 800 MHz radio system serves KDOT, KHP and various emergency responders (including ambulances) communicate while they are on emergency runs. The system facilitates the statewide interoperable public safety radio system. The system also has a portable tower loaded on a semi-trailer (called a Communication on Wheels – COW) that can be moved to assist in providing communications capabilities to emergency crews during large emergencies.

The City of Manhattan is one of the major ITS stakeholders and has significant ITS assets and capabilities in the region. In addition to traffic signal control, the Manhattan Traffic Operations Facility (MTOF) serves as the traffic operations center, as well as the traffic maintenance facility, for the City. The MTOF monitors and controls City owned CCTV cameras, traffic signals, Bluetooth receivers, and RWIS station(s); and utilizes various communications media systems to communicate with field devices.

Figure 6: Map of Bluetooth Reader



4.2 Service Packages

The service packages of an ITS Architecture define a "service-oriented" perspective of how an architecture can be structured. Service packages are a convenient way to assemble ITS components to address frequently needed services without having to itemize the components. This can be compared to buying a car. In one purchase you acquire a complex set of systems such as engine, drive train, suspension, cargo handling, etc.) In the same way, service packages present how the ITS elements (and their assigned subsystems and terminators) work together to deliver a given ITS service, as well as the flow of information that connect those ITS elements with other important external systems. They are tailored to fit real world transportation problems and needs. Service packages enable transportation planners and decision makers to select appropriate ITS services that satisfy local and statewide needs.

All 97 service packages in the National ITS Architecture (Version 7.1) were considered for their applicability to the Flint Hills Region. Table 2 below summarizes the status of ITS deployment with respect to service packages in the region. A detailed list of applicable service packages, as well as associated ITS elements, are presented in Section 5 of the Turbo Architecture Report. They can also be found on the Architecture website (http://flinthillsits.com).

Table 2: Service Packages for the Flint Hills Region

Service Package	Service Package Name	Status
APTS01	Transit Vehicle Tracking	Existing
APTS02	Transit Fixed-Route Operations	Existing
APTS03	Demand Response Transit Operations	Existing
APTS05	Transit Security	Planned
APTS06	Transit Fleet Management	Planned
APTS08	Transit Traveler Information	Planned
ATIS01	Broadcast Traveler Information	Existing
ATMS01	Network Surveillance	Existing
ATMS02	Traffic Probe Surveillance	Existing
ATMS03	Traffic Signal Control	Existing
ATMS06	Traffic Information Dissemination	Existing
ATMS07	Regional Traffic Management	Planned
ATMS08	Traffic Incident Management System	Existing
ATMS16	Parking Facility Management	Planned
ATMS26	Mixed Use Warning Systems	Planned
EM01	Emergency Call-Taking and Dispatch	Existing
EM02	Emergency Routing	Existing
EM06	Wide-Area Alert	Existing
EM08	Disaster Response and Recovery	Existing
EM09	Evacuation and Reentry Management	Existing
EM10	Disaster Traveler Information	Existing
MC01	Maintenance and Construction Vehicle and Equipment Tracking	Existing
MC03	Road Weather Data Collection	Existing
MC04	Weather Information Processing and Distribution	Existing
MC06	Winter Maintenance	Existing

Service Package	Service Package Name	Status
MC07	Roadway Maintenance and Construction	Existing
MC08	Work Zone Management	Planned

4.3 Stakeholders' Operational Roles and Responsibilities

An operational concept defines each stakeholder's current and future roles and responsibilities for operating the region's ITS systems. Defining the roles and responsibilities of the participating stakeholders is an important step in realizing the common goal of an interoperable ITS system throughout the region.

Stakeholders' operational roles and responsibilities are detailed on the Flint Hills Regional ITS Architecture Website, as well as in the Turbo Architecture Database and in Section 6 of the Turbo Architecture Report. These roles and responsibilities have been defined based on the operations of current systems and inputs from the stakeholders (for both current and future systems). Together, these roles and responsibilities define the operational concept for the ITS Architecture, and provide an overview how ITS services operate within the region.

4.4 Functional Requirements

A "functional requirement" is a task or activity that is currently performed or is planned to be performed by each system in the region to provide the required regional ITS services. The National ITS Architecture has pre-defined all possible functional areas (i.e. equipment packages). The regional architectures are created by asking the stakeholders to select those that apply from this master list of functional requirements.

The process to develop the functional requirements for the Flint Hills Regional ITS Architecture began with the mapping of functional areas (equipment packages) to service packages and associated ITS elements. The functional requirements of each equipment package were then tailored to represent the specific local agency functions performed. Turbo Architecture is then used to produce lists and graphics that can be easily interpreted by the end users.

Functional requirements of all ITS inventory elements in the Flint Hills Region are contained in Section 7 of the Turbo Architecture Report. They can be found on the Regional ITS Architecture Website and the Turbo Architecture Database.

4.5 Interfaces

While it is important to identify the various ITS systems and stakeholders as part of the Architecture, a primary purpose of the Flint Hills Regional ITS Architecture is to identify the connectivity between systems. The two ways to describe this connectivity are:

- **Architecture Interconnects** define the connections between equipment and systems which may be deployed by the agencies throughout the region. In other words, it defines which entities interact with each other.

- **Architecture (Information) Flows** define a high level information exchange associated with each interconnect between equipment and systems. In other words, what information is passed along the interconnect paths.

An example of an interconnect diagram is illustrated in Figure 7.

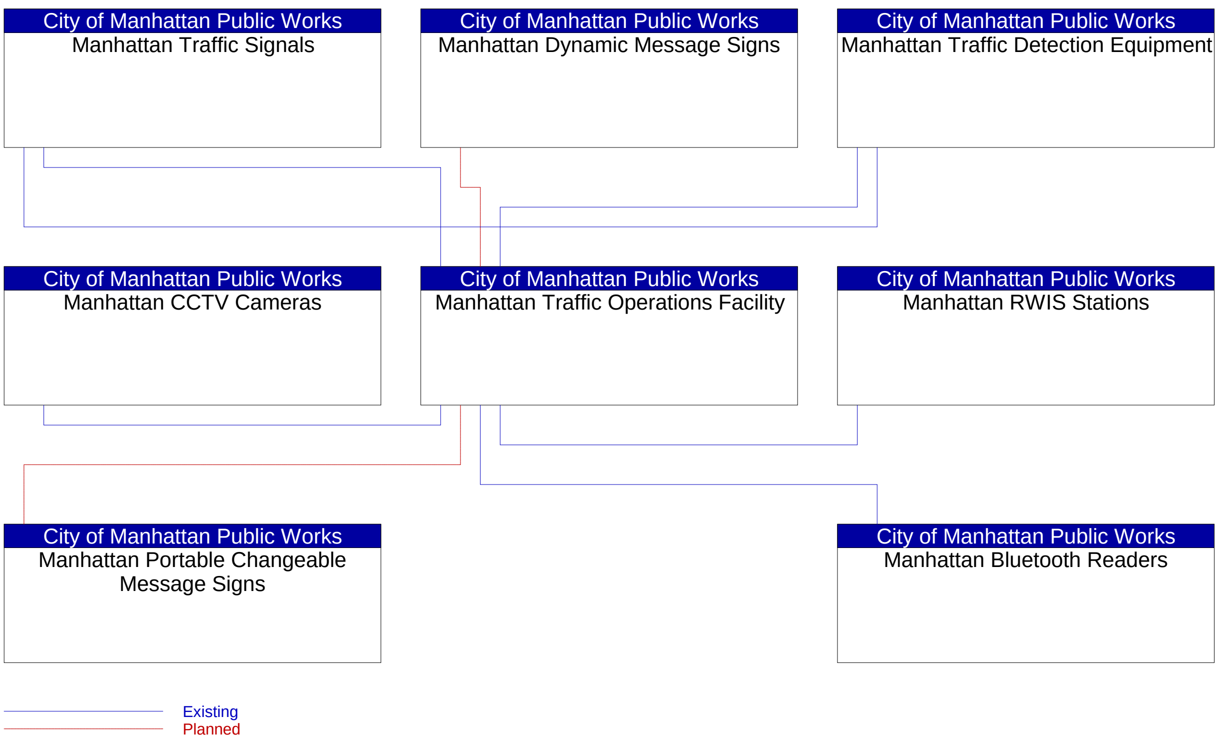


Figure 7: Interconnect Diagram Example: MTOF and Selected Field Devices

Figure 8 illustrates the architecture flow diagram between the MTOF and selected field devices (traffic signals and CCTV cameras) owned by the City of Manhattan. Architecture (information) flows provide a high-level description of information exchanges associated with each interconnect path between equipment and systems. From these diagrams the stakeholders can easily identify the existing or potential information exchange between agencies and systems. This provides a framework for analyzing how elements are related and thus identifies the areas for potential coordination and cooperation among agencies. Quite often, from these diagrams agencies can identify missing communication flows that should occur, leading to refinements during the lifecycle of the system.

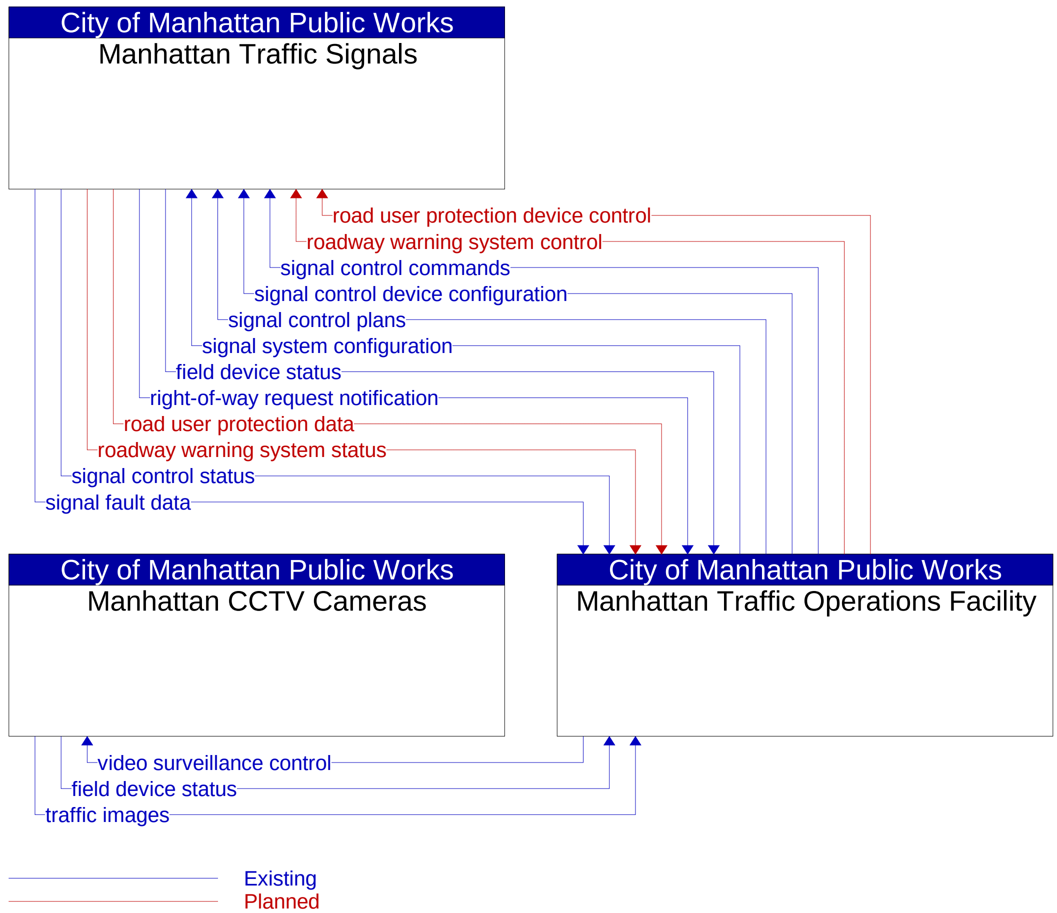


Figure 8: Architecture Flow Diagram: MTOF, Traffic Signals and CCTV Cameras

The National ITS Architecture provides guidance in identifying potential information to be exchanged between commonly used ITS elements in the inventory, and the Turbo software is used to generate the architecture flow diagrams between ITS elements in the inventory.

A detailed listing of the interconnects and architecture flows of all ITS inventory elements is contained in the Turbo Architecture Report, the Turbo Architecture Database, and the ITS Architecture website.

4.6 Standards

Identification of ITS technical standards that support interfaces in the regional ITS architecture are often not understood by stakeholders, so the National ITS Architecture was created to provide stakeholders with easy access to appropriate ITS standards that can be specifically applied to an ITS project. It is important that stakeholders are aware of the importance of ITS standards, especially with respect to cost, risk, and interoperability issues both within the region and when connecting with other regions. These standards can save money in the long run and ensure that various devices and systems are compatible and interoperable.

While the Flint Hills Regional ITS Architecture includes various ITS applications, it does not cover every conceivable ITS technology. As such, not all ITS standards will be applicable to the existing ITS component and future deployment. Fifty (50) ITS standards were identified as standards supporting current and future ITS applications in the region. A list of ITS Standards applicable to the Flint Hills Region is contained in Section 9 of the Turbo Architecture Report, the Turbo Architecture Database, and the website.

5.0 Recommended ITS Projects and Implementation Sequencing

The ITS projects included in the Flint Hills Regional ITS Architecture were identified primarily based on stakeholder input. A project sequence defines the order in which ITS projects may be implemented. A good sequence is based on a combination of two factors:

- **Prioritization of projects based on existing conditions and stakeholder needs**: The ITS projects were prioritized to reflect a deployment path (sequence). Although the information collected through stakeholder surveys and meetings was the basis of the ITS Architecture, real-world conditions of changing technology and funding opportunities continue to evolve. Projects are reevaluated and reprioritized annually to maintain an updated list of priorities.

- **Prioritization of projects dependent upon prior projects being completed:** For example, a fiber optic network would need to be in place before a set of detectors are constructed to provide a means to communicate with the detection system. These project dependencies influence the project sequencing. It is important to identify these dependencies between projects during the planning stages.

The project timeframes provide a means to position each project along the architectures lifetime. This enables the scheduling of funds and resources to deliver the projects in an appropriate sequence. Three timeframe categories are used and their definitions are described below:

Table 3: Project Implementation Timeframes

Category	Time Frame	Year of Deployment
Short Term	0 – 3 years	2017 – 2019
Medium Term	4 – 6 years	2020 – 2022
Long Term	7 years and beyond	2023 and beyond

The Flint Hills Regional ITS Architecture represents a roadmap for transportation systems deployment and integration in the region over the next 10 years (from 2015 to 2025). ITS projects that are currently planned, as well as projects that have been identified by stakeholders for consideration over the next 10 years, are listed in Table 4. A project "status" is also provided for each item, and are reviewed with each annual update.

Table 4: Project Status Descriptions

Status	Description
Completed	Project implemented. Competition date in parentheses.
Active	Project is being implemented or steps are being taken to implement the project.
Planned	Project is included in budget (or CIP) or is likely to be implemented in the near-term.
Identified as Need	No funding has been identified, nor has the project undergone significant planning for implementation.

Table 5: Future ITS Projects

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
1-15	FHATA Computer-Aided Dispatch / Automatic Vehicle Location System	A new transit CAD/AVL system will be procured through KDOT to replace the current system. The AVL/GPS will be in the form of on-board tablets that will provide real-time monitoring of vehicles and trips. The tablets can also function as mobile data terminals (MDTs) to provide bus operators information such as route information, schedule and adherence, alerts on incidents and detours, etc.	Short Term (2016)	FHATA		Completed (2016)	April 2017
2-15	FHATA On-Board Security Cameras	This project will procure new security cameras that will be installed on FHATA transit vehicles to improve safety and security of transit riders and operators. Camera images can be accessed in real-time provided that communications is established between the vehicles and the dispatch center; or camera recordings can be accessed at the end of the vehicle shift at the transit garage.	Short Term (2017)	FHATA		In-Progress (Estimated Completion 2017)	April 2017
3-15	Real-Time Transit Information on Mobile Apps	The project will develop a mobile app for smartphone/tablets to provide near real-time bus location information based on the data from AVL equipment on FHATA buses.	Short Term (2017)	FHATA		In-Progress (Estimated Completion 2017)	April 2017
4-15	FHATA Electronic Vehicle Inspection Report	This project will procure Zonar Electronic Vehicle Inspection Report (EVIR) to provide FHATA the capability of performing pre- and post-trip bus inspections.	Short Term (2018)	FHATA		Planned	April 2017

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
5-15	Road Weather Information System Stations	This project will install additional road weather information system (RWIS) stations in the City of Manhattan. The City of Manhattan currently has one RWIS station located on K-18. The project will install three additional RWIS monitoring stations on the North, East and West arterials surrounding the city, as well as the wireless or fiber links for communications.	Short Term (2017-2019)	Manhattan Public Works		In-Progress. (Estimated Completion 2019) See Figure 10.	April 2017
6-15	North Tuttle Creek Boulevard (US-24) Coordination Project	This project will allow connections to 6 additional traffic signals along US-24 from East Poyntz North to Kimball Avenue. This project will also install 2 to 3 additional PTZ cameras. In addition, this project will install a fiber optic network for parts or all of the project area, or a hybrid fiber and wireless bridging link for other parts of the project.	Short Term (2015-2018)	Manhattan Public Works		In-Progress. Two intersections remaining to bring online.	April 2017
7-15	Kimball Avenue Coordination Project	This project will encompass bringing online 5 intersections along the Kimball Avenue corridor, as well as 4 additional PTZ cameras. This project will require the installation of fiber optic cable throughout the corridor. This corridor receives all K-State athletic event traffic to and from the stadiums, as well as traffic that will be generated during and after the completion of the National Bio and Agro-Defense Facility (NBAF).	Short Term (2015-2018)	Manhattan Public Works	Kansas State University, K-State Foundation, K-State Athletics, Kansas Homeland Security	In-Progress. One Intersection remaining to bring online	April 2017

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
8-15	Junction City Traffic Signal Interconnects and Upgrades	Junction City currently has one corridor that has signals interconnected; however the communications has been broken. The initial focus of this project will be repair, replacement and/or upgrade of the existing interconnects to enable corridor based signal coordination. Additional signal interconnects desired will be identified. This project will also include upgrades of controllers, hardware, etc. to improve signal connectivity and operational efficiency.	Short to Medium Term (2017-2021)	Junction City Public Works		In-Progress, 6th & Washington and 6th & Franklin Intersections are connected.	April 2017
9-15	Junction City Traffic Signal Timing Optimization	Develop/update and implement signal timing plans along key corridors and/or at key intersections to facilitate more efficient movement of traffic, particularly during peak hours.	Short to Medium Term (2016-2021)	Junction City Public Works		Identified as Need	February 2016
10-15	Manhattan/K-State Fiber Optic Sharing	Kansas State University has a fiber optic network that in many places is within City-owned right-of-way. An agreement has been formulated allowing some dark K-State fiber to be utilized by the City to increase it ITS network footprint. This will allow the Manhattan Traffic Operations Facility connections to some intersections that are currently isolated from its network because of topographic or line of sight issues. This project allows the City to gain access to additional intersections and allows K-State Police and Athletics access to the City's traffic management system. Riley County will also connect their 911 PSAP to the K-State 911 PSAP via a point-to-point microwave link with this K-State fiber. A connection will also be made to the fire station at 2000 Denison Avenue for use of the facility during and after emergencies.	Short to Medium Term (2015-2021)	Manhattan Public Works and Kansas State University	Riley County	In-Progress. Locations and facilities are identified.	April 2017

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
11-15	Regional ITS Expansion	This project represents general ITS installation and expansion projects in the Flint Hills Region that are not specifically listed (that is, specific locations and/or corridors to be determined in the future). The project scopes may include, but not be limited to, installation of additional CCTV cameras, DMS (permanent and portable), vehicle count/speed detection stations, RWIS stations, and communications.	Short to Long Term (2017-2025)	All regional stakeholders		Planned. See Figure 9 and Figure 10	February 2016
12-15	Expansion of Bluetooth Travel Time Data Collection Equipment	Continued installation of Bluetooth readers as identified in Figure 6. Additional corridors for Bluetooth reader installation will be identified in the future.	Short to Long Term (2017-2025)	Manhattan Public Works	FHMPO, Pottawatomie County	See Map in Figure 6	April 2017
13-15	Parking Management System	Install an advanced parking management system on and around the Kansas State University Campus. The system will include parking count sensors, dynamic message signs (DMS), and a software package that can determine the availability of parking spaces at parking lots/ramps and display this information on the DMS near the ramp entrances. This information can also be disseminated via internet webpages. This parking management system will be used for everyday parking as well as special events (such as game days).	Medium Term (2019-2021)	Kansas State University	Manhattan Public Works	Identified as Need	February 2016
14-15	Bicycle Detection System	Install a bicycle detection system at signalized intersections to improve safety and reduce bicycle-vehicle collisions.	Medium Term (2019-2021)	Manhattan Public Works	Kansas State University	Planned	Feb 2016

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
15-15	Emergency Vehicle Preemption	Junction City current uses a sound-based emergency vehicle preemption (EVP) system. This project will replace the sound-based system with a light-based EVP system. EVP equipment will be installed at Junction City traffic signals that receives request from emergency vehicles approaching the intersections for signal preemption and provides a green light for the approaching phase of the emergency vehicle. Corresponding equipment will be installed on emergency vehicles (police vehicles, fire trucks, ambulances, etc.) to enable the preemption of the signal timing.	Medium Term (2019-2021)	Junction City Public Works	Junction City Fire, Police, EMS		Feb 2016
16-15	Fiber Communications Expansion	Expand and build redundancy into Manhattan Public Works Department's fiber network to improve communications between the Manhattan Traffic Operations Facility (MTOF) and its traffic signals and ITS devices. The fiber network expansion will allow the MTOF to connect to additional traffic signals and ITS devices as well provide media and bandwidth to share CCTV camera images to 911 centers in the region. This fiber expansion project is also essential to provide the necessary communications backbone to facilitate the implementation of the regional traffic operations center concept that will connect Junction City with the MTOF for regional traffic management and operations (see Project #20-15). In addition, it is desired to have fiber connections to all fire stations and radio communications towers in Riley County to enhance communications for emergency services.	Medium to Long Term (2019-2025)	Manhattan Public Works	Junction City Public Works, Kansas State University, Manhattan Fire Department	Identified Need. See Figure 10 and Figure 11	Feb 2016

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
17-15	Manhattan Traffic Information Website Enhancement	This project will enhance the current City of Manhattan Traffic Information Webpage. The current webpage provides street closures, detours, snow and ice maintenance routes, and traffic camera images. This project will enhance the webpage design as well as provide information on transit services, parking, incidents, and game-day traffic information. Upon implementation of the regional traffic operations center, a longer term enhancement may include evolving the website to a regional traffic information website for the Manhattan-Junction City area.	Medium to Long Term (2019-2025)	Manhattan Public Works	FHMPO, FHATA, Kansas State University, Junction City Public Works, Fort Riley, KDOT	Planned	February 2016
1-17	Riley County-wide Radio Project	Upgrade of existing radio technologies to an 800 mhz system which will vastly improve county-wide radio communications for Riley County Police Department, Emergency Management, Riley County Fire Department, and Manhattan Fire Department.	Short Term (2019)	Riley County	RCPD, MFD, RCFD, and Riley County Emergency Management	In-Progress	April 2017
2-17	Riley County Emergency Operations Center	Stand-alone communications center (dispatch) to Riley County that incorporates a new Emergency Operations Center (EOC) and provides access to the City of Manhattan traffic cameras.	Medium to Long Term (2020-2025)	Emergency Services Directors	RCPD, MFD	Identified as Need	April 2017
3-17	N. Manhattan Fiber	Installation of fiber along N. Manhattan Ave. from Anderson Ave. to Kimball Ave.	Short Term (2019)	Manhattan Public Works	Kansas State University	Planned	April 2017

#	Project Title	Description	Timeframe	Lead Agency	Participating Agencies	Status	Last Update
18-15	Traffic Camera Video Sharing with 911 Centers	The project will facilitate the sharing of live Manhattan Traffic Operations Facility CCTV camera feeds with 911 centers in the region for the purpose of increased information sharing and situation awareness for transportation, incident and emergency management (helpful on game days, flood events, incident management).	Medium to Long Term (2019-2025)	Manhattan Public Works	Riley County 911, Geary County/Junction City 911, K-State Athletics, K-State Police, KHP, Fort Riley	Identified as Need	February 2016
19-15	Real-Time Transit Information at Transit Stops	This project will install information displays/signs at key transit stops. The information displays/signs will display transit arrival/departure information that is estimated based on information from AVL equipment on FHATA buses.	Long Term (2023 and beyond)	FHATA		Identified as Need	February 2016
20-15	Regional Traffic Operations Coordination	This project will implement a regional traffic operations center to facilitate traffic management and operations at a regional level. The Manhattan Traffic Operations Facility (MTOF) will become a regional traffic operations center (TOC) that can centrally monitor and control traffic signals in Manhattan and Junction City. The regional TOC will also be capable of controlling and monitoring other ITS devices such as CCTV cameras, DMS, RWIS stations in the region.	Long Term (2023 and beyond)	Manhattan Public Works	Junction City Public Works, FHMPO, Fort Riley, K-State	Identified as Need	February 2016
21-15	Kansas Highway Patrol AVL System	This project represents the installation of AVL equipment within Kansas Highway Patrol vehicles for dispatch and monitoring of KHP vehicles.	Long Term (2023 and beyond)	Kansas Highway Patrol		Identified as Need	February 2016

Figure 9: Map of Weather Stations and Fixed and PTZ Cameras

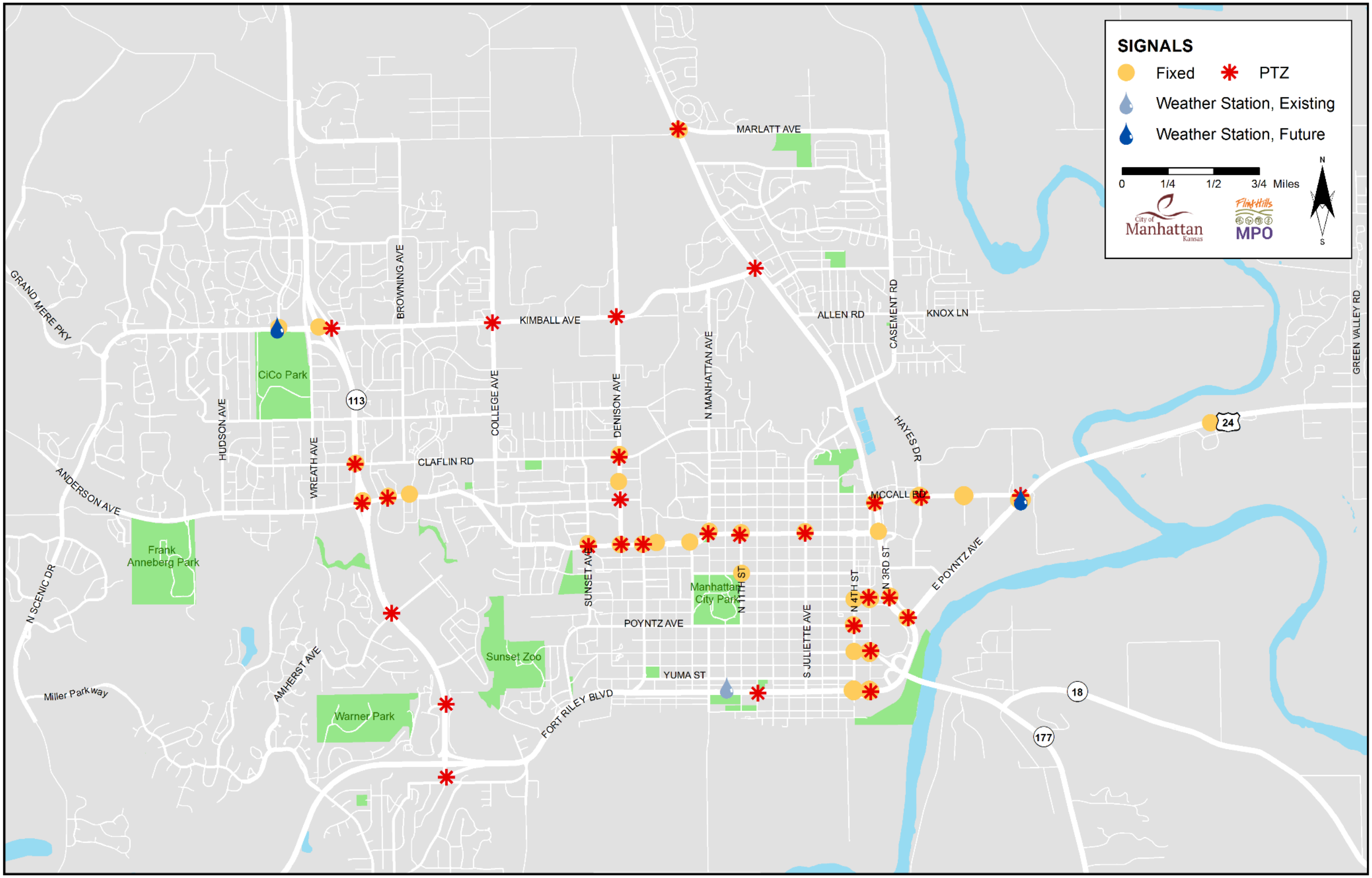


Figure 10: Wide Area Network (WAN) Network Map

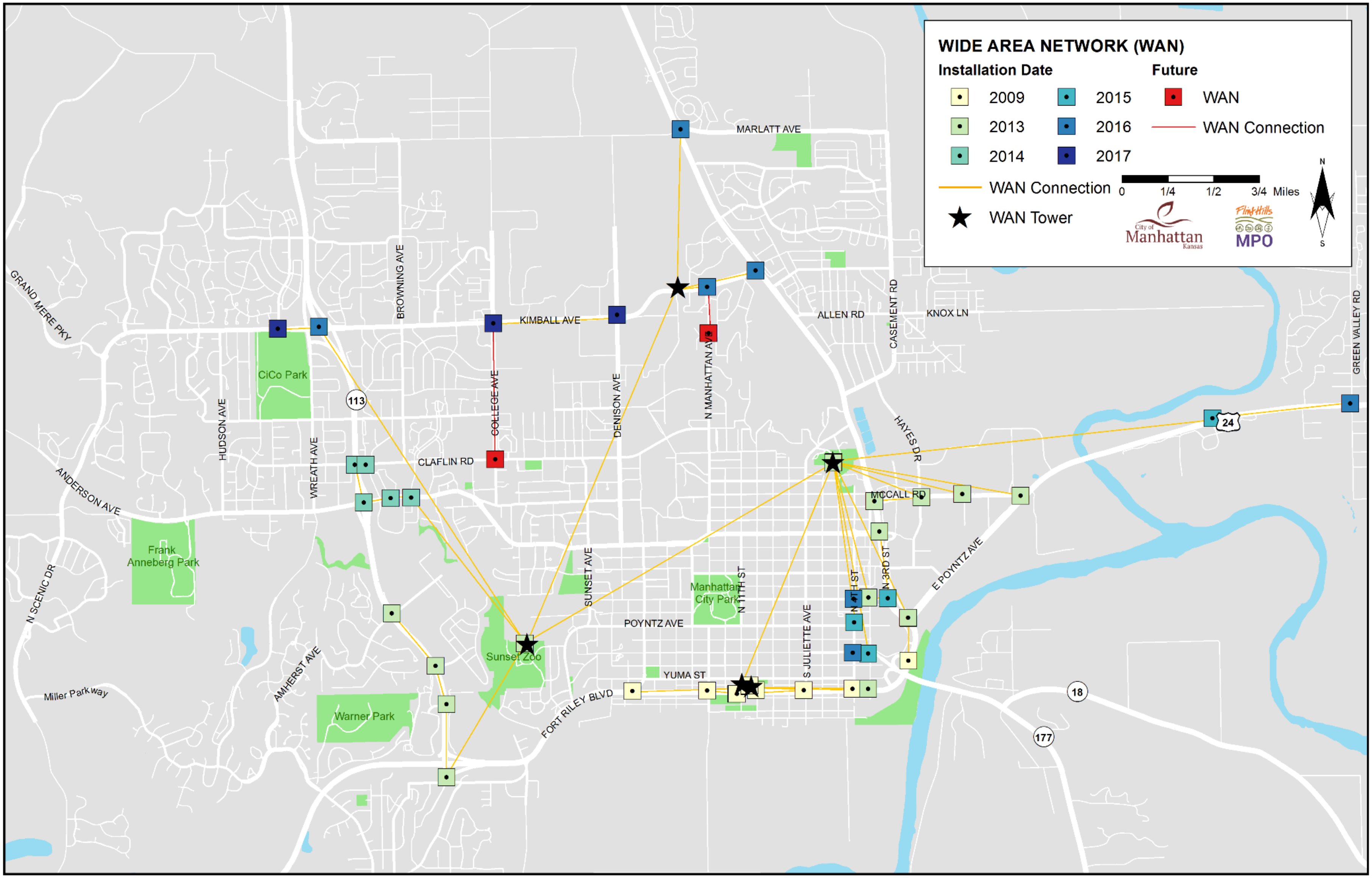
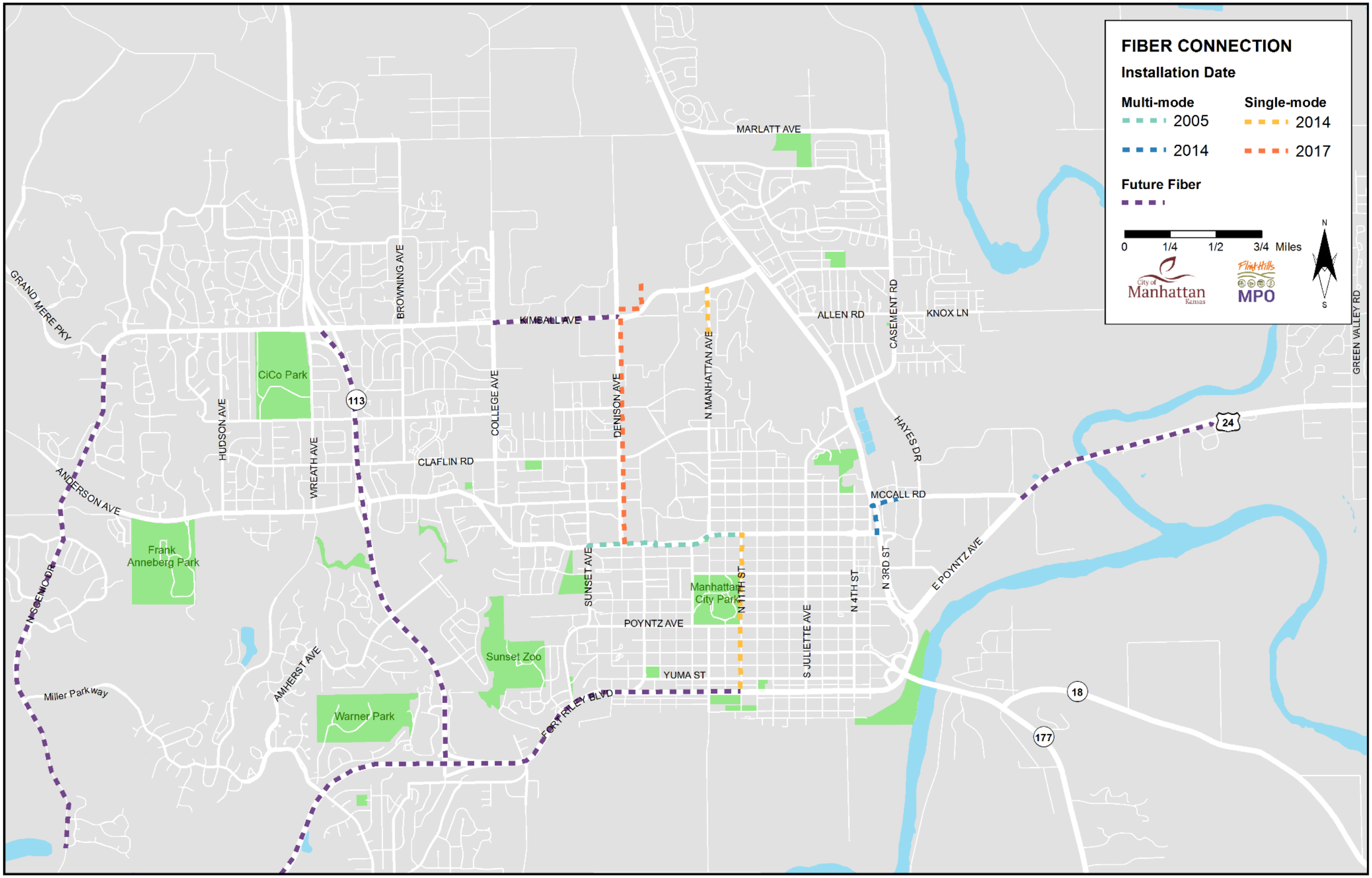


Figure 11: Fiber Connections Map



6.0 Use of the Architecture

6.1 Project Planning

The FHMPO will be responsible for housing and maintaining the ITS Architecture. Being responsible for the architecture requires the FHMPO to be able to deliver a subset of the regional ITS architecture that relates to specific projects. In other words, they must be able to produce a project architecture when a local agency is pursuing an ITS project. Typically a project architecture can be extracted from the Regional ITS Architecture if the project was included in the Regional ITS Architecture. For a project that is not included in the Regional ITS Architecture, a project architecture will need to be developed and incorporated into the Regional ITS Architecture. The owner agency of the project should follow the procedures described in the Architecture Maintenance Plan to coordinate with the FHMPO in developing the project architecture.

In order to produce a project architecture, the first step is to identify the type of service package(s) (e.g. transit, traveler information, emergency management, etc.) that are related to the project. Depending on the scope of the project, multiple types of service packages could be relevant and all should be identified. For example, for a project involving the installation of dynamic message signs, the relevant service package types would be traveler information and emergency management. After service package types are identified, the specific service package(s) that describe the project must be identified. In continuing the example, the specific service packages that relate to dynamic message sign installation would be ATMS06 Traffic Information Dissemination, EM06 Wide-Area Alert, and MC08 Work Zone Management.

Once specific service packages have been identified, the service package diagrams must be reviewed for accuracy and there is no duplication of functionality with another service package. For each project, the following items should be considered and inputted into Turbo:

- Ensure all specific service packages that relate to the project are identified (i.e. ATMS06, EM06, MC08, etc.);
- A specific service package may be relevant to multiple agencies. In this case, create multiple instances of that service package (i.e. an ATMS06 for City of Manhattan, and ATMS06 for KDOT, etc.);
- Select the appropriate inventory items that are related to each specific service package;
- Identify the appropriate stakeholder that owns the inventory item; and
- Verify whether the data flow is planned or existing.

Following review of the service package diagrams, the updated diagrams should be passed along to the agencies who are implementing the project to ensure all appropriate stakeholders are involved and they have the information needed to determine any potential impact on other projects.

6.2 Project Programming

An up-to-date regional ITS architecture is important because projects must be aligned with the area's regional ITS architecture to receive federal funds. This section discusses how stakeholders can determine if a project is consistent with the architecture.

In order to use the Flint Hills Regional ITS Architecture to support project development, the agency must identify how the project contributes to or aligns with a portion of the architecture. This is a key step when using the architecture because it requires the agency to view the ITS project in the broader context of the entire architecture. Having an agency consider the wider architecture while the project's scope is being defined, enables them to consider the services, functionality, and integration opportunities that are envisioned by the region as a whole. This step is also required to meet the FHWA Architecture Rule/FTA Architecture Policy.

The ITS Architecture should be used as early in the project development lifecycle as possible to fully consider integration opportunities. The architecture should be reviewed before firm project cost estimates are established to allow opportunity to adjust the scope to accommodate regional functionality and interfaces identified. This opportunity may occur before or after programming/budgeting, depending on how the ITS project is defined in the programming/budget documents.

6.3 Funding for ITS Projects

In addition to staffing availability, standard adoption, and technical resources, funding availability is the backbone for successful ITS project integration and implementation. Adequate funding ensures that proposed projects are deployed effectively and in a timely fashion, to allow this plan to remain useful in the future.

The ITS funding will be needed in the following activities in order to successfully implement, operate, maintain, and integrate ITS elements in the Flint Hills Region:

- Planning and design of new ITS elements
- Capital investment for ITS infrastructure
- System operations and maintenance
- Staff training

6.3.1 Federal Funds

ITS projects proposed for the Flint Hills Region would qualify for several categories of federal highway and transit funding, such as: National Highway Performance Program (NHPP), Surface Transportation Program (STP), Highway Safety Improvement Program (HSIP), and FTA Section 5307.

6.3.2 KDOT ITS Set-Aside Program

The goal of this program is to further promote ITS within Kansas by funding studies, research, technology developments, and technology applications. This program was established in 2000 as part of the 10-year comprehensive transportation plan to facilitate the deployment of rural and urban ITS programs. Funding may be authorized on an annual basis beyond the initial ten-year period. Cities, counties, other state agencies, and KDOT can submit applications to fund ITS projects.

6.3.3 Local Funds

Local jurisdictions may also utilize taxes collected from property, sales, and/or other financial mechanisms (e.g. tax increment financing or TIF) to fund and/or provide local match to the implementation of the transportation program. Similar to state funds, this income may be combined into a general use fund to be used for various purposes.

6.3.4 Partnerships

A public/private partnership is a business relationship between the public and private sectors. Both entities, to a specific degree, share responsibilities and the costs, risks, and rewards associated with delivering goods and/or services. From a transportation standpoint, a public/private partnership is a form of service delivery with a collaborative approach based on reallocating traditional responsibilities, costs, risks, and rewards between the public agency and private entities.

6.3.5 Homeland Security Grants

The U.S. Department of Homeland Security administers grant funds to enhance the ability of states, local and tribal jurisdictions, and other regional authorities in the preparation, prevention, and response to terrorist attacks and other disasters. These grants include, but are not limited to areas of:

- Critical Infrastructure Protection
- Regional and Local Transit Systems
- Equipment and Training for First Responders
- Homeland Security Grants
- Port Security

These grants can be used to fund projects with security applications, such as surveillance cameras, security/threat sensors and detectors, communication devices, and training for supporting emergency and threat response activities.

6.4 Project Design Concerns

When designing a project, functionality and ITS standards provide guidance and criteria to identify how the project will relate to the region's overall operations. As projects grow in size, the functions and standards become complex and sometimes require agreements between agencies. It is beneficial to identify the agencies involved and the type(s) of agreement(s) needed early on in the project design.

6.4.1 How ITS components are shown in the architecture

The National ITS Architecture uses service packages to depict the current and future functions of ITS systems. Entities that represent sources of information are called "subsystems", which are grouped into four classes: centers, fields, vehicles, and travelers (as shown in Table 6). Also depicted in Table 6 are descriptions from the National ITS Architecture for each subsystem and examples of those subsystems in the region.

Table 6: Subsystem Definitions

Subsystem	Definition	Examples in Flint Hills Region
Center	Provides management, administrative, and support functions for the transportation system. The center subsystems each communicate with other centers to enable coordination between modes and across jurisdictions.	Manhattan Traffic Operations Facility, County Emergency Operations Centers, 911 Communications Centers
Field	Intelligent infrastructure distributed along the transportation network which perform surveillance, information gathering, and information dissemination and whose operation is governed by the center subsystem.	Traffic Signals, CCTV Cameras, Dynamic Message Signs, Vehicle Detection
Vehicle	Covers ITS related elements on vehicle platforms such as automatic vehicle location equipment and operations capabilities for portable field equipment.	Maintenance and Construction Vehicles, Public Safety Vehicles, Incident Response Vehicles
Traveler	Equipment used by travelers to access ITS services prior to a trip, including information service providers.	Transit Bus Arrival/Departure Signs, Smartphones, Tablets, Personal Computers

6.4.2 How to find general functional requirements related to a proposed project

Functional requirements explain how an inventory item provides the services described in their equipment packages. Equipment packages group inventory items together based on the overall function they serve and are listed in deployment-sized pieces (for example: emergency dispatch, roadway basic surveillance, traffic data collection, and transit center fixed-route operations).

The functional requirements can be found on the National ITS Architecture website (http://www.iteris.com/itsarch). The following process should be followed to access requirements for specific inventory items:

- Select "Architecture" in the top left corner of the Home Page of the National ITS Architecture website
- Then select "Physical Architecture"
- Then select the "Physical Entities" link in the text of the Physical Architecture web page
- From the two tables on the Physical Entities web page, select the subsystem or terminator for which you are seeking functional requirements
- A list of functionalities will be identified for each relevant equipment package.

6.4.3 How to obtain specific functional requirements from the Flint Hills Regional ITS Architecture

The need to obtain specific functional requirements from the Flint Hills Regional ITS Architecture related to a specific project can be found on the ITS Architecture website hosted by the FHMPO.

A complete listing of functional requirements for the Flint Hills Regional ITS Architecture can be found in Section 7 of the Turbo Architecture Report.

6.4.4 How to select communication standards that apply to the project

ITS standards define how system components interact within the overall framework of the National ITS Architecture. The use of standards ensures interoperability amongst various functions of an ITS project so that components or technologies from various vendors, at different scales (local, regional, and national), are still compatible. Standards also facilitate innovation in technology development without necessitating replacement of the hardware or software systems needed to operate the new technology. Other purposes for ITS standards include:

- ITS standards used in a deployment can greatly reduce component development costs;
- ITS standards are open and non-proprietary, helping state and local transportation managers avoid costly single-source procurements and locked-in maintenance relationships with vendors;
- ITS standards support the deployment of interoperable ITS systems, helping agencies link together different types of ITS technologies and making system expansions easier to plan and implement; and
- ITS standards are being developed for many different types of ITS technologies and their use in project deployment is a key aspect of conformity with the FHWA Final Rule 940.

New standards that are developed go through an approval process before they are included in documents as formalized standards. Existing standards are amended and modified as needed based on new standards development or new technology development. Several national and international standards organizations are working toward developing ITS standards for communications, field infrastructure, messages and data dictionaries, and other areas. The organizations participating in ITS standards activities include:

- AASHTO (American Association of State Highway and Transportation Officials)
- ANSI (American National Standards Institute)
- APTA (American Public Transportation Association)
- ASTM (American Society for Testing and Materials)
- IEEE (Institute of Electrical and Electronics Engineers)
- ITE (Institute of Transportation Engineers)
- NEMA (National Electrical Manufacturers Association)
- SAE (Society of Automotive Engineers)

A listing of ITS standards that are pertinent to the Flint Hills Regional ITS Architecture is contained in Section 9 of the Turbo Architecture Report and on the Regional ITS Architecture Website.

6.5 How to Navigate the Website

The purpose of the Flint Hills Regional ITS Architecture website is to organize the details of the architecture into a form that is more readily accessible to stakeholders. It provides a method for stakeholders to access the architecture information in order to encourage use of the architecture in both transportation planning and project implementation. The Flint Hills Regional ITS Architecture website can be accessed via the FHMPO's ITS Architecture website at http://flinthillsits.com.

The menu bar at the left of the Flint Hills Regional ITS Architecture website provides access to different pages of the architecture. The pages to which each of these buttons leads are described below.

Home: This button takes the user to the homepage for the Flint Hills Regional ITS Architectures. The homepage describes the purpose of the architecture.

Scope: This page provides the geographic scope and service scope of the architecture. It also provides the planning time frame for the architecture.

Stakeholders: This page presents the full list of regional stakeholders, along with descriptions for each.

Inventory: This page presents the inventory of ITS elements along with a brief description of each. The inventory of ITS elements is arranged in an alphabetic order. The list of inventory can also be viewed by entity (subsystems and terminators as defined by the National ITS Architecture) or by stakeholder.

Inventory by Entity: This page presents the inventory of ITS elements arranged by entity (subsystems and terminators). This allows all elements with related functions to be viewed simultaneously. Clicking on an element name opens a detail page that provides more information about the element, including a listing of all interfacing elements.

Inventory by Stakeholder: This page presents the inventory of ITS elements arranged by stakeholder. This allows all the elements owned by a single stakeholder to be viewed simultaneously. Clicking on an element name leads to a detail page that provides more information about the element, including a listing of all interfacing elements.

Services: This page presents a list of relevant service packages for the region and their deployment status. Clicking on the service package name links to the definition of the service package, its deployment status in the region, and a list of ITS elements associated with the service package.

Ops Concept: This page presents a table of relevant ITS service areas for the region. Clicking on a service area links to a detailed page with a list of stakeholders providing the service and their roles and responsibilities in the operations of the relevant ITS systems in the region.

Requirements: The page presents a list of ITS functional areas for the region. Clicking on a functional area leads to a detailed page that provides a description of the functional area, a list of regional ITS elements supporting the functions, and a list of functional requirements.

Interfaces: This page presents a table that identifies interfaces among ITS elements for the region. Clicking on an element in the “Element” column leads to a context diagram that shows how the element interfaces with other elements in the region. Clicking on an element in the “Interfacing Element” column brings up a detailed page that shows an interface diagram between the two elements, along with the definitions of the architecture/information flows.

Standards: This page provides a list of ITS standards that are applicable to the region. Clicking on the title of a standard opens a page that identifies how the standard can be applied to facilitate communications and electronic information exchanges in the region.

Projects: This page presents a list of potential ITS projects for the region, along with recommended implementation time frame and brief project descriptions. Clicking on a project title opens a detailed page that provides additional information on the project.

7.0 Glossary

Adaptive Traffic Signal System: A system that automatically adjusts traffic signal green times to improve the flow of vehicles as conditions change. The system monitors current traffic conditions, demand and capacity.

Advanced Public Transportation System (APTS): A variety of technology applications that make public transportation more efficient and convenient. Some examples include automated fare payment systems, enunciators to inform people inside and outside the transit vehicles, smart phone APP's to track bus arrival times, and many other applications.

Advanced Traffic Management System (ATMS): A broad category of systems that collect and process information from sensors and CCTV cameras along major roadways. Once processed, the information is then used to manage traffic control devices such as ramp meters, traffic signals and other control devices. These systems are also the source of much of the data used to inform motorists through the Advanced Traveler Information Systems listed below.

Advanced Traveler Information System (ATIS): A system, which distributes information to the traveling public over a variety of methods such as variable-message sign, kiosks, Internet, cable television, personal hand-held devices, etc.

Architecture Flow: Architecture Flows (also referred to as "information flows") refer to information that moves between the components of the physical architecture view of the National ITS Architecture. Architecture flows are the primary tool that is used to define the Regional ITS Architecture interfaces. These architecture flows define what types of information is transferred and how that transfer should occur. For example, one architecture flow would be a dispatcher communicating information to an emergency vehicle responding to an incident.

Architecture Interconnect: Interconnects are communications paths that carry information between components of the physical architecture view of the National ITS Architecture. Several different types of interconnects are defined in the National ITS Architecture to reflect the range of interface requirements in ITS. Some common examples are vehicle to vehicle, point to point, and roadside to vehicle links.

Arterial Traffic Management: Systems that monitor traffic conditions on roads other than freeways (ex. arterial streets and rural roads). The data collected is used to adjust traffic signal timing in order to improve traffic flow. The information is also used for incident management purposes, and is distributed to the public in a variety of ways.

Automated Vehicle Maintenance: This technology performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on agency fleet and construction equipment. It includes on-board sensors capable of automatically performing diagnostics and using it to schedule and manage vehicle maintenance.

Automatic Vehicle Location (AVL): AVL systems track the approximate location of vehicles moving within a transportation network. The most common applications of AVL technology are for dispatching emergency vehicles, tracking transit vehicles and providing passengers with arrival time estimations through information displays.

Bluetooth Technology: Bluetooth readers mounted on the side of the road can detect anonymous MAC addresses, wireless identifications used to connect Bluetooth technologies on mobile devices in vehicles such as phones, headsets and music players. The travel time of vehicles can be determined in real time by re-identifying Bluetooth devices in vehicles. The data collected by Bluetooth readers can also be used for origin-destination (O-D) studies.

Closed-Loop System: A system in which a computer controls a process using information received from within the process itself (e.g., a closed loop coordinated traffic signal system uses data collected by traffic detectors and then uses this information to modify the traffic signal timing plans.)

Computer-Aided Dispatch (CAD): "Intelligent" interactive mapping and data entry systems that assist in the process of dispatching, monitoring, and managing emergency services. Emergency-dispatching hubs use computers to store, use, and report on information such as incident histories, manpower activities, and other tasks in ways that are logical and simplify the dispatchers' tasks.

Dedicated Short Range Communications: A wireless communications channel used for close-proximity communications between vehicles and the roadway devices. It enables communications to occur between devices that are very near each other, usually within just a few feet. Examples include automated toll collection, transit vehicle electronic fare payments and equipment maintenance reporting. These systems can also deliver information to drivers, and provide electronic transactions for automated vehicle operations.

Dynamic Message Sign (DMS): Electronic signs that display traffic conditions, alerts or other useful information to motorists or pedestrians. The term is used interchangeably with previous terminology such as variable message signs (VMS) and changeable message signs (CMS).

Element: This is the basic building block of Regional and Project ITS Architectures. It is the name used by stakeholders to describe a system or piece of a system.

Emergency Vehicle Preemption (EVP): This technology allows emergency vehicles (police, fire trucks, ambulances, etc.) to get priority treatment as they approach traffic signals. These systems can sense the location of the emergency vehicles and adjust the green times so they arrive at the incident sites faster and safer.

Equipment Package: Equipment packages are the building blocks of the physical architecture subsystems. Equipment Packages group similar processes of a particular subsystem together into an "implementable" package making it easier for the end users to select as they build the architecture or define a project. The grouping takes into account how the processes must function.

Fixed-Point to Fixed-Point Communications: A communication link serving stationary devices. It may operate using a variety of public or private communication networks and technologies. Examples include twisted pair, coaxial cable, fiber optic, microwave relay networks, and spread spectrum radio.

Incident Detection: Incident Detection provides the capability for traffic managers to detect and verify that incidents have occurred. This includes analyzing data from traffic surveillance equipment, monitoring alerts from external reporting systems, collecting special event information, and responding to reports from their agency personnel in the field.

Incident/Emergency Management: Incident/Emergency Management enables communities to quickly identify any conditions that interrupt normal traffic flow such as crashes, vehicle breakdowns and debris in the roadway. The system also supports agency coordination to minimize clean-up and medical response time.

Intelligent Transportation Systems (ITS): ITS applies state-of-the-art and emerging technologies to provide more efficient and effective solutions to current multimodal transportation problems. Some examples of ITS are dynamic message signs, closed-circuit television monitoring systems, and traffic signal systems.

ITS Architecture: A common framework for planning, defining, and integrating intelligent transportation systems. An architecture functionally defines what the pieces of the system are and the information that is exchanged between those pieces. Architecture is defined functionally and does not prescribe particular technologies. This allows the architecture to remain effective over time as technologies evolve. It defines "what must be done," not "how it will be done."

Maintenance and Construction Operations (MCO): These are functions that support monitoring, operating, maintaining, improving and managing the physical condition of roadways, roadside equipment, and required resources.

Mobile Data Terminal (MDT): Mobile Data Terminals (MDTs) are computerized devices used in emergency, transit, patrol, maintenance, and other vehicles to communicate with a central dispatch. They feature a screen on which to view information and a keyboard or keypad for entering information, and may be connected to various peripheral devices, such as an AVL System.

On Board Security Monitoring System: On board security system for transit vehicles. This includes surveillance and sensors to monitor the on-board environment, silent alarms that can be activated by transit user or operator, and a remote vehicle disable function. The surveillance equipment includes video (e.g. CCTV cameras), audio systems and/or event recorder systems.

Ops Concept or Operational Concept: An Operational Concept describes the roles and responsibilities of stakeholders in providing the ITS services included in the ITS Architecture. For example, one of the roles and responsibilities of the Manhattan Public Works Department is to operate and maintain the traffic signal system.

Physical Architecture: The physical architecture is the part of the National ITS Architecture that provides agencies with a physical representation (though not a detailed design) of the important ITS interfaces and major system components. It provides a high-level structure to support the processes and data flows defined in the logical architecture.

Regional ITS Architecture: A local version of the ITS National Architecture that is tailored for a specific region. It can be used to produce project architecture reports for specific federally funded projects.

Road Weather Information System (RWIS): A system consisting of roadside meteorological components strategically located to provide information about weather issues affecting transportation. The principal components of RWIS include pavement sensors, atmospheric sensors, remote processing units (RPU), and central processing units (CPU).

Security Sensors and Surveillance Equipment: This technology includes cameras and sensors to monitor transportation infrastructure (e.g., bridges, tunnels and management centers) to detect potential threats. Such equipment includes acoustic, environmental threat (nuclear, explosive, chemical), motion and object sensors, and video and audio surveillance devices.

Service Package: Service packages are a combination of ITS architecture components tailored to provide a specific ITS service. For example, the Traffic Incident Management System Service Package combines incident detection systems, roadside surveillance devices, and coordination of traffic management centers to fulfill a number of useful needs related to the rapid clearing of incidents.

Standards: Documented technical specifications sponsored by a Standards Development Organization (SDO) to be used consistently as rules, guidelines, or definitions of characteristics for data transactions.

Subsystem: The principle elements of the physical architecture view of the National ITS Architecture. Subsystems are individual pieces of the Intelligent Transportation System defined by the National ITS Architecture. Subsystems are grouped into four classes: Centers, Field, Vehicles, and Travelers.

Terminator: Terminators define the boundary of an architecture. The National ITS Architecture terminators represent the people, systems, and general environment that connect to Intelligent Transportation Systems.

Turbo Architecture: An automated software tool used to build and maintain an ITS Architecture. It provides a means to input and manage system inventory, service packages, architecture flows and interconnects with regard to a Regional ITS Architecture and/or multiple Project ITS Architectures.

Wi-Fi: Wi-Fi is a short-hand generic term referring to the wireless interface of mobile computing devices, such as laptops in local area networks (LANs) and Internet access. Standards are in development that will allow Wi-Fi to be used by cars on highways in support of an Intelligent Transportation System to increase safety, gather statistics, and enable mobile commerce.