Monday, April 26, 2021
1:30-3:00 PM
Virtual meeting hosted in
Parks and Recreation Administration Building
1141 Massachusetts St

To participate or provide public comment register via zoom: Virtual Meeting Registration

Written public comment must be received by the MPO by 5:00 p.m. on the day before the meeting. Send correspondence electronically to mpo@lawrenceks.org. Comments received after the deadline will not be posted and there is no guarantee that such comments will be considered. The MPO is sensitive to members of the public who may not have access to technology. For those persons, written comments may be dropped in the Utility Billing Drop Box, located at the cut-out at 6th Street and New Hampshire Street. Comments should be marked for the **MPO ITS Plan**.

**The MPO will provide a method at the Parks and Recreation Administration Building for individuals without access to the internet or a telephone - and only such persons - to observe or participate in the meeting.*

Intelligent Transportation Systems (ITS) Steering Committee Agenda

1. **Zoom Meeting Preamble**
2. **Introductions**
3. **Public Comment**
4. **Meeting 3 Notes – Attached**
5. **Plan Update Process – Attached**

Draft Plan Components

6. **Plan Goals (Discussion) – Attached**
7. **Project Estimates & Funding Sources (Discussion) – Attached**
8. **Project Pages (Discussion) – Attached**
9. **Draft RAD-IT Website (Discussion) –** https://assets.lawrenceks.org/assets/mpo/ITS/2021/web/web/index.htm
10. **Next Steps**
    - **a.** Provide any final comments by 5pm on April 30.
    - **b.** Anticipated 15-day public comment period – May 6 to May 21.
    - **c.** Technical Advisory Committee and MPO Policy Board – June consideration for approval.

Special Accommodations: *Please notify the Lawrence-Douglas County Metropolitan Planning Organization (L-DC MPO) at (785) 832-7700 at least 72 hours in advance if you require special accommodations to attend this meeting (i.e., qualified interpreter, large print, reader, hearing assistance). We will make every effort to meet reasonable requests.*

The L-DC MPO programs do not discriminate against anyone on the basis of race, color, or national origin, according to Title VI of the Civil Rights Act of 1964. For more information or to obtain a Title VI Complaint Form, see www.lawrenceks.org/mpo/title6 *or call (785) 832-7700.*

LAWRENCE - DOUGLAS COUNTY MPO
METROPOLITAN PLANNING ORGANIZATION

MEETING 3 NOTES
Intelligent Transportation Systems (ITS) Steering Committee
Tuesday, April 13, 2021
10:30 - Noon
Virtual meeting hosted in
Parks and Recreation Administration Building
1141 Massachusetts St

	Agency	Stakeholder		Agency	Stakeholder
	FTA	Eva Steinman	X	Lawrence	Nick Hoyt
X	FHWA	David LaRoche	X		Dustin Smith
X	KDOT	Michael Flory, Taylor McHenry, Garry Olson, Mike Floberg	X		Caleb Pettengill
	KTA	David Jacobsen	X		Micah Seybold
X	KC Scout	Randy Johnson	X		Rob Neff
	Baldwin City	Ed Courton	X		Kevin Fussell
	Eudora	Branden Boyd	X	Douglas County	Chad Voigt
			X	Lawrence Transit	Adam Weigel
			X	KU On Wheels	Aaron Quisenberry
	Staff			**Public**	
	L-DC MPO	Jessica Mortinger	X	Douglas County Emergency Communications	Tony Foster
X	L-DC MPO	Ashley Bryers			
X	L-DC MPO	Sarah Buford			
X	L-DC MPO	Ari Leyva			

1. **Zoom Meeting Preamble (10:30am)**

2. **Introductions –** Introductions were made. Rob Neff said he invited Tony Foster to participate in the meeting based on discussions about a couple of the ITS projects.

3. **Public Comment –** No public comments were given.

4. **Meeting 2 Notes –** Meeting notes were found satisfactory.

5. **Plan Update Process (Discussion) –** No comments were made.

Intelligent Transportation System (ITS) Plan Update

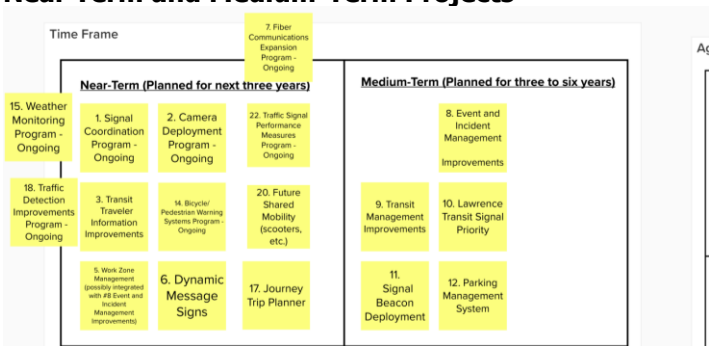
Task	March 4 @ 1:30 - 3:00	March 29 @ 1:30 - 3:00	April 13 @ 10:30 - Noon	April 26 @ 1:30 - 3:00	May	June
Development						
Steering Committee	Kickoff	Meeting 2	Meeting 3	Meeting 4		
Meeting Topic	Overview, Discuss ITS needs, & Verify goals (T2040 & ITS)	Discuss projects (new & old)	Discuss timeline, priorities & necessary agreements	Review draft plan		
Homework	Review & comment on ITS needs & Review existing projects for Meeting 2	Provide any further comments on projects	Review & comment on necessary agreements	Review & comment on draft plan		
Review						
15-day public comment period					Anticipated - May 6 - May 21*	
Document public comments & make necessary edits					X	
TAC/MPO Policy Board consideration of ITS Plan						Anticipated - June 1 & June 17*
Pending Policy Board approval post online and send to KDOT, FHWA, and FTA						X

* Anticipated dates. The final dates depend on how the planning process advances.

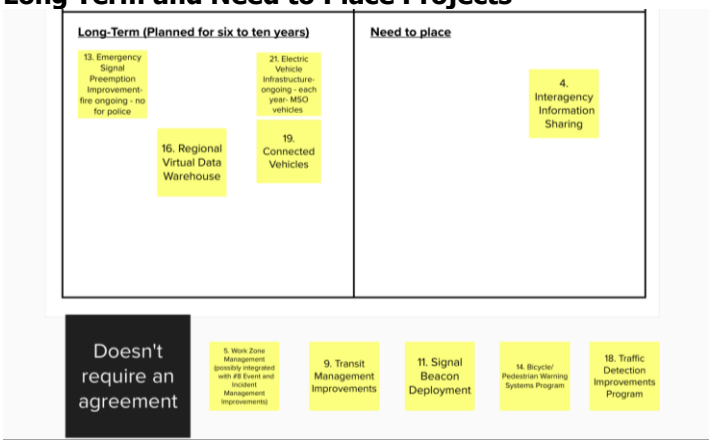
2.25.21

** Public participation process includes: Newspaper advertisement, email to subscription list, place document online and at public locations - Baldwin City Public Library, Eudora City Hall, Lawrence Public Library, Lecompton City Hall, and MPO Office, send to TAC and Policy Board for review

6. **Prioritizing Projects (Discussion) –** The Committee used Mural change where the projects were placed in priority order.
    a. **Near Term and Medium-Term Projects**

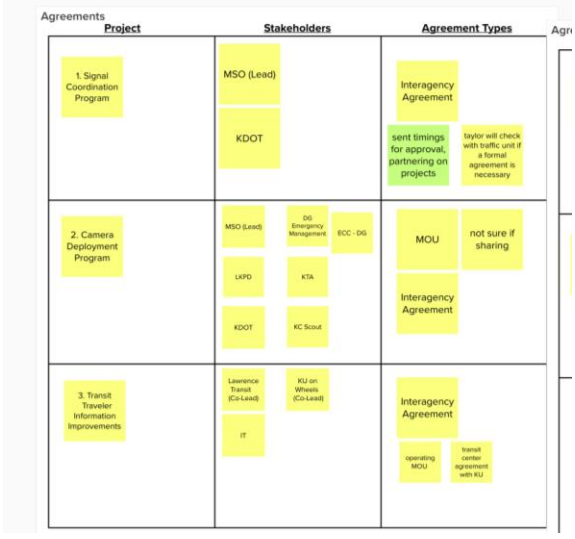


    b. **Long Term and Need to Place Projects**

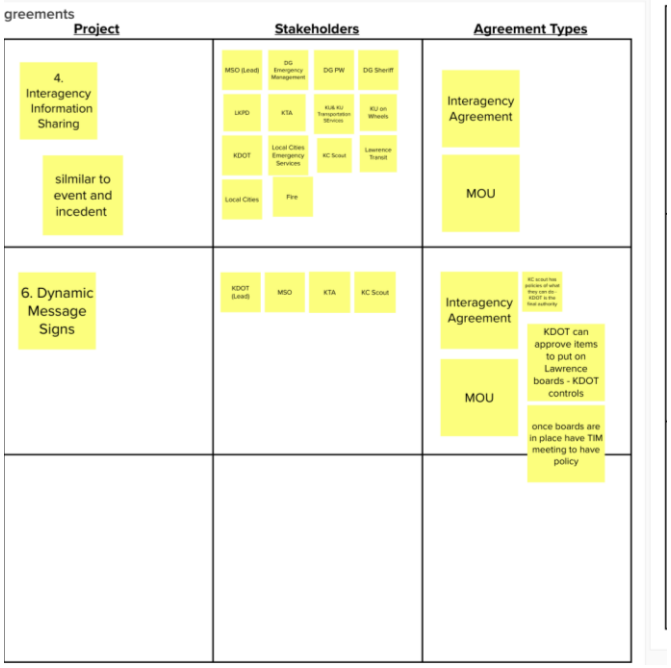


7. **Necessary Agreements for ITS Projects–** The Committee used Mural do discuss stakeholders and existing and necessary agreements.

    a. **Signal Coordination Program, Camera Deployment Program, Transit Traveler Information Improvements**

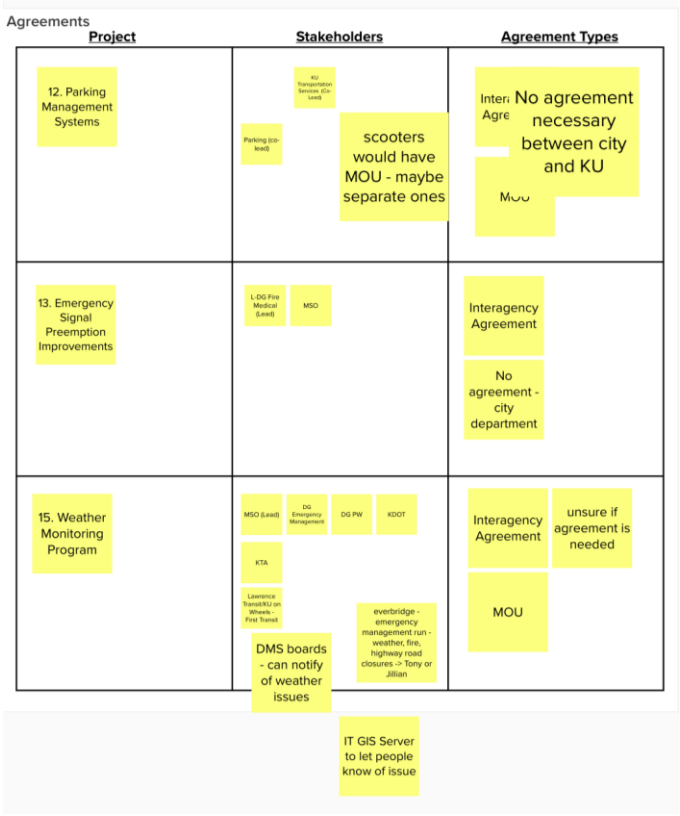


b. Intraagency Information Sharing, Dynamic Message Signs

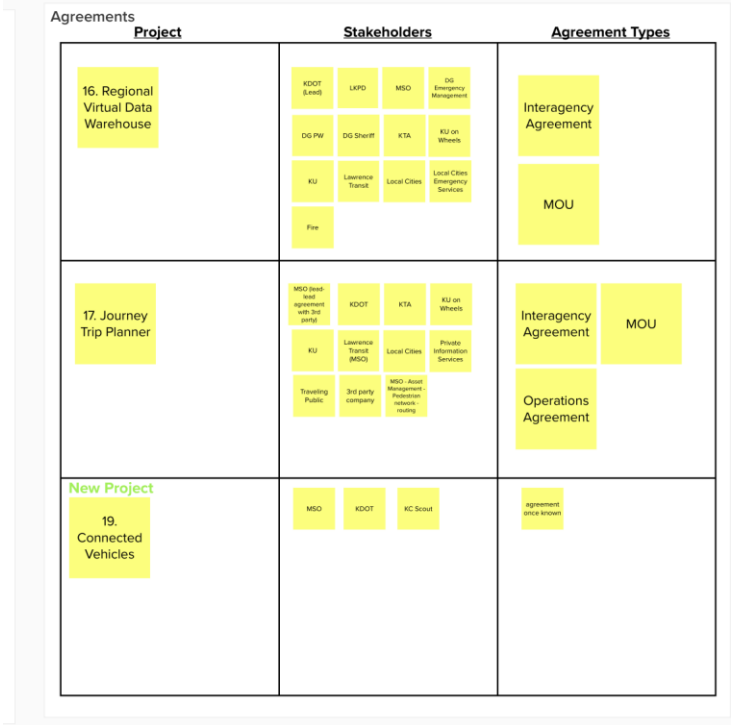


c. Fiber Communications Expansion Program, Event and Incident Management Improvements, Lawrence Transit Signal Priority

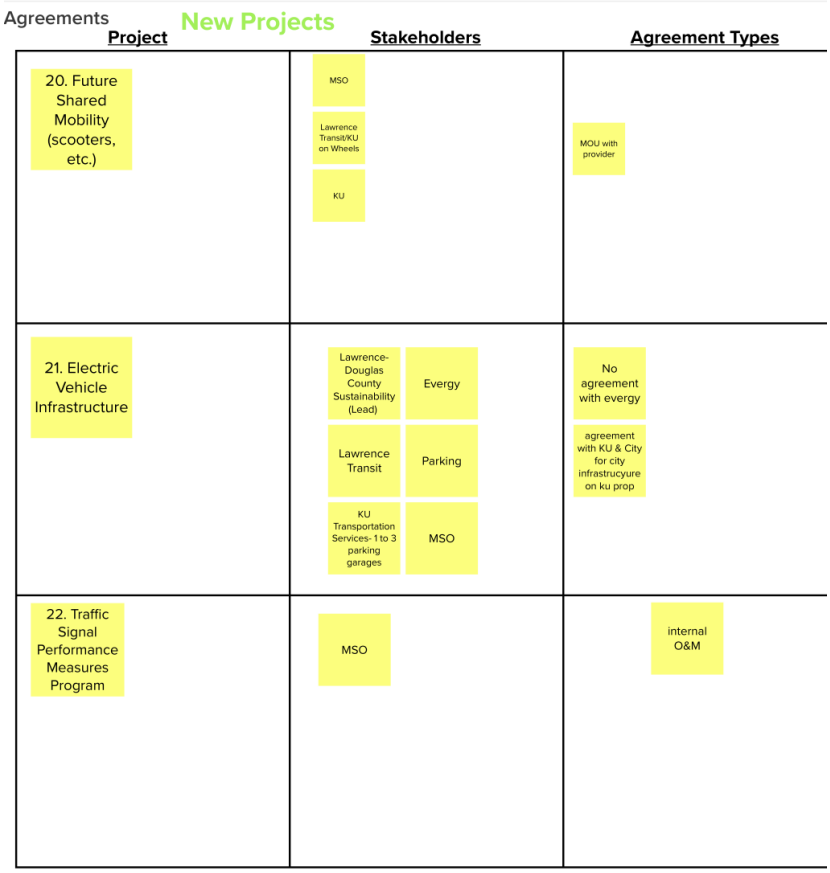
d. Parking Management Systems, Emergency Signal Preemption Improvements, Weather Monitoring Program



e. Regional Virtual Data Warehouse, Journey Trip Planner, Connected Vehicles



f. Future Shared Mobility, Electric Vehicle Infrastructure, Traffic Signal Performance Measures Program



8. Next Meeting – Meeting adjourned at 11:40pm

- Meeting 4 - April 26 @ 1:30

Intelligent Transportation System (ITS) Plan Update

Task	March 4 @ 1:30 - 3:00	March 29 @ 1:30 - 3:00	April 13 @ 10:30 - Noon	April 26 @ 1:30 - 3:00	May	June
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2. L-DC Regional ITS Vision and Goals

The L-DC Regional ITS Vision and Goals describe the guiding principles for how ITS should be planned, developed, and implemented in the Region. The Vision and Goals were 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 (MTP, currently called Transportation 2040)

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 project and programs are shown in **Table 1** with dots to indicate which T2040 goals they support.

Table 1: ITS 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 Electric Vehicle 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	●	●	●	●

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 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.

14.4 L-DC Region ITS Projects

Table 12 lists the sequenced ITS 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. Neither do the vast majority of 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 cost estimates for near-term projects are more precise than the estimates for the medium-term and long-term projects. Near-term projects assume the use of current technologies whose costs are better known. Medium-term and long-term projects are not as clearly defined because stakeholder participation has not been committed, and technologies may change before the projects are designed.

Further there are several projects which are programs of projects with yearly projects to achieve the project. The yearly projects are not identified, but are shown within the Ongoing Expenses column.

Ashley will keep working on this prior to the meeting. This is the updated version as of 4.23.21

Table 8: L-DC Regional ITS Projects

	Projects	Capital			Ongoing Expenses		
		Low Estimate		High Estimate	Low Estimate		High Estimate
Ongoing Programs	1 Signal Coordination Program	$ 740,000			$ 50,000	to	$ 100,000
	2 Traffic Detection Improvements Program	$ 774,000	to	$ 1,444,000	$ 100,000	to	$ 200,000
	3 Traffic Signal Performance Measures Program	$ 8,000			$ 15,600	to	$ 31,200
	4 Fiber Communications Expansion Program	$ 839,400					
	5 Camera Deployment Program	$ 372,000	to	$ 580,000	$ 5,000	to	$ 30,000
	6 Emergency Signal Preemption Improvements Program						
	7 Weather Monitoring Program	$ 50,000			$ 10,000	to	$ 20,000
	8 Electric Vehicle Infrastructure and Vehicles Program						
	8a Lawrence Public Charging Stations	$ 75,000					
	8b Private Charging Stations						
	8c Transit Charging Stations	$ 1,022,182		$ 4,161,741			
	8d Transit Vehicles	$ 12,412,500		$ 47,167,500			
	8e Lawrence City Vehicles (Including Fleet and Operations)						
	8f Other Cities/County Vehicles						
	9 Work Zone Management Program	$ 120,000	to	$ 174,000			
	10 Bicycle/Pedestrian Warning Systems Program	$ 750,000	to	$ 900,000			
	Total Estimated Ongoing Programs Cost	**$ 17,163,082**	**to**	**$ 54,427,241**	**$ 180,600**	**to**	**$ 381,200**
Near-Term (planned for the next three years)	11 Shared Mobility Program	Unknown	to	Unknown			
	12 Dynamic Message Signs	$ 1,800,000	to	$ 2,400,000			
	13 Signal Beacon Deployment	$ 600,000	to				
	14 Transit Traveler Information Improvements	$ 96,000	to	$ 14,400			
	Total Estimated Near-Term Programs Cost	**$ 2,496,000**	**to**	**$ 2,414,400**			
Medium-Term (*planned for three to six years*)	15 Transit Management Improvements	$ 722,090					
	16 Transit Signal Priority	$ 46,200	to	$ 97,800			
	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	**$ 1,818,290**	**to**	**$ 3,097,800**			
	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	**$ 26,856,662**	**to**	**$ 67,221,641**			
	Total Cost of All Projects	**$ 48,334,034**	**to**	**$127,161,082**	**$ 180,600**	**to**	**$ 381,200**

15. L-DC Region ITS Project Funding

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

Table 13 lists each L-DC Region ITS 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 13: Potential L-DC Region ITS Project Funding Sources

Red indicates a new project so the various funding sources are not known.

	Locally Administered		State Administered		Federally Administered		
	Local Transportation Funds	Local Emergency Funds	KDOT	ITS Earmark Funds	Homeland Security	Federal Highway Funds	Federal Transit Funds
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 Electric Vehicle 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. Similar to 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.

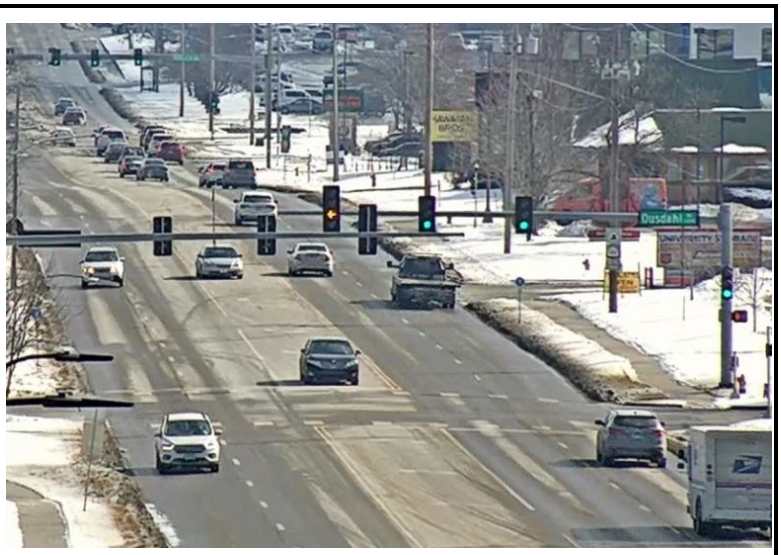
Federal Transit Funds – Transit funds administered by the Federal Transit Administration (FTA) can come in the form of grants, matching funds, disbursement of other transit funds, or special monies for specific projects. In recent history, the FTA has made rural and small urban transit systems a priority, 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 projects.

14.4.1 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 Cost:

The project cost is approximately **$3,500 per interstation** for design and implementation. The City anticipates budgeting between $50,000 and $100,000 per year for coordination and timing projects. 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:

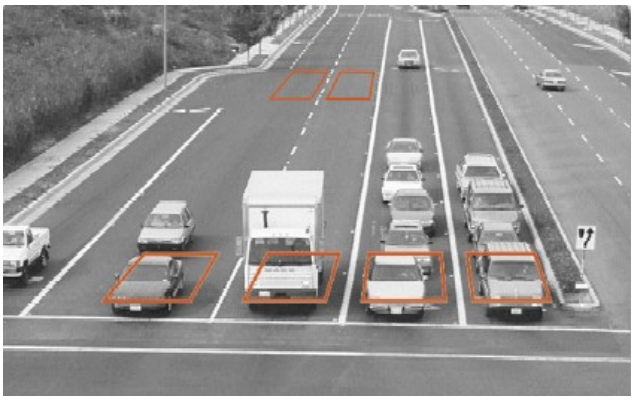
The effectiveness of this project can be measured through the following measures:

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

14.4.2 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 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.

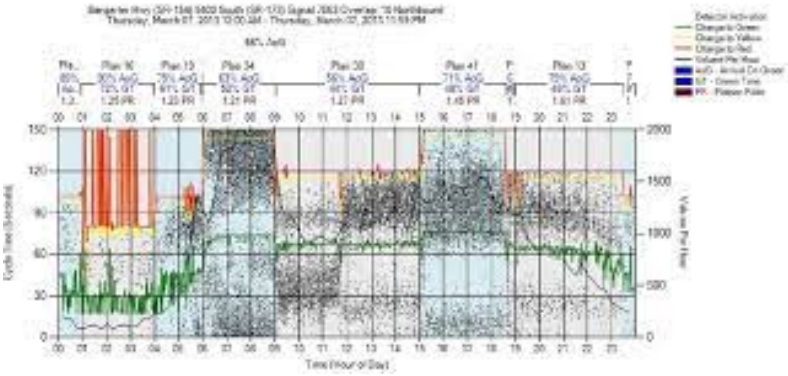
Performance Measures:

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

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

14.4.3 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 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:

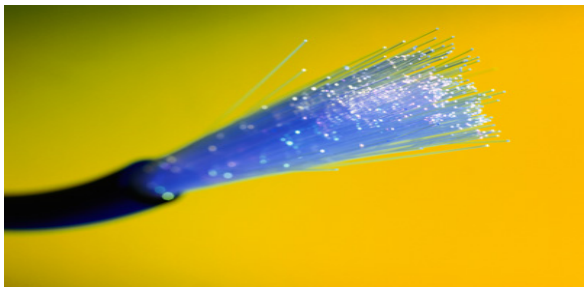
The effectiveness of this project can be measured through the following measures:

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

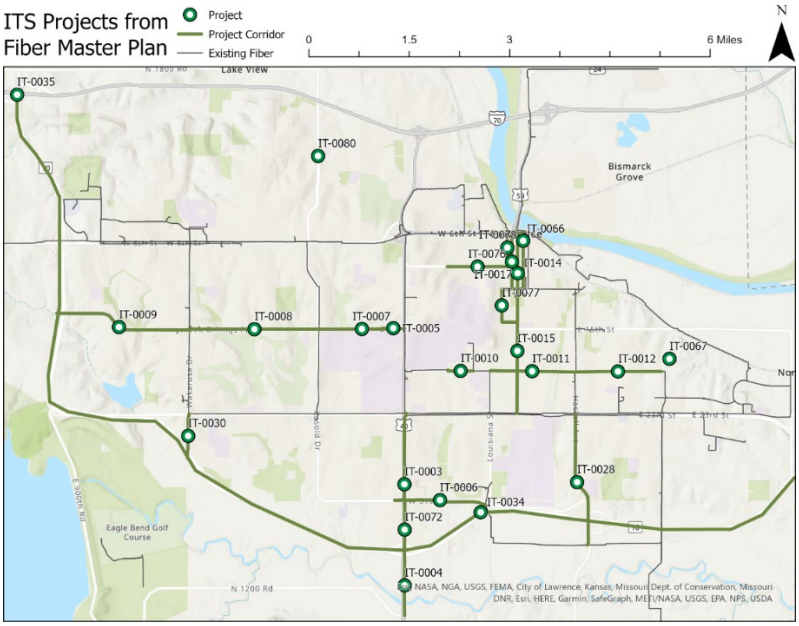
14.4.4 Fiber Communications Expansion Program

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: Fiber MOUs with Douglas County, KU, and multiple private communication providers

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

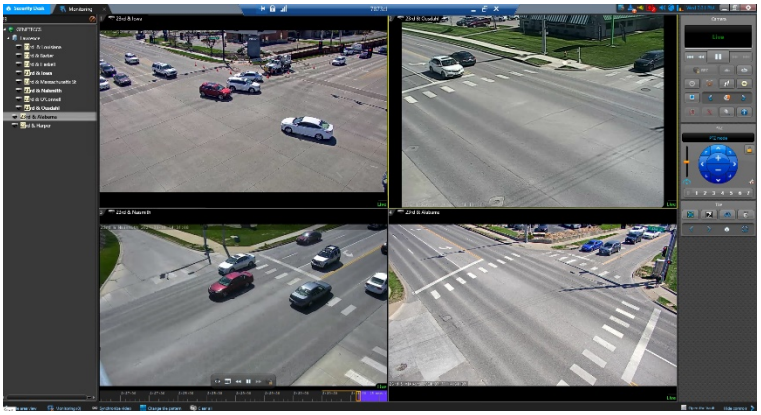
performing other roadway construction and maintenance that may impact the network. The OA may also address the sharing of fiber and how the strands may be distributed by Stakeholder or function.	
Need(s) Addressed: • Provide quality real time congestion related information. • Improve traffic information 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 improves virtually all other ITS Projects in the Region.
Estimated Cost: The estimated cost of the Communications Expansion is: • (Insert from list) **The total estimated cost is $4.7 million**. This cost estimate has been 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.	

14.4.5 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 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**.

Performance Measures:

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

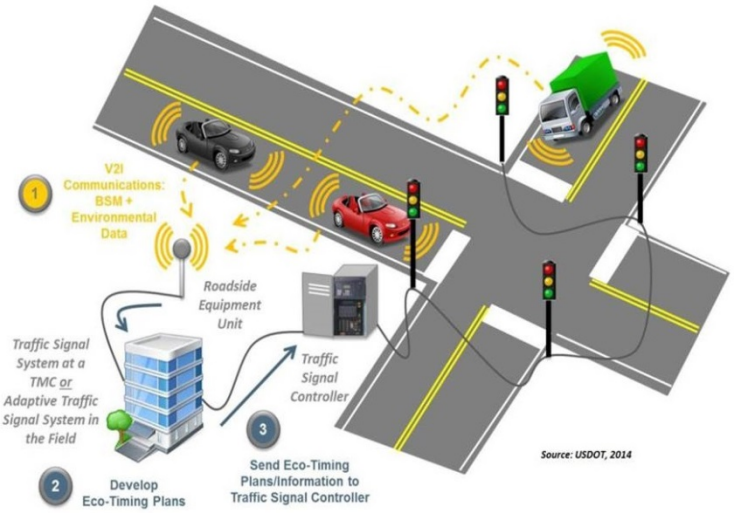
- Travel times in the corridors.
- Incident response times.
- Impact of images on traffic management.

14.4.6 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. This project needs to be contionously implemeted 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 17).



Timeframe: Ongoing	*Project Areas:* • Locations throughout the City of Lawrence
Lead stakeholder: • **Lawrence-Douglas County Fire Medical**	*Other stakeholders:* • 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: • Reduce emergency vehicle delays at signals. • Enable remote emergency control of signals.	*ITS Service Packages:* PS03: Emergency Vehicle Preemption & PS03: Emergency Vehicle Preemption (Emergency Signal Preemption Upgrade)

Estimated 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 20 vehicles and up to 30 intersections, **the estimated total cost is $166,000 to $360,000**. This estimate is based on the federal ITS Knowledge database.

Performance Measures:

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

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

14.4.7 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 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.

14.4.8 Electric Vehicle Infrastructure and Vehicles Program

Description:

This project will install electric vehicle charging stations and associated infrastructure. Currently two 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 transited to electric or some other non-fossil fuel energy source. This includes trash trucks, snowplows, etc.

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:

The purchase of 50 electric vehicle charging stations and 7 transit vehicle charging stations equates to $1,097,182 (as a personal vehicle charging station costs $1,500 and a transit charging station cost $146,026). The cost of replacing XXXXX city vehicles (fleet vehicles, trash trucks, snowplows, etc.) is unknown. As the Climate Action Plan is developed this cost will become clearer.

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

14.4.9 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 17) and 2) for work zones (project 10).

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 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 $120,000 to $174,000**. This estimate is based on the federal ITS Knowledge database[5].

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.

[5] http://www.itsknowledgeresources.its.dot.gov/its/benecost.nsf/files/bclldepl2011update/$file/ben_cost_less_depl_2011%20update.pdf

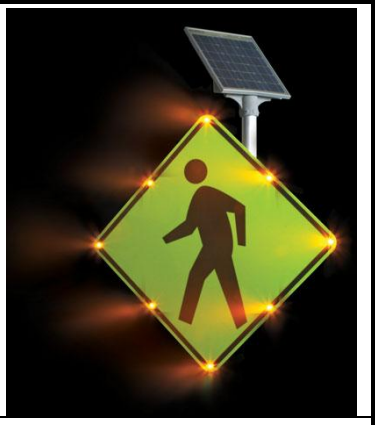
14.4.10 Bicycle/Pedestrian Warning Systems Program

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:	*Project Areas:*
Long-term (six to ten years)	• Locations throughout the City of Lawrence

Related Programs:

- Traffic Detection Improvements Program

Lead stakeholder:	*Other stakeholders:*
• **City of Lawrence Municipal Services and Operations**	• Traveling Public

Agreements:

Not necessary

Need(s) Addressed:	*ITS Service Packages:*
• Improve bicycle/pedestrian warning systems.	VS12: Pedestrian and Cyclist Safety

Estimated 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 the federal ITS Knowledge database.

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.

14.4.11 Shared Mobility Program

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:

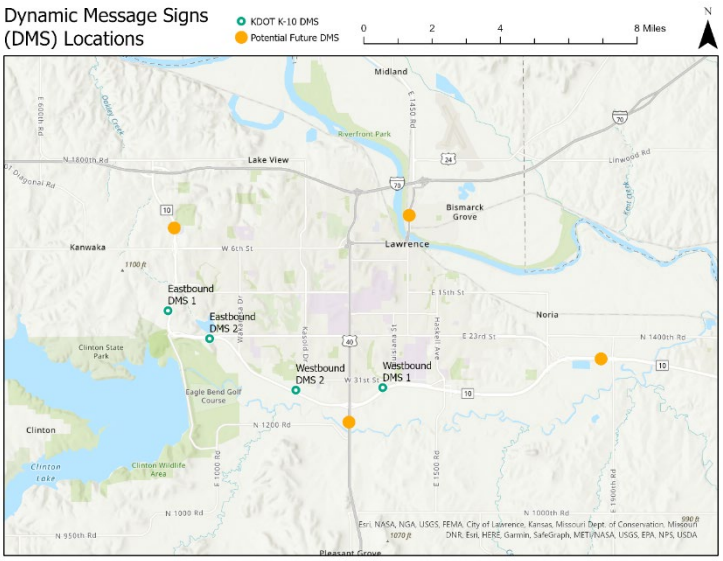
- Single occupancy vehicle commute trips per capita

14.4.12 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

Related Programs:

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

Lead stakeholder:

- **City of Lawrence Municipal Services and Operations – Lead for City signs**
- ***KDOT – lead for KDOT signs***

Other Stakeholders:

- KDOT
- KTA
- KC Scout

Agreements:

MOU: The four proposed 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 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 four would cost another $900,000 to $1,200,000.** 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.

14.4.13 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 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.

14.4.15 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 multi-modal 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 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.

14.4.16 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 general 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:

- **Lawrence Transit**
- **KU on Wheels**

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

PTS07: Transit Passenger Counting

PT06: Transit Fleet Management

Estimated 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:

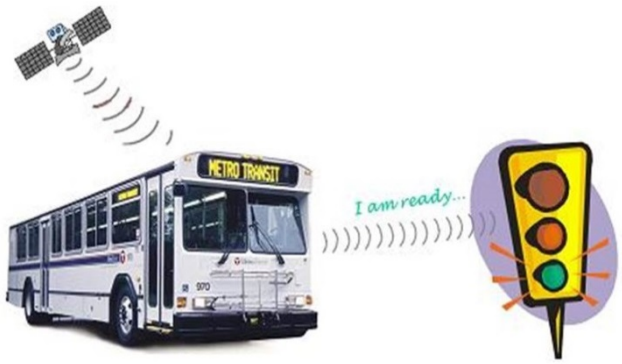
- Transit ridership.
- Operations cost per transit trip.
- Survey of transit passenger satisfaction.

14.4.17 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 in order 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 Cost:

The estimated cost of this project includes on-board technology ranging in cost from $900 to $2,100 per vehicle, and intersection control hardware and software that ranges from $5,000 to $10,000. Assuming 18 vehicles and up to six intersections, **the estimated total cost is $46,000 to $98,000**. This estimate is based on the federal ITS Knowledge database.

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.

14.4.18 Parking Management Systems Project

Description:

This project will improve the management of parking in the City of Lawrence and on the KU campus through the use of 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 selecting a new parking management software and 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 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.

14.4.19 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 actually 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 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.

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.

14.4.20 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 is able to 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 in order 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 general 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 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.

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.

14.4.21 Journey Trip Planner Tool Project

Description:

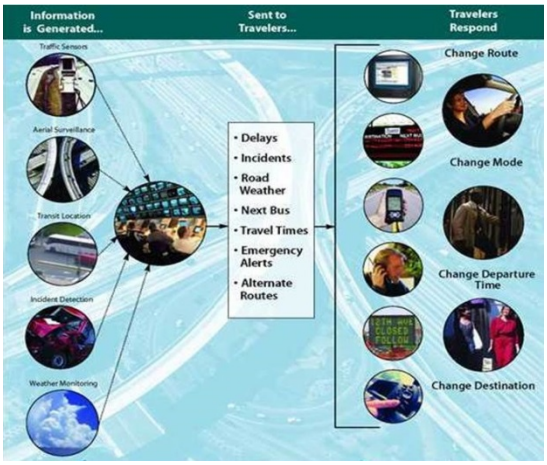
The Journey Trip Planner will be an online tool available to travelers through their computers and personal devices that allows them to plan trips using one or more modes, including personal vehicle, transit, bicycle and pedestrian.

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 Program

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

ITS Service Packages:

TI01: Broadcast Traveler Information

TI02: Personalized Traveler Information

PT08: Transit Traveler Information

PT14: Multi-modal Coordination

Estimated 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.

Performance Measures:

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

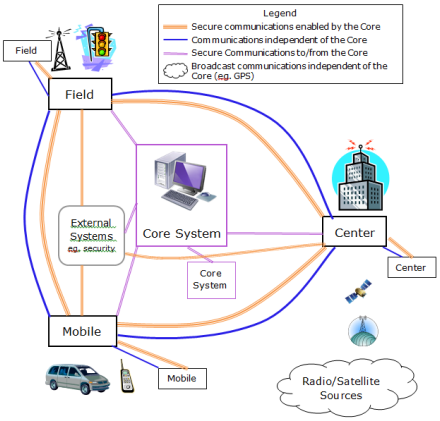
- Use of modes other than personal vehicle.
- Average travel time in the Region

14.4.22 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 implemeting the infrastructure for connected vehicles, planning needs to occur to be ready when it is rolled out nationwide.

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