Lawrence-Douglas County

Intelligent Transportation System (ITS) Strategic Deployment and Maintenance Plan

LAWRENCE - DOUGLAS COUNTY
MPO
METROPOLITAN PLANNING ORGANIZATION

MPO Policy Board Approval
July 15, 2021

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Revision History

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Executive Summary

The Lawrence-Douglas County Metropolitan Planning Organization (MPO) updated our Intelligent Transportation Systems (ITS) Plan in the spring of 2021. (The plan was approved by the MPO Policy Board on July 15, 2021.) The plan includes this document and the Regional Architecture Development for Intelligent Transportation (RAD-IT) website. A Steering Committee (Table ES-1) provided staff direction on this plan update and met four times.

Table ES-1: 2021 Steering Committee

Category	Agency
Federal Transportation Agencies	FTA
	FHWA
State, County, and City Highway and Traffic Agencies	KDOT
	KTA
	KC Scout
	Baldwin City
	Eudora
	Lawrence
	Doulas County
Emergency Communications	DG Emergency Communications Center
Transit Providers	Lawrence Transit
	KU on Wheels

ITS is the application of technologies and communications to improve the multimodal transportation system in an area. ITS includes detection systems and cameras for monitoring traffic conditions on roadways, dynamic message signs to provide real time travel information, vehicle location systems to track transit and emergency services vehicles, and a host of other technological elements and agency coordination processes. Essentially it equals better travel through technology.

The ITS Plan has a vision and is consistent with Transportation 2040 (the long-range transportation plan).

Lawrence-Douglas County Regional ITS Vision

The Lawrence-Douglas County Region will use Intelligent Transportation Systems to provide cost-effective and practical technologies that enhance the safety, capacity, operations, and evaluation of the multimodal transportation.

Transportation 2040 identifies four goals that are consistent with federal planning guidelines. They are:

1. **Access & Choices** – Enhance transportation options and choices for improved system performance
2. **Mobility & Prosperity** – Efficient movement of people, goods, and freight
3. **Preservation, Safety, & Security** – Prioritize preservation, safety, and security of the transportation network
4. **Sustain & Enhance** – Minimize adverse social, economic, and environmental impacts created by transportation

To implement Transportation 2040, we envision utilizing ITS technologies to improve multimodal transportation to improve movement of people and goods, reduce travel time, mitigate crashes, and enhance safety. The programs and projects require integrating ITS into the regional transportation planning and project development process. Implementation of ITS requires improving the information sharing among the region's transportation agencies and with the public. ITS can provide increased security

and safety for multimodal transportation through improved infrastructure monitoring and emergency management. ITS will allow the region to maximize the utilization of existing infrastructure and facilities. The programs and projects identified in the ITS plan often support multiple Transportation 2040 goals and have the potential to improve the regional ability to measure the performance of the transportation network. ITS programs and projects are shown in **Table ES-2** with dots to indicate which Transportation 2040 goals they support.

Table ES-2: ITS Programs and Projects Implementing Transportation 2040 Goals

	Access & Choices	Mobility & Prosperity	Preservation, Safety, & Security	Sustain & Enhance
1 Signal Coordination Program	●	●	●	●
2 Traffic Detection Improvements Program	●	●	●	●
3 Traffic Signal Performance Measures Program	●	●		●
4 Fiber Communications Expansion Program	●	●	●	
5 Camera Deployment Program			●	●
6 Emergency Signal Preemption Improvements Program		●	●	
7 Weather Monitoring Program			●	●
8 Alternative Fuels or Low-No Emissions Infrastructure and Vehicles Program	●	●	●	●
9 Work Zone Management Program		●	●	●
10 Bicycle/Pedestrian Warning Systems Program		●	●	
11 Shared Mobility	●	●		●
12 Dynamic Message Signs	●	●	●	●
13 Signal Beacon Deployment		●	●	
14 Transit Traveler Information Improvements	●	●		
15 Transit Management Improvements	●	●		
16 Transit Signal Priority		●		●
17 Parking Management System	●	●		
18 Event and Incident Management Improvements	●	●	●	●
19 Regional Virtual Data Warehouse	●		●	
20 Journey Trip Planner Tool	●	●		●
21 Connected Vehicles	●	●	●	●

Table ES-3 lists the sequenced ITS programs or projects for the L-DC Region. The inclusion of a project in this list does not mean that it has been programmed in other regional transportation plans. Many programs or projects on this list have committed funding. This Plan is a means for identifying potential ITS projects that should be considered and possibly programmed into the Region's funding processes.

It should also be noted that these are planning level cost estimates, which will need to be refined as project scopes are defined.

For more information:

View the full plan visit: https://lawrenceks.org/mpo/its

Email questions to: mpo@lawrenceks.org

LAWRENCE - DOUGLAS COUNTY MPO
METROPOLITAN PLANNING ORGANIZATION

Table ES-3: L-DC Regional ITS Programs or Projects

		Projects	Total Project/Program Cost Low Estimate		High Estimate
Ongoing Programs *(Projects that are not one time expenses)*	1	Signal Coordination Program	$ 250,000		$ 500,000
	2	Traffic Detection Improvements Program	$ 1,000,000	to	$ 1,500,000
	3	Traffic Signal Performance Measures Program	$ 236,000		$ 386,000
	4	Fiber Communications Expansion Program	$ 839,400		
	5	Camera Deployment Program	$ 366,000	to	$ 570,000
	6	Emergency Signal Preemption Improvements Program	$ 73,000		$ 170,000
	7	Weather Monitoring Program	$ 50,000		$ 500,000
	8	Electric Vehicle Infrastructure & Vehicles Program			
		8a Lawrence Public Charging Stations	$ 75,000		
		8b Private Charging Stations	$ 375,000		
		8c Transit Charging Stations	$ 5,200,000		
		8d Transit Vehicles	$ 12,412,500		$ 49,650,000
		8e Lawrence City Vehicles (Including Fleet & Operations) - 782	Unknown		Unknown
		8f Lawrence City Charging Infrastucture	Unknown		Unknown
		8g Other Cities Vehicles and Charging Infrastructure	Unknown		Unknown
		8h County Vehicles and Charging Infrastructure - 371	Unknown		Unknown
	9	Work Zone Management Program	$ 240,000	to	$ 348,000
	10	Bicycle/Pedestrian Warning Systems Program	$ 750,000	to	$ 900,000
		Total Estimated Ongoing Programs Cost	**$ 21,866,900**	**to**	**$ 54,524,000**
Near-Term *(planned for the next three years)*	11	Shared Mobility	Unknown	to	Unknown
	12	Dynamic Message Signs	$ 3,150,000	to	$ 4,200,000
	13	Signal Beacon Deployment	$ 600,000	to	
	14	Transit Traveler Information Improvements	$ 250,000	to	$ 280,000
		Total Estimated Near-Term Programs Cost	**$ 4,000,000**	**to**	**$ 4,480,000**
Medium-Term (*planned for three to six years*)	15	Transit Management Improvements	$ 722,090		
	16	Transit Signal Priority	$ 66,000	to	$ 234,000
	17	Parking Management System	$ 250,000	to	$ 1,000,000
	18	Event and Incident Management Improvements	$ 800,000	to	$ 2,000,000
		Total Estimated Medium-Term Cost	**$ 1,838,090**	**to**	**$ 3,234,000**
Long-Term *(planned for six to ten years)*	19	Regional Virtual Data Warehouse	$ 15,000	to	$ 300,000
	20	Journey Trip Planner Tool	$ 300,000	to	$ 570,000
	21	Connected Vehicles	Unknown	to	Unknown
		Total Estimated Long-Term Cost	**$ 315,000**	**to**	**$ 870,000**
		Total Cost of All Projects	**$ 28,019,990**	**to**	**$ 63,108,000**

1. Introduction and Planning Process

1.1 Overview

The Lawrence-Douglas County Metropolitan Planning Organization (MPO) updated the Regional Intelligent Transportation System (ITS) Architecture and ITS Strategic Deployment Plan (SDP) for the Lawrence and Douglas County (L-DC) Metropolitan Region in 2015. The Architecture is a framework for defining the Region's ITS plans and how future programs and projects will integrate and interoperate with existing and new systems. The SDP defines a strategy for sequencing and deploying ITS in the Region. ITS uses specific language which can be confusing. Reference **Appendix C – Glossary** for definitions of terms.

In 2021, the MPO completed a minor update to ensure the programs and projects were still accurate and to update the goals to reflect the long-range transportation plan, Transportation 2040 (T2040), which was approved by the MPO Policy Board on March 15, 2018.[1] The long-range transportation plan provides a vision of the region's transportation services through the year 2040. The Regional ITS Architecture does not plan that far ahead but needs to be consistent with T2040 over a shorter timeframe. The L-DC Regional ITS Architecture has a ten-year horizon, looking forward to 2031, and will be updated in coordination with the long-range transportation plan.

The Update Project followed the Federal Highway Administration Guidance for Regional ITS Architecture[2] development as illustrated in **Figure 1**

The L-DC Regional ITS Architecture covers the L-DC MPO Metropolitan Planning Area (MPA) planning boundaries, as shown in **Figure 2**. The boundary encompasses all of Douglas County including the four cities in the MPA (Baldwin City, Eudora, Lawrence, and Lecompton).

[1] Access T2040 at: https://lawrenceks.org/mpo/t2040

[2] Regional ITS Architecture Guidance Document, http://ops.fhwa.dot.gov/publications/regitsarchguide/

Figure 1: 2015 Regional ITS Architecture Development Process

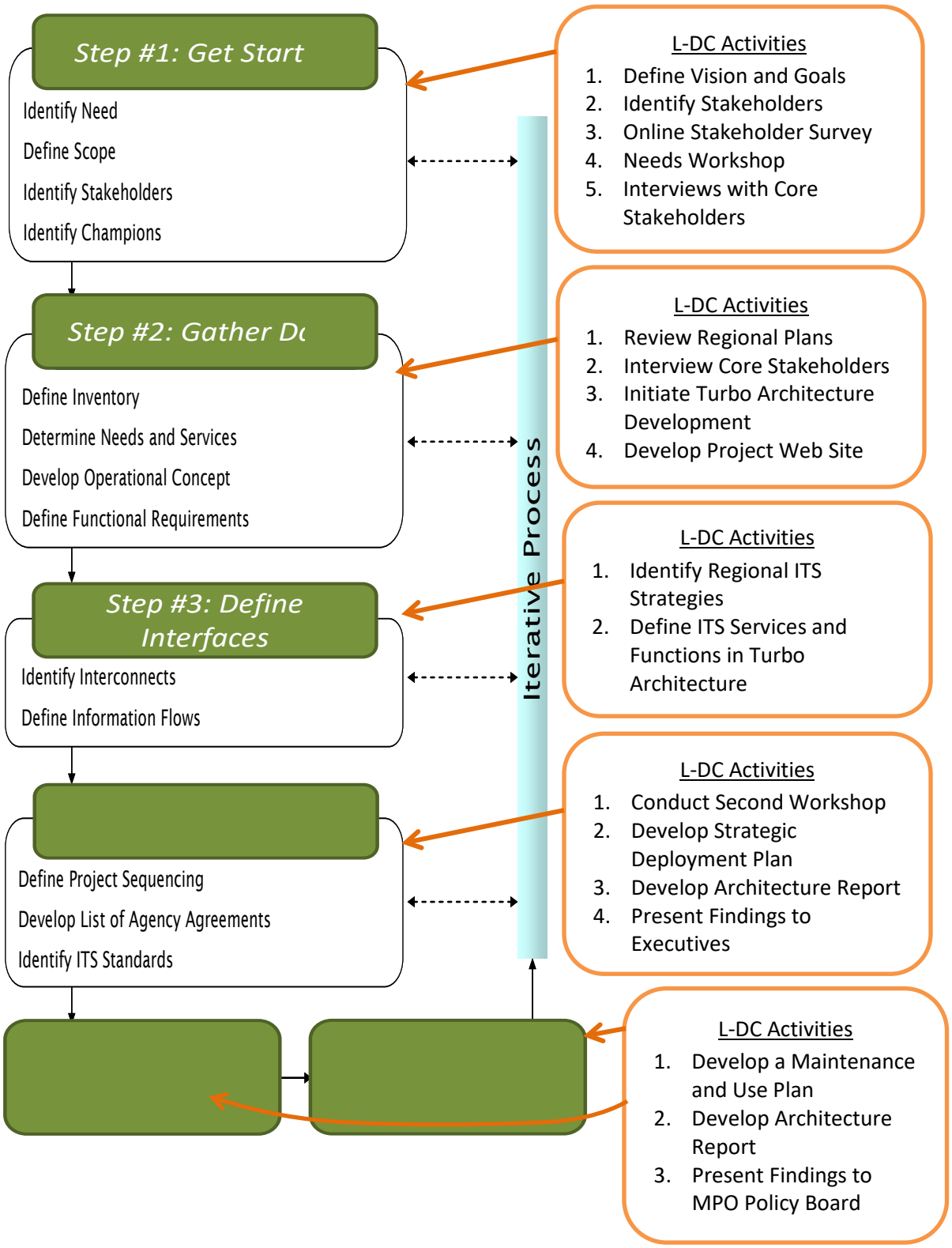
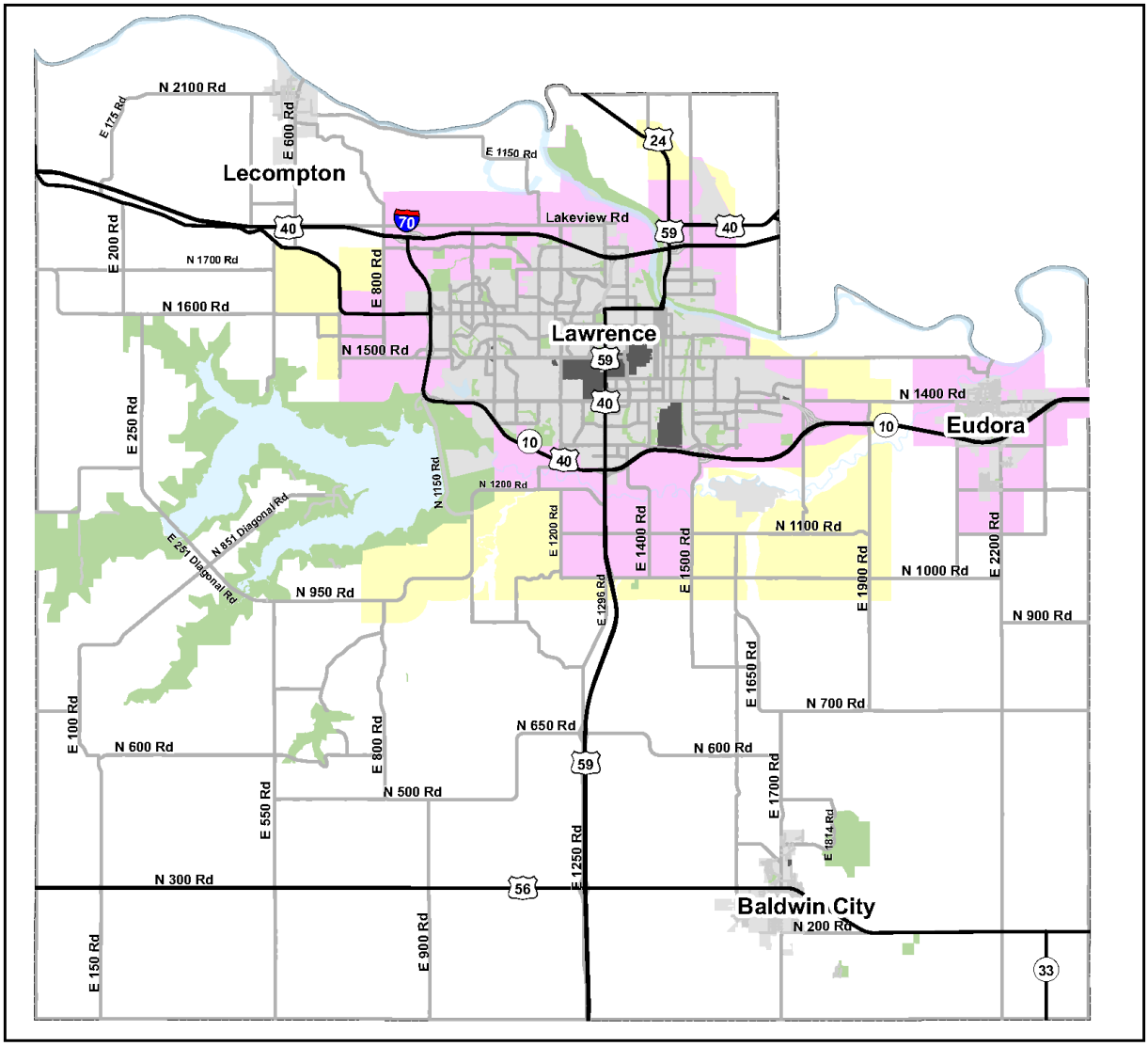


Figure 2: Geographic Boundaries for the L-DC Regional ITS Architecture



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1.2 Planning Process

A larger planning effort was conducted in 2015 to develop the Regional ITS Architecture. A consultant team was utilized to conduct the planning process. The consultants developed a project website, which was subsequently moved to https://lawrenceks.org/mpo/its. The team conducted a survey to collect travel behavior and perceived needs from stakeholders. A stakeholder workshop was held to define regional needs and potential program and project ideas. Further, stakeholder interviews were conducted to gain a better understanding of the plans, operations and needs of key stakeholders. The needs identified are listed in **6. L-DC Regional ITS Needs.** The results of the public input process from the 2015 and 2021 plan process are listed in **Appendix B – Prioritized L-DC Region ITS Needs and Strategies.**

In 2021, MPO staff led the update process rather than utilizing a consultant. Due to the COVID-19 pandemic, four steering committee meetings were held over Zoom to update the ITS Architecture. A screenshot from the third meeting is shown in **Figure 3. Figure 4** displays the meeting topics for the ITS plan update. A public comment period occurred May 6 – May 21. The public input is documented in **Appendix A – Public Input.** The plan was approved by the MPO Policy Board on July 15, 2021.

Figure 3: 2021 Zoom Steering Committee Meeting

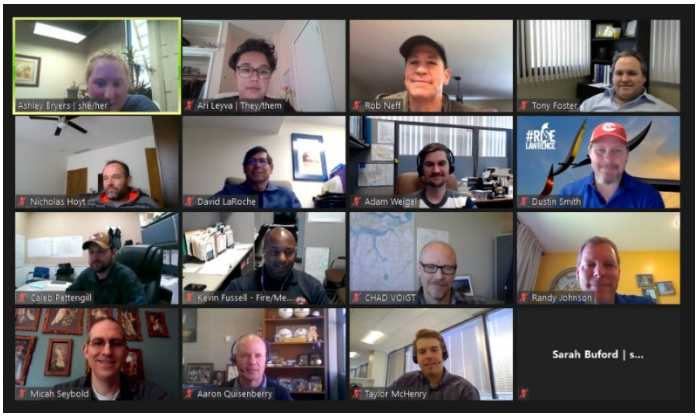
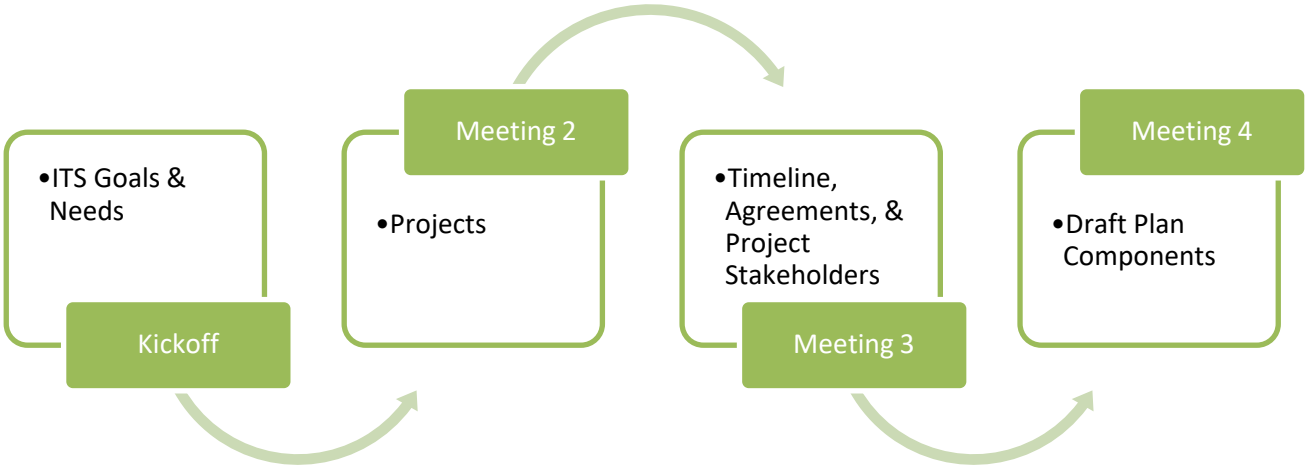


Figure 4: 2021 Steering Committee Meeting Topics



2. L-DC Regional ITS Vision

The L-DC Regional ITS Vision describes the guiding principles for how ITS should be planned, developed, and implemented in the Region. The Vision was developed to be consistent with the goals of Transportation 2040.

Lawrence-Douglas County Regional ITS Vision

The Lawrence-Douglas County Region will use Intelligent Transportation Systems to provide cost-effective and practical technologies that enhance the safety, capacity, operations, and evaluation of the multimodal transportation.

2.1 Metropolitan Transportation Plan Goals

The Metropolitan Transportation Plan (MTP) is called Transportation 2040 and was approved by the MPO Policy Board on March 15, 2018. Transportation 2040 provides a long-range vision of the Region's transportation strategies for all modes. The L-DC Regional ITS Architecture must stay consistent with the MTP to help achieve the Region's transportation goals. Transportation 2040 identifies four goals that are consistent with federal planning guidelines. They are:

1. **Access & Choices** – Enhance transportation options and choices for improved system performance
2. **Mobility & Prosperity** – Efficient movement of people, goods, and freight
3. **Preservation, Safety, & Security** – Prioritize preservation, safety, and security of the transportation network
4. **Sustain & Enhance** – Minimize adverse social, economic, and environmental impacts created by transportation

To implement the MTP we envision utilizing ITS technologies to improve multimodal transportation to improve movement of people and goods, reduce travel time, mitigate crashes, and enhance safety. The programs and projects require integrating ITS into the regional transportation planning and project development process. Implementation of ITS requires improving the information sharing among the region's transportation agencies and with the public. ITS can provided increased security and safety for multimodal transportation through improved infrastructure monitoring and emergency management. ITS will allow the region to maximize the utilization of existing infrastructure and facilities. The programs and projects identified in the ITS plan often support multiple T2040 goals and have the potential to improve the regional ability to measure the performance of the transportation network. ITS programs and projects are shown in **Table 1** with dots to indicate which T2040 goals they support.

Table 1: ITS Programs and Projects Implementing Transportation 2040 Goals

	Access & Choices	Mobility & Prosperity	Preservation, Safety, & Security	Sustain & Enhance
1 Signal Coordination Program	●	●	●	●
2 Traffic Detection Improvements Program	●	●	●	●
3 Traffic Signal Performance Measures Program	●	●		●
4 Fiber Communications Expansion Program	●	●	●	
5 Camera Deployment Program			●	●
6 Emergency Signal Preemption Improvements Program		●	●	
7 Weather Monitoring Program			●	●
8 Alternative Fuels or Low-No Emissions Infrastructure and Vehicles Program	●	●	●	●
9 Work Zone Management Program		●	●	●
10 Bicycle/Pedestrian Warning Systems Program		●	●	
11 Shared Mobility	●	●		●
12 Dynamic Message Signs	●	●	●	●
13 Signal Beacon Deployment		●	●	
14 Transit Traveler Information Improvements	●	●		
15 Transit Management Improvements	●	●		
16 Transit Signal Priority		●		●
17 Parking Management System	●	●		
18 Event and Incident Management Improvements	●	●	●	●
19 Regional Virtual Data Warehouse	●		●	
20 Journey Trip Planner Tool	●	●		●
21 Connected Vehicles	●	●	●	●

3. Regional ITS Stakeholders

Table 2 is a summary of the types of groups and examples of key stakeholders that have been invited to participate in this ITS planning effort. Stakeholders were identified as either Core or Community Stakeholders.

Appendix D – Core Stakeholders Descriptions lists the core stakeholders who materially participate in the programming, deployment, and operation of ITS in the L-DC Region. Examples of Core Stakeholders are Cities, Kansas Department of Transportation (KDOT), Douglas County and federal agencies. Community Stakeholders are organizations and individuals with an interest in the Region's transportation network and who have defined their need for improved transportation safety and efficiency. **Table 3** displays the Steering Committee formed by the MPO Policy Board to guide the update to the ITS plan.

Table 2: L-DC Regional ITS Architecture Stakeholders Identified in the 2015 Process

Stakeholder Group	L-DC Stakeholders
Federal Transportation Agencies	Federal Highway Administration (FHWA) Federal Transit Administration (FTA)
State, County, and City Street, Highway and Traffic Agencies	Kansas Department of Transportation (KDOT) Kansas Turnpike Authority (KTA) KC Scout Baldwin City City of Eudora City of Lawrence City of Lecompton Douglas County
Public and Private Transportation Providers	Lawrence Transit KU on Wheels (Kansas University) Cottonwood, Inc. Independence, Inc. Kansas Motor Carrier Association Major regional goods movement companies
State, County, and City Public Safety Agencies and Emergency Service Providers	Kansas Highway Patrol (KHP) Kansas Department of Emergency Management (KDEM) Douglas County Emergency Communications Douglas County Emergency Management Douglas County Sheriff's Office KU Public Safety Lawrence-Douglas County Fire Medical Lawrence Police Baldwin City City of Eudora City of Lecompton
Universities, Colleges and Schools	Kansas University (KU) Haskell Indian Nations University Lawrence Public Schools, USD497 Baldwin Public Schools, USD348 Eudora Public Schools, USD491 Lecompton Public Schools, USD343
Media and Information Service Providers	WOW Broadband Service Provider AT&T Telecommunication iNet Interactive
Advisory and Advocacy Groups	Horizon 2020 Technical Advisory Committee – MPO Regional Transit Advisory Committee - MPO Lawrence-Douglas County Bicycle Advisory Committee Lawrence Pedestrian Coalition Lawrence Sustainability Advisory Committee Lawrence Traffic Safety Commission Lawrence Public Transit Advisory Committee LiveWell Lawrence

Table 3: 2021 Steering Committee

Category	Agency	Contact	Title
Federal Transportation Agencies	FTA	Eva Steinman	Community Planner
	FHWA	David LaRoche	Safety/ITS/Traffic Operations Engineer
State, County, and City Highway and Traffic Agencies	KDOT	Shari Hilliard	State ITS Engineer
	KTA	David Jacobson	Director of Engineering
	KC Scout	Randy Johnson	Manager
	Baldwin City	Ed Courton	Community Development Director
	Eudora	Branden Boyd	Public Works Director
	Lawrence	Nick Hoyt, Dustin Smith, Caleb Pettengill, Micah Seybold, Rob Neff, Kevin Fussell	Engineering Program Manager, Senior Project Engineer, Traffic Supervisor, GIS Manager, Police Sergeant, Fire Captain
	Doulas County	Chad Voigt	Public Works Director
Emergency Communications	DG Emergency Communications Center	Tony Foster	Director
Transit Providers	Lawrence Transit	Adam Weigel	Lawrence Transit Manager
	KU on Wheels	Aaron Quisenberry	Associate Director

4. L-DC Region ITS Inventory

ITS Architecture inventory defines the physical entities of the L-DC Region's ITS. As defined in the FHWA Regional ITS Architecture Rule[3], an ITS inventory is a list of systems/elements and the elements that interface with them. An element is defined as the name used by the Region's stakeholders to describe a transportation technology system or piece of a system.

A system in the L-DC Region ITS inventory may be used throughout the Region and be interconnected to many stakeholders, such as the Douglas County Dispatch Center, which dispatches vehicles for multiple emergency responders. Or, a system may be connected to only one stakeholder, such as KDOT's maintenance vehicles.

Because the L-DC Regional ITS Architecture defines information exchanges, the inventory only includes systems that can send and receive information to/from other systems. For example, standalone systems, such as a flashing stop light that is not connected to other signals or a center, are not part of the inventory. However, traffic signals that can communicate with other signals, a traffic management center or any other system are included.

4.1 RAD-IT

RAD-IT is an interactive software to develop regional and project architectures. RAD-IT uses the National ITS Architecture as a starting point to support developing architectures that are consistent with federal requirements.

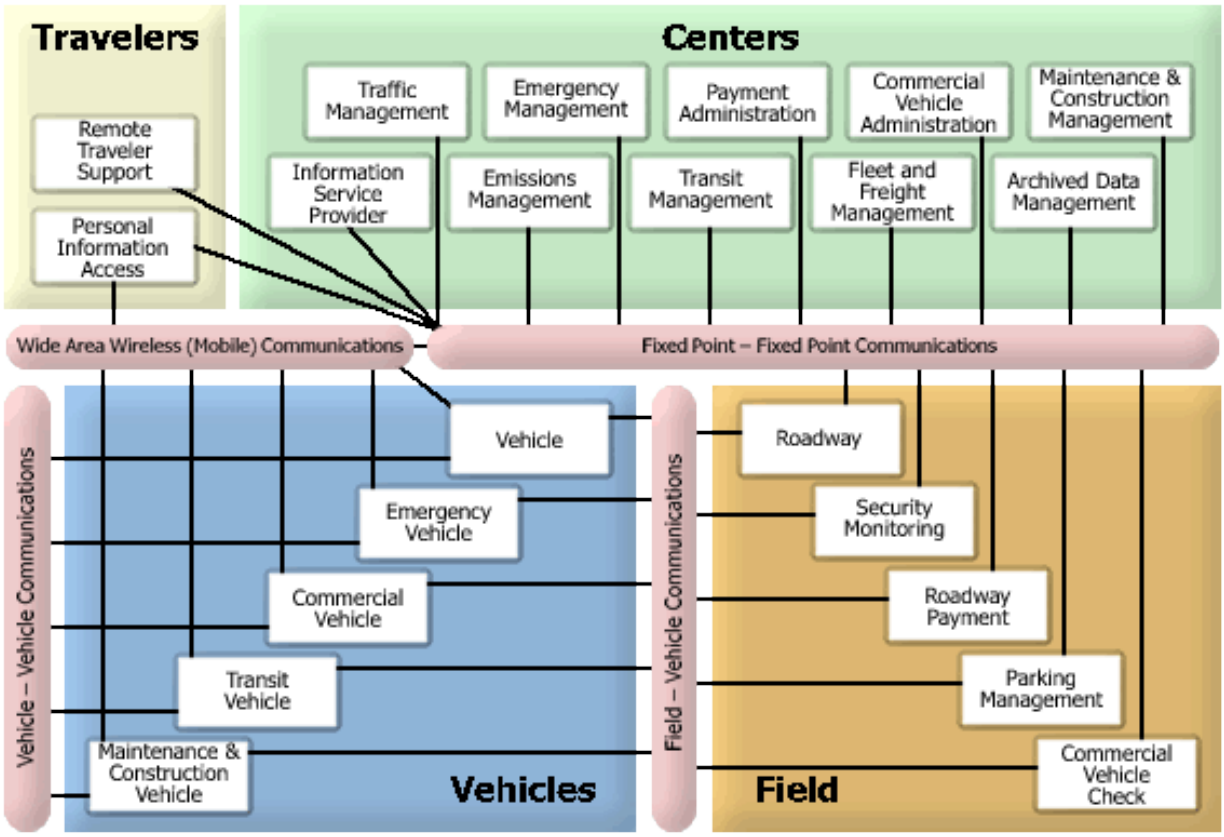
RAD-IT was used to develop the L-DC Regional ITS Architecture. The RAD-IT output matches the existing inventory described in **4.3 L-DC Region Existing ITS Inventory**.

[3] FHWA Rule / FTA Policy on Regional ITS Architecture, http://ops.fhwa.dot.gov/its_arch_imp/policy.htm

4.2 Inventory Element Types

ITS Architecture inventory defines the physical entities of the region's ITS. **Figure 5** provides a high-level view of the National ITS Architecture.

Figure 5: National ITS Architecture Physical Entities



As **Figure 5** shows, there are four types of entities: Centers, Field, Travelers, and Vehicles. The Region's existing elements do not encompass all types of entities shown in the diagram; however, all the region's elements are contained within National ITS Architecture. For example, the Region does not include or interact with any emissions management systems, but it does include transit management for Lawrence Transit and KU on Wheels, and maintenance and construction management through KDOT and the Region's various public works offices.

> ***Centers*** provide management, administrative, and support functions for the transportation system. A center represents a collection of functionality and not necessarily a physical facility. Examples of centers in the L-DC Region are the City of Lawrence Traffic Operations Center and Douglas County Emergency Communications.
>
> ***Field*** entities are connected infrastructure along the transportation network that perform surveillance, information provision, and plan execution control functions. A field entity's operation is typically governed by a center subsystem. They may also directly interface to

vehicles. Field elements examples in the L-DC Region are City of Lawrence Traffic Signals and KTA Dynamic Message Signs (DMS).

Travelers refer to the devices used by travelers to access ITS services to plan a trip and during a trip. This includes devices owned and operated by travelers, as well as devices owned by transportation and information providers. Examples of traveler-owned devices are smart phones and personal computers. Examples of a device owned by a transportation system operator may be an information kiosk.

Vehicles refer to ITS related elements on vehicles and include general driver information and safety systems applicable to all vehicle types. These may include the vehicle radio, navigation system or other onboard computer system. There are four fleet vehicle subsystems (Transit, Emergency, Commercial, Maintenance, and Construction Vehicles) with each having unique capabilities defined in the Architecture. Examples of vehicles in the L-DC Region include passenger vehicles, buses, maintenance vehicles, commercial vehicles, police, and fire vehicles.

For all types, entities are not defined by their size or physical presence, but by their functionality. For example, a traffic management center may be a large facility with a video wall, multiple workstations, and other amenities where an agency controls its devices and monitors traffic conditions. A traffic management center may also be a single laptop that remotely exchanges information with field devices, disseminates traffic information and controls signs and signals. A single ITS element may also function as multiple types of centers. For example, a city may have a single system to manage both traffic and emergency response, making it both a traffic management center and emergency management center.

4.3 L-DC Region Existing ITS Inventory

The L-DC Region ITS Inventory is a summary of known existing ITS in the region that currently, or have the capability to, exchange information outside of their operating agency. The inventory is intentionally broad and includes devices that may not physically be in the Region, but with which Regional ITS elements may interact. The inclusion of many devices is to ensure that the L-DC Regional ITS Architecture can accurately identify all opportunities to use ITS to improve the Region's transportation system.

Although every regional inventory varies based on specific needs, there are several general "best practices" guidelines that have been applied during the development of the L-DC regional inventory. They are:

Appropriate Level of Detail

The inventory is managed to provide the appropriate level of detail while identifying key integration opportunities in the region. Grouping was used to simplify the inventory. For example, instead of listing each individual signal owned and operated by the City of Lawrence, the L-DC Regional ITS Architecture inventory reflects one regional ITS element identified as "City of Lawrence Traffic Signals."

Elements Outside the Region

The L-DC Regional ITS Architecture inventory includes element(s) representing operations centers in areas outside the Region wherever there are important interfaces from the Region to these operations centers. These include inventory such as the Kansas Highway Patrol dispatch center in Salina, KC Scout in Kansas City, Missouri and KDOT's 511 traveler information system based in Topeka.

The inter-regional interfaces should be coordinated across Regional ITS Architectures in Kansas to avoid duplicate and/or conflicting definitions of the same interface.

Table 4 lists the existing L-DC Region ITS inventory. Each inventory item is listed by the stakeholder who owns it.

Table 4: L-DC Existing ITS Inventory

Stakeholder	Element	Description
City of Lawrence Municipal Services and Operations	City of Lawrence CCTV Cameras	Closed circuit television cameras operated by the City of Lawrence for traffic condition monitoring and management of incidents.
	City of Lawrence Maintenance Center	Maintenance center used to track and dispatch maintenance vehicles, to manage maintenance and construction projects, and to share maintenance and construction information.
	City of Lawrence Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by the City of Lawrence. Vehicles have automated vehicle location (AVL).
	City of Lawrence Parking Management	City of Lawrence Parking Management tracks the usage and collects payment at City of Lawrence parking facilities.
	City of Lawrence Traffic Operations Center	Lawrence Traffic Operations Center (TOC) is responsible for the operation of the signal system, CCTV cameras and any other City ITS deployments.
	City of Lawrence Traffic Field Equipment	Equipment used to monitor traffic and road conditions, identify incidents, and collect data for long range planning within the City of Lawrence.
	City of Lawrence Traffic Signals	Traffic signal system operated by the City of Lawrence.
	City of Lawrence Website	Transportation information website for the City of Lawrence.
City of Lawrence Police Department	City of Lawrence Police Center	Center used for police operations, monitoring vehicles, incidents and traffic cameras.
	City of Lawrence Police Vehicles	Patrol vehicles owned and operated by the City of Lawrence Police Department. Vehicles have automated vehicle location (AVL) and mobile data terminals (MDT).
Douglas County Public Works	Douglas County Maintenance Center	Maintenance center used to track and dispatch maintenance vehicles, to manage maintenance and construction projects, and to share maintenance and construction information.
	Douglas County Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by Douglas County. Vehicles have automated vehicle location (AVL).
	Douglas County Website	Website for Douglas County.

Stakeholder	Element	Description
Douglas County Emergency Communications	Douglas County Emergency Communications Center	Answers all 911 calls made from within the county, except calls made from the KU campus, and dispatches appropriate emergency response. The 911 Dispatch center serves as primary dispatch for the City of Lawrence, Eudora, Baldwin City, and Lecompton.
Douglas County Emergency Management	Douglas County Emergency Operations Center (EOC)	Emergency Operations Center (EOC) for Douglas County. Responsible for communications and coordination of local resources during a disaster or large scale incident.
Douglas County Sheriff's Office	Douglas County Sheriff Vehicles	Patrol vehicles owned and operated by the Douglas County Sheriff's Department.
Google	Google Transit	Web site operated by Google.com that provides transit information in the Region, including Lawrence Transit route and schedule information.
KC Scout	KC Scout Traffic Center	Scout manages traffic on more than 125 miles of continuous freeways in the greater Kansas City metropolitan area. Scout uses cameras to monitor the highways from its traffic management center in Lee's Summit, relies on sensors to gage traffic flow, uses large electronic message boards to send urgent traffic notices to drivers along the freeways, and activates a Highway Advisory Radio system that motorists in Missouri can tune to in the event of a freeway incident.
Kansas Department of Emergency Management	KDEM Virtual Emergency Operation Center	Kansas Department of Emergency Management (KDEM) virtual EOC provides statewide function for emergency response and management.
Kansas Highway Patrol	KHP Communications Center	Statewide center for KHP communications for Highway Patrol operations.
	KTA Communications Center	Center for communications for KTA Highway Patrol operations.
	KHP Troop G Vehicles	Vehicles used by the KHP Troop G (KTA). Includes patrol cars and service patrol vehicles.
	KHP Troop B Vehicles	Vehicles used by the KHP Troop B.
Kansas Turnpike Authority (KTA)	KTA Communications Center	Center for communications for KTA Highway Patrol operations.
	KTA Dynamic Message Signs	Dynamic Message Signs (DMS) operated by KTA for traffic information dissemination.
	KTA Maintenance Center	KTA center responsible for managing maintenance and construction on the Turnpike.
	KTA Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by KTA.
	KTA Payment Management	KTA management of toll payments.
	KTA Toll Plazas	Toll collection locations used by KTA.
	KTA Traffic Cameras	Cameras operated by KTA used for traffic surveillance, incident management, and toll enforcement.
	KTA Traffic Field Equipment	Equipment operated by KTA that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.
	KTA Traffic Operations Center	KTA TOC is responsible for the daily operations of the turnpike.
	KTA Traveler Advisory Radio	Highway Advisory Radio (HAR) system operated by KTA to provide current weather and traffic information along the Kansas Turnpike.
	KTA Website	Website operated by KTA for the dissemination of traveler information.
Kansas Department of Transportation (KDOT)	KDOT 511 Traveler Information	511 telephone system and web site that provide up-to-date traveler information about road conditions, construction detours and weather information.
	KDOT District 1 Maintenance Center	KDOT center responsible for managing maintenance and construction on state-maintained highways in KDOT District 1.
	KDOT District 1 Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by KDOT.
	KDOT Road Weather Information Systems	Data collection equipment that gathers environmental conditions in the field, such as roadway temperature, ambient temperature, and moisture levels.
University of Kansas (KU)	KU Maintenance Center	Function at the KU Maintenance Department responsible for construction and maintenance on the KU campus, including roads.
	KU Parking Management System	Monitors parking usage in lots and collects fees for parking usage. Includes the ability for people to pay using their smart phone.
	KU Parking Vehicles	Vehicles used for parking enforcement that include License Plate Readers to identify vehicles parked on campus.
	KU Parking and Transit Website	Website for the University of Kansas.
KU Public Safety	KU Dispatch	Dispatch center that answers all 911 calls made from the KU campus and dispatches KU Police and City of Lawrence Fire/EMS as appropriate. The dispatch center serves as the backup center for Douglas County 911 Dispatch.
	KU Police Vehicles	Patrol vehicles owned and operated by KU police.
Kansas University Transit (KU on Wheels)	KU on Wheels Vehicles	Fixed route and demand-response transit vehicles providing KU on Wheels service. Include AVL and on-board security cameras.
	KU on Wheels Website	Website for KU on Wheels with information about fares and schedules.
Lawrence-Douglas County Fire Medical	Fire Medical Center	Center used for fire and medical operations, monitoring vehicles and incidents.
	Fire Medical EMS Vehicles	Fire and EMS vehicles owned and operated by the Lawrence-Douglas County Fire Department.

Stakeholder	Element	Description
Lawrence Transit	Lawrence Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and demand-response vehicles operated by Lawrence Transit and KU on Wheels.
	Lawrence Transit Vehicles	Fixed and flex route and demand-response transit vehicles operated by Lawrence Transit. Include AVL and on-board security cameras.
	Lawrence Transit System Website	Website operated by Lawrence Transit with information about fares and schedules. Currently static information only.
Local Cities Emergency Services	Local Cities Emergency Vehicles	Local law enforcement, fire, and EMS vehicles not specifically called out in the Regional ITS Architecture.
Local Cities	Local Cities Maintenance Centers	Function at the local cities responsible for construction and maintenance in the local cities.
	Local Cities Maintenance Vehicles	Public works departments responsible for the maintenance of roadways in municipalities not specifically called out in the Regional ITS Architecture.
	Local Cities Website	Local city websites not specifically called out in the Regional ITS Architecture.
Local Transit	Local Transit Vehicles	The vehicles of other transit providers in the Region not specifically identified in the Regional ITS Architecture. Provide demand-response service.
	Local Transit Centers	The operation centers of other transit providers in the Region not specifically identified in the Regional ITS Architecture. Manage demand-response service.
Media	Local Print and Broadcast Media	Local media that provides traffic or incident information to the public.
National Weather Service (NWS)	National Weather Service	Service that provides official US weather, marine, fire and aviation forecasts and warnings.
Private Information Services	Traveler Information Services	Third-party solutions that provide basic and interactive traveler information to the public, including al modes.
Schools	School Buses	Local school buses in L-DC Region.
	Unified School District	School districts that represent elementary, secondary, and high schools in the Region.
Traveling Public	Commercial Vehicles	Privately owned commercial vehicles that travel throughout the Region.
	Personal Computing Devices	Computing devices that travelers use to access public information in the Region.
	Private Vehicles	Vehicles operated by a private individual in the Region.

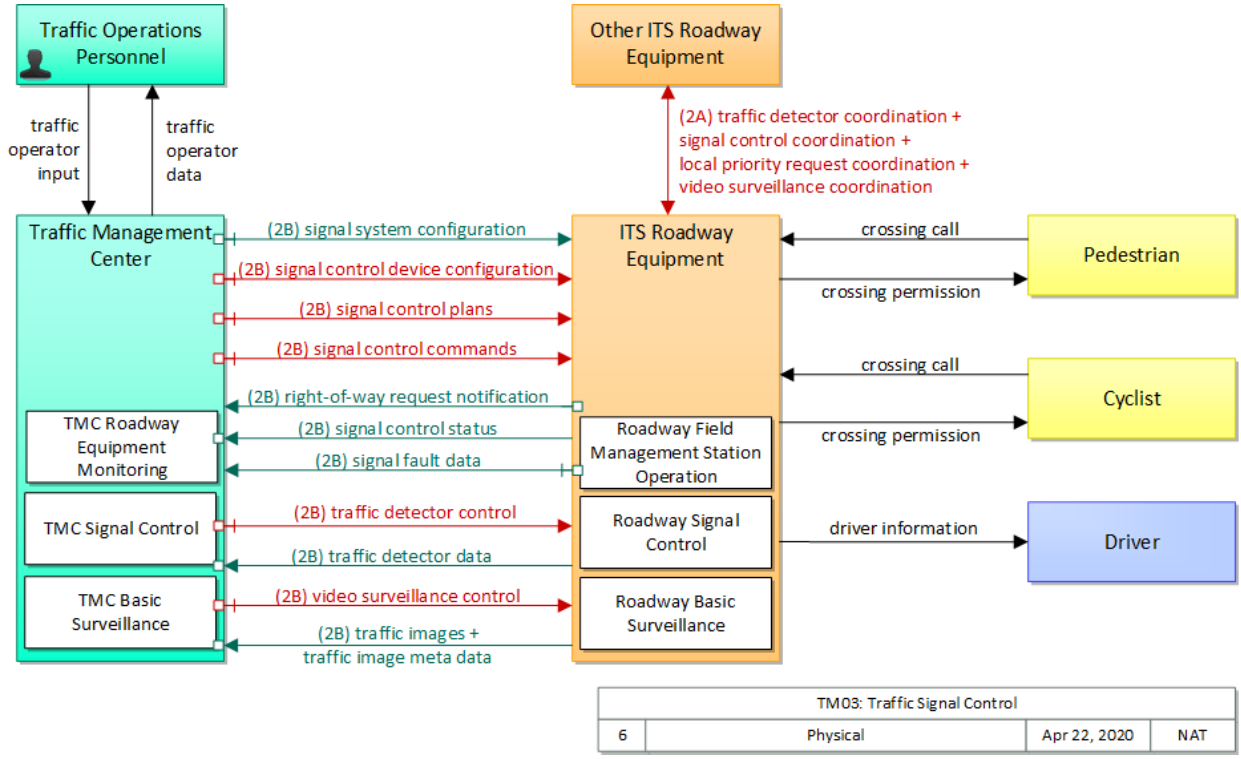
5. Existing L-DC Region ITS Services

The National ITS Architecture defines 97 Service Packages that “bundle” ITS elements to address specific services, such as surface street control or traveler information.

An ITS Service Package does not always directly translate to an ITS program or project. Instead, Service Packages are the “building blocks” of ITS, and a specific ITS program or project may include several service packages that provide multiple related functions. For example, a transit ITS program or project designed to improve service efficiency may include Service Packages for vehicle tracking, fixed-route management and automated passenger counting.

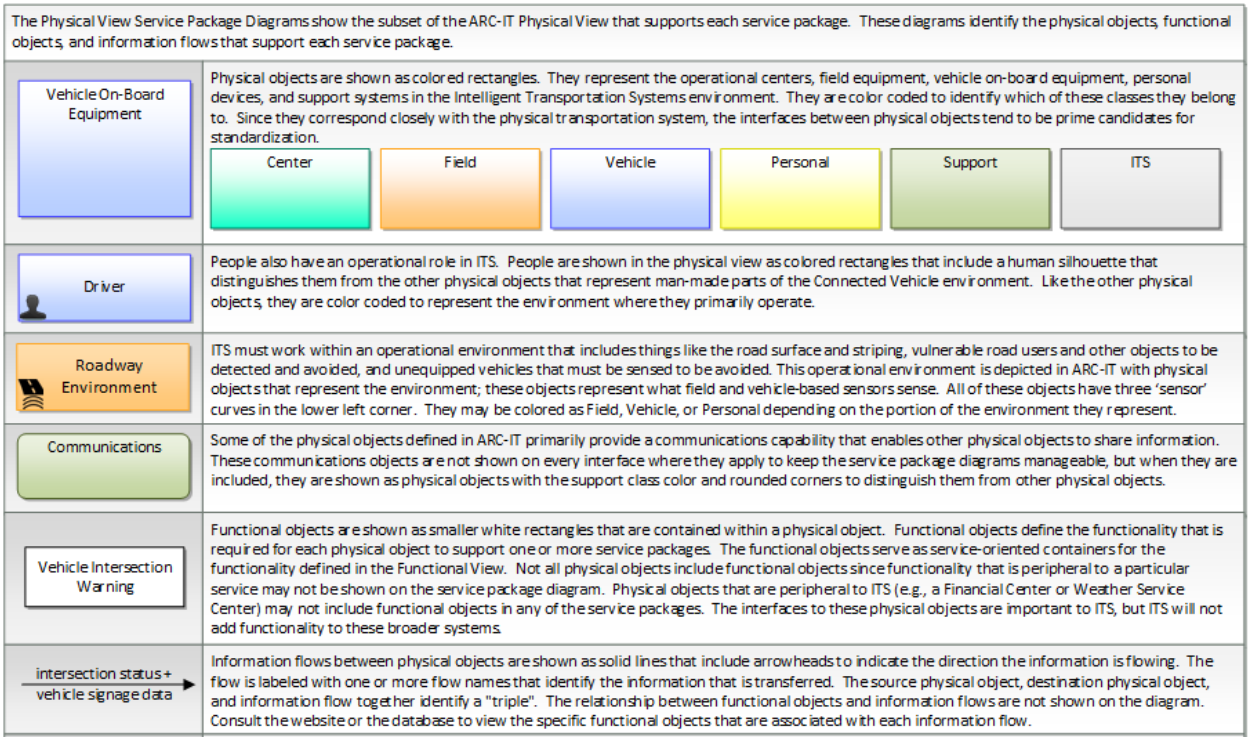
Figure 6 describes how the pieces flow together, while **Figure 7** is the legend.

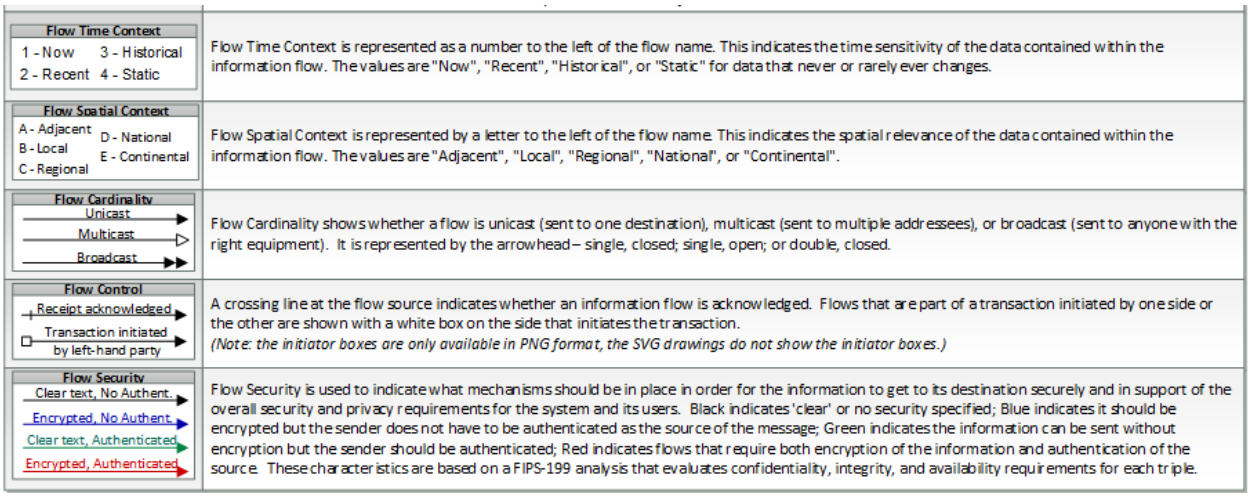
Figure 6: Service Package TM03: Traffic Signal Control



Source: TM03: Traffic Signal Control Service Package:
https://local.iteris.com/arc-it/html/servicepackages/sp122.html#tab-3

Figure 7: TM03: Traffic Signal Control Legend





Source: TM03: Traffic Signal Control Service Package:
https://local.iteris.com/arc-it/html/servicepackages/sp122.html#tab-3

5.1 Existing L-DC Region ITS Service Packages

The L-DC has not and will not deploy all National ITS Services Packages. **Figure 8** identifies the existing ITS Service Packages in the Region. The existing Service Packages have been derived from the current services provided by the Region's Stakeholders, and from the inventory documented in **4.3 L-DC Region Existing ITS Inventory**.

Figure 8: L-DC Region Existing ITS Service Packages

Project	Service Package
01 - Signal Coordination Program	TM03: Traffic Signal Control
02 - Traffic Detection Improvements Program	TM01: Infrastructure-Based Traffic Surveillance
03 - Traffic Signal Performance Measures Program	TM03: Traffic Signal Control
05 - Camera Deployment Program	TM01: Infrastructure-Based Traffic Surveillance
06 - Emergency Signal Preemption Improvements Program	PS03: Emergency Vehicle Preemption
07 - Weather Monitoring Program	WX01: Weather Data Collection
07 - Weather Monitoring Program	WX02: Weather Information Processing and Distribution
12 - Dynamic Message Signs	TM06: Traffic Information Dissemination
14 - Transit Traveler Information Improvements	PT08: Transit Traveler Information
15 - Transit Management Improvements	PT02: Transit Fixed-Route Operations
15 - Transit Management Improvements	PT04: Transit Fare Collection Management
17 - Parking Management Systems	PM01: Parking Space Management
17 - Parking Management Systems	PM03: Parking Electronic Payment
18 - Event and Incident Management Improvements	PS14: Disaster Traveler Information
20 - Journey Trip Planning Tool Project	TI01: Broadcast Traveler Information

6. L-DC Regional ITS Needs

The existing ITS inventory provides an overview of the current ITS in the Region. This section documents the needs that can be addressed by ITS but are not, either in part or whole, addressed by the existing ITS.

6.1 L-DC Regional ITS Needs

Based on stakeholder input during the 2015 plan development process, the highest priority transportation needs for the L-DC Region are:

1. ***Improve information sharing among agencies***. The Stakeholders indicated that better information sharing was a high priority need for the Region. They stated that better sharing of existing information, including traffic and maintenance data and video images, can help address the Region's issues.
2. ***Improve traffic information dissemination***. The Stakeholders stated that the Region would benefit from improved dissemination of information regarding real-time traffic conditions. This includes providing information about congestion, incidents, directions for detours, and routing to events. Improved traffic information may require improved collection of traffic conditions.
3. ***Improve event management.*** This need addresses the coordination of agencies for events in the Region. It may include better interagency planning of road closures and restrictions, management of parking facilities, and interagency coordination for traffic control and incident response.
4. ***Improve multimodal information.*** The Region's traveling public indicated a significant need for improved and coordinated information regarding all modes, including transit, bicycle, motorized vehicles, pedestrian, and parking, to help them make intelligent decisions regarding how and when they travel. The need for information included pre-trip and en-route.
5. ***Improve traffic flow at intersections through improved signal timing and control***. The City of Lawrence has coordinated signals on some corridors. This Stakeholder need is specifically to improve flow at high-volume intersections during peak hour traffic in Lawrence.
6. ***Improve incident detection***. This need includes being able to detect incidents more rapidly as well as more rapidly gathering information to respond appropriately. Improved incident detection also includes the need that all relevant Stakeholders have access to incident information, primarily existing video images.
7. ***Improve inter-agency coordination***. Improved coordination would result in Lawrence Transit receiving better and more complete information about road closures, restrictions and maintenance that impact their fixed-route and paratransit routing and schedules. The interagency coordination could also help emergency responders be aware of closures and restrictions that could delay their responses.
8. ***Improve incident response coordination among agencies***. This need is closely related to the needs for improved inter-agency coordination and improved information sharing. To improve response coordination will require better information sharing and for the agencies to be able to communicate their plans and activities.

9. ***Improve transit efficiency and information sharing***. This need is for the transit agency to be better able to monitor the location of its vehicles, and thereby monitor the vehicle performance and provide better information to transit riders about vehicle schedules.

Appendix B – Prioritized L-DC Region ITS Needs and Strategies provides an update to the needs identified in the 2015 planning process.

7. Planned L-DC ITS Services

ITS Services were identified to address the L-DC Region's ITS needs that were consistent with the ITS Strategies. As described in **5. Existing L-DC Region ITS Services**, Service Packages are deployable units of ITS Service. The projects that were developed for the L-DC Region and that are described in **14. L-DC Region ITS Program or Project Funding** are developed to include one or more of the ITS Service Packages that address the Region's needs.

Table 5 lists the projects and ITS Service Packages planned for the L-DC Region. In some cases, these Service Packages exist in the Region but are planned to include new functionality or Stakeholders.

Table 5: L-DC Region Planned ITS Service Packages

Project	Service Package
02 - Traffic Detection Improvements Program	TM03: Traffic Signal Control (Traffic Detection Improvements)
06 - Emergency Signal Preemption Improvements Program	PS01: Emergency Call-Taking and Dispatch (Emergency Signal Preemption Upgrade)
06 - Emergency Signal Preemption Improvements Program	PS03: Emergency Vehicle Preemption (Emergency Signal Preemption Upgrade)
07 - Weather Monitoring Program	WX01: Weather Data Collection (Weather Monitoring)
07 - Weather Monitoring Program	WX02: Weather Information Processing and Distribution (Weather Monitoring)
08 - Electric Vehicle Infrastructure and Vehicles Program	ST05: Electric Charging Stations Management
10 - Bicycle/Pedestrian Warning Systems	VS12: Pedestrian and Cyclist Safety (Vicycle/Pedestrian Warning)
19 - Regional Virtual Data Warehouse	DM01: ITS Data Warehouse (Regional Data Warehouse)
20 - Journey Trip Planning Tool Project	TI01: Broadcast Traveler Information (Journey Trip Planner)
20 - Journey Trip Planning Tool Project	TI02: Personalized Traveler Information (Journey Trip Planner)
20 - Journey Trip Planning Tool Project	TI04: Infrastructure-Provided Trip Planning and Route Guidance (Journey Trip Planning)
21 - Connected Vehicles Project	ST09: Connected Eco-Driving
21 - Connected Vehicles Project	SU01: Connected Vehicle System Monitoring and Management
21 - Connected Vehicles Project	TM04: Connected Vehicle Traffic Signal System
09 - Work Zone Management Program	MC06: Work Zone Management (Workzone Management)
09 - Work Zone Management Program	MC07: Work Zone Safety Monitoring (Workzone Management)
15 - Transit Management Improvements	PT02: Transit Fixed-Route Operations (Transit Traveler Improvements)
15 - Transit Management Improvements	PT04: Transit Fare Collection Management (Transit Traveler Improvements)
15 - Transit Management Improvements	PT06: Transit Fleet Management (Transit Traveler Improvements)
15 - Transit Management Improvements	PT07: Transit Passenger Counting (Transit Traveler Improvements)
16 - Transit Signal Priority	PT09: Transit Signal Priority (Lawrence Transit)
17 - Parking Management Systems	PM01: Parking Space Management (Parking Management Systems)
17 - Parking Management Systems	PM03: Parking Electronic Payment (Parking Management Systems)
17 - Parking Management Systems	PM04: Regional Parking Management (Parking Management System)
18 - Event and Incident Management Improvements	MC08: Maintenance and Construction Activity Coordination (Event and Incident Management Improvements)
18 - Event and Incident Management Improvements	SU03: Data Distribution (Event and Incident Management Improvements)
18 - Event and Incident Management Improvements	TM08: Traffic Incident Management System
01 - Signal Coordination Program	TM01: Infrastructure-Based Traffic Surveillance (Signal Control and Coordination)
01 - Signal Coordination Program	TM03: Traffic Signal Control (Signal Coordination and Control)
03 - Traffic Signal Performance Measures Program	TM07: Regional Traffic Management
05 - Camera Deployment Program	TM07: Regional Traffic Management (Camera Deployment and Image Sharing)
09 - Work Zone Management Program	MC07: Work Zone Safety Monitoring
09 - Work Zone Management Program	MC08: Maintenance and Construction Activity Coordination
10 - Bicycle/Pedestrian Warning Systems	VS12: Pedestrian and Cyclist Safety
11 - Shared Mobility Program	TI06: Dynamic Ridesharing and Shared Use Transportation
12 - Dynamic Message Signs	TM01: Infrastructure-Based Traffic Surveillance (Dynamic Message Signs)
12 - Dynamic Message Signs	TM07: Regional Traffic Management (Dynamic Message Signs)
13 - Signal Beacon Deployment	TM12: Dynamic Roadway Warning (Signal Beacons)
14 - Transit Traveler Information Improvements	PT08: Transit Traveler Information (Transit Traveler Information Improvements)
16 - Transit Signal Priority	PT09: Transit Signal Priority
17 - Parking Management Systems	PM04: Regional Parking Management
18 - Event and Incident Management Improvements	MC08: Maintenance and Construction Activity Coordination

8. L-DC Region Operational Concept

The ITS Operational Concept is a Stakeholder–oriented view of the operational characteristics of ITS. While the Service Packages show the information flowing between ITS elements to perform functions, the operational concept describes the Stakeholder roles and responsibilities in developing, operating, and maintaining the Region's ITS.

Within the operational concept are each Stakeholder's roles and responsibilities. For ITS, these are related to the implementation and operation of ITS. The Operational Concept is what is expected of each Stakeholder, at a management and operational level, for the ITS to function, provide value and be used for its intended purpose.

The process of documenting the Operational Concept for the Region develops existing roles and allows the Stakeholders to identify what they are capable of, must prepare for, or will need support in performing. The process also assists in identifying gaps and duplication of efforts. Ultimately, the roles and responsibilities will be the basis for interagency agreements for the development, deployment, and operation of ITS. The entire list of existing and future roles and responsibilities is too long to include in the body of this document. They are documented for all Stakeholders and Service Areas in the L-DC Regional ITS RAD-IT Architecture database.

9. L-DC Region ITS Functional Requirements

To effectively deliver the ITS services in the L-DC Region, each system must perform certain functions. While the Operational Concept focused on how people and agencies will interact with ITS, functional requirements focus on what the ITS elements are required to do to accomplish the region's ITS objectives.

Operational Concepts *focuses on how people and agencies will interact with ITS*

Functional requirements *focus on what the ITS elements are required to do to*

A functional requirement is a declarative "shall statement" that precisely states a task or activity performed by an ITS element in the region. Each functional requirement is specific and discrete, defining a function that an ITS system must perform. For example, the KDOT roadside devices "shall include dynamic messages signs for dissemination of traffic information and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g., vehicle restrictions, or lane open/closed)."

The functional requirements for the L-DC Regional ITS Architecture have been selected based on the ITS Services, using the RAD-IT software tool. The selection has been tailored based on the stakeholders, inventory, and the region's objectives.

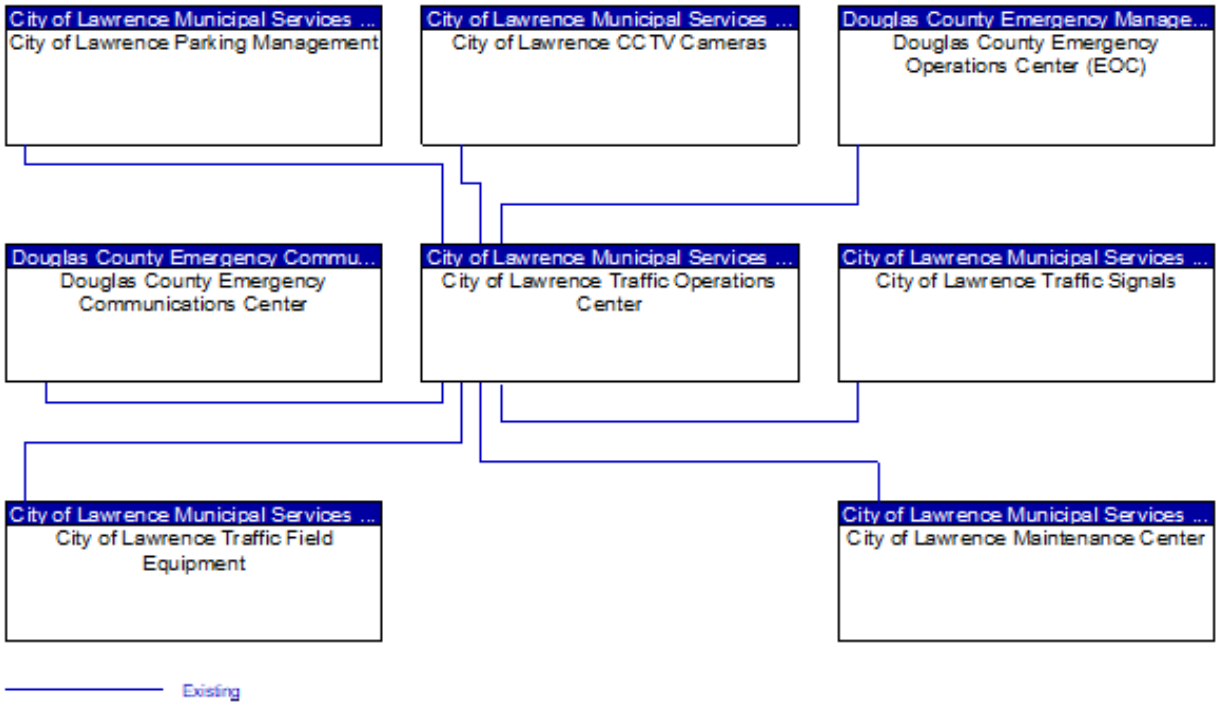
The L-DC Regional TS Architecture functional requirements are very detailed and comprehensive and total in the hundreds. They can be viewed at the project level in RAD-IT.

10. L-DC Region Interconnects and Information Flows

The various ITS elements must connect and exchange information for the L-DC Regional ITS Architecture to perform the functions required to and meet the Region's transportation needs. Connections between the elements of the L-DC Regional ITS Architecture are defined at two levels, interconnects, and information flows.

Interconnects are the data connections between the Region's ITS elements. For example, a transit vehicle will have an interconnect to the transit center via wireless communication. The Lawrence Traffic Operation Center will be connected to traffic signals, traffic cameras, other centers and, potentially to the traveling public. **Figure 9** shows the City of Lawrence Traffic Operations Center's existing interconnects. Note that the Regional ITS Architecture contains both existing and planned interconnects, but **Figure 9** only shows the existing for the sake of keeping the diagram simple.

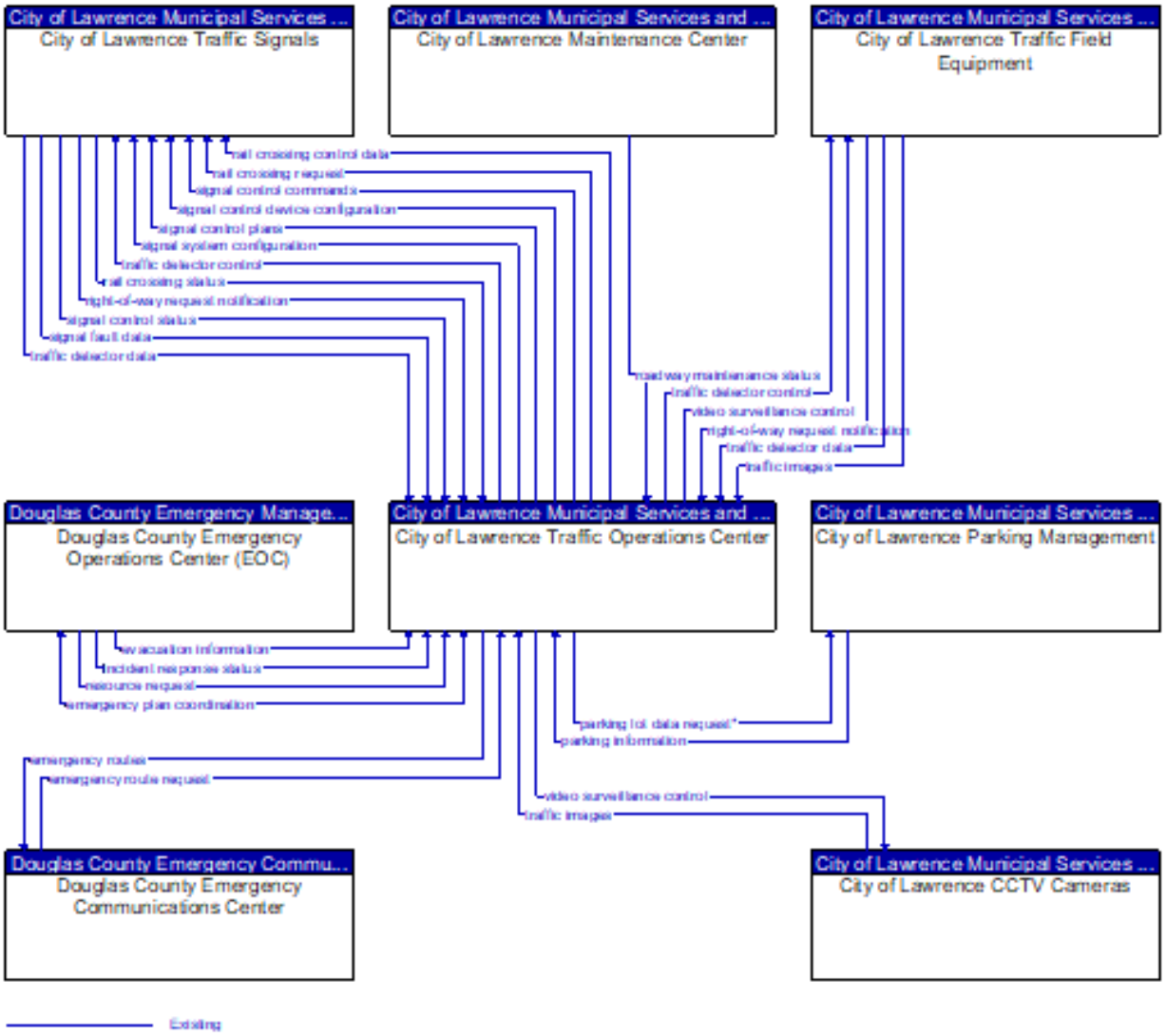
Figure 9: Existing City of Lawrence Traffic Operations Center Interconnects



Each interconnect contains specific information flows. Information flows define each type of information that will be exchanged between ITS elements. Information flows are significant because they define what data they each system will send and receive. The Regional ITS Architecture also defines open, non-proprietary standards for most information flow formats and protocols. The standards allow the Region to build systems that are interoperable and able to exchange information with other existing and new ITS. Standards are discussed in more detail in **12. L-DC Region ITS Program and Project Interagency Agreements.**

Figure 11 shows some of the existing information flows that occur among the City of Lawrence Traffic Operations Center and other ITS elements. As with interconnects, the Regional ITS Architecture has all existing and planned information flows, but **Figure 11** is a limited view for the sake of simplicity.

Figure 10: Existing City of Lawrence Traffic Operations Center Information Flows



The L-DC Regional ITS Architecture contains all existing and planned interconnects and information flows among the region's ITS elements. Diagrams of all information flows are available on the L-DC Regional ITS Architecture web site. The diagrams represent multiple contexts, including being able to view any ITS device with all existing and planned flows to and from that ITS device.

11. L-DC Region ITS Standards

11.1 National ITS Standards Development

ITS standards are fundamental to the establishment of an open ITS environment, a goal originally envisioned by the architecture developers. It is an important component of the information flows in a Regional ITS Architecture. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve.

Establishing regional and national standards for exchanging information among ITS deployments is important not only from an interoperability point of view. It also reduces risk and cost since a region can select among multiple vendors for products and applications. Standards help create competition, better products, and lower prices. Eight Standards Development Organizations (SDO) are responsible for defining ITS standards. **Table 6** identifies the SDOs and the types of interfaces for which they define standards.

Table 6: ITS Standard Development Organizations

Standard Development Organization	Interfaces Addressed
AASHTO (American Association of State Highway and	Traffic Management Center to Other Centers Traffic Management Center to Field Devices
ANSI (American National Standards Institute)	Commercial Vehicle Operations related system interfaces
APTA (American Public Transportation Association)	Transit Center to Other Centers Transit Center to Transit Vehicles
ASTM (American Society for Testing and Materials)	Archived Data Management Center Interfaces Vehicle to Vehicle Field to Vehicle
IEEE (Institute of Electrical and Electronics Engineers)	Vehicle to Vehicle Field to Vehicle
ITE (Institute of Transportation Engineers)	Traffic Management Center to Other Centers Traffic Management Center to Field Devices
NEMA (National Electrical Manufacturers Association)	Traffic Management Center to Other Centers Traffic Management Center to Field Devices
SAE (Society of Automotive Engineers)	Traveler Information Interfaces Location Referencing

Not all the standards defined by the SDOs will be used in the L-DC Region. Even within the Region, not all agencies will use standards. To conform to federal requirements, however, the Regional ITS Architecture is required to reference those standards that are applicable to the Region's ITS elements and information flows.

The standards that are most widely applicable to ITS deployments are the National Transportation Communications for ITS Protocol (NTCIP) family that define interfaces for Traffic Management Centers to Other Centers and to Field Devices. NTCIP is a group of communication protocols and data definition standards that have been designed for use in all types of systems dealing with the transportation environment, including those for freeways, traffic signals, emergency management, traveler information, and data archiving. It has been adopted by the FHWA to meet the needs and requirements for ITS

communication and to ensure that inter-network connectivity is done through industry standard interfaces.

11.2 ITS Standards in Procurement Specifications

The use of ITS standards in procurement specifications often depends on how much risk can be afforded. Because the ITS standards are always evolving, there is the risk of a standard changing during a regional ITS program's or project's development. Also, early deployers will often identify improvements to the standard that are not addressed by the current version of the standard. However, many standards are now mature and stable. Also, there is a FHWA Testing Program underway to speed up testing of ITS Standards. The use of standards in procurement should be decided on a project-by-project basis.

Making the best choices for standards depends on multiple factors, including throughput (how much data must be transmitted or received on the interface), network topology (how the ITS systems are connected to each other), and infrastructure (fiber optic lines, leased land lines, etc.), among others. The exact process for making this decision will be a function of project Stakeholders, with the support of the Architecture Maintenance Team. The Architecture Maintenance Team is discussed in **15.2 Architecture Maintenance**.

In determining when and how to incorporate ITS standards for a given interface, it is critical to understand the relative maturity of the standards. Currently, many of the exact standards for specific projects have not been formally published, but the process for making those decisions is developing. For each potential standard that may be applicable, the project Stakeholders and Architecture Maintenance Team should consider:

- Has the ITS standard been approved or published by the Standard Development Organizations (SDOs)?
- Has the ITS standard been adopted by multiple vendors?
- Has the ITS standard been tested, whether informally by vendors or through the formal ITS Standards Testing Program funded by FHWA?
- Is there an amendment to the ITS standard currently in the works, and if so, how much of the standard will change as a result?

11.3 Standards Availability

Standards are available directly from the SDOs, as described earlier in **11.1 National ITS Standards Development**. Standards documentation is available for purchase as individual copies and as sets, where a set is a series of standards. However, the purchase price does not allow copying of the standard, use by more than one entity concurrently, and it does not include updates. Additionally, region-wide licensing is not available.

Detailed knowledge or the possession of standards is not necessary for the Region's ITS Stakeholders. However, Stakeholders and the Architecture Maintenance Team should be aware of the standards identified as applicable for each information flow and understand which standards they will use.

11.4 ITS Standards for the L-DC Region

The ITS standards for the region are based on the information flows, as described in **10. L-DC Region Interconnects and Information Flows**. In reviewing and applying ITS standards, the user should be aware of the following:

- The standards only need to be applied where there will be an exchange of data or monitoring/control functions between systems.
- The specific standards listed are not static. As the standards are implemented, changes are being made. In addition, the standards are being changed as technology evolves. Typically, these changes result in standards that are backward compatible, although new functionality may not be supported with the older versions of the relevant standard.

Appendix E – ITS Standards Supporting Regional and National Interoperability lists the standards included in the Lawrence-Douglas County ITS Regional Architecture.

12. L-DC Region ITS Program and Project Interagency Agreements

Agreements among the stakeholder agencies and organizations in the L-DC Region may be required to realize the integration proposed in the ITS Architecture. Each connection between systems owned by different Stakeholders represents cooperation among Stakeholders and a potential need for an agreement.

One of the first steps of any ITS Program and/or Project development should be to review existing Stakeholder agreements that support sharing information, funding, or specific ITS programs or projects. The review should assess if the existing agreements can be extended and used to support the cooperative implementation and operation of ITS in the region. The L-DC Region's existing interagency agreements may already address some of the agreements identified in this Plan.

The list of the necessary L-DC Region ITS Program and/or Project agreements was developed based on the stakeholder roles and responsibilities, awareness of the types of existing or planned ITS for implementation by the region, and the information that will be exchanged among systems for the ITS Programs or Projects.

12.1 Agreement Types

There is a wide range of agreement types that may be necessary to develop and implement an ITS program or project. The nature of existing interagency relationships and existing "local practices" may influence the types of agreements various agencies develop. For example, two agencies that are co-located or frequently work together may have a working relationship that simplifies the need for detailed agreements. Other Stakeholders brought together for the first time by an ITS Program or project, may need a more clearly defined agreement that helps each understand the responsibilities and capabilities of each Stakeholder.

Table 7 contains descriptions of common types of agreements relevant to the Region's ITS program or projects as identified in the *FHWA Regional ITS Architecture Guidance Document*.

Table 7: Common ITS Program or Project Agreement Types

Type of Agreement	Description
Handshake Agreement	Early agreement between one or more partners. Not recommended for long term operations. Does not require formal documentation.
Memorandum of Understanding (MOU)	Initial agreement used to provide minimal detail and usually demonstrates a general consensus. Used to expand a more detailed agreement like an Interagency Agreement, which may be broad in scope but contains all of the standard contract clauses required by a specific agency. May serve as a means to modify a much broader agreement, allowing the master agreement to cover various ITS projects throughout the region and the MOUs to specify the scope and differences between the projects.
Interagency Agreement (IA)	Between local public agencies (e.g. transit authorities, cities, counties, etc.) for operations, services, or funding. Documents responsibility, functions, and liability at a minimum.
Operational Agreement (OA)	Between any agency involved in funding, operating, maintaining or using the right-of-way of another public or private agency. Identifies respective responsibilities for all activities associated with shared systems being operated and/or maintained.
Funding Agreement (FA)	Documents the funding arrangements for ITS projects (and other projects). Includes at a minimum standard funding clauses, detailed scope, services to be performed, detailed project budgets, etc.
Master Agreements (MA)	Standard contract and/or legal verbiage for a specific agency and serves as a master agreement by which all business is done. It can be found in the legal department of many public agencies Allows states, cities, transit agencies, and other public agencies that do business with the same agencies over and over (e.g., cities and counties) to have one Master Agreement that uses smaller agreements (e.g., MOUs, Scope-of-Work and Budget Modifications, Funding Agreements, Project Agreements, etc.) to modify or expand the boundaries of the larger agreement to include more specific language

12.2 Agreement Focus

Rather than focus on specific technologies in an agreement, the focus is typically on the scope-of-service and specific agency responsibilities for various components of the service. The agreement should also describe the high-level information that each agency needs to exchange to meet the objectives of the ITS Program or Project. The agreement should not focus on how the delivery of that information will occur.

A simple handshake agreement may be enough for some L-DC Region ITS planning activities. Once interconnections and integration of systems occur, however, agencies may want a more formal agreement in place to document items such as how operations will occur and who will maintain the system. Documented agreements will aid agencies in planning their operational costs, understanding their respective roles and responsibilities, and in building trust for future projects. Formal agreements are necessary where funding or financial arrangements are defined, or where participation in large regionally significant projects is required.

A few ITS Programs or Projects planned for the L-DC Region do not require agreements because they involve a single Stakeholder or involve multiple agencies each acting independently. The projects that are not foreseen as requiring Stakeholder agreements are:

- Traffic Detection Improvements (Program 2)
- Traffic Signal Performance Measures Program (Program 3)
- Bicycle/Pedestrian Warning Systems (Program 10)
- Signal Beacons (Project 13)
- Transit Management Improvements (Project 16)

In the ITS program and project tables found in **13.4. L-DC Region ITS Programs or Projects** the agreement types are listed. For most projects, it is recommended that a Memorandum of Understanding (MOU) be

the first step in project planning. The purpose of an initial MOU is to confirm that all Stakeholders are in support of the project and in agreement on what the objectives are. Stakeholders becoming a party to the MOU will then pursue further agreements, as needed, for development, deployment, operations, and funding. In some cases, an MOU is not listed as needed. These ITS programs or projects are generally those with clear objectives or among Stakeholders with an existing working relationship.

13. L-DC Region ITS Programs or Projects

ITS programs or projects are deployable bundles of ITS Services that will achieve the Region's ITS strategies and map directly to the Region's needs. The projects represent ITS that may occur over the course of at least ten years. The projects are defined in a logical, or ordered, sequence. The project sequencing contributes to the integrated regional transportation system depicted in the architecture.

Note that the ITS programs or projects are described at a high level. The descriptions are general, any location information has not been committed to at this time, and the cost estimates are accurate to an order of magnitude. More specific detail, such as precise costs, specific locations and device quantities are established in each project's planning process.

13.1 Project Definition Process

The development of the ITS programs or projects for the L-DC Region was performed in coordination with the Stakeholders, who provided needs, existing ITS inventory and their capabilities. The 2015 planning process mapped the needs to ITS Services that address them.

Next ITS strategies that aligned with the Stakeholders' capabilities and operations were identified. Then, the Strategies and ITS User Services were reviewed in detail by the Project Team to define Candidate ITS Programs or Projects. The Candidate ITS Programs or Projects represented realistic and deployable groupings of the ITS Services. In some cases, a single strategy resulted in a Candidate Project. In others, a single Candidate Project was defined to achieve several ITS strategies.

The Candidate Project definition stage was followed by a Stakeholder review as discussed **13.2 Project Review**.

13.2 Project Review

The Candidate ITS Programs or Projects were presented to Stakeholders at a Workshop on April 9, 2015. Stakeholders reviewed the need, feasibility, and dependencies of the projects, as well as identifying any regional needs which were not addressed through the Candidate ITS Programs or Projects. The Stakeholders were asked to suggest changes that included modifying Candidate ITS Programs or Projects and to propose new ITS ideas.

During the 2021 process, the Steering Committee reviewed the projects to provide updated information about timing and if projects had been completed. Further the needs were reviewed to determine if there was any progress made since the last plan was completed. Additionally, the newly identified ITS needs were discussed and new projects were identified.

13.3 Project Sequencing

Stakeholder feedback was incorporated into the definition of ITS Programs or Projects, and into how they would be sequenced. Sequencing determines when projects should be planned to maximize the benefit of ITS most effectively in the Region, build upon existing and other planned ITS, and deploy mature and proven technologies.

Projects in the L-DC Regional ITS Architecture are placed in three timeframes rather than attempting to establish specific decreasing priority ranking for all identified projects. They are:

1. ***Near-term*** – Near-term projects are needed in the next three years (2021 - 2024). These projects address the Region's highest-priority needs using realistic and mature technologies. Funding may not presently be available for the near-term projects, but they represent those projects that should be considered first as funding becomes available.

2. ***Medium-term*** – Medium-term projects should be deployed within the next six years (2027). Medium-term projects address needs in the region that may not be as critical as those identified for the near-term. A project may also be programmed for the medium-term if its deployment is dependent upon other projects not yet deployed, or if funding opportunities will not become available in the near-term.
3. ***Long-term*** – Long-term projects should be deployed in the next ten years (2031). These projects address Regional needs that are not currently high priorities but can be addressed through ITS. They may also be considered long-term because their deployment depends on other projects planned in the near- and medium-term, are unfunded, or are dependent upon technologies that are still evolving.

Further some of the projects were identified as programs that were ongoing and have specific projects within them. It is important to understand that the Project Sequencing is intended as a guide and not an inflexible prescription. Some projects should be considered longer-term efforts because near-term deployment may represent an unacceptable risk or capital cost, or because there is no near-term funding available. In some cases, major events in a region may shift a region's priorities and an ITS Program or Project identified as medium- or long-term can be shifted to the near-term to address the newly high-priority needs. In other cases, an early opportunity to deploy a medium- or long-term Project in the Region, with relatively low risk, may present itself. Or perhaps, a technology or system advanced more quickly than was originally anticipated by this Plan.

13.4. L-DC Region ITS Programs or Projects

Table 8 lists the sequenced ITS programs or projects for the L-DC Region. The inclusion of a project in this list does not mean that it has been programmed in other regional transportation plans. Many programs or projects on this list have committed funding. This Plan is a means for identifying potential ITS projects that should be considered and possibly programmed into the Region's funding processes.

It should also be noted that these are planning level cost estimates, which will need to be refined as project scopes are defined.

Table 8: L-DC Regional ITS Programs or Projects

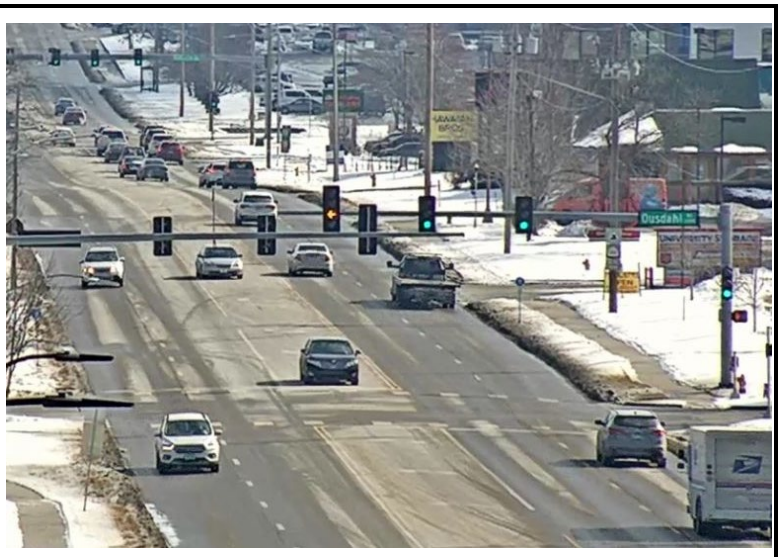
		Projects	Total Project/Program Cost Low Estimate		High Estimate
Ongoing Programs *(Projects that are not one time expenses)*	1	Signal Coordination Program	$ 250,000		$ 500,000
	2	Traffic Detection Improvements Program	$ 1,000,000	to	$ 1,500,000
	3	Traffic Signal Performance Measures Program	$ 236,000		$ 386,000
	4	Fiber Communications Expansion Program	$ 839,400		
	5	Camera Deployment Program	$ 366,000	to	$ 570,000
	6	Emergency Signal Preemption Improvements Program	$ 73,000		$ 170,000
	7	Weather Monitoring Program	$ 50,000		$ 500,000
	8	Alternative Fuels or Low-No Emissions Infrastructure and Vehicles Program			
		8a Lawrence Public Charging Stations	$ 75,000		
		8b Private Charging Stations	$ 375,000		
		8c Transit Charging Stations	$ 5,200,000		
		8d Transit Vehicles	$ 12,412,500		$ 49,650,000
		8e Lawrence City Vehicles (Including Fleet & Operations) - 782	Unknown		Unknown
		8f Lawrence City Charging Infrastucture	Unknown		Unknown
		8g Other Cities Vehicles and Charging Infrastructure	Unknown		Unknown
		8h County Vehicles and Charging Infrastructure - 371	Unknown		Unknown
	9	Work Zone Management Program	$ 240,000	to	$ 348,000
	10	Bicycle/Pedestrian Warning Systems Program	$ 750,000	to	$ 900,000
		Total Estimated Ongoing Programs Cost	**$ 21,866,900**	to	**$ 54,524,000**
Near-Term *(planned for the next three years)*	11	Shared Mobility	Unknown	to	Unknown
	12	Dynamic Message Signs	$ 3,150,000	to	$ 4,200,000
	13	Signal Beacon Deployment	$ 600,000	to	
	14	Transit Traveler Information Improvements	$ 250,000	to	$ 280,000
		Total Estimated Near-Term Programs Cost	**$ 4,000,000**	to	**$ 4,480,000**
Medium-Term (*planned for three to six years*)	15	Transit Management Improvements	$ 722,090		
	16	Transit Signal Priority	$ 66,000	to	$ 234,000
	17	Parking Management System	$ 250,000	to	$ 1,000,000
	18	Event and Incident Management Improvements	$ 800,000	to	$ 2,000,000
		Total Estimated Medium-Term Cost	**$ 1,838,090**	to	**$ 3,234,000**
Long-Term *(planned for six to ten years)*	19	Regional Virtual Data Warehouse	$ 15,000	to	$ 300,000
	20	Journey Trip Planner Tool	$ 300,000	to	$ 570,000
	21	Connected Vehicles	Unknown	to	Unknown
		Total Estimated Long-Term Cost	**$ 315,000**	to	**$ 870,000**
		Total Cost of All Projects	**$ 28,019,990**	**to**	**$ 63,108,000**

13.4.1 Signal Coordination Program

Description:

This project will expand and improve the use of traffic signal coordination along major corridors throughout the City of Lawrence. This program will enable signal coordination control of signals at these intersections through control at the Traffic Operations Center. Signal coordination is a continuing process. Staff will monitor existing coordination and prioritize future changes as traffic patterns change, communication infrastructure is expanded, and signal equipment improved.

The effectiveness of existing plans and implementing a new coordination plan will be evaluated through the Signal Performance Measures Data and traffic count data. Plans will be updated after significant equipment upgrades or adding new signals to a corridor.



Timeframe:

Ongoing

Related Programs:

- Camera Deployment
- Work Zone Management
- Dynamic Message Signs
- Fiber Communications Expansion
- Event and Incident Management
- Traffic Detection Improvements
- Traffic Signal Performance Measures
- Regional Virtual Data Warehouse Project
- Connected Vehicles

Completed Project Areas:

- 6th Street from Massachusetts Street to George Williams Drive (2020).
- Iowa Street from 6th to 34th Street (2020).
- 23rd/Clinton Pkwy from Harper to Inverness (2021).

Potential Future Project Areas:

- Bob Billings from Iowa Street to Wakarusa
- N 2nd Street from Kansas River to KTA
- Tennessee/Kentucky St from 7th Street to 19th Street
- 19th Street from Massachusetts to Iowa Street
- Kasold Drive from 6th Street to Clinton Pkwy

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other Stakeholders:

- KDOT

Agreements

Interagency Agreement: The IA may incorporate the funding arrangement that describes the role of funding provided by the participating Stakeholders. The IA may also include the expectations of each agency for the operation and use of the expanded signal control, and how the Project's performance will be measured. Because the project includes cameras, the IA may indicate KDOT and the City's expectations for sharing images with other agencies and the public.

Need(s) Addressed:

- Improve traffic flow at intersections through improved signal timing and control.
- Implement or improve signal coordination.

ITS Service Packages:

TM03: Traffic Signal Control

Estimated Planning Level Cost:

The project cost is approximately **$3,500 per intersection** for design and implementation. The City anticipates budgeting between **$50,000 and $100,000 per year** for coordination and timing projects for a final project cost of **$250,000 to $500,000**. This cost assumes the use of existing equipment at each intersection. The cost of new cameras, controllers, fiber optic network, and signal head improvements will be included in other programs.

Performance Measures:

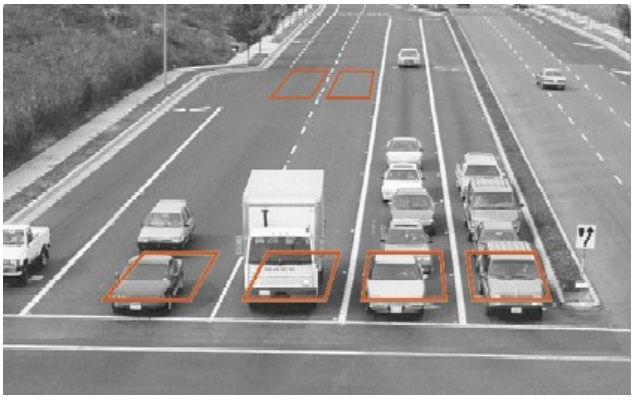
The effectiveness of this project can be measured through the following measures:

- Travel times in the corridors.
- Congestion levels in the corridors.
- Vehicle delay at intersections.

13.4.2 Traffic Detection Improvements Program

Description:

The Traffic Detection Improvements Program will continue to upgrade existing camera-based detection devices with radar detection equipment. Upgrading detection technology will improvement signal reliability and coordination plan performance.



The City has upgraded to radar-based detection at 36 of the 102 City owned or maintained traffic signals to improve system reliability and provide better data to for system performance measurement. Future improvements may include advanced detection and other improvements to better classify vehicles and pedestrians and provide better response. An ultimate detection system may only detect the presence of vehicles, but also be to identify and track when they arrive at the intersection (red/yellow/green) and provide accurate traffic counts.

The detection equipment may also be able to identify and classify pedestrians and bicycles at intersections. Once bicyclists and pedestrians are detected, the intersection can respond accordingly by providing a green when only a bicycle is present, or automatically triggering a walk sign for the pedestrian.

The Traffic Detection Improvement Project can be coordinated with the Bicycle/Pedestrian Warning Systems Project to detect bicycles and pedestrians.

Timeframe:

Ongoing

Project Areas:

- City of Lawrence

Related Programs:

- Signal Coordination and Control Expansion
- Work Zone Management
- Dynamic Message Signs
- Fiber Communications Expansion
- Event and Incident Management
- Traffic Signal Performance Measures

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Agreements:

Not necessary

Need(s) Addressed:

- Improve traffic flow at intersections through improved signal timing and control.
- Improve bicycle/pedestrian warning systems.

ITS Service Packages:

TM01: Infrastructure-Based Traffic Surveillance

Estimated Planning Level Cost:

The City is currently spending approximately **$20,000 per intersection** to upgrade to radar-based detection. Between **$100,000 and $200,000 per year** is budgeted to continue to improve detection systems. The system will continue to be improved after radar-based detection is fully implemented by adding advanced detection or bicycle/pedestrian detection as needed.

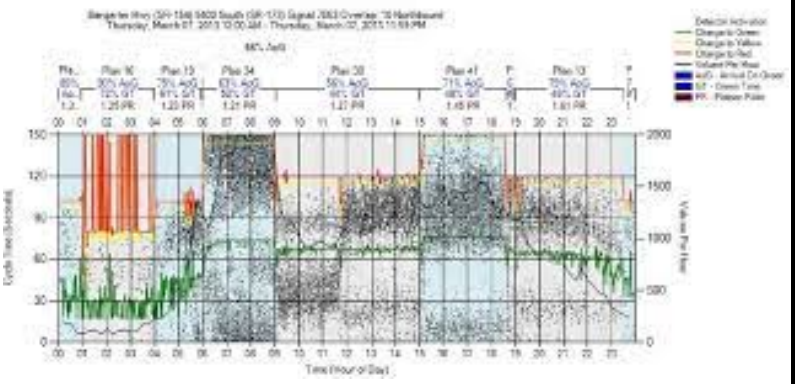
Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Traffic flow at intersections.
- Reduced bicycle/pedestrian crashes.

13.4.3 Traffic Signal Performance Measures Program

Description:



The Traffic Signal Performance Measures Program will allow the Traffic Operations Center to identify signal failures or significant traffic pattern changes in real time and quickly respond. Through expanding the fiber optic communications infrastructure, more modern controllers are now able to send high-resolution data where data trends can be established for different intervals. The TOC will monitor system trends to inform repairs and allocate resources for timing or coordination updates. The system will allow staff to track system performance over time and send real time alarms for detection failures or other data anomalies.

The system can measure turning movement counts, red-light violations, split failure, phase terminations, arrivals on green/yellow/red and pedestrian delay. The initial phase of the program will maximize the use of the existing infrastructure and focus on alarming for detection failures. The next step for developing this program will require detection improvements to track at what point in the cycle vehicles are arriving at the intersection. This information can be used to identify areas that require an updated timing/coordination plan due to long term traffic pattern changes or where a special event plan would be most beneficial. Future phases may include integrating the data in the Work Zone Management, Dynamic Message Signs and Event Management Programs.

Timeframe:

Ongoing

Project Areas:

- City of Lawrence

Related Programs:

- Work Zone Management
- Dynamic Message Signs
- Fiber Communications Expansion
- Event and Incident Management
- Traffic Detection Improvements

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Agreements:

Not Necessary

Need(s) Addressed:

- Improve traffic flow at intersections through improved signal timing and control.
- Improve signal reliability.
- Improve response time to make repairs.
- Improve understanding of the effectiveness of coordination and timing plans.
- Identify times or areas for timing and coordination improvements or special event plans.

ITS Service Packages:

TM03: Traffic Signal Control

TM07: Regional Traffic Management

Estimated Planning Level Cost:

The estimated cost to implement a Traffic Signal Performance Measures Program **is $8,000 to install the software and $300 per year per intersection included in the program**. Signals will be added to the program as the fiber system is expanded. Additional resources will be required to develop effective alarms and data analysis systems.

Performance Measures:

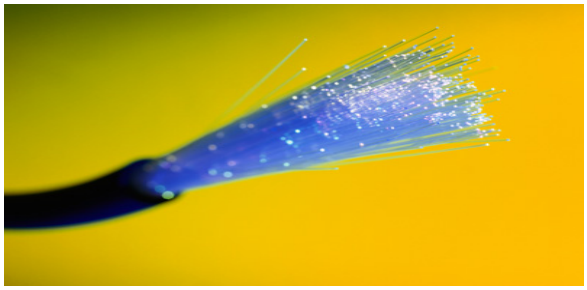
The effectiveness of this project can be measured through the following measures:

- Travel times in the corridors.
- Congestion levels in the corridors.
- Vehicle delay at intersections.

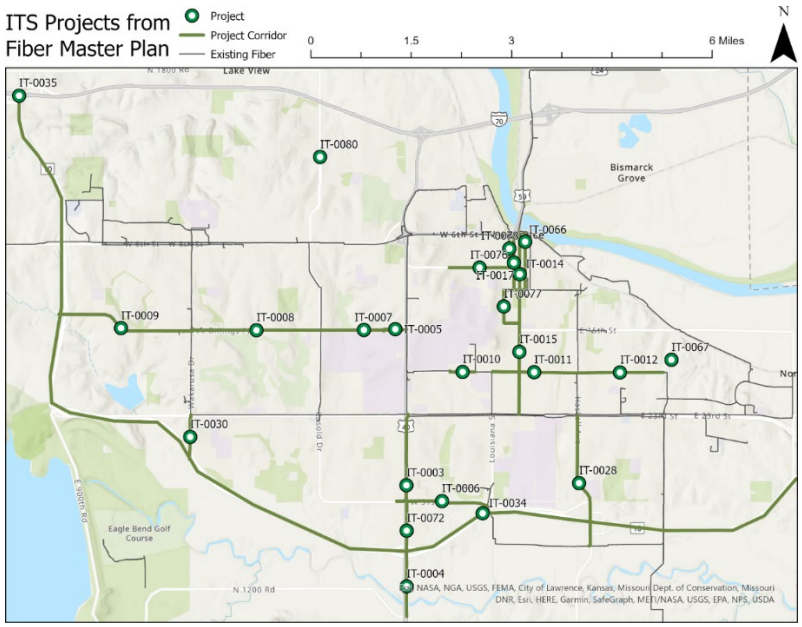
13.4.4 Fiber Communications Expansion Program

Description:

This project will expand the deployment of the Region's communications network that is available for the exchange of transportation data. It will primarily use fiber optic, but also use alternative data communications where fiber is not feasible or cost-effective. Alternate technologies may include cellular and microwave. The purpose is to increase the connectivity of devices and agencies in the Region for improved data collection, device management and information sharing.



The City of Lawrence already has significant fiber connectivity, including to 52 of 104 signals and a majority of its traffic cameras. This project would expand that network to integrate other agencies and devices. It is important to note that the deployment of fiber will be done with other Stakeholders who will also benefit from using the communications network.



Project #	Project Name	Total Score	Cost
IT-0003	23rd & Iowa to 31st & Iowa	18	$ 264,999
IT-0007	Bob Billings Iowa to Kasold Expansion	17	$ 263,640
IT-0010	19th St Naismith to Illinois	17	$ 81,508
IT-0012	19th St Haskell to Oconnell	17	$ 266,237
IT-0014	Downtown Massachusetts 6th to 11th	17	$ 176,715
IT-0015	Massachusetts 11th to 23rd	17	$ 382,200
IT-0017	Downtown Vermont St 6th to 11th	17	$ 186,183
IT-0028	Haskell Avenue 23rd to SLT	17	$ 414,797
IT-0004	US-59 Signal South of SLT	17	$ 184,469
IT-0066	Downtown New Hampshire St 6th to 11th	17	$ 189,746
IT-0008	Bob Billings Kasold to Wakarusa Expansion	16	$ 397,056
IT-0011	19th St Lousiana to Haskell	16	$ 261,265
IT-0006	31st Nieder to Lousiana	16	$ 289,247
IT-0005	Bus Transit Hub Connectivity	16	$ 76,093
IT-0072	Iowa Steet - 31st to SLT	16	$ 171,026
IT-0076	W 9th Street Fiber	16	$ 199,061
IT-0077	Tennessee Street - 11th to 14th loop	16	$ 179,636
IT-0078	Kentucky Street - 7th to 9th	16	$ 82,913
IT-0009	Bob Billings & Wakarusa to SLT Completion	13	$ 427,759
IT-0030	P&R District 1 & 3 Shops Connectivity	12	$ 136,491
IT-0034	KDOT SLT Connectivity	8	unknown
IT-0067	Consolidated Field Operations in Venture P	7	unknown
IT-0080	Kasold & Peterson Signal	7	unknown
		Total	**$ 4,631,041**

Timeframe:

Ongoing - Medium-term (three to six years)

Project Areas:

City of Lawrence (see list above)

Related Programs:

- Signal Coordination Program
- Traffic Detection Improvements Program
- Traffic Signal Performance Measures Program

Lead stakeholder:

- **City of Lawrence Information Technology**

Other Stakeholders:

- City of Lawrence Municipal Services and Operations
- Douglas County Public Works
- KDOT
- KTA
- University of Kansas
- KC Scout
- Private communications providers

Agreements:

MOU: The City has MOUs with Douglas County, KU, and multiple private communication providers regarding fiber.

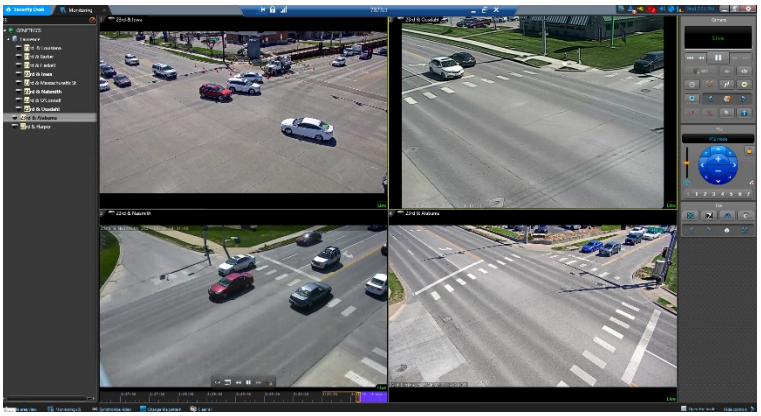
Interagency Agreement: The IA should address the access of each agency to the communications network, the bandwidth available to each agency, and the agencies' authority to connect devices. The IA may also address issues such as right-of-way access for installation and maintenance of communications hardware.

Operating Agreement: The OA should address the ongoing maintenance and operation of the communications network. It may include the expectations of the agencies and private communications providers to keep the system operational, and the expectations of stakeholders in

performing other roadway construction and maintenance that may impact the network. The OA may also address the sharing of fiber and how the strands may be distributed by Stakeholder or function.	
Need(s) Addressed: • Provide quality real time congestion related information. • Improve traffic information dissemination. • Improve information sharing among agencies. • Improve event management. • Improve inter-agency coordination. • Improve incident response coordination among agencies.	*ITS Service Packages:* No specific ITS Service Packages are directly addressed by this project. However, improved communications significantly improve virtually all other ITS Programs or Projects in the Region.
Estimated Planning Level Cost: **The total estimated cost is $4.7 million**. This cost estimate was developed by the City of Lawrence.	
Performance Measures: The effectiveness of this project can be measured through the following measures: • Number of devices connected. • Number of agencies sharing information. • Data exchange rates among devices and centers.	

13.4.5 Camera Deployment Program

Description:



This project expands upon the Traffic Signal Coordination Program by adding new and updating existing cameras to the City's available inventory of traffic images.

Currently the City has PTZ cameras at 52 out of 102 City owned or maintained traffic signals and 360-degree cameras at 6 six locations in Downtown Lawrence. Between 6 and 10 cameras are planned to be added to the system in 2021 as part of the South Iowa Traffic Signal Improvement Project. This expansion may include multiple City-owned cameras along K-10 at Iowa Street and 27th Street.

Traffic and engineering staff will work with local law enforcement agencies to specific the most effective equipment to install at each site. The project will implement improved image-sharing technology at the City of Lawrence Traffic Operations Center to improve real-time sharing of images with other agencies in the Region. This will allow the Traffic Operations Center to view images from KTA's two cameras on the Turnpike in Douglas County, and be able to share real-time images to the Region's emergency responders and traffic management agencies via the Internet. The City of Lawrence will be able to share camera images but will not share control of City cameras. Only the Traffic Operations Center will be able to control their pan-tilt-zoom functions.

Timeframe:

Ongoing

Related Programs:

- Signal Coordination and Control Expansion
- Work Zone Management
- Dynamic Message Signs
- Fiber Communications Expansion
- Event and Incident Management
- Traffic Detection Improvements
- Traffic Signal Performance Measures
- Regional Virtual Data Warehouse Project

Planned 2021 Project Areas:

- South Iowa
- K10 and Iowa Street
- K10 and 27th Street

Potential Future Project Areas:

- City Wide

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other Stakeholders:

- City of Lawrence Police
- Douglas County Emergency Communications
- KTA
- KDOT
- KC Scout

Agreements

MOU: Because the City of Lawrence will be solely responsible for deploying upgraded software and the operation and maintenance of the cameras, a simple MOU is recommended among agencies to agree upon the sharing of images from the cameras. The MOU may describe the expectation of the City in how other agencies use the images, and the agencies' expectation of availability of camera images.

Interagency Agreement: The IA should describe specifically how agencies will connect to the camera software, such as through a direct connection with the Traffic Operations Center, or via a private or public web site. The IA may also include any funding arrangements that describe the sharing of costs for operating and maintaining the camera sharing software.

Need(s) Addressed:

- Improve arterial roadway traffic surveillance.
- Improve access to regional cameras.
- Improve incident detection.
- Improve freeway traffic surveillance.
- Improve information sharing among agencies.

ITS Service Packages:

TM01: Infrastructure-Based Traffic Surveillance

TM07: Regional Traffic Management (Camera Deployment and Image Sharing)

Estimated Planning Level Cost:

The project cost is approximately **$3,000 to $5,000 per intersection** depending on required equipment. The City anticipates budgeting between $5,000 and $30,000 per year to continue to improve the camera system.

The project cost is related only to new control software for existing cameras. The estimated cost for implementation of image sharing technology is **$60,000**. The total cost is between **$366,000 and $570,000.**

Performance Measures:

The effectiveness of this project can be measured through the following measures:

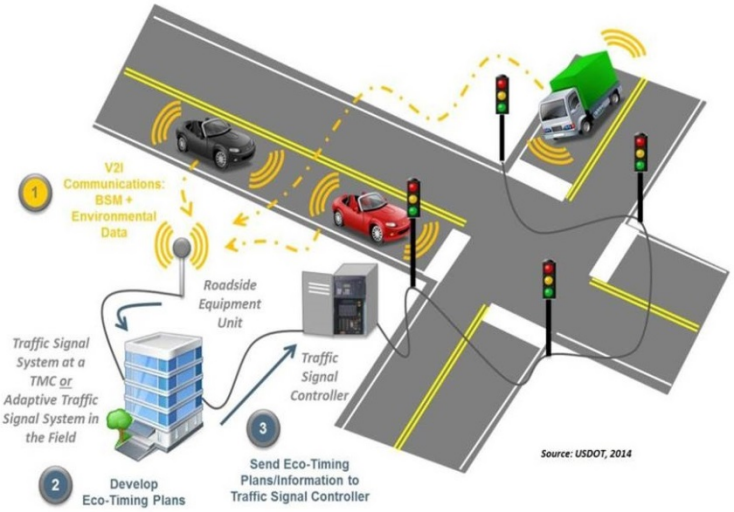
- Travel times in the corridors.
- Incident response times.
- Impact of images on traffic management.

13.4.6 Emergency Signal Preemption Improvements Program

Description:

In 2017-2018 Lawrence-Douglas County Fire-Medical vehicles and intersections were upgraded from the old strobe-based system to vehicle-to-signal controller wireless communication. The new system uses wireless communications that sends an encrypted signal directly from the vehicle to the signal controller. The wireless communication is more reliable and can provide a more rapid response for the approaching emergency vehicle. The technology was also instituted on all 104 existing traffic signals. This project needs to be continuously implemented as new Fire-Medical vehicles are purchased and signalized intersections are constructed.

The Lawrence Police Department is interested in remote control of intersections during events and incidents (project 19).



Timeframe:	*Project Areas:*
Ongoing	• Locations throughout the City of Lawrence
Lead stakeholder:	*Other stakeholders:*
• **Lawrence-Douglas County Fire Medical**	• City of Lawrence Municipal Services and Operations • Lawrence Police • Douglas County Emergency Communications

Related Programs:

- Work Zone Management Program
- Event and Incident Management Program

Agreements:

Interagency Agreement: Any existing agreement between the City and Fire-Medical addresses how emergency signal preemption is used in the City of Lawrence. That agreement can remain in place to describe each agency's roles and responsibilities and when signal preemption is used. An IA is needed to define the technology that will be used in the improved signal preemption. It will describe what is expected of the City to implement wireless communications with fire and medical vehicles, and the system that will be deployed on-board vehicles.

Need(s) Addressed:	*ITS Service Packages:*
• Reduce emergency vehicle delays at signals. • Enable remote emergency control of signals.	PS03: Emergency Vehicle Preemption & PS03: Emergency Vehicle Preemption (Emergency Signal Preemption Upgrade)

Estimated Planning Level Cost:

The estimated cost of this project includes on-board technology ranging in cost from **$800 to $2,000 per emergency vehicle**, **and intersection control hardware and software that ranges from $5,000 to $10,000**. Assuming 6 vehicles a year for 10 years and 1 signal every two years for 10 years, **the estimated total cost is $73,000 to $170,000**. This estimate is based on the federal ITS Knowledge database from 2015.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Incident response times.
- Impact on traffic flow and congestion.

13.4.7 Weather Monitoring Program

Description:

This program will deploy road-weather sensors in the Region to improve the monitoring and response to weather conditions. Ultimately, the weather sensors will be able to collect wind, precipitation, images of the roadway, pavement conditions and ice or snow accumulation.

Information collected from the sensors throughout the Region will be shared to provide maintenance crews the ability to observe conditions at remote locations and be able to plan and respond to severe weather.

The information can be used to determine when and how many winter maintenance vehicles to deploy, and what types of materials will be needed to clear the roadways for travel. The information may also be used by the 911 dispatch center to identify conditions and provide better routing to emergency vehicles.

Timeframe:

Ongoing

Related Programs:

- Signal Beacons Project

Project Areas:

- Lawrence-Douglas County Region

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other stakeholders:

- Douglas County Emergency Communications Center
- Douglas County Public Works
- KDOT
- KTA
- Lawrence Transit
- KU on Wheels
- First Transit
- City of Lawrence Information Technology

Agreements:

MOU: The MOU should define the roles and responsibilities of each stakeholder and define the purpose of the deployment of multiple weather sensors in the Region. The MOU should also identify the agreed upon data to be collected and how it will be shared among the participating Stakeholders. The MOU should also address the type of sensors to be deployed by multiple agencies to ensure interoperability with central software.

Interagency Agreement: The IA should address specific standards and data formats to be collected and exchanged by the weather sensors. The IA should also define who will operate the central software and how information will be shared from that central software to other participating Stakeholders. The IA should also address operations and maintenance obligations for each participating Stakeholder.

Need(s) Addressed:

- Improve weather and road condition information.
- Improve maintenance response to incidents and requests.
- Improve ability to monitor and provide information about flooding.

ITS Service Packages:

WX01: Weather Data Collection
WX02: Weather Information Processing and Distribution

Estimated Planning Level Cost:

City of Lawrence is in the process of implementing Phase 1 in 2021 of this project at a cost of **$50,000**. Phase 1 includes establishing a communication system, software, website, installing pavement sensor condition monitors at 3 locations and rain gauges at two locations. The estimated cost of a full environmental weather stations including cameras is **$40,000 to $60,000 per unit** depending on communications and power. The City plans to expand the system at a cost of **$10,000 - $20,000 per year**.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Time to clear roadways.
- Usage of maintenance equipment and materials.
- Incident response time.

13.4.8 Alternative Fuels or Low-No Emissions Infrastructure and Vehicles Program

Description:

This project will install alternative fuels or low-no emissions infrastructure and vehicles. This could include compressed natural gas vehicles, electric vehicles, hydrogen vehicles, other future technologies, and the associated infrastructure. Currently two electric charging stations are located at Rock Chalk Park. Lawrence-Douglas County Sustainability is working to implement Lawrence City Commission Ordinance 9744, which establishes a goal of 100% clean, renewable energy for all energy sections including transportation by 2035. A downtown charging station is being planned for 711 New Hampshire St. KU Transportation Services is adding electric vehicle stations to potentially all three of their parking garages.

Lawrence Transit received a federal grant for 5 electric buses and charging infrastructure. These will be delivered in 2022. As part of Lawrence Transit's fleet replacement plan, they plan to apply for additional electric buses yearly through federal grant programs. If an average of 1-2 vehicles are purchased every year the fleet will be completely converted to electric buses by 2035.

The Lawrence-Douglas County Sustainability Office will be launching a Climate Action Plan in the spring of 2021. This plan will begin the planning for transitioning to zero emissions/renewable transportation. Thus, this program will become more fully fleshed out as more planning occurs.

To further reach sustainability goals, all city fleet vehicles will be transitioned to a non-fossil fuel energy source. This includes trash trucks, snowplows, etc. This program is split into various components:

- 8a Lawrence Public Charging Stations
- 8b Private Charging Stations
- 8c Transit Charging Stations
- 8d Transit Vehicles
- 8e Lawrence City Vehicles (Including Fleet & Operations) – 782
- 8f Lawrence City Charging Infrastructure
- 8g Other Cities Vehicles and Charging Infrastructure
- 8h County Vehicles and Charging Infrastructure – 371

Timeframe:

Ongoing - Long-Term (six to ten years)

Related Programs:

- Journey Trip Planner Project
- Potentially Connected Vehicles

Project Areas:

- City of Lawrence
- Douglas County

Lead Stakeholder:

- **Lawrence-Douglas County Sustainability Office**

Other stakeholders:

- Lawrence Transit
- KU Transportation Services
- City of Lawrence Parking
- City of Lawrence Municipal Services and Operations

Agreements:

Interagency Agreement: The IA between KU and the City of Lawrence will be developed for the city infrastructure on KU property.

Future other agreements may be necessary.

Need(s) Addressed:

- Sustainable transportation
- Air quality
- Foreign reliance on fossil fuels

ITS Service Packages:

ST05: Electric Charging Stations Management

Estimated Cost:

Charging stations are approximately $1,500 each. 50 public stations are anticipated costing $75,000, 250 private charging stations cost $375,000. Transit charging stations cost approximately $80,000. 65 transit charging stations are necessary equaling $5,200,000. A full-size electric bus costs approximately $822,500. An entire fleet of 60 electric buses cost approximately $49,650,000. The cost of converting Lawrence City vehicles and Douglas County vehicles to electric are unknown. The total expense for this program excluding the replacement of fleet vehicles is **$18,062,500 - $67,712,500**. As the Climate Action Plan is developed the complete picture of these costs will become more refined.

Performance Measures:

The effectiveness of this project can be measured through the following measures for the Transit portion of the program:

- Assess how battery electric technology performs in our operating environment
- Better understand operational implications (routes, charging, availability, etc.)
- Evaluate operating/maintenance costs vs. diesel
- Develop fleet electrification plan and timeline based on findings

13.4.9 Work Zone Management Program

Description:

The Work Zone Management Program will continue to improve an integrated implementation of technologies to improve the safety and efficiency of work zones. The City of Lawrence can recently made improvements with portable message signs requirements, construction zone mapping and public outreach. Future improvements may include using cameras to monitor traffic and operations in work zones, radio broadcasts to inform travelers of maintenance and construction activities and potential delays, portable barriers that can be controlled by maintenance crews, and locally controlled signals to improve flow and manage traffic. The work zone management systems will be portable and allow for monitoring of conditions at the Traffic Operations Center.

Timeframe:

Ongoing

Project Area:

- Work zones in the City of Lawrence

Related Programs:

- Event and Incident Management Project
- Dynamic Message Signs Project
- Emergency Signal Preemption Improvements Project
- Regional Virtual Data Warehouse Project

Lead Stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other Stakeholders:

- Douglas County Emergency Communications
- Lawrence Police
- Lawrence-Douglas County Fire-Medical

Agreements:

Interagency Agreement: The IA should describe specifically how agencies will communicate and navigate work zones and events and incidents. The agreement needs to detail procedures for MSO, Douglas County Emergency Communications, Lawrence Police, and Lawrence-Douglas County Fire-Medical for Two policies are needed: 1) for events and incidents (project 18) and 2) for work zones (project 9).

Need(s) Addressed:

- Improve/enhance work zone traffic handling plans.
- Increase use of portable traffic control equipment (Dynamic Message Signs, Highway Advisory Radio, etc.).

ITS Service Packages:

MC06: Work Zone Management

MC07: Work Zone Safety Monitoring

MC08: Maintenance and Construction Activity Coordination

Estimated Planning Level Cost:

The estimated costs for work zone management assume each unit includes a video camera, Highway Advisory Radio, portable Dynamic Message Sign, and portable Traffic Management System for a unit cost of $102,000 to $152,000. Work Zone Management may also require a software upgrade at the Traffic Operations Center to manage the mobile equipment at a cost of $18,000 to $22,000. **Total estimated cost for a work zone management system is $240,000 to $348,000**. This estimate was originally based on the federal ITS Knowledge database from 2015 but was expanded on to reflect 2021 estimates.[4] Additional costs through deployment of this program could be spread across projects where work zone management is needed

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Reduced crashes and injuries in work zones.
- Traffic flow in work zones.
    - Traffic speeds in work zones.

[4] https://www.itskrs.its.dot.gov/node/209269

13.4.10 Bicycle/Pedestrian Warning Systems Program

Description:

Bicycle-Pedestrian Warning Systems will provide advanced notice of the presence of bicycles and pedestrians on or near the roadway to traffic. This will improve awareness by drivers and the safety of bicyclists and pedestrians.

The systems may be deployed in locations with heavy pedestrian and bicycle traffic, such as the downtown Lawrence area and at shared use path crossings. The systems can be manually actuated or automatically detect bicyclists and pedestrians and provide a warning, such as a flashing beacon or lights embedded in the roadway. The systems may also automatically trigger walk signals at intersections when pedestrians are present. The operational status of the system and the state of the pedestrian crossings could be communicated to the Traffic Operations Center.

Note that this project may be coordinated with the long-term project for video detection, which can include the ability to detect and classify bicycles and pedestrians at intersections.

Timeframe:

Long-term (six to ten years)

Project Areas:

- Locations throughout the City of Lawrence

Related Programs:

- Traffic Detection Improvements Program

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other stakeholders:

- Traveling Public

Agreements:

Not necessary

Need(s) Addressed:

- Improve bicycle/pedestrian warning systems.

ITS Service Packages:

VS12: Pedestrian and Cyclist Safety

Estimated Planning Level Cost:

The estimated cost of a Rectangular Rapid Flashing Beacon (RRFB) system is approximately $35,000 to $50,000 per location. The cost for a Pedestrian Hybrid Beacon or HAWK signals approximately $100,000 per location. Assuming ten RRFB's and four HAWK signals, **the total estimated cost for this project is $750,000 to $900,000**. This estimate is based on recent City of Lawrence projects.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Reduction in bicycle/pedestrian crashes.
- Impact on traffic flow and congestion.

13.4.11 Shared Mobility Project

Description:

Shared mobility refers to various vehicles that people use for transportation without owning it. This includes automobiles, bike, scooters, and others. Shared mobility can be implemented in various ways:

1. A traveler arranges for the temporary use of a vehicle.
2. A traveler arranges for a vehicle to pick them up at a specific location and take them to another location (either ride matching or ridesharing including services provided by Uber and Lyft).
3. Bikeshare or scooter rental.

Most likely this would be accomplished through a third-party system.

Timeframe:

Near-term (next three years)

Project Areas:

City of Lawrence

Related Programs:

- Journey Trip Planner Project

Lead Stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other stakeholders:

- Lawrence Transit
- KU on Wheels
- University of Kansas

Agreements:

MOU: The MOU should outline the roles and responsibilities of the third-party provider.

Need(s) Addressed:

- Increase the share of modes used other than the single occupancy vehicle (SOV) to improve the overall efficiency of the transportation system.

ITS Service Packages:

TI06: Dynamic Ridesharing and Shared Use Transportation

Estimated Cost:

This cost is largely unknown and would be borne by the third-party company providing the services.

Performance Measures:

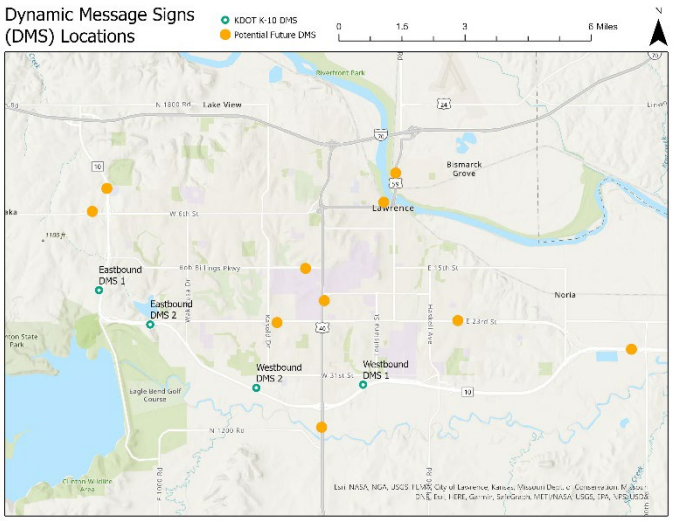
The effectiveness of this project can be measured through the following measures:

- Single occupancy vehicle commute trips per capita

13.4.12 Dynamic Message Signs Project

Description:

This project has two components: 1) KDOT installing "end of queue warning" Dynamic Message Signs along the 2-lane portion of K-10 and 2) other potential Dynamic Message Signs at strategic locations in the Region to aid in providing traffic information to the public and managing congestion and event traffic.



KDOT is constructing a system for "end of queue warning" along the 2-lane portion of K-10. These boards will work in conjunction with 6 radar sensors measuring vehicle speeds along various spots along K-10. When there are slowdowns or vehicle queues at the Wakarusa traffic signal or elsewhere along this 2-lane corridor, real-time messaging will be displayed on the nearest upstream board alerting drivers of the congested conditions ahead. There will be 2 DMS boards and 3 traffic sensors for each travel direction of K-10. In the event of a complete closure along this highway corridor, the most upstream boards will advise drivers to divert onto City of Lawrence surface streets, namely Iowa and Clinton Parkway. This system will be operational starting in the Summer of 2021.

The other potential DMS signs will provide event, detour, parking, and other information to travelers as they enter the City of Lawrence. Locations will be selected prior to critical travel decision points to encourage travelers to take alternate routes when there is congestion on main roads. A camera would also be installed at each DMS location. The cameras will be used to monitor the status of the DMS.

Timeframe:

Near-term (next three years)

Project Areas:

KDOT K-10 Locations

- K-10 – Eastbound near Bob Billings Parkway
- K-10 – Eastbound near Wakarusa Drive
- K-10 – Westbound near old Kasold Drive
- K-10 – Westbound near Michigan Street

Potential Areas

- Southbound US-59 south of the Turnpike
- Westbound K-10 east of the City
- Eastbound K-10 north of K-40
- Northbound US-59 south of the South Lawrence Trafficway
- Eastbound 6th Street before Tennessee Street
- Southbound and Northbound Iowa Street between 15th Street and 23rd Street
- Eastbound East 23rd Street at Harper Street
- Westbound Bob Billings Parkway west of Iowa Street
- Westbound Clinton Parkway east of Kasold Drive

Related Programs:

- Work Zone Management Program
- Event and Incident Management Program
- Parking Management Systems Project

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations (Co-Lead)**
- **KDOT (Lead for KDOT signs)**

Other Stakeholders:

- KDOT
- KTA
- KC Scout

Agreements:

MOU: The four proposed KDOT DMS will be controlled by KC Scout but with considerable input from the City of Lawrence and KTA. An MOU will be needed to define the types of messages each agency may place on the signs, the hierarchy of authority for the signs, and the shared expectations for the signs in performing traffic, event, and incident management. The MOU is critical because the City and KC Scout currently do not jointly operate any devices in the Region.

Interagency Agreement: The IA should describe specifically how agencies will connect to the signs, either directly or through the DMS. The IA should also establish funding arrangements for operating and maintaining the signs and the software required to control them.

Need(s) Addressed:	*ITS Service Packages:*
• Provide quality real time congestion related information. • Improve traffic information dissemination. • Provide better road construction information and notification. • Disseminate better information regarding limited alternative routes. • Improve congestion management during seasonal/local events.	TM06: Traffic Information Dissemination & TM06: Traffic Information Dissemination (Dynamic Message Signs)
Estimated Planning Level Cost: The estimated cost of the DMS and camera deployments **is $225,000 to $300,000 per site, thus the four planned to be installed by KDOT will cost a total of $900,000 to $1,200,000, while the additional ten would cost another $2,250,000 to $3,000,000.** This estimate is based on the cost of KDOT's recent DMS deployments.	
Performance Measures: The effectiveness of this project can be measured through the following measures: • Traffic flow during events. • Level of usage of signs. • Survey of travelers to determine changes in travel behavior.	

13.4.13 Signal Beacons Project

Description:

The Signal Beacons Project provides a low-technology way to provide travelers of alerts of roadway conditions. The beacons will be located along the roadway ahead of points of safety concern, such as potential roadway flooding locations, or an upcoming traffic signal that a driver should be made aware of.

The beacons will be connected to other field devices. For example, a flood warning beacon will be connected to a weather sensor that detects water level on the roadway. The beacon will trigger when the sensor detects water higher than a preset threshold. In the case of a traffic signal warning beacon, the beacon may only alert drivers when the signal they are approaching is red. Or it may simply warn at all times of the presence of the signalized intersection ahead.

Timeframe:

Short-term (one to three years)

Related Programs:

- Weather Monitoring

Planned Project Areas:

- 11th Street and Haskell Avenue
- N 2nd Street and Locust Street
- Locations throughout the Lawrence-Douglas County Region

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations**

Other stakeholders:

- Douglas County Public Works
- KDOT

Agreements:

Not necessary

Need(s) Addressed:

- Improve incident detection.
- Improve road/weather condition information.
- Improve ability to monitor and provide information about flooding.

ITS Service Packages:

TM12: Dynamic Roadway Warning

Estimated Planning Level Cost:

The estimated cost of this project is approximately $25,000 to $40,000 per site for roadway and environmental sensors, and for the flashing beacon that is triggered by the sensor. Costs may vary based on the availability of power and communications at beacon sites. **The total estimated cost for the two sites identified for short term implementation is $60,000**.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Reduction in stranded vehicles.
- Accuracy of flood detection.
- Change in travel behavior.

13.4.14 Transit Traveler Information Improvements Project

Description:

This project will provide real-time transit vehicle arrival times to transit passengers at bus stops and transfer centers. Lawrence Transit and KU on Wheels are already able to provide this information via an app to passengers' phones, and this project will increase information distribution using electronic signs and the web.

The electronic signs will be deployed at the Multimodal Transfer Facility at Bob Billings & Crestline, Downtown area transfer improvements, and in the future at key stops that are heavily used or are frequent transfer locations. The signs display "next bus" arrival times.

Timeframe:

Near-term (next three years)

Project Areas:

- Up to 12 bus bays at Bob Billings & Crestline, 5 bus bays Downtown, and future stops and transfer locations to be determined.

Related Programs:

- Transit Signal Priority Project
- Transit Management Improvements

Lead stakeholders:

- **KU on Wheels (Co-Lead)**
- **Lawrence Transit (Co-Lead)**

Other Stakeholders:

- City of Lawrence Information Technology
- First Transit

Agreements:

MOU: Separate operating MOUs between Lawrence Transit and KU on Wheels with First Transit and a Transit center agreement between the City and KU.

Interagency Agreement: The IA should address access to power and communications at the roadside needed by the transit agencies to connect digital signs. The IA should identify the specific locations, the type of power required and access to communications. The IA should also clearly indicate the responsibility for the costs of using power and communications.

Need(s) Addressed:

- Improve multimodal traveler information.
- Improve transit traveler information.
- Expand traveler information delivery methods.
- Improve transit efficiency and information sharing.
- Monitor transit vehicle locations.
- Enable dissemination/ display of real-time bus arrival times.

ITS Service Packages:

PT08: Transit Traveler Information

Estimated Planning Level Cost:

The estimated cost for this project is approximately **$250,000 for 17 real-time signs and 2 kiosks** at the Bob Billings & Crestline facility and Downtown. Future signs at other locations are estimated **to cost $10,000 per location**.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Transit ridership.
- Transit passenger satisfaction.

13.4.15 Transit Management Improvements

Description:

Transit Management Improvements will be a series of technology upgrades to both Lawrence Transit and KU on Wheels vehicles. The improvements include systems that allow transit to better manage and plan its services though better data collection and analysis tools as well as improve the customer experience.

GTFS real-time development will allow Lawrence Transit and KU on Wheels to provide real-time bus information to third-party trip planning apps, which will improve the passenger experience. A mobile fare payment system with Bluetooth validators will reduce the use of cash on transit and more efficiently collect fares, leading to shorter dwell times at stops. Additional automated vehicle location hardware on paratransit vehicles would allow for the development of a microtransit platform to allow comingling of trips between T-Lift, Jay-Lift, and public microtransit service. Automated annunciators will provide audio stop announcements on fixed route buses for every stop, fulfilling federal ADA requirements and improving the consistency of the passenger experience. On-board digital rider alert panels will allow staff to update information remotely to all vehicles to provide information to passengers to notify them of reroutes, survey opportunities, or other safety or public service announcement information. Rear destination signs will allow passengers to locate their bus more easily at transfer locations.

Timeframe:

Medium-term (three to six years)

Project Areas:

- City of Lawrence

Related Programs:

- Transit Traveler Information Improvements Project
- Transit Signal Priority Project

Lead stakeholders:

- **KU on Wheels (Co-Lead)**
- **Lawrence Transit (Co-Lead)**

Agreements:

Not necessary

Need(s) Addressed:

- Shareable real-time bus information.
- Automate passenger counting.
- Improve fare payment systems.
- Improved flexibility and efficiency with microtransit.
- Improved passenger experience and ADA requirements with automated annunciators.
- Improved passenger information

ITS Service Packages:

PT02: Transit Fixed-Route Operations

PT04: Transit Fare Collection Management

PT07: Transit Passenger Counting

PT06: Transit Fleet Management

Estimated Planning Level Cost:

The estimated cost of these transit management improvements is shown below:

- GTFS-RT development: $50,000
- Automated vehicle annunciator hardware + install: $70,000
- Mobile fare payment system with validators: $40,000
- Microtransit service platform: $155,000
- Digital rider alert panels: $312,090
- Rear destination signs: $95,000

The total estimated cost is $722,090

Performance Measures:

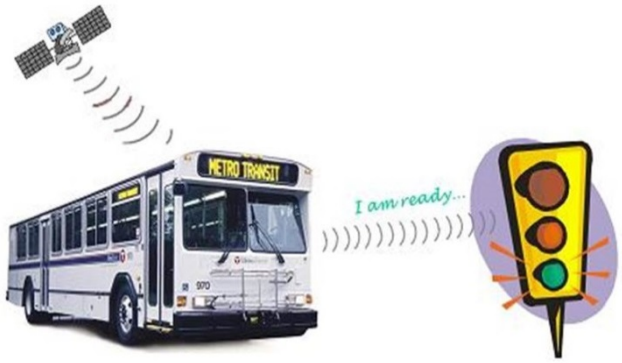
The effectiveness of this project can be measured through the following measures:

- Transit ridership.
- Operations cost per transit trip.
- Survey of transit passenger satisfaction.

13.4.16 Transit Signal Priority Project

Description:

The Transit Signal Priority will equip Lawrence Transit fixed-route buses with a device that alerts a traffic signal controller that the bus is present and would like an early or extended green light. The signal controller, or Traffic Operations Center determines whether it is feasible to shift the signal cycle at the intersection to expedite the bus's movement through the intersection.



Transit Signal Priority will only be deployed at to-be-determined locations where buses frequently experience delay. The purpose of signal priority will be to help prevent buses from being delayed and to ensure transfer connections can be made. Transit Signal Priority requests from buses may be based on a variety of factors that include a bus's current adherence to schedule, the number of riders on the bus, or the headway between buses on the same route.

Note that this project will require a review of State and City law regarding the use of devices to provide green lights to vehicles.

Timeframe:	*Project Areas:*
Medium-term (three to six years)	• City of Lawrence

Related Programs:

- Transit Traveler Information Improvements
- Transit Management Improvements

Lead stakeholders:	*Other stakeholders:*
• **Lawrence Transit**	• City of Lawrence Municipal Services and Operations • City of Lawrence Information Technology

Agreements:

MOU: The MOU should address expectations and roles regarding priority signal control for Lawrence Transit. The MOU should define preliminary goals and system functional requirements.

Interagency Agreement: The IA is needed to formally document how the signal priority system will work, to exclude unauthorized users, and to report system usage and impact on timing plans. The IA may include funding, depending on the source of funds and how costs are distributed between controller hardware/software upgrades, on-bus equipment, and Traffic Operations Center improvements.

Need(s) Addressed:	*ITS Service Packages:*
• Reduce transit vehicle delay at key intersections.	PT09: Transit Signal Priority

Estimated Planning Level Cost:

The estimated cost of this project includes on-board technology ranging in cost from $2,000 to $3,000 per vehicle, and intersection control hardware and software that ranges from $5,000 to $30,000. Assuming 18 vehicles and up to six intersections, **the estimated total cost is $66,000 to $234,000**. This estimate is based a presentation, "Importance of Transit Signal Priority" from 2018.[5]

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Transit ridership.
- Transit schedule adherence.
- Impact on traffic flow and congestion.

[5] Alan Danaher, 6th National BRT Conference, 2018. http://onlinepubs.trb.org/onlinepubs/Conferences/2018/BRT/ADanaher.pdf

13.4.17 Parking Management Systems Project

Description:

This project will improve the management of parking in the City of Lawrence and on the KU campus using advanced technologies to track usage and space availability.

Vehicle count systems will monitor the usage of parking at City and KU lots. This information will be shared with the public to help them travel directly to where parking is located.

The system may also be able to dynamically control parking pricing to encourage travel patterns to parking lots with the most availability.

The parking management system will collect data to help parking management agencies develop parking plans. Information generated by the Parking Management Systems can also be shared by trip planning tools and through Regional traveler information systems.

KU Transportation Services will most likely move to the same smart phone paying app the City of Lawrence recently deployed. KU Transportation Services is moving to a different system for when people do not pay their parking tickets.

The City of Lawrence Parking is implementing the 10 Year Operational & Development Plan submitted by Desman Design Management in June 2017 - https://lawrenceks.org/pds/parking.

Timeframe:

Medium-term (three to six years)

Project Areas:

- City of Lawrence parking structures and lots
- KU parking structures and lots

Related Programs:

- Journey Trip Planner Project
- Dynamic Message Signs Project

Lead stakeholders:

- **City of Lawrence Parking (Co-Lead)**
- **KU Transportation Services (Co-Lead)**

Agreements:

MOU: The MOU should outline the roles and responsibilities of the City and KU in collecting and sharing parking information. The MOU should also provide basic guidelines that define the types of parking management systems to be implemented to ensure interoperability and similar data collection.

Interagency Agreement: The IA should establish how information will be exchanged between the parking systems and the Traffic Operations Center, or with traveler information systems and a virtual regional data warehouse. The IA should also describe how data will be used by each stakeholder, and interagency operation of parking facilities during events.

Need(s) Addressed:

- Improve parking management and parking information.

ITS Service Packages:

PM01: Parking Space Management

PM03: Parking Electronic Payment

PM04: Regional Parking Management

Estimated Planning Level Cost:

The estimated cost of this project is between $250,000 and $1,000,000. The cost is based on up to five parking structures participating and is dependent upon the technology deployed at each facility. The estimated cost is based on the range of costs for similar recent deployments reported in the federal ITS Knowledge database.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Parking usage.
- Parking revenue.
- Traffic congestion during events.

13.4.18 Event and Incident Management Project

Description:

The Event and Incident Management Improvements Project will expand upon several near-term projects: the deployment of DMS, the increased collection and sharing of traffic images, the improved information sharing among agencies, and remote control of intersections during events and incidents. It will also utilize the expanded communications network to link management centers.

This project will improve the real-time communication and coordination among emergency responders and traffic management to coordinate event traffic management plans, respond to incidents in real-time, and provide travelers with congestion, parking, and alternative transportation mode information. The project will define means for all agencies in the Region to exchange information as needed.

KC Scout currently performs regional event and incident management in the Kansas City region and provides a solid template for the L-DC Region to emulate. In addition, software used by KC Scout may be suitable for the L-DC Region and provide interoperability among the regions.

Timeframe:

Medium-term (three to six years)

Project Areas:

- Lawrence-Douglas County Region

Related Programs:

- Work Zone Management Program
- Dynamic Message Signs Project
- Emergency Signal Preemption Improvements Project
- Regional Virtual Data Warehouse Project

Lead stakeholder:

- **Douglas County Emergency Communications (Co-Lead)**
- **City of Lawrence Municipal Services and Operations (Co-Lead)**

Other Stakeholders:

- City of Lawrence Police
- Douglas County Public Works
- Douglas County Sheriff's Office
- KDOT
- KTA
- KU on Wheels
- KU
- Kansas Highway Patrol
- Lawrence Transit
- Local Cities
- Local Cities Emergency Services
- KC Scout
- Douglas County Emergency Communications
- Lawrence-Douglas County Fire-Medical

Agreements:

MOU: The MOU should be used in describing how emergency responders and transportation management agencies will coordinate to share resources and information. A key element of this MOU should be defining at a high-level the types of information that will be shared, and how they will be used. In addition, if emergency responders will have some say in how traffic is managed during emergencies, the MOU should describe the level of input and how instructions should be exchanged.

Interagency Agreement: An incrementally developed IA should address how agencies will work together for information sharing, operations, etc. The primary purposes of the agreement are to describe agency expectations and roles for information and resource sharing across jurisdictional boundaries. The IA should address the standards and formats agreed to for the electronic exchange of event and incident information. The IA should also establish any platform or software that will be used by all participating Stakeholders. In addition, the IA should address the funding needed to purchase the software, develop a plan, and operate and maintain information sharing systems. The agreement needs to detail procedures for MSO, Douglas County Emergency Communications, Lawrence Police, and Lawrence-Douglas County Fire-Medical for Two policies are needed: 1) for events and incidents (project 17) and 2) for work zones (project 10

Need(s) Addressed:	*ITS Service Packages:*
• Improve incident response times and routing. • Improve event management. • Improve incidence response coordination between agencies. • Improve coordination on construction notification and information distribution. • Provide quality real time congestion related information. • Improve maintenance response to incidents and requests. • Interagency coordination on most advantageous placement of maintenance vehicles (prior to anticipated need). • Improve incident response coordination among agencies. • Improve information sharing among agencies. • Improve inter-agency coordination.	PS14: Disaster Traveler Information MC08: Maintenance and Construction Activity Coordination TM08: Traffic Incident Management System

Estimated Planning Level Cost:

The estimated cost for this Project includes improved software to detect incidents at the Traffic Operations Center, increased use of portable and fixed message signs, Highway Advisory Radio, and interagency data integration. **Costs of similar projects in other states have ranged from $800,000 to $2,000,000.** This estimate is based on the federal ITS Knowledge database from 2015.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Traffic flow during events.
- Incidence clearance times.
- Incident response times.
- Satisfaction of emergency response agencies.

13.4.19 Regional Virtual Data Warehouse Project

Description:

This project will develop a virtual method for agencies to share traffic, maintenance, transit, emergency, and incident information. The Virtual Data Warehouse does not create a centralized location for data storage. Instead, each agency maintains its own data, but can share the data it chooses with other agencies though a Regional integration system.

Data may include both archives and real-time data such as signal timing, incident responses and video images. Authorized agencies will be able to use the information and images for managing traffic and incidents, and for maintenance planning.

Key functions of the virtual warehouse will be to provide a standardized format for sharing and retrieving Regional data to make it usable and to ensure that all regional Stakeholders are using the same information for their operations. The data will also have the potential for sharing with the public.

While this project is important, its value is limited until the Region increases its ability to collect information through other ITS Projects identified in the near-, medium- and long-term. As the project is built out it will be split into a Statewide Data Warehouse maintained by KDOT and a Lawrence-Douglas County version maintained by City of Lawrence Municipal Services and Operations department.

Timeframe:

Long-term (six to ten years)

Project Areas:

- Lawrence-Douglas County Region

Related Programs:

- Work Zone Management Program
- Event and Incident Management Project
- Journey Trip Planner Project
- Signal Coordination Program
- Camera Deployment Program

Lead stakeholder:

- **KDOT (Co-Lead)**
- **City of Lawrence Municipal Services and Operations (Co-Lead)**

Other stakeholders:

- City of Lawrence Police
- Douglas County Emergency Communications
- Douglas County Public Works
- Douglas County Sheriff's Office
- KTA
- KU on Wheels
- KU
- Lawrence Transit
- Local Cities
- Local Cities Emergency Services
- Lawrence-Douglas County Fire-Medical

Agreements:

MOU: This MOU should develop high-level expectations for what types of data will be exchanged through the virtual warehouse, how they will be used, and the responsibilities of each agency in providing accurate and usable information. The MOU should also describe at a high-level who will be granted access to data, and for what purposes.

Interagency Agreement: The IA is needed to formally document how the data warehouse will operate and the formats and protocols used for data exchange. The IA should define the level of access by Stakeholders, as well as how the system will be maintained. The IA can also define any warehouse functionality for data reporting and display. For funding participation, the IA should define development, deployment, and operation funding sources.

Need(s) Addressed:

- Improve information sharing among agencies.
- Improve system operation monitoring.
- Improve coordination on construction notification and information distribution.
- Improve maintenance response to incidents and requests.
- Provide central information clearinghouse.

ITS Service Packages:

DM01: ITS Data Warehouse

Estimated Planning Level Cost:

The estimated cost of this project varies widely depending upon the level of deployment and standardization of data in the Region. **The cost of similar efforts in other parts of the United States ranged from a low of $15,000 to a high of $300,000**. It should be noted that an effort such as this requires a high level of effort to keep operational after deployment. This estimate is based on the federal ITS Knowledge database from 2015.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Amount of Regional information available to agencies.
- Amount of Regional information available to the public.

13.4.20 Journey Trip Planner Tool Project

Description:

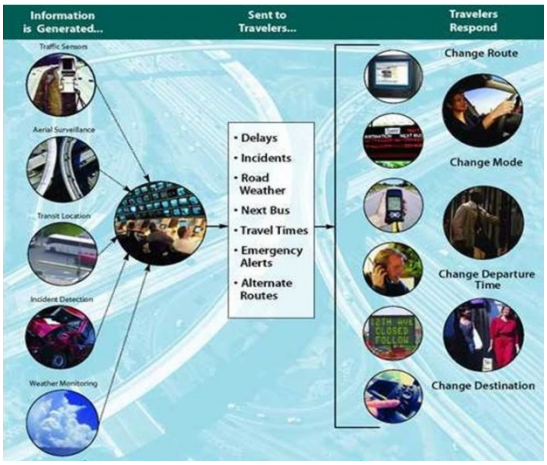
The Journey Trip Planner will be an online tool available to travelers through their computers and personal devices that allows them to plan trips using one or more modes, including personal vehicle, transit, bicycle, and pedestrian.

The Journey Trip Planner will be interactive and allow the user to enter their origin and destination as well as the planned time of travel and preferred mode(s) of travel. The Trip Planner will provide information such as traffic conditions, real-time parking availability, routing, schedules, and costs for various modes.

The Trip Planner can encourage travelers to use transit, carpool, use park-and-ride facilities and complete trips by foot, bicycle and bus for events and commutes.

Note that for the Trip Planner to be useful it will require reliable information on all modes of travel and parking from the Region's Stakeholders. Much of the needed information will be collected through other projects in this Plan including the Virtual Data Warehouse.

Many third-party services provide this service. For it to be fully functional the various stakeholders would need to make their information available to the platform.



Timeframe:

Long-term (six to ten years)

Project Areas:

- Lawrence-Douglas County Region

Related Programs:

- Regional Virtual Data Warehouse Project
- Connected Vehicles Project
- Electric Vehicle Infrastructure Project
- Shared Mobility Project

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations (co-lead with agreement with 3rd party)**
  - Includes Asset Management and Pedestrian Network Routing

Other stakeholders:

- Douglas County Public Works
- KDOT
- KTA
- KU on Wheels
- KU
- Lawrence Transit
- Local Cities
- Private Sector Information Services
- Traveling Public

Agreements:

MOU: This MOU should develop high-level expectations for disseminating information from the regional stakeholders to the public. It should expand on the understanding that much of the disseminated information may come from the Virtual Regional Data Warehouse.

Interagency Agreement: The IA should formally document the types of information the participating public-sector Stakeholders agree to share through a regional traveler information system. The IA should also expand upon the IA for the Virtual Regional Data Warehouse to ensure that traveler information, including incident and emergency information, is provided for dissemination.

Operations Agreement: The OA should be developed between the public and private sectors to define the types of information to be shared with services that will provide commercial traveler information. The OA should define the quality and frequency of public information and the limitations placed on the private sector in processing and disseminating that information.

Need(s) Addressed:

- Improve multimodal traveler information.
- Provide interstate/inter-region traveler information covering a wide area.
- Improve transit traveler information.
- Improve multimodal information.
- Expand traveler information delivery methods.

ITS Service Packages:

TI01: Broadcast Traveler Information

TI02: Personalized Traveler Information

PT08: Transit Traveler Information

PT14: Multimodal Coordination

Estimated Planning Level Cost:

The estimated cost of similar projects in the United States have ranged from approximately $300,000 to $570,000 for hardware, software, and deployment. Additional hardware, such as DMS or kiosks can significantly increase the overall project cost. For the L-DC Region, it is assumed that DMS deployed in previous projects will be used, and **the total estimated cost is $300,000 to $570,000**. This estimate is based on the federal ITS Knowledge database from 2015.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

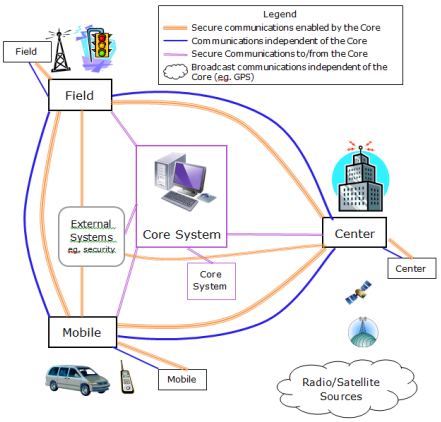
- Use of modes other than personal vehicle.
- Average travel time in the Region

13.4.21 Connected Vehicles Project

Description:

The transition to "connected vehicles" may significantly impact the way vehicles and the transportation network interact. Connected vehicles could mean utilizing vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. It also could mean providing customized real-time driving advice to drivers so that they can adjust their driving behavior to save fuel and reduce emissions. Connected vehicle applications provide connectivity:

- Among vehicles to enable crash prevention
- Between vehicles and the infrastructure to enable safety, mobility, and environmental benefits
- Among vehicles, infrastructure, and wireless devices to provide continuous real-time connectivity to all system users.



The image provides a conceptual illustration of connected vehicles.

Currently, the connected vehicle environment includes three major approaches to communication[6]:

1. Vehicle to vehicle (V2V)
2. Vehicle to infrastructure (V2I)
3. Vehicle to pedestrian (V2P).

While there is no talk in the region about implementing the infrastructure for connected vehicles, planning needs to occur to be ready when it is rolled out nationwide. Maintaining adaquate pavement marking condition could be necessary.

Timeframe:

Long-term (six - ten years)

Project Areas:

- Lawrence-Douglas County

Related Programs:

- Signal Coordination Program
- Journey Trip Planner Project
- Potentially Electric Vehicle Infrastructure Program

Lead Stakeholder:

- **KDOT**

Other stakeholders:

- City of Lawrence Municipal Services and Operations
- KC Scout

Agreements:

Interagency Agreement: An IA will be necessary once the project is more fully fleshed out.

Need(s) Addressed:

- Technology and innovation
- Safety
- Economic development

ITS Service Packages:

TM04: Connected Vehicle Traffic Signal System

ST09: Connected Eco-Driving

SU01: Connected Vehicle System Monitoring and Management

Estimated Cost

The costs associated with this project is unknown.

Performance Measures:

The effectiveness of this project can be measured through the following measures:

- Effective rollout of technology
- Efficient driving behaviors

[6] View more about the Connected Vehicle: Vehicle-to-Pedestrian Communications at: https://www.its.dot.gov/factsheets/cv_v2pcomms.htm

14. L-DC Region ITS Program or Project Funding

The L-DC Region ITS programs or projects may be eligible for funding from a variety of sources, including some specifically for the deployment of advanced technologies. ITS programs and projects should also compete for transportation funds against other, more traditional transportation projects, such as road-widening and expansion.

Table 9 lists each L-DC Region ITS program and project and indicates the known *potential* funding resources that may be applicable. For some projects, a single funding source is applicable. For most, multiple sources are applicable, and Project Stakeholders are encouraged to apply for as many funding opportunities as needed. This Plan does not indicate that funding has been committed or programmed for any of the Projects.

Table 9: Potential L-DC Region ITS Program and Project Funding Sources

	Locally Administered		State Administered		Federally Administered			
	Local Transportation Funds	Local Emergency Funds	KDOT	ITS Earmark Funds	Homeland Security	Federal Highway Funds	Federal Transit Funds	Other Federal Programs
1 Signal Coordination Program	●		●					
2 Traffic Detection Improvements Program	●		●	●		●		
3 Traffic Signal Performance Measures Program	●		●			●		
4 Fiber Communications Expansion Program	●		●			●		
5 Camera Deployment Program	●	●	●			●		
6 Emergency Signal Preemption Improvements Program	●	●		●	●	●		
7 Weather Monitoring Program	●		●	●		●		
8 Alternative Fuels or Low-No Emissions Infrastructure and Vehicles Program	●		●				●	●
9 Work Zone Management Program	●		●			●		
10 Bicycle/Pedestrian Warning Systems Program	●		●	●		●		
11 Shared Mobility Program	●		●			●		
12 Dynamic Message Signs	●		●			●		
13 Signal Beacon Deployment	●		●	●				
14 Transit Traveler Information Improvements	●						●	
15 Transit Management Improvements	●			●			●	
16 Transit Signal Priority	●			●			●	
17 Parking Management System	●		●	●		●		
18 Event and Incident Management Improvements	●	●	●	●	●	●		
19 Regional Virtual Data Warehouse	●		●	●		●		
20 Journey Trip Planner Tool	●		●	●		●		
21 Connected Vehicles	●		●			●		

Local Transportation Funds – These funds are administered for transportation projects, including maintenance and operations, at the local level. The funds may come from a range of sources, including local tax revenue, but are administered at the discretion of local agencies such as the City of Lawrence and Douglas County.

Local Emergency Funds – These funds are administered at the local level for emergency management projects, including ongoing maintenance and operations of emergency responders. Like local transportation funds, they may come from a range of sources, but are administered at the discretion of local agencies.

KDOT Funds – This is a funding plan of highway and transit projects for the state. The plan is published every year and includes transportation projects on the state, city, and county highway systems, as well as projects in the national forests and Indian reservations. These projects use various federal and state funding programs. KDOT funds include the state's ITS set-aside funds.

ITS Earmark Funds – Earmarks are federal funds that are administered by KDOT. Local agencies work with KDOT to apply for earmark funds. Earmark funds may be subject to limitations, such as the purpose and project defined in the federal application and matching local or state funds. Near-term projects are not considered eligible for earmarks because they are planned for deployment sooner than an earmark can be applied for and designated.

Homeland Security – Homeland Security funds are administered by the Federal Department of Homeland Security. To date, they have infrequently been disbursed to regional transportation projects. However, as security and transportation management become more integrated in Traffic Control Centers and Emergency Operations Centers, it is possible that more funds will be used to support coordinated emergency management.

Federal Highway Funds – Federal Highway Funds are comprised of several potential sources that are administered at the national level. They may include matching funds, grants, and other sources, such as operational tests or model deployments. For these funds to be used for ITS, a Regional ITS Architecture must be in place. This project addresses that federal Architecture requirement.

Federal Transit Funds – Transit funds administered by the Federal Transit Administration (FTA) can come in the form of grants, matching funds, disbursement of other transit funds, or special monies for specific projects. In recent history, the FTA has made rural and small urban transit systems a priority, and it has allocated significant funds for transit technologies through grant applications and model deployments. Like FHWA funds, a Regional ITS Architecture must be in place before FTA funds can be spent on transit ITS programs or projects.

Other Federal Funds – The Department of Energy and others operate federal grant programs provide funding for ITS programs/projects.

15. L-DC Regional ITS Architecture Use and Maintenance

The Lawrence-Douglas County (L-DC) Regional Intelligent Transportation System (ITS) Architecture is a valuable tool for Stakeholders to use in developing consistent, interoperable, and effective ITS. The success of the L-DC Regional ITS Architecture is dependent upon its proper use.

15.1 Architecture Use

There are three key times that the L-DC Regional ITS Architecture can be used:

1. **Planning** – The Architecture should be used to assist in the traditional transportation planning process for all L-DC Region Stakeholders. The planning process defines projects that include ITS elements. The Architecture can be used to determine the sequence of ITS deployment and provide high-level descriptions that complement the Region's other transportation planning efforts, such as updates to the Metropolitan Transportation Plan (MTP) by the L-DC Metropolitan Planning Organization (MPO).

2. **Design** – The Architecture should be followed during the design of ITS programs or projects to ensure that the ITS elements will be interoperable and able to communicate with other systems

in the Region. In addition, the Architecture can be used in design to verify that the desired functions will be provided by the project's ITS elements.

3. **Implementation** – During implementation, the Architecture can provide information to support the procurement and testing of ITS. Architecture elements of use include the functional requirements that define what the ITS should do, and the information exchange standards, which define open, non-proprietary protocols and formats for data exchange with other systems.

To help maximize the Architecture's value for the Region, this document provides a strategy for how the L-DC Regional ITS Architecture will be maintained to support those processes in the future.

15.2 Architecture Maintenance

The L-DC Regional ITS Architecture is a living document and will be modified as the Region's plans and priorities change, ITS programs and projects are implemented, and the Region's ITS needs and services evolve. The Architecture was developed with a ten-year time horizon, as reflected by the project time frames:

- near- (zero to three years).
- medium- (three to six years).
- long-term (six to ten years).

The goal of maintaining the Architecture is to keep the L-DC Regional ITS Architecture accurate, accessible, and easy to use for ITS planning, design, and implementation. If the Architecture's information is not consistent with the MTP and TIP, it is less likely to be used by the Region's Stakeholders.

The key aspects of the Architecture maintenance process are:

- Architecture ownership.
- Maintenance responsibility and staffing.
- Maintenance skills and training.
- Maintenance elements.
- Maintenance schedule.
- Identifying needed Architecture changes.
- Change Management Process.

The L-DC Regional ITS Architecture is owned by the L-DC MPO. The MPO is responsible for the Architecture's maintenance. The process follows the steps shown in **Figure 12: Architecture Maintenance Process**.

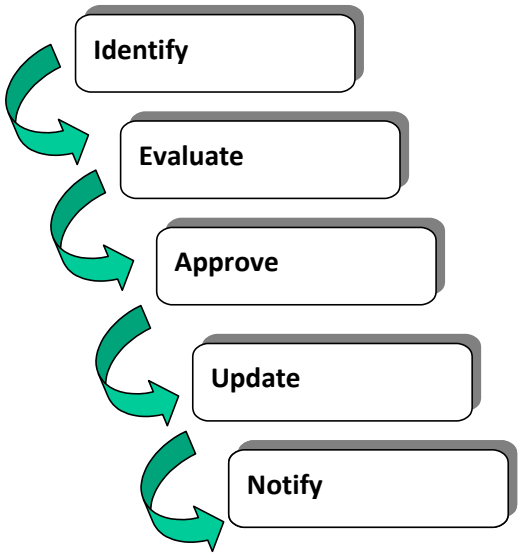
Identify – Any of the Region's Stakeholders can identify a change in the Architecture and submit a request to the L-DC MPO. Change requests should be maintained in a change log (or change database) that would track each potential change

Evaluate – Each significant change request needs to be evaluated to determine what impact it has upon the Architecture Baseline. Change evaluation happens through Stakeholder consensus as part of the overall Architecture update.

Approval – The next step is for approval, deferral, or rejection of a change request. If a change request is rejected or deferred, the requester will be notified with an explanation.

Update Baseline – This activity involves updating the L-DC Regional ITS Architecture Turbo database and documentation. This step requires the skill and expertise described in the Maintenance Skills and Training section.

Figure 11: Architecture Maintenance Process



Notify Stakeholders – The final part of the maintenance process is to notify stakeholders of changes or updates to the architecture.

15.3 Architecture Change Process

At the discretion of the L-DC MPO, very minor changes, such as to stakeholder descriptions or names, or those that impact only a single project may be made at the time they are identified. However, changes that impact more than one stakeholder, multiple projects or introduce new elements and services, should be reviewed by the Maintenance Team. The process will include:

1. Stakeholder identifying changes and notifying the MPO either as it occurs or through the annual Architecture Maintenance Survey.
2. The Maintenance Team will review the proposed changes and decide to accept or deny the changes.
3. Once modifications are accepted, MPO staff will update appropriate portions of the architecture and publish the online ITS architecture and Strategic Deployment Plan and Maintenance Plan.
4. The MPO will notify stakeholders of the updates.

The Regional ITS Architecture is referenced in Transportation 2040 (the region's Metropolitan Transportation Plan – MTP) and the Transportation Improvement Program (TIP). The Regional ITS Architecture should be reviewed prior/concurrently/shortly after a new MTP is completed to ensure the architecture continues to accurately representant the regional goals. This 2021 process is occurring prior to the new Transportation 2050 MTP development.

To keep the TIP consistent with the MTP and ITS Architecture, a TIP Architecture Consistency Statement should be completed by the Lead Stakeholder as part of TIP project submission and approved by the L-DC MPO. If the project described in the Consistency Statement is different than how it is represented in the Architecture, this will require an Architecture update or a revision to the Architecture Consistency Statement.

Appendix A – Public Input

A larger planning effort was conducted in 2015 to develop the Regional ITS Architecture. A consultant team was utilized to conduct the planning process. The consultants developed a project website, which was subsequently moved to https://lawrenceks.org/mpo/its. The team conducted a survey to collect travel behavior and perceived needs from stakeholders. A stakeholder workshop was held to define regional needs and potential project ideas. Further, stakeholder interviews were conducted to gain a better understanding of the plans, operations and needs of key stakeholders. The needs identified are listed in **6. L-DC Regional ITS Needs**.

Appendix A.1 2015 Survey and Workshop Results

Overview

The planning process for the Regional Intelligent Transportation (ITS) Architecture update began during November of 2014. As part of the process, the Lawrence-Douglas County Metropolitan Planning Organization (MPO), along with local, state, and federal representatives in the region explored ways to use technology to improve the efficiency and safety of roads, bicycle and pedestrian facilities, public transit, and emergency services. By January 8, 2015, the MPO had engaged potential ITS stakeholders in the planning process via an online, opinion survey and an initial ITS Stakeholder Workshop.

The survey (final layout included as an attachment to this report) was available online from November 26 – December 31, 2014. A total of 78 people responded to it. The following two methods were used to advertise the survey to stakeholders:

- A direct link placed on the MPO page of the City's website.
- Two e-blasts sent to the 184 stakeholders who were included in the project contact list.

Table A-1: E-Blast Results

Title	Date	Open Rate	Click-through Rate	Comparison Rate(s)*
Better Mobility in Lawrence-Douglas County: Could technology help?	Nov. 26	35.2%	29.0%	Government avg. is 25.7% (open); 3.6% (click) Travel and transportation avg. are 20.0% (open); 2.8% (click) *http://mailchimp.com/resources/research/email-marketing-benchmarks
K-7 and I-70 Interchange Construction: What's the best way to share information about it?	Dec. 4	29.5%	26.9%	

The survey consisted of nine multiple choice questions and focused on the following key items:

- The most important travel information to stakeholders
- Degree of familiarity with ITS
- Travel habits (frequency, timeframe, and mode)
- Key issues affecting travel

- General information about the survey respondents

During the survey period, an ITS Stakeholder Workshop was held. It took place on December 8, 2014 in the Heritage Room of the Carnegie Building (200 W. 9th Street) in Lawrence, Kansas from 10 a.m. until 12 p.m. Notice was provided via email and a total of 16 people attended, representing KDOT , Douglas County, MPO Policy Board and Regional Transit Advisory Committee, Federal Highway Administration, Kansas Highway Patrol, Lawrence Public Works and Police Departments, Lawrence/University of Kansas Transit, Cottonwood, and the Lawrence-Douglas County Bicycle Advisory Committee and Health Department.

Workshop participants were asked to build on the initial results of the online survey by using maps, markers, and/or post-it notes to identify and provide more information about priority improvements and the biggest issues affecting travel in the region. Specific feedback was gathered about:

- Trucking and freight movements
- Congested intersections and/or corridors
- Issues with bicycle, pedestrians, and/or transit
- Construction activities and/or weather-related travel
- Geographic locations or types of issues that may benefit most from ITS

Because the ITS Stakeholder Workshop was designed to expand upon the initial survey results, the responses gathered from both were comparable. Further, many workshop participants responded to the survey in advance of the workshop or soon thereafter.

Results and Analysis

Most survey respondents described themselves as residents, motorists, and/or employees who travel within Lawrence-Douglas County daily but predominantly during the morning and afternoon rush hours via car or van. Construction and/or incident locations, multimodal transportation routes, and congestion areas were among the most important types of travel information to them. When asked about familiarity with ITS, most respondents commented that they were “somewhat familiar” or “not familiar” with it. Still, they responded that of the six suggested types of ITS strategies, the strategies listed in Table B-2 might have the most potential for addressing their priority issues

Table A-2: Strategies and Issues Results from 2015 Survey

6 Potential ITS Solutions	Priority Issue 1: Safe use of bicycle, pedestrian, and/or transit options	Priority Issue 2: Congestion at busy intersections or streets	Priority Issue No. 3: Construction or special events
Synchronization of traffic signals for vehicles and pedestrians	**X**	**X**	**X**
Sharing real-time traffic information with agencies and the public	**X**	**X**	**X**
Roadway sensors for traffic speed and volume information	**X**	**X**	
Information about bike, walk, transit, and/or parking options	**X**		
Digital signs for detours, weather conditions, and other traffic issues		**X**	**X**
Emergency response and motorist assistance for incidents			

Workshop participants connected the key issues and concerns to geographic locations, noting the following:

- **Bike/pedestrian movement**
  - Eudora and Baldwin Center – Pedestrian movement
  - Bikes – Challenging to navigate traffic
  - Bike signals – Open/close trails
  - Lawrence Community Shelter – Added bike/pedestrian/transit demand, other safety concerns
  - South Douglas County highways – Bike/vehicle interaction
  - University of Kansas – Pedestrian issues around campus (hilly, student drivers)
  - K-10/South Lawrence Trafficway – Safely crossing
  - South of Lawrence – Bike presence on narrow roads and no shoulder
  - K-10 Bridge connection to the high school in Eudora – No bike/pedestrian access
- **23rd Street**
  - At Iowa – Flooding and congestion
  - Issues with buses stopping
  - Schools at Ousdahl – Flooding roadway, congestion, bike/pedestrian safety crossings

- **Congestion**
  - 6th Street at Massachusetts, Iowa, and Wakarusa
  - 9th, 19th, and 23rd Streets
  - 9th to 6th Streets and Massachusetts to Iowa during games
  - Jayhawk Boulevard
  - 6th Street and K-10
  - Lawrence High School
  - 19th and Louisiana
  - Clinton Parkway (also flooding)
  - Venture Park (industrial/office) – Anticipated west of K-10/Harper
  - Mixed use (office/retail) – Anticipated north of Iowa/South Lawrence Trafficway
  - Mercato development – Anticipated west of 6th Street/South Lawrence Trafficway
  - Wakarusa at Harvard – May be improved with roundabout but motorists need to be educated about them
  - 6th Street and Rockledge – Accident location during game day; need communication system with alerts, traffic channel, etc.
  - 33rd Street/Iowa (Target/Wal-Mart retail area) – Difficult on Fridays
- **Weather**
  - N 1000/E 1500 (flooding)
  - McDonald Drive
  - Bob Billings and Kasold
- **Other**
  - Event traffic and/or routing event traffic, e.g., on K-10
  - Kasold and Bob Billings – Weather conditions and road treatment
  - Transit travel information – Real-time schedule information
  - Cottonwood has over 250 transit trips
  - Baldwin City and Lawrence – Freight movement
  - Baldwin City – Intermodal facility truck traffic
  - South Lawrence Trafficway – Evaluate in three years
  - Downtown – Pedestrian safety
  - Traffic information, parking, transit – Let people know where parking's located
  - Priorities: Major corridors

The stakeholders also recommended potential solutions for some the issues, including:

- **Coordination and management**
  - Early planning for coordinated management center
  - Access management
- **Accommodations for alternative modes of transportation**
  - "Ride to lanes" for the bike route to Lone Star Lake (safety concerns)
  - 6th/Iowa to Michigan – Need crossing hawk
  - Detect motorized vehicles on a bike trail, e.g., Lawrence River Trail
  - Bike/pedestrian crossing for the K-10 Bridge in Eudora
  - "K-10 Connector" bus service with signposts and stop notification
  - Traffic signal priority around the new transit facility
  - Transit signals at stops and signal prioritization for both buses and police (at 21st and Iowa for buses)
  - Audible signals at 15th Street and Iowa as well as 6th and Wakarusa

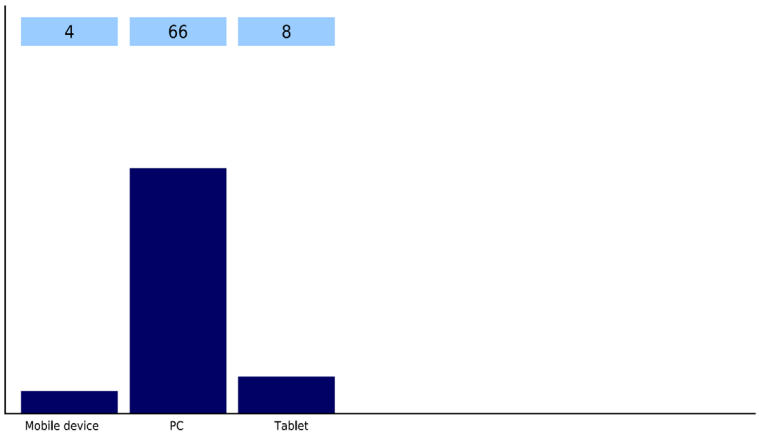
- **Information Sharing and Access**
  - Message board for incident management
  - Availability of information on traffic issues, transit, parking
  - Need radio channel, smartphone app, etc.
  - Multiple mediums for information transfer
  - Build on the snow-plowing information already being provided
  - Digital tools that provide information at the point of decision-marking, e.g., digital transit signs

2014 Complete Survey Results

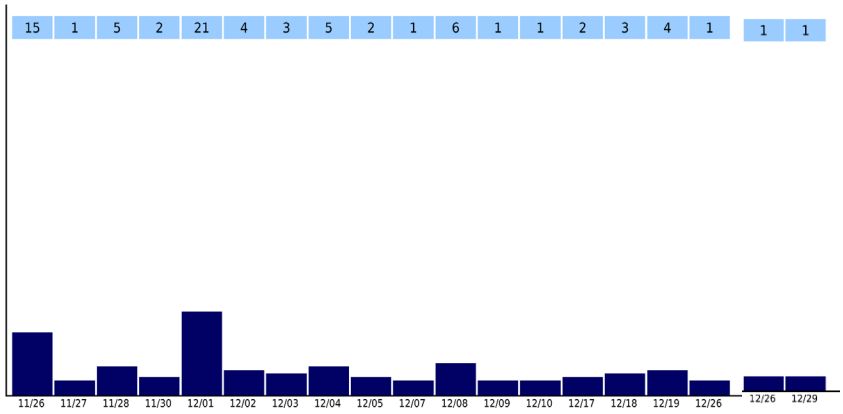
Open date: 11-24-2014. Close date: 01-01-2015.

Number of surveys taken: **78** (excluding tests)

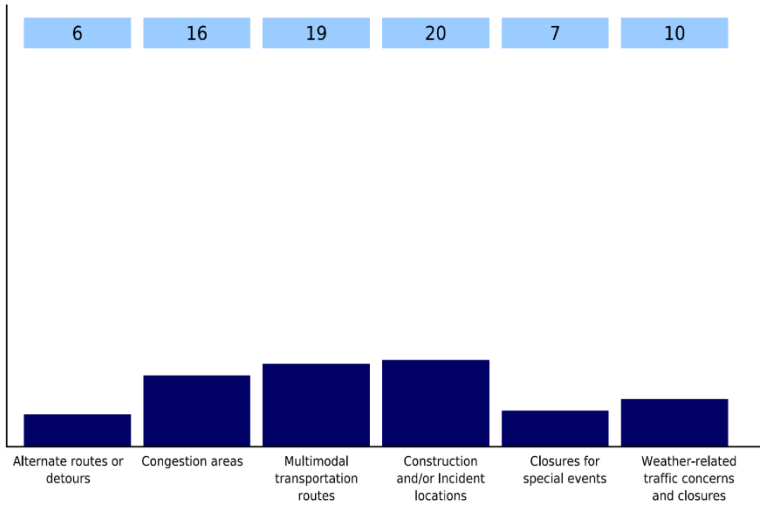
By Device



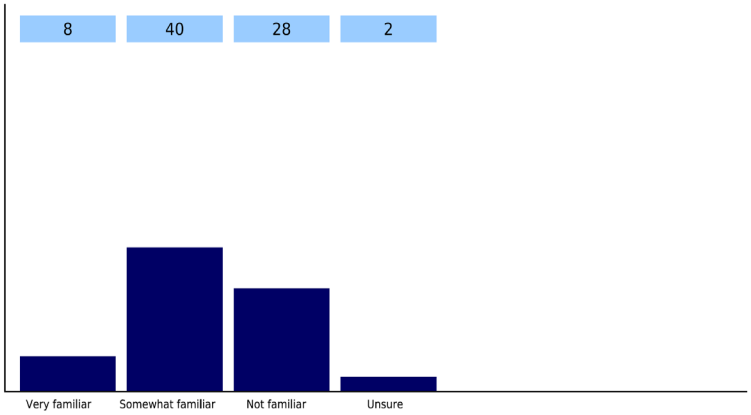
By Date



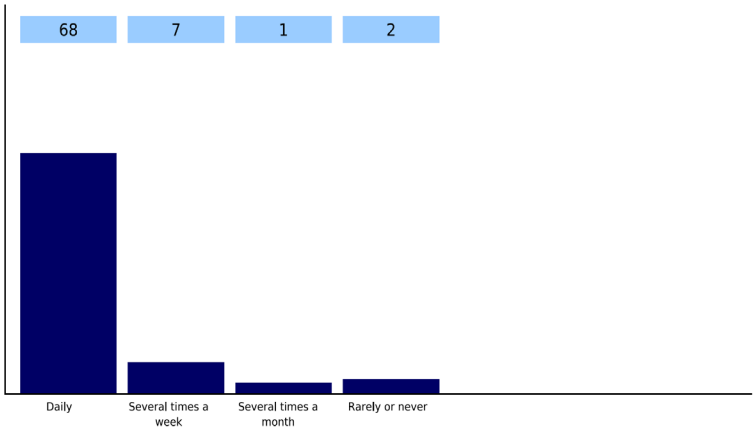
1. Most Important Types of Travel Information



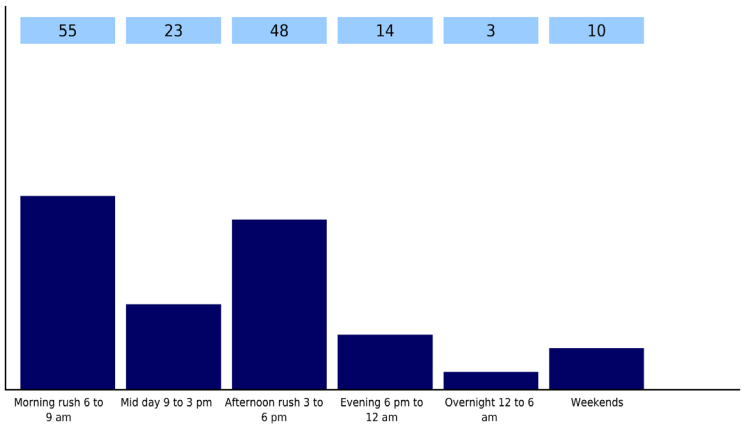
2. Familiarity with ITS



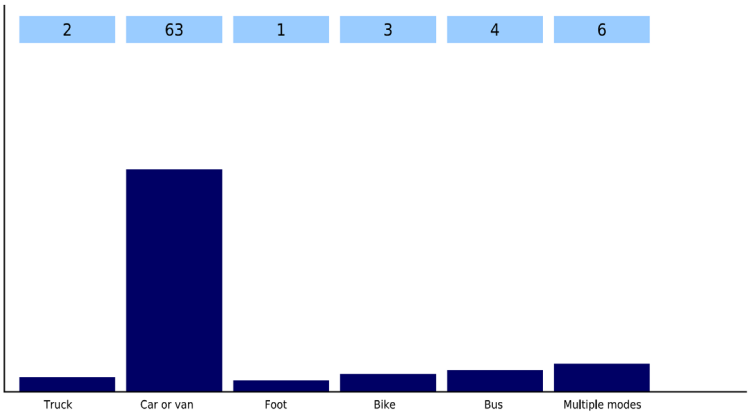
3. Frequency of Travel within Lawrence-Douglas County



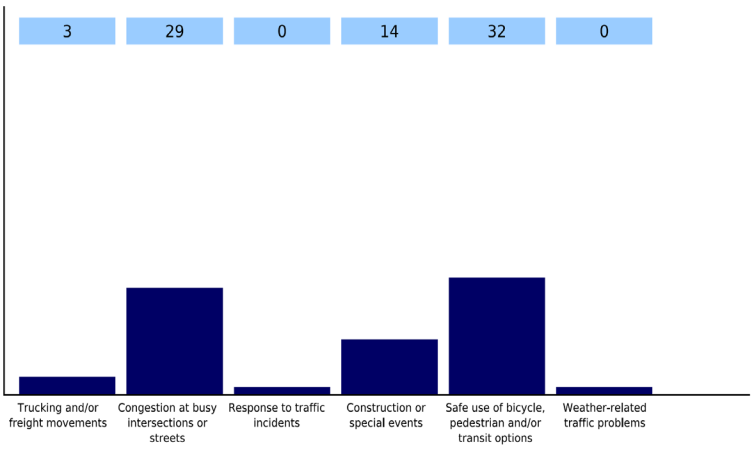
4. Timeframes for Traveling within Lawrence-Douglas County (Select up to 2)



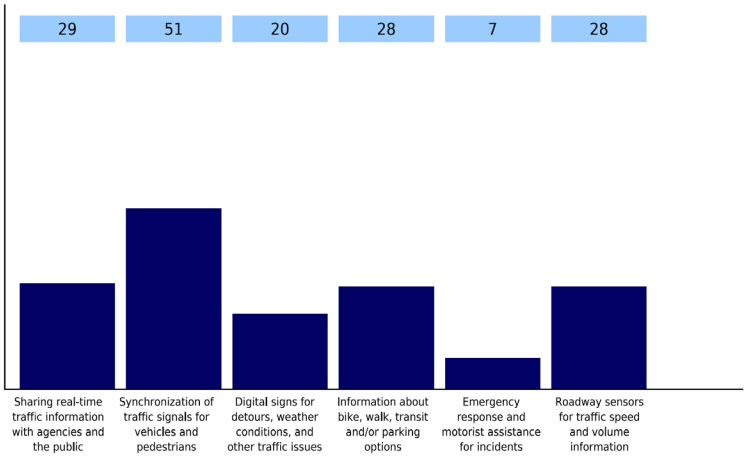
5. Primary Mode of Travel within Lawrence-Douglas County



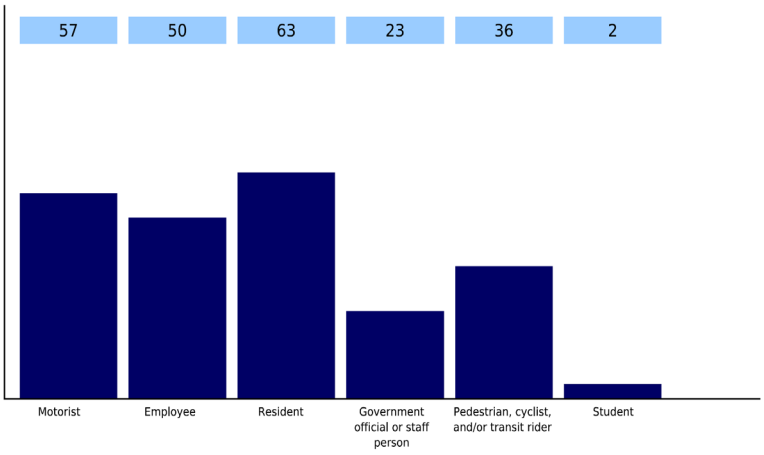
6. Biggest Issues AffectingTravel within Lawrence-Douglas County



7. Potential ITS Strategies for Addressing Traffic Issues (Select up to 3)



8. Self Descriptions (Select up to 6)



Appendix A.2 2021 Public Comment

The 2021 draft plan was available for public comment May 6 – May 21, 2021 at https://lawrenceks.org/mpo/tellus and in paper copy at the Lawrence Public Library, Courthouse County Clerk's Office, Lawrence City Hall Riverfront - Planning & Development Services Office. Three public comments were received via our survey on https://lawrenceks.org/mpo/tellus. No comments were mailed to staff. The survey responses are listed below.

Do you have any thoughts or comments about our proposed Intelligent Transportation Systems (ITS) projects/programs?

- This is a disappointing approach to traffic management. The goal should be to reduce the need for these complicated programs by reducing the dependency on cars and parking through the development of our core neighborhoods to encourage walkability.
- I like the well thought out ideas. It is great seeing the work that is put into this. While electric cars are still a ways off, I think it is important to ensure any changes to infrastructure are being put in place as soon as possible. I see it is in the plan, but think it will come much sooner. I am also concerned about pedestrian crossings/bike crossings. There are still many dangerous

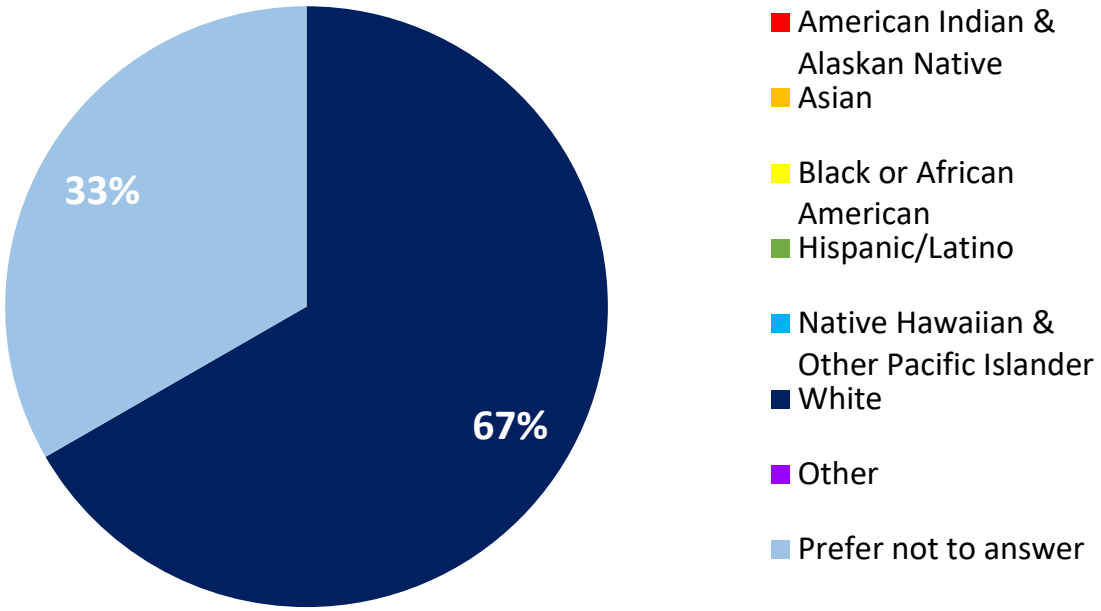
places and I don't think the city is a pedestrian/bike friendly place. Many people don't understand the signs or the laws. ITS can help, but a lot of education is needed also. trying to use technology to eliminate risks and taking using computers to manage traffic is a great way to make the city safer and glad to see it is happening. This may not be ITS related, but I also think there are some great passive ways to help. things like roundabouts, turn lanes, and managing street access can go a long ways.

- I believe this is a step in the right direction. I wish the city would review previous costly studies about traffic flow and accident avoidance. The study that made the most sense was on 23rd street. It was noted that there are too many access points to many of the businesses. Timed lights are worthless when cars must continuously slow or stop for turning vehicles. There's been a lot of expense with calming devices in neighborhoods. Most would not be driving the back roads if traffic flowed better on our major streets.

Do you have other thoughts or comments about Intelligent Transportation Systems (ITS) in Lawrence or throughout Douglas County?

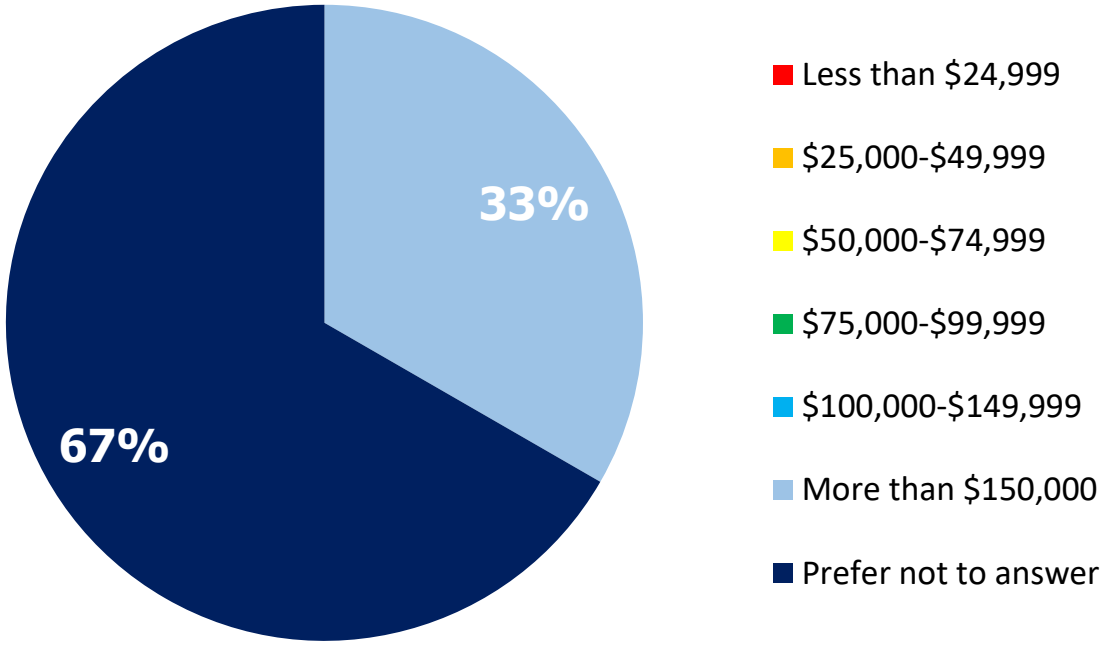
- Not sure what other new technologies are up and coming that may change some of the plans. I didn't see what 5G might do to replace putting in Fiber (It is a long report so may have missed it). It is also too bad that some of this tech is so expensive. 35 to 50K for a pedestrian crossing seems outrageous. Hopefully the city is able to keep up with hiring and keeping people who have the technology background to manage the complexity that this will bring in the near future. I tried to signin but could not get the cookies issue figured out. Thank you for all that you are doing to help make the city/county a better place. I am happy to provide my name though. Doug VF
- Hopefully the city will be transparent about data pulled from such a system an how it's used. I did not see it mentioned, but license tag readers are often a part of such intelligent systems.

What race/ethnicity best describes you? (Select all that apply)



Number of responses – 3

What is your household's approximate income for the current year? (Select one)



Number of responses – 3

What is your zip code (Home)?

- 66044
- 66047
- 66049

Number of responses – 3

What is your zip code (Work)? (If not applicable, leave blank.)

- 66044
- 66047

Number of responses – 2

Appendix B – Prioritized L-DC Region ITS Needs and Strategies

Appendix B.1 ITS Needs

The lists all identified ITS needs for the L-DC Region within service areas that parallel the service areas of the National ITS Architecture. The National ITS Architecture service areas are:

- Arterial Traffic Management
- Commercial Vehicle Operations
- Data Management and Integration
- Emergency Management
- Freeway Traffic Management
- Maintenance and Construction Operations
- Parking Management
- Public Safety
- Public Transportation
- Support
- Sustainable Travel
- Traveler Information
- Vehicle Safety
- Weather

Within the service areas, the needs have been prioritized as high, medium, or low based on Stakeholder input. High priority needs are those that were identified by a broad cross-section of Stakeholders and were considered very important to improving the efficiency and safety of the transportation network. Medium priority needs were those that were identified by fewer Stakeholders or were identified as less critical. Low-priority needs are those that were identified by specific Stakeholders or were considered important to the Region but not critical at the present.

There is significant overlap of needs among the different service areas. This is because many needs impact more than one area of transportation operations. For example, the management of events involves managing traffic as well as managing emergency response during events and planning for the additional need for transportation services prior to major events.

Arterial / Traffic Management Needs

Examples of arterial/traffic management include: Signal Coordination; Centralized Control; Traffic Information Systems; Vehicle Detection Systems; Video Systems; Adaptive Signal Control; Traffic Management Systems/Centers; and Highway Rail Intersection Technologies.

Table B-1: L-DC Region Arterial / Traffic Management Needs

Arterial / Traffic Management Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve traffic flow at intersections through improved signal timing and control.	H	• In March 2021, developed new timing plans for Iowa St., 6th St., Clinton Pkwy, and 31st St. • Other timing plans are needed specifically at Bob Billings Pkwy, N 2nd St, Downtown, etc.
Improve traffic information dissemination.	H	• Traffic count data was added to an interactive GIS map • Dynamic Message Signs are being installed on K10 • A warning sign to let drivers know about the traffic light at K10/Wakarusa Dr./27th St. was installed.
Improve event management.	H	

Implement or improve signal coordination.	H	• Started making progress, but more can be done
		  ○ Have counts for South Iwo and for KU basketball games, but do not have plans
		  ○ Want to develop timing plan for KU football and downtown

Improve incident detection.	H	• Need a master plan for signal communication that includes standards/reviews for camera placement before installation and camera policy about cameras (city is working on) • IT is developing a Fiber Master Plan to get fiber to all signal intersections
Improve parking management and parking information.	M	• I70 is part of the 8-state truck parking information. Technology tells drivers who many open spaces are available at truck parking locations. • In the Spring of 2021, Lawrence is implementing a mobile parking system which includes license plate readers, kiosks in lieu of meters at lots.
Improve information sharing among agencies.	M	

Arterial / Traffic Management Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve system operation monitoring.	M	• The City is exploring real time monitoring (seawave demo at 8 intersections) for future possible deployment of fiber connected intersections • Transit dispatch monitors real-time bus locations using AVL
Improve arterial roadway traffic surveillance.	L	
Reduce transit vehicle delay at key intersections.	L	• A location is now identified for the transfer facility at Bob Billings Pkwy and Crestline Dr. Design is occurring in 2021.
Reduce emergency vehicle delays at signals.	L	• A new system which was not based on light strobes was installed 2017-2018.

Freeway Management Needs

Examples of freeway management systems include: Vehicle Speed Detection Systems; Video Systems; Ramp Metering; Variable Message Signs; Highway Advisory Radio; and Traffic Management Systems/Centers.

Table B-2: L-DC Region Freeway Management Needs

Freeway Management Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve traffic information dissemination.	H	
Improve information sharing among agencies.	H	
Improve inter-agency coordination.	H	
Improve incident detection.	M	
Improve system operation monitoring.	M	
Improve freeway traffic surveillance.	L	• K10/waka/27th camera 2020 - did not have more than cell communication before, but was updated
Improve incident management in urban areas.	L	

Public Transportation Needs

Examples of public transportation systems include: Public Transportation Management; En-route Transit Information; Personalized Public Transit; Public Traveler Safety; Traveler Service Information; Ride Matching and Reservations; Smart Card Payment/Transaction Systems.

Table B-3: L-DC Region Public Transportation Needs

Public Transportation Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve multimodal traveler information.	H	
Improve information sharing among agencies.	H	
Improve transit traveler information.	H	• Real-time bus location information available on DoubleMap app
Reduce transit vehicle delay at key intersections.	M	
Enable dissemination/display of real-time bus arrival times.	M	• Real-time bus location information available on DoubleMap app
Improve service planning (scheduling and run-cutting).	M	• Contractor builds run cut in Excel currently. Possibility to expand Remix package to include scheduling.
Improve fare payment systems.	M	
Improve regional and interregional trip planning.	L	
Automate passenger counting.	L	• APC installed on fixed route
Improve fleet management.	L	• Currently developing a fleet replacement plan for more regular replacement.

Emergency Management Needs

Examples of emergency management systems include: Incident Detection; Incident Management; Hazardous Materials Response and Handling; Emergency Notification and Personal Security; Emergency Vehicle Management; Advanced Dispatching and Response Systems.

Table B-4: L-DC Region Emergency Management Needs

Emergency Management Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve event management.	H	

Emergency Management Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve incident response coordination between agencies.	H	• Lawrence Transit is working on policy for providing warming bus for DGCO emergency personnel during emergency events
Improve information sharing among agencies.	H	
Improve incident detection.	M	
Improve incident response times and routing.	M	
Improve transportation system performance monitoring.	M	
Improve road/weather condition information.	M	
Improve bicycle/pedestrian warning systems.	M	• The Signal Timing Plan looked at adding count downs and audible warnings for ped crossings • The first dedicated bike signal was installed at 21st and Mass in March 2021 • A bike detection loop was installed at 14th and Mass in November 2018.
Improve ability to monitor and provide information about flooding.	M	• In March 2018, Douglas County installed a lake level sensor at Lone Star Lake. • Improved the pumps at the N 2nd St underpass to help with flooding (more work is occurring)
Improve access to regional cameras.	M	
Enable remote emergency control of signals.	L	• Traffic control can adjust from the office for signals on fiber - 52 out of 104 signals are on fiber
Monitor transit vehicle locations.	L	• AVL system allows dispatchers to monitor transit vehicle locations

Maintenance and Construction Operations Needs

Examples of maintenance and construction operation systems include: Advanced Work Zone Management and Traffic Control; Vehicle Detection Systems; Video Systems; Vehicle/Speed Detection

Systems; Variable Message Signs; Highway Advisory Radio; Integration with Traffic Management Systems/Centers; Advanced Dispatching and Routing Systems; Advanced Vehicle Tracking Systems; Fleet Maintenance and Management Systems.

Table B-5: L-DC Region Maintenance and Construction Operations Needs

Maintenance and Construction Operations Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve coordination on construction notification and information distribution.	H	• The Douglas County road closure map has been improved. • Lawrence has a map of all active ROW permits • ROW, construction alerts, and special event notifications are better in Lawrence
Provide quality real time congestion related information.	H	
Provide signal preemption for some maintenance fleet vehicles.	M	
Improve/enhance work zone traffic handling plans.	M	• Lawrence now reviews plans as part of the ROW process for traffic control
Increase use of portable traffic control equipment (Dynamic Message Signs, Highway Advisory Radio, etc.).	M	• Speed feedback signs will be used as part of the Neighborhood Traffic Management Program • K10 is getting DMS signs installed
Improve maintenance response to incidents and requests.	M	
Improve fleet information/management (maintenance schedules, mileage accumulations, tracking snow removal vehicles w/AVL).	L	• City IT / MSO Working on AVL for additional sensor inputs on Snow Vehicles, plow up/down, sander open/closed • Douglas County snow vehicles have AVL to track where the vehicles have gone.
Interagency coordination on most advantageous placement of maintenance vehicles (prior to anticipated need).	L	

Regional Traveler Information Needs

Examples of regional traveler information systems include: En-route Traveler Information; Pre-trip Traveler Information; Portable Event Management Systems; In-vehicle Route Guidance; Traffic Information; Variable Message Signs; Highway Advisory Radio; Internet, Media; Tourist Information Systems.

Table B-6: L-DC Region Traveler Information Needs

Regional Traveler Information Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve multimodal information.	H	• Improved notices about lane closures and transit route changes - email and social media
Improve traffic information dissemination.	H	
Provide quality real time congestion related information.	M	
Expand traveler information delivery methods.	L	
Provide better road construction information and notification.	L	• Lawrence is creating project websites for larger road projects • Improved notices about lane closures and transit route changes • New change to require construction companies to put up DMS specific number of days before work is done • GIS map links directly to construction permits
Improve weather and road condition information.	L	• The snow traffic cameras have upgraded the still shots

Commercial Vehicle Operations Needs

Examples of commercial vehicle operations systems include: Commercial Vehicle Electronic Clearance; Automated Roadside Safety Inspection; On-board Safety Monitoring; Commercial Vehicle Administration Processes; Hazardous Material Incident Response; Commercial Vehicle Fleet Management; Services to Assist Agricultural Harvesting and Migration.

B-7: L-DC Commercial Vehicle Operations Needs

Commercial Vehicle Operations Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Disseminate better information regarding limited alternative routes.	M	
Provide interstate/inter-region traveler information covering a wide area (targeted to commercial vehicle operators).	M	
Improve congestion management during seasonal/local events.	M	
Improve truck routing in rural / small towns.	L	
Provide quality real time congestion related information.	L	
Improve truck storage/parking information (during major road closures).	L	

Integration Needs

Examples of Integration include: Integration of Systems; Integration with Traffic Management Centers; Determining Central vs. Distributed Control; Communications Infrastructure; Integration of Agencies; Resolution of Institutional Issues.

Table B-8: L-DC Region Integration Needs

Integration Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve information sharing among agencies.	H	

Integration Need	Relative Priority (High, Medium, Low)	Progress Since 2015 Plan
Improve fiber optic network.	M	Fiber improvements, 17 traffic signals connected to fiber since 2015 2018 - Connected 9 traffic signals (W 6th Street & Champion Lane, W 6th Street & Folks Road, W 6th Street & Monterey Way, W 6th Street & Kasold Drive, W 6th Street & Lawrence Avenue, W 6th Street & Schwarz Road, W 6th Street & Rockledge Road, W 2nd Street & McDonald Drive, W 19th Street & Haskell Avenue. 2019 - Connected 1 new traffic signal (W 6th & Wisconsin Street) 2020 - Connected 3 traffic signals (W 8th Street & Kasold Drive, Harvard Road & Kasold Drive, Bob Billings Parkway & Kasold Drive). 2021 - Connected 4 traffic signals (W 19th Street & Stewart Avenue, W 19th Street & Ousdahl, W 19th Street & Naismith Drive, W 22nd Terrace & Kasold Dr) Fiber master plan in progress - internal scoring system
Develop interagency governmental agreements that would allow sharing of information, etc.	M	
Improve system compatibility.	M	
Provide central information clearinghouse.	L	

Parking Management Needs

This area addresses the management of parking operations including both space management and the electronic payment for parking. This area supports communication and coordination between equipped parking facilities and regional coordination between parking facilities and traffic and transit management systems. It includes monitoring and managing parking spaces and in lots, garages, and other parking areas and facilities as well as loading/unloading zones.

Table B-9: L-DC Region Parking Management Needs

Parking Management Need	Relative Priority (High, Medium, Low)	Progress/ Activities
Improve parking management and parking information.	M	• Mobile payment and license plate readers will be installed in spring 2021 • Wayfinding parking signs installed in 2019 • Implementing the 10-Year Parking Operations and Development Plan. During 2017, the City of Lawrence conducted a study of the parking system serving downtown Lawrence, the east Lawrence neighborhood and the neighborhoods surrounding the University of Kansas. The consultant-led study included a comprehensive evaluation of the parking system serving the study area, including metering, enforcement, neighborhood parking issues, utilization and demand analysis, parking system finances, development code requirements related to parking, Public Transit's support of parking and capital assets. The 10-Year Parking Operations and Development Plan was approved by the City Commission on July 18, 2017. https://lawrenceks.org/pds/parking/

Support Needs

This area addresses monitoring, maintaining, and managing of the connected vehicle system which includes, centers, field equipment, vehicles, and traveler devices. In addition, it covers the security and privacy of the communications in the connected vehicle environment as well as fundamental services, such as location and data distribution, that support the full range of ITS services.

No Support Needs were identified in the 2021 planning process.

Sustainable Travel Needs

This area addresses the operation of transportation system to minimize the environmental impact. It promotes a transportation system that balances accessibility, mobility, protection of human safety and environment. It covers all aspects of transportation system from optimizing traffic signals and ramp meters to managing HOV/HOT lanes, monitoring vehicle emissions and managing vehicle electric charging stations.

Table B-10: L-DC Sustainable Travel Needs

Sustainable Travel Needs	Relative Priority (High, Medium, Low)	Progress/ Activities
Electric vehicle infrastructure	H	Two charging stations installed at Rock Chalk Park

Vehicle Safety Needs

This area addresses the vehicle's safety for automated, connected, and non-equipped vehicles. Its focus is on the enhancement of safety, security, and efficiency in vehicle operations, by warnings and assistance to users or input to the operation of the vehicle.

Table B-12: L-DC Region Vehicle Safety Needs

Vehicle Safety Needs	Relative Priority (High, Medium, Low)	Progress/ Activities
Connected vehicle infrastructure	L	

Weather Needs

This area addresses activities that monitor and notify users and transportation network managers of weather and environmental conditions that have an impact on the road transportation network and its users.

Table B-13: L-DC Region Weather Needs

Weather Needs	Relative Priority (High, Medium, Low)	Progress/ Activities
A weather monitoring program is necessary	M	

Appendix B.2 ITS Strategies

The following strategies were developed during the 2015 planning process to address the needs identified in **Appendix B.1 ITS Needs**.

Arterial / Traffic Management Strategies

The strategies for improving arterial and traffic management will expand upon the City of Lawrence's existing traffic cameras, coordinated signals, and Traffic Operations Center, as well as the Douglas County Emergency Communications Center ability to track and dispatch emergency services. Many significant corridors are already coordinated, and the City has a robust and expanding fiber optic network that can be used for ITS. Arterial / Traffic Management strategies are:

- Deploy traffic signal coordination and/or adaptive signals in key Lawrence corridors.
- Increase the use of traffic cameras for traffic management and incident detection.
- Share real-time information by sharing traffic images with the public and other agencies.
- Provide en-route traffic information to travelers through strategically placed Dynamic Message Signs (DMS).
- Share event, maintenance, and incident information among agencies for planning and response.
- Manage parking facilities and share parking information with the public to improve event management.
- Increase performance monitoring through increased data collection and analysis.

Freeway Management Strategies

There are two operators of highways in the Region: KTA and KDOT. Additionally, KC Scout is in Kansas City, but operates systems throughout Kansas. KTA operates the turnpike through the L-DC Region and has traffic cameras, traffic sensors and Highway Advisory Radio (HAR) in the L-DC Region, as well as DMS in adjacent areas. These are managed from the KTA Traffic Management Center and information is also shared through the KTA website. KDOT maintains the other state and US Highways in the L-DC Region. Both agencies will benefit from better information dissemination to the public through their web sites and KDOT's 511 system. In addition, both agencies can improve incident response and event coordination through information sharing with other local transportation agencies. Freeway Management strategies are:

- Provide en-route traffic information to travelers through strategically placed DMS.
- Share event, maintenance, and incident information among agencies for planning and response.
- Increase the use of traffic cameras for incident detection.
- Increase performance monitoring through increased data collection and analysis.

Public Transportation Strategies

Lawrence Transit and Kansas University's KU on Wheels have a considerable amount of existing advanced public transportation technology for their fixed-route and paratransit services, such as vehicle tracking and real-time bus arrival information for passengers. The Region also has a limited number of other providers delivering paratransit services to focused groups, such as the disabled and senior citizens. The public transportation strategies expand on the existing technologies and coordinate with traffic management to improve multimodal transportation. The Public Transportation strategies are:

- Develop traveler information tools that inform the public of traffic, transit, parking, pedestrian, and bicycle travel.
- Share event, maintenance, and incident information with transit for planning service.
- Deploy transit traveler information, including real-time web information, trip planning and roadside real-time bus arrival information.
- Deploy transit signal priority at signals near the Lawrence Transit center.
- Deploy advanced fixed-route operations management systems.
- Implement smart-card fare payment and potentially integrate the card with other electronic payment systems, such as for parking or social services.

Emergency Management Strategies

The Douglas County Emergency Communications Center is responsible for 911 call answering and dispatching most of the Region's police, fire, and medical responders. The Highway Patrol dispatches its own troopers in the Region, and KU has emergency dispatch on the university campus. The Region's strategies for improving emergency management involve improved coordination among the emergency responders as well as with maintenance, traffic, and transit agencies. This includes improved information sharing and shared responsibility for management during incidents and events. The Emergency Management strategies are:

- Share event, maintenance, and incident information among agencies for planning and response.
- Share traffic images with emergency responders.
- Share transit vehicle locations with emergency responders.
- Deploy bicycle/pedestrian warning systems on major roadways.
- Share traffic information with emergency responders to improve emergency vehicle response and routing.
- Deploy flood monitoring devices at key roadway locations, such as East 900th Road at Clinton Lake.

Maintenance and Construction Operation Strategies

Many of the Region's maintenance vehicles already utilize vehicle tracking to monitor location and to optimize winter maintenance routing. The Region also has sensors for road weather conditions on the Turnpike. The maintenance and construction strategies expand on the existing ITS to address the key need for improved information about construction and maintenance activities to improve traffic management, transit operations and emergency response. Other strategies address improved winter maintenance operations and efficient, safe work zones. The Maintenance and Construction Operation strategies are:

- Share maintenance and constructions plans with agencies for planning and response.
- Share real-time information by sharing traffic images with the public and other agencies.
- Deploy signal preemption on snowplows for winter maintenance operations.
- Deploy smart work zone systems to better manage maintenance and construction zones.

Regional Traveler Information Strategies

Currently, L-DC Region travelers access information through web sites and through KDOT's 511 system. The needs indicate more integrated and local traveler information that is tailored for multiple modes and can be used to help manage traffic and events in the Region, such as at KU and regional parks. The Regional Traveler Information strategies are:

- Deploy DMS for event, traffic, and work zone information.
- Centralize information from multiple agencies for coordination and sharing.
- Deploy a multimodal trip planning tool via the web and mobile devices.

Commercial Vehicle Operations Strategies

Commercial Vehicle Operations (CVO) needs are largely aligned with the needs of other groups in the L-DC Region. The primary CVO need that can be addressed locally regarded improved real-time information about traffic and roadway conditions that would impact truckers' travel. Other identified needs, such as wide-area traveler information are addressed at the Kansas State level through the 511 System and the Kansas Truck Routing and Intelligent Permitting System[7] (K-TRIPS), which provides detailed routing for oversize/overweight commercial vehicles. The Commercial Vehicle Operations strategies are:

- Provide en-route traffic information to travelers through strategically placed DMS.

[7] https://www.k-trips.org/ - truck routing system for Kansas state highways.

- Deploy DMS for event, traffic, and work zone information.

Integration Strategies

The L-DC Region's Integration needs largely entail improved coordination among agencies during the planning and deployment of ITS, and ensuring the infrastructure is in place for successful ITS deployment. The resulting strategies include approaches that complement the strategies described in the seven other Service Areas. The Integration strategies are:

- Share event, maintenance, and incident information among agencies for planning and response.
- Manage parking facilities and share parking information with the public to improve event management.
- Increase performance monitoring through increased data collection and analysis.
- Coordinate the development of ITS programs and projects among agencies.
- Continue to engage Stakeholders to increase awareness in the Region of the planned and deployed ITS.

Appendix C – Glossary

Acronym	Description
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADMS	Archival Data Management System – refers to technologies designed to collect and store roadway related data for planning and/or for sharing with other agencies.
ANSI	American National Standards Institute
APTA	American Public Transportation Association
ASTM	American Society for Testing and Materials
ATIS	Advanced Traveler Information Systems – provide travelers with information from various sources through one user interface such as the phone (511) or the Internet.
ATMS	Advanced Traffic Management Systems - to enhance mobility on roadways by incorporating the latest technological advancements such as Variable Message Signs (VMS)
AVL	Automatic Vehicle Location – used for real time tracking of emergency vehicles, transit vehicles and school buses.
BNSF	Burlington Northern Santa Fe Railroad
CAD	Computer Aided Dispatching – used for emergency and fleet dispatching.
CCTV	Closed Circuit Television - cameras placed to observe traffic conditions. These are only used for observation and have no automatic speed enforcement capabilities.
CVAS	Commercial Vehicle Administrative Systems – a subpart of the Commercial Vehicle Information System, see CVISN.
CVRIA	Connected Vehicle Reference Implementation Architecture
DMS	Dynamic Message Signs – electronic message signs used to provide real-time traffic warnings and Amber Alert messages. Other names are Variable Message Signs (VMS) and Changeable Message Signs (CMS).
EM	Emergency Management, or Emergency Managers – Douglas County has an emergency management agency.
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System – used to provide information tied to specific physical locations, such as road segments.
HRI	Highway-Rail Intersection – refers to technologies designed to make at-grade highway/rail crossings safer.
IEEE	Institute of Electrical and Electronics Engineers
ISP	Information Service Provider – usually the radio or television or other private organization that provides road conditions or other information for travelers.
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
KANROAD	KDOT GIS-based traveler information system.
KDOT	Kansas Department of Transportation
KHP	Kansas Highway Patrol
KTA	Kansas Turnpike Authority
L-DC FM	Lawrence-Douglas County Fire-Medical
L-DC MPO	Lawrence-Douglas County Metropolitan Planning Organization
LPD	Lawrence Police Department

Acronym	Description
MCO	Maintenance and Construction Operations – refers to ITS solutions designed to make highway maintenance and construction safer for travelers and more efficient for highway agencies.
MDT	Mobile Data Terminal
MPA	Metropolitan Planning Area
MTP	Metropolitan Transportation Plan – The L-DC MPO's current MTP is the Transportation 2040 (T-2040) Plan.
NEMA	National Electrical Manufacturers Association
NWS	National Weather Service
OS/OW	Oversize, Overweight pertaining to commercial vehicles using public highways.
PD	Police Department
PW	Public Works
RWIS	Road-Weather Information Systems, also called environmental sensors. Used to measure pavement temperature (potential for icing), wind, and other weather-related conditions. RWIS is also used to support highly accurate weather forecasting systems.
SAE	Society of Automotive Engineers
SDO	Standard Development Organization
SDP	Strategic Deployment Plan
TMC	Traffic Management Center
TOC	Traffic Operations Center
TOMC	Traffic Operations and Management Center
UPRR	Union Pacific Railroad

Appendix D – Core Stakeholders Descriptions

Table D-1 lists the Core L-DC Regional ITS Architecture Stakeholders and indicates the categories in which they currently, or in the future materially participate in the Region's ITS. The Architecture Stakeholders represent agencies who will program, develop, deploy and/or operate ITS. As previously discussed, Core Stakeholders do not include advisory and advocacy groups who support the planning process. This in no way is meant to diminish the contribution or importance of advisory and advocacy groups. Instead, the Core Stakeholders represent those who are depicted in the Architecture as having an ownership role in ITS.

Table D-1 Core Stakeholders Descriptions

Stakeholder	Transportation Services Category(ies)	Stakeholder Description
City of Lawrence Planning and Development Services	Regional Planning	The City of Lawrence Planning and Development Services Department provides planning oversight for the region's transportation system and supports funding and implementation efforts.
City of Lawrence Municipal Services and Operations	Maintenance and Construction Parking Management Surface Street Management	The City of Lawrence Municipal Services and Operations develops, builds, operates and maintains the transportation network owned by the City. They operate the City Traffic Operations Center (TOC).
City of Lawrence Police Department	Emergency Management	The City of Lawrence Police Department provides emergency and law enforcement services within the City.
Douglas County Public Works	Maintenance and Construction Surface Street Management	Douglas County develops, builds, operates and maintains the transportation network owned by Douglas County.
Douglas County Emergency Communications	Emergency Management	Douglas County Emergency Communications serves the citizens of Douglas County by providing enhanced 911 telephone services for the entire county (except the University of Kansas Campus), radio dispatching personnel and equipment for the law enforcement, fire, and medical response agencies Region.
Douglas County Emergency Management	Emergency Management	Douglas County Emergency Management provides 24 hour service to the Region. It protects citizens from various hazards by providing and coordinating resources, expertise, leadership, and advocacy through risk-based emergency preparedness programs involving mitigation, management, response, and recovery.
Douglas County Sheriff's Office	Emergency Management	The Douglas County Sheriff's Office provides public safety services for Douglas County.

Stakeholder	Transportation Services Category(ies)	Stakeholder Description
Federal Highway Administration (FHWA – Region 7)	Regional Planning	The FHWA assists states, local governments, and tribal/federally owned lands in the design, construction, and maintenance of the Nation's highway system. The Kansas division of the FHWA provides leadership, guidance, and direction in the planning, construction, and maintenance of Kansas' transportation projects.
Federal Transit Administration (FTA – Region 7)	Regional Planning	The FTA provides financial and technical assistance to local public transit systems. Currently the State of Kansas (and the L-DC Region) falls under Region 7 of the FTA.
Google	Traveler Information	Google provides real-time traffic information and transit information in the L-DC Region through its web site.
KC Scout	Freeway Management Traveler Information	Kansas City Scout is a bi-state traffic management operation for the Kansas City area. KDOT and MoDOT designed Scout to lessen traffic jams by improving rush-hour speeds, to increase safety by decreasing the number of rush-hour accidents, and to improve emergency response to traffic situations.
Kansas Department of Emergency Management (KDEM)	Emergency Management	The KDEM is a subgroup of the Kansas Adjutant General's Department. The main goal of the Kansas Department of Emergency Management is to create sustainable capabilities across all phases of Emergency Management in Kansas. KDEM works with local Kansas communities to assist one another in times of disaster response, and to ensure proper disaster agencies and proper Emergency Operation Plans are in effect in all Kansas counties.
Kansas Highway Patrol (Troop B)	Emergency Management	The Kansas Highway Patrol (Troop B) has the primary responsibility of maintaining the safety of the State, Federal, and Interstate highways within the Region.
Kansas Turnpike Authority (KTA)	Electronic Toll Collection Freeway Management Maintenance and Construction Traveler Information	The Kansas Turnpike Authority (KTA) provides highway transportation services for all turnpike users. KTA is responsible for all repairs and upgrades for the roadway, and for toll collection on the Turnpike. KTA is part of the Kansas Department of Transportation (KDOT).
Kansas Department of Transportation (KDOT)	Commercial Vehicle Operations Freeway Management Maintenance and Construction Traveler Information	KDOT is a state government organization responsible for the maintenance of Kansas public roadways. Currently KDOT District 1 is the district that is responsible for the L-DC Region.
KTA Highway Patrol (Troop G)	Emergency Management	The KTA Highway Patrol [Troop G] is responsible for the patrolling of the Kansas Turnpike. The Kansas Turnpike Highway Patrol is headquartered in Wichita, Kansas and operates 24/7. Other responsibilities of the Kansas Turnpike Highway Patrol include providing security at interchange and service areas, managing unpaid tolls, and performing special projects when contracted out.

Stakeholder	Transportation Services Category(ies)	Stakeholder Description
University of Kansas (KU)	Parking Management Surface Street Management	KU manages parking and traffic on the KU campus.
KU Public Safety	Emergency Management	KU Public Safety provides law enforcement services on the KU campus and coordinates with other regional agencies for event management.
Kansas University Transportation Services (KU on Wheels)	Transit Services	KU On Wheels (KUOW) provides fixed-route and demand-response bus service for the KU community.
Lawrence-Douglas County Fire Medical	Emergency Management	Lawrence-Douglas County Fire Medical provides fire suppression services to the City of Lawrence and emergency medical services to all of Douglas County, Kansas.
Lawrence Transit	Transit Services Traveler Information	Lawrence Transit provides fixed-route and demand-response bus service within Lawrence.
Local Cities Emergency Services	Emergency Management	Local city emergency response agencies providing fire and police services in Baldwin City, the City of Eudora and the City of Lecompton.
Local Cities Public Works	Maintenance and Construction Surface Street Management	Local Cities Public Works develop, build, operate and maintain the transportation network owned by Baldwin City, the City of Eudora and the City of Lecompton.
Local Transit	Transit Services	Local transit providers, such as Independence Inc., provide demand-response transit (shuttle) services to the Region's residents.
Media	Information Services	The media includes private parties that provide information to the Region, including broadband, cable, wireless, television and print journalism.
National Weather Service (NWS)	Weather Information	NWS provides current and forecasted weather condition information for the Region and nation.
Private Sector Information Services	Traveler Information	Private companies that aggregate and collect traffic and traveler information for dissemination to the public via mobile applications and the Internet.
Schools	Transit Services	Schools represent the Region's school districts and other schools who transportation services for students.
Traveling Public	Electronic Toll Collection Traveler Information	The traveling public in the L-DC Region.

Appendix E – ITS Standards Supporting Regional and National Interoperability

Table E-1: Lawrence-Douglas County ITS Standards

Standard	Standard Number	Standard Version	Standard Title
3GPP Cellular Network	3GPP Network		3GPP Cellular Communications Network
Addressed Elsewhere in Stack	Addressed Elsewhere		Addressed Elsewhere in Stack
Development needed		N/A	Standard(s) need to be developed
General Transit Feed Specification	GTFS	2019	General Transit Feed Specification
GTFS Realtime	GTFS Realtime	2019	General Transit Feed Specification Realtime
IEEE 1609.2 WAVE - Security Amendment 1	IEEE 1609.2a	2017	IEEE 1609.2a-2017 - IEEE Standard for Wireless Access in Vehicular Environments--Security Services for Applications and Management Messages - Amendment 1
IEEE 1609.2 WAVE - Security Amendment 2	IEEE 1609.2b	2017	IEEE Standard for Wireless Access in Vehicular Environments--Security Services for Applications and Management Messages - Amendment 2--PDU Functional Types and Encryption Key Management
IEEE 1609.3 WAVE - Networking Services	IEEE 1609.3	2016	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services
IEEE 802.11 Wireless LAN (Wi-Fi)	IEEE 802.11	2016	IEEE Draft Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specificatio
IEEE 802.2 LLC	ISO/IEC 8802-2	1998	IEEE Standard for Information technology -- Telecommunications and information exchange between systems--Local and metropolitan area networks -- Specific requirements -- Part 2: Logical Link Control
IETF RFC 2460 IPv6	IETF RFC 2460	6	Internet Protocol, Version 6 (IPv6) Specification
IETF RFC 3411 SNMP Architecture MIB	IETF RFC 3411	2002	An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks
IETF RFC 3412 SNMP Message Processing MIB	IETF RFC 3412		Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
IETF RFC 3413 SNMP Target and Notification MIBs	IETF RFC 3413		Simple Network Management Protocol (SNMP) Applications
IETF RFC 3414 SNMP USM MIB	IETF RFC 3414		User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
IETF RFC 3415 SNMP VACM MIB	IETF RFC 3415		View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)
IETF RFC 3416 SNMP Protocol Operations	IETF RFC 3416		Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)
IETF RFC 3418 SNMP MIB	IETF RFC 3418		Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)
IETF RFC 4180 CSV Files	IETF RFC 4180		Common Format and MIME Type for Comma-Separated Values (CSV) Files
IETF RFC 4291 IPv6 Addressing	IETF RFC 4291		IP Version 6 Addressing Architecture
IETF RFC 4293 SNMP IP MIB	IETF RFC 4293		Management Information Base for the Internet Protocol (IP)
IETF RFC 4443 IPv6 ICMP	IETF RFC 4443		Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
IETF RFC 4861 IPv6 Neighbor Discovery	IETF RFC 4861		Neighbor Discovery for IP version 6 (IPv6)
IETF RFC 4862 IPv6 Stateless Address	IETF RFC 4862		IPv6 Stateless Address Autoconfiguration
IETF RFC 5280 X.509	IETF RFC 5280		Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile
IETF RFC 6353 TLS for SNMP	IETF RFC 6353		Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)
IETF RFC 7159 JSON	IETF RFC 7159	1.2	The JavaScript Object Notation (JSON) Data Interchange Format
IETF RFC 7230 HTTP	IETF RFC 7230		Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing
IETF RFC 793 TCP	IETF RFC 793		Transmission Control Protocol
IETF RFC 8446 TLS	IETF RFC 8446	1.3	The Transport Layer Security (TLS) Protocol
Internet Subnet Alternatives			Internet Subnet Alternatives
ISO 14906 EFC - DSRC	ISO 14906	2 (2011) Cor1 (2013) Amd.1 (2015)	Electronic fee collection -- Application interface definition for dedicated short-range communication
ISO 15628 DSRC Application Layer	ISO 15628	2 (2013)	Intelligent transport systems -- Dedicated short range communication (DSRC) -- DSRC application layer
ISO 21219-15 TPEG2 - Traffic Event	ISO 21219-15		Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 15: Traffic event compact (TPEG2-TEC)
ISO 21219-24 TPEG2 - Light Encryption	ISO 21219-24	2017	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 24: Light encryption (TPEG2-LTE)
ISO 21219-6 TPEG2 - Message Mgmt	ISO 21219-6	1	Intelligent transport systems - Traffic and travel information via transport protocol experts group, generation 2(TPEG2) -- Part 6: Message management container (TPEG2-MMC)
ISO 21320-1 ZIP	ISO 21320-1	2015	Information technology — Document Container File — Part 1: Core
ITE TMDD Vol 2	ITE TMDD Vol 2	3.03d	Traffic Management Data Dictionary Standard for the Center-to-Center Communications: Volume 2: Design Content
Not Needed	No Standard Needed		No Standard Needed
NTCIP CCTV Objects	NTCIP 1205	01.Amd1.14	NTCIP Objects for CCTV Camera Control
NTCIP Global Objects	NTCIP 1201	03.15r	NTCIP Global Object (GO) Definitions
NTCIP Message Sign Objects	NTCIP 1203	3.05	NTCIP Object Definitions for Dynamic Message Signs (DMS)
NTCIP Signal Control Priority Objects	NTCIP 1211	02.24j	NTCIP Objects for SCP
NTCIP Signal Controller Objects	NTCIP 1202	3.22	NTCIP Object Definitions for ASC

Standard	Standard Number	Standard Version	Standard Title
NTCIP Signal System Master Objects	NTCIP 1210	01.55r	NTCIP Objects for Signal System Masters
NTCIP SP-Ethernet	NTCIP 2104	1.11	NTCIP SP-Ethernet
NTCIP Transportation Sensor Objects	NTCIP 1209	2.18	NTCIP Object Definitions for Transportation Sensor Systems (TSS)
NTCIP Video Switch Objects	NTCIP 1208	1.12	NTCIP Object Definitions for Video Switches
NTCIP Weather Station Objects	NTCIP 1204	3.08	NTCIP Environmental Sensor Station Interface Standard
SAE J2353 ATIS DD	SAE J2353	201906	Data Dictionary for Advanced Traveler Information Systems (ATIS)
SAE J2354 ATIS Messages	SAE J2354	201906	Message Sets for Advanced Traveler Information System (ATIS)
SAE J2945/0 DSRC Common Design Elements	SAE J2945	201712	Dedicated Short Range Communication (DSRC) Systems Engineering Process Guidance for J2945/x Documents and Common Design Concepts
TCIP - Data	APTA TCIP-S-001 Vol 2	4.1.1	Transit Communications Interface Profiles - TCIP Data and Dialog Definitions
W3C SOAP	W3C SOAP 1.2	1.2	SOAP Version 1.2
W3C WSDL	W3C WSDL 1.1		Web Services Description Language (WSDL) 1.1
W3C XML	W3C XML	5	Extensible Markup Language (XML) 1.0 (Fifth Edition)
Work Zone Data Exchange	WZDx		Work Zone Data Exchange

Appendix F – TIP Consistency Form

Three questions were added to the Transportation Improvement Program (TIP) project submission form – https://lawrenceks.org/mpo/tip/submit – to capture additional ITS project information.

1. Related project name if already exists in the Regional ITS Architecture (include project number):
2. List any other stakeholders besides the lead one:
3. ITS needs addressed by the project:

Appendix G – Annual Architecture Annual Maintenance Survey

Please provide the following information:

Name and title	*Agency:*
Email:	*Phone number:*

1. **Did your agency implement or upgrade any projects listed in the ITS Architecture within the past 12 months? This includes any modifications to existing ITS systems or technologies previously installed.**

   ☐ Yes ☐ No

   If yes, describe in the table below. If more than four projects were implemented or upgraded, add lines as needed.

Project 1	
Project Name:	
Project Number (in the ITS Architecture):	
Description:	

Project 2	
Project Name:	
Project Number (in the ITS Architecture):	
Description:	
Project 3	

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Project Name:	
Project Number (in the ITS Architecture):	
Description:	

Project 4	
Project Name:	
Project Number (in the ITS Architecture):	
Description:	

2. **Are there any ITS projects to add to the ITS Architecture? They could be technology, communications related, emergency management, etc.**

   ☐ Yes ☐ No

   If yes, complete the TIP submission form to provide additional information about the project(s).

3. **Would you be interested in peer-to-peer mentoring or assistance with planning for ITS projects or ideas?**

   If yes, please provide a brief description of what you would like assistance within the box below.

   ☐ Yes ☐ No
