LAWRENCE-DOUGLAS COUNTY REGIONAL ITS ARCHITECTURE
TECHNICAL MEMORANDUM #2
ITS STRATEGIES

DRAFT

Submitted to

Lawrence-Douglas County Metropolitan Planning Organization

Submitted by

ITERIS Innovation for better mobility

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GLOSSARY

Acronym	Description
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.
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, for example.
CVAS	Commercial Vehicle Administrative Systems – a subpart of the Commercial Vehicle Information System, see CVISN.
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 crossing safer.
ISP	Information Service Provider – usually the radio or television or other private organization that provide road conditions or other information for travelers.
ITS	Intelligent Transportation Systems

Acronym	Description
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
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 Long Range Transportation Plan with a horizon of 2040.
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.
SDP	Strategic Deployment Plan
TMC	Traffic Management Center
TOC	Traffic Operations Center
TOMC	Traffic Operations and Management Center
UPRR	Union Pacific Railroad

1. Project Overview

The Lawrence-Douglas County Metropolitan Planning Organization (L-DC MPO) is updating the Intelligent Transportation System (ITS) Architecture for the Lawrence and Douglas County Metropolitan Region. The Architecture is a framework for defining the Region's ITS plans and how future projects will integrate and interoperate with existing and new systems.

The goal of the L-DC Regional ITS Architecture Update Project is ***to develop a framework for the planning and development of Intelligent Transportation Systems that improve the safety and efficiency of travel in the Lawrence-Douglas County Region***. The goal will be achieved through the following objectives:

- Meet all federal and state architecture requirements.
- Engage the Stakeholders in defining the Region's needs and ITS goals.
- Provide a comprehensive strategy that integrates ITS planning into the Region's transportation planning.
- Plan ITS solutions that complement and are consistent with the Region's other plans.
- Update the Regional ITS Architecture and plan with the Region's transportation professionals' support and understanding in order to ensure that the architecture and plan are user-friendly and easy to use and maintain by the Region's Stakeholders.

The Stakeholders are directly involved and identify needs to be addressed using ITS throughout this project. The Update Project is mapping those needs to ITS Strategies, User Services and, ultimately, to ITS projects that may implement new ITS or expand the functionality of existing systems. At its conclusion, this Update Project will develop a Regional ITS Architecture and a corresponding Strategic Deployment Plan (SDP).

The Regional ITS Architecture will describe existing and planned ITS in terms of:

- Projects
- Stakeholders
- ITS Elements
- User Services
- Functional Requirements
- Information Flows
- Roles and Responsibilities
- Needed Project Agreements
- Applicable Operating Standards

The SDP will provide more specific details about how the ITS described in the Architecture will be deployed, including:

- Project Scopes
- Estimated Project Costs and Project Sequencing
- Strategies for Deployment and Funding

The L-DC Regional ITS Architecture Update began in November, 2014 and will be completed in May, 2015.

1.1 Description of Project Process and this Document

The L-DC Regional ITS Architecture Update is being completed through eight tasks. The following list highlights those tasks covered by this Technical Memorandum:

1. **Project Management** includes management of communications, progress reporting, quality control and assurance, and the development of a Project Management Plan that describes key concepts of how the project will be completed.
2. **ITS Inventory and Regional Data** includes a review of the 2008 architecture, interviews with regional Stakeholders, and a review of other regional transportation planning documents that identify the region's goals, objectives and plan for transportation improvements.
3. **Stakeholder Consultation and ITS Vision** identifies the Region's transportation Stakeholders and engages them in identifying the Region's transportation needs through a workshop, surveys and interviews.
4. **Key Regional ITS Strategies** determines the priority of Stakeholder needs and define how ITS can address the Region's needs in a manner consistent with the Region's transportation goals and plans. This task includes defining ITS services, projects and the roles and responsibilities of Stakeholders in deploying and operating ITS.
5. **Regional ITS Architecture and Web Site** will include a physical representation of the architecture in the software program Turbo Architecture. The architecture will be presented to the public through an interactive web site that includes all elements of the architecture.
6. **Maintenance Strategy** will describe how the architecture will be maintained to stay current with the Region's other planning and current status of ITS projects.
7. **Strategic Deployment Plan** will describe how the Region's ITS projects can be planned, procured and deployed in a manner consistent with the Region's objectives.
8. **Presentations and Workshop** will provide executive and detailed PowerPoint slide presentations of the architecture process, the resulting projects and how they will benefit the Region. This task will include a second workshop for Stakeholders to discuss how their needs have been addressed through the architecture.

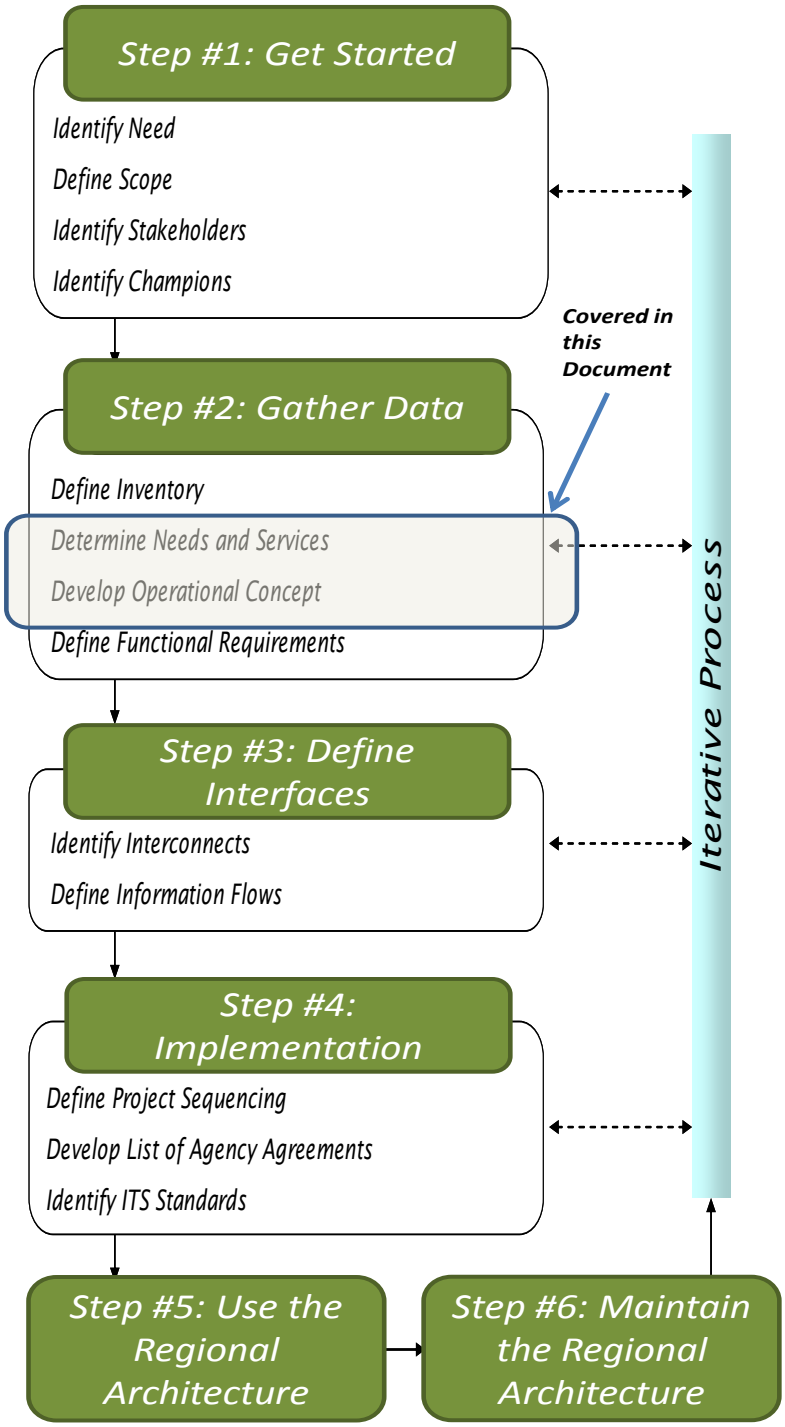
This document, Technical Memorandum #2, summarizes the findings of Task 3 and 4. It includes the results of the initial Stakeholder outreach and Stakeholder interviews, prioritization of the Region's needs and defining the Region's ITS strategies. The result of this is the identification of preliminary ITS projects that are defined at a high-level.

Figure 1 shows the process for developing, using and maintaining a Regional ITS Architecture in accordance with Federal Highway Administration (FHWA) guidance[1]. The L-DC Regional ITS Architecture Project covers the development process, which is represented by Steps #1 through #4. The Project also provides guidance for Steps #5 and #6, which are the use and maintenance of the Regional Architecture. The area highlighted in gray represent the portion of the process addressed by this Technical

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

Memorandum. The information contained in this document is used throughout the subsequent steps of the Regional ITS Architecture development.

Figure 1: Regional ITS Architecture Development, Use and Maintenance Process from FHWA



1.2 Project Boundaries

The L-DC Regional ITS Architecture has established boundaries for transportation services, geographic Region and timeframe. This section describes each of the boundaries.

1.2.1 Transportation Services Boundaries

The L-DC Regional ITS Architecture examines transportation services in the following categories:

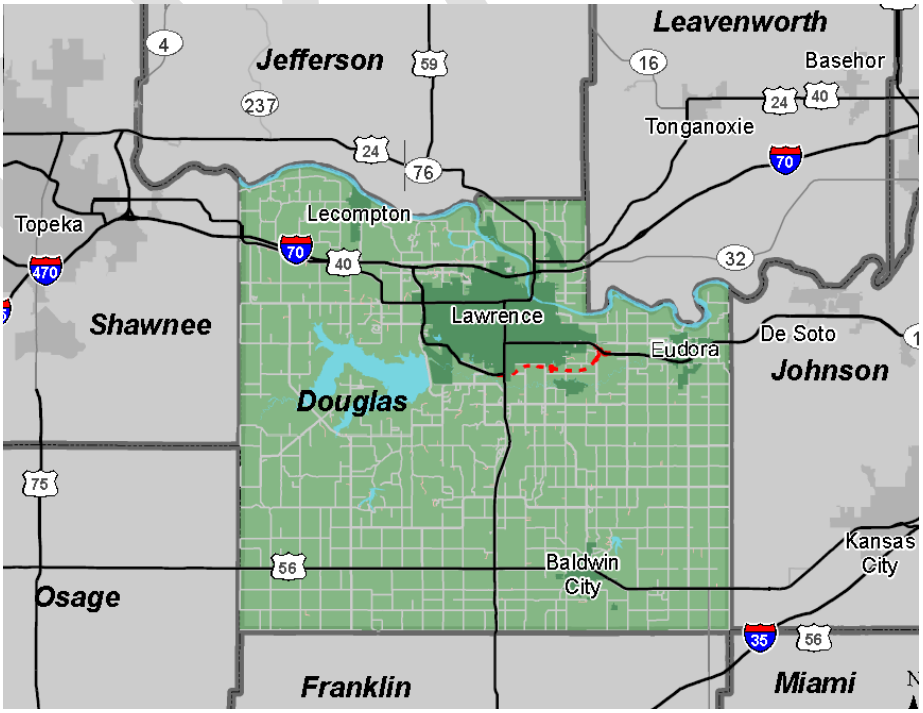
1. Arterial Traffic Management
2. Freeway Traffic Management
3. Traveler Information
4. Transit Management and Information
5. Commercial Vehicle Operations
6. Emergency Management
7. Maintenance and Construction

Planned ITS Projects and existing systems in the Region will fall into the seven transportation service categories.

1.2.2 Geographic Boundaries

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

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



1.2.3 Timeframe

The L-DC Regional ITS Architecture complements the Region's Metropolitan Transportation Plan (MTP), *Transportation 2040*. The MTP provides a vision of the Region's transportation services through the year 2040. A Regional ITS Architecture typically does not plan as far forward as a MTP, but needs to be consistent with the MTP over a shorter timeframe. The L-DC Regional ITS Architecture will have a ten-year horizon, looking forward to 2025, and will updated in coordination with the MTP.

Projects in the L-DC Regional ITS Architecture are placed in three timeframes:

1. ***Near-term*** – Near-term projects are needed in the next three years (2018), and align with fiscally-constrained projects in the MTP and the Region's Transportation Improvement Program (TIP). These projects address the Region's highest-priority needs using realistic and mature technologies.
2. ***Medium-term*** – Medium-term projects should be deployed in the next three to six years (2021). Medium-term projects address needs in the Region that may not be as critical as those in 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 for the project are not known.
3. ***Long-term*** – Long-term projects should be deployed in the next six to ten years (2025). These projects address Regional needs that are typically not 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, they are unfunded, or they are dependent upon technologies that are still evolving.

2. L-DC Regional ITS Vision and Goals

The ITS Vision and Goals have been defined by the Project Team. The ITS Vision and Goals describe the guiding principles for how to plan, develop and implement ITS in the Region. The ITS Vision and Goals have been established to be consistent with, and complement, the goals of the Metropolitan Transportation Plan (MTP)[2].

2.1 Transportation 2040 Goals

Transportation 2040 is the L-DC MTP. It provides a long-range vision of the Region's transportation strategies for all modes. The Regional ITS Architecture must stay consistent with the MTP in order to help achieve the Region's transportation goals.

The MTP for the L-DC Region identifies four goals that are consistent with federal planning guidelines. The goals are:

1. Improve Safety and Security.
2. Focus on System Preservation and Economic Efficiency.
3. Maximize Accessibility and Mobility.
4. Consider the Environment and Quality of Life.

2.2 L-DC Regional ITS Vision

The ITS Vision is the guiding principle for the development of the Regional ITS Architecture and Strategic Deployment Plan and ITS investment in the Region. The Vision has been developed based on input from the Project Team.

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 area's modes of transportation.

[2] L-DC MPO MTP, http://www.lawrenceks.org/mpo/t2040

2.3 L-DC Regional ITS Goals

The ITS Goals describe how the Region will achieve its vision of improved transportation through ITS. **Table 1** lists the ITS goals as developed by the Project Team. Each ITS goal is mapped to the related Region's MTP goals.

Table 1: L-DC Regional ITS Goals

ITS Goal	Related MTP Goals
1. Integrate efficient and effective ITS into regional transportation planning and project development.	1, 2, 3, 4
2. Improve information sharing among the Region's transportation agencies and with the public.	1, 2, 3
3. Increase the safety and security of all modes of transportation through improved infrastructure monitoring and emergency management.	1
4. Improve the utilization of existing facilities and infrastructure.	2, 4
5. Improve the ability to evaluate and measure the performance of the transportation network through the effective use of technology.	2, 3

3. L-DC Regional ITS Needs

The existing ITS inventory provides an overview of the current conditions and ITS services in the Region. The project's next step was to determine the needs that can be addressed by ITS but are not, either in part or whole, addressed by the existing ITS Services.

3.1 Needs Gathering Process

In order to identify and understand the L-DC Region's needs, the Project Team developed multiple strategies for engaging Stakeholders. The purposes of the needs gathering activities were:

- To identify the Stakeholders and their transportation roles and responsibilities.
- To identify the range of needs identified by different Stakeholder types.
- To define the geographic and service scope of the Stakeholders' needs.
- To understand the priority of the Region's needs.

The Stakeholder outreach strategies included the following:

Interactive Web Site

The project established an interactive web site in which Stakeholders could participate and provide input on the Region's transportation needs through a survey. Stakeholders were asked about their background, and their roles and responsibilities in the Region's transportation systems, and then they were asked to identify their key transportation concerns. The interactive survey also included a range of potential ITS solutions for the Stakeholders to consider.

The following two methods were used to advertise the survey to Stakeholders:

- A direct link placed on the MPO web page[3] of the City's website.
- Two group e-mails sent to the Project's identified 184 potential Stakeholders

The survey was available through the Digicate[4] web platform from November 26, 2014 to December 31, 2014. The Project Team invited the Region's Stakeholders to complete the survey and a total of 78 people responded. Over 80% of the respondents completed the survey using a personal computer, and more than half of the respondents completed the survey in the first two weeks it was available. Over 80% of the respondents also indicated that their primary mode of travel was by car or van, ten percent were pedestrian, bicyclist or transit riders, and the remainder traveled by truck or multiple modes.

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

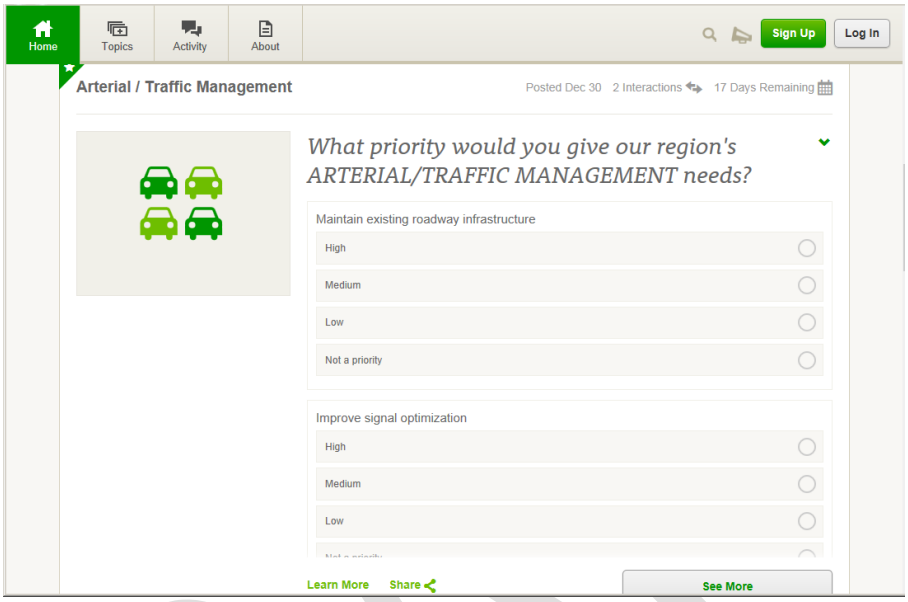
- The travel information that was most important to the Region.
- The respondent's degree of familiarity with ITS.
- The respondent's travel habits (frequency, timeframe, and mode).

[3] http://www.lawrenceks.org/mpo
[4] http://digicate.com/main.php

- The respondent's perception of what key issues affect L-DC travel.
- General information about the survey respondents.

Figure 3 provides a typical screenshot from the interactive web site.

Figure 3: Interactive Project Web Site



The results of the survey included the respondents' perception of the types of traveler information for the Region. As can be seen in **Figure 4**, construction, multi-modal and congestion information were rated most important by the Stakeholders.

Figure 4: Stakeholder Response to Most Important Traveler Information

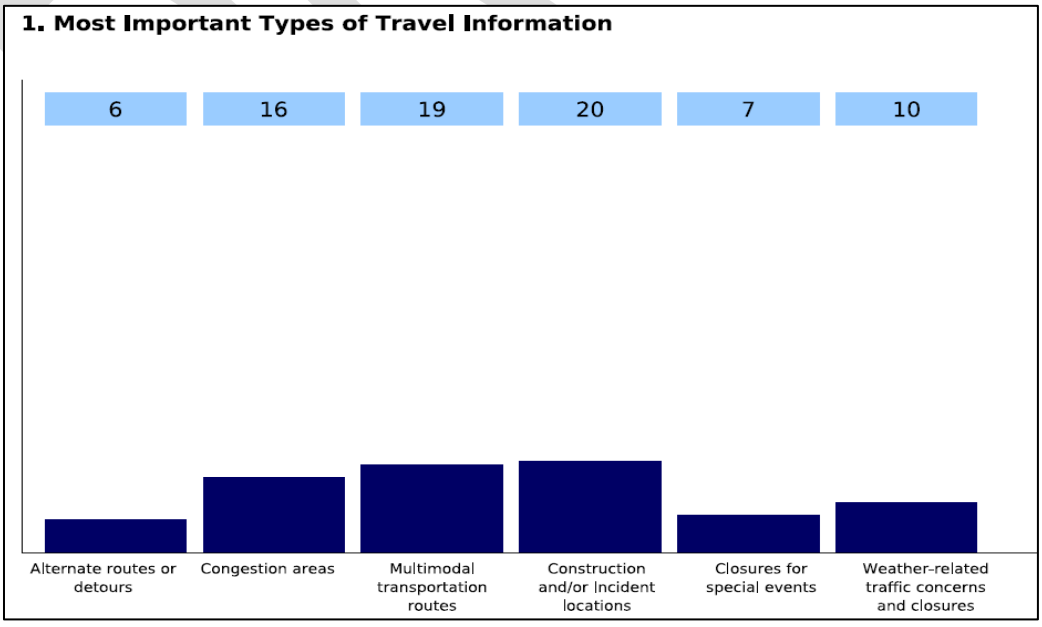
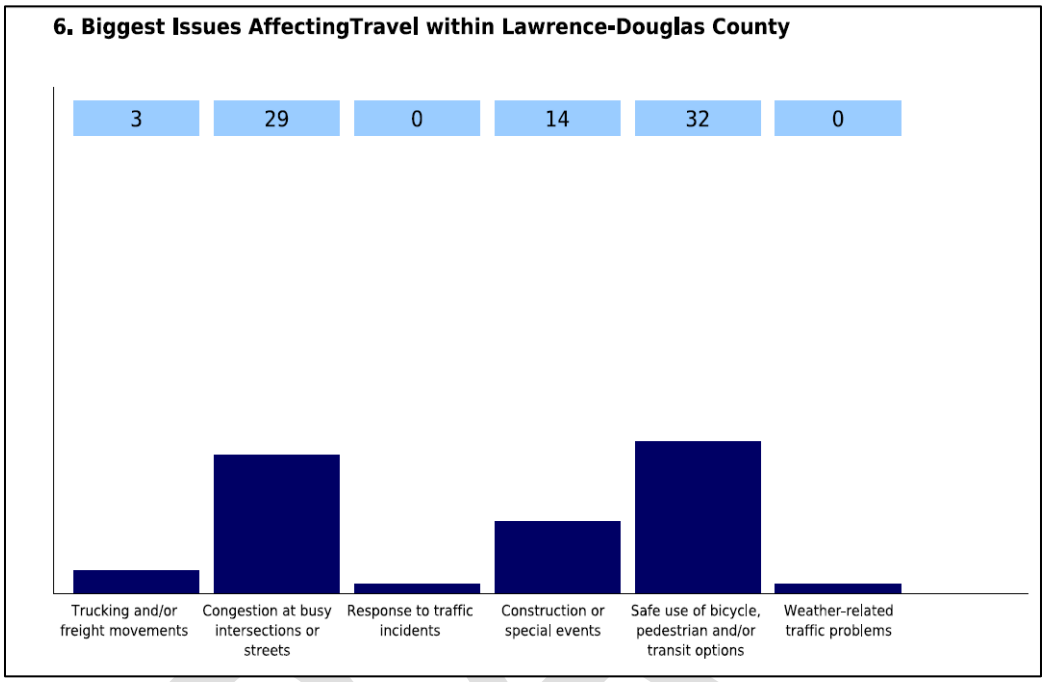


Figure 5 shows that the Stakeholders' biggest travel issues in the Region were the ability to safely use and interact with bicycles and transit, congestion and construction and special events.

Figure 5: Stakeholder Response to Biggest Issues Affecting Travel in the Region



The results of the web site survey were not intended to collect detailed information about the Stakeholders' needs. Instead, the online survey was intended to educate the Project Team about the Stakeholders, introduce the concepts of ITS to the Stakeholders and to collect general information about needs. That general information was used by the Project Team used to focus needs discussions and Stakeholder outreach activities, including the first Stakeholder Workshop.

Stakeholder Workshop

An ITS Stakeholder Workshop was held on December 8, 2014 in the Heritage Room of the Carnegie Building (200 W. 9th Street) in Lawrence, Kansas. Invitations were provided via email to over 100 Core and Community Stakeholders. Individuals representing the following entities attended and participated:

- City of Lawrence Police
- City of Lawrence Public Works
- Cottonwood, Inc. (developmental disabilities services)
- Douglas County
- Douglas County Health Department
- Federal Highway Administration
- Kansas Department of Transportation
- Kansas Highway Patrol

- L-DC MPO Policy Board and Regional Transit Advisory Committee
- Lawrence/University of Kansas Transit
- Lawrence-Douglas County Bicycle Advisory Committee

The Workshop was used to build upon the preliminary results from the online survey. After a review of ITS and the Region's current transportation network status, the Stakeholders participated in an exercise to identify the Region's specific transportation needs.

The Stakeholders were randomly assigned to small groups to ensure that each group consisted of individuals with a diversity of roles in the Region's transportation. Each group was given a map to mark up with transportation needs. The needs could be , or specific to a location or corridor. Following this exercise, each group presented their needs to all of the workshop attendees. The Project Team collected the maps and documented the needs by group and by Stakeholders.

Figure 6 shows a group of Stakeholders at the Workshop documenting Regional transportation needs.

Figure 6: Stakeholders at the Worskhop Mapping Needs

Specific feedback was gathered from the Stakeholders about issues regarding:

- Congested intersections and corridors.
- Event-related congestion and management issues.
- Bicycle, pedestrians and transit needs.
- Construction activities.
- Bicycle and pedestrian interactions with vehicles.

- Weather-related issues impacting travel.
- Geographic locations or types of issues that may benefit most from ITS.

A summary of the needs identified during the Workshop are included in Appendix A. More discussion on the needs is provided in **Section 3.2** of this Technical Memorandum.

Stakeholder Interviews

Following the Stakeholder Workshop, the Project Team met with Core Stakeholders for one-on-one meetings. The meetings were conducted in person and via telephone. The Core Stakeholders interviewed included:

- Local Cities Public Works and Police
- City of Lawrence Police
- City of Lawrence Public Works
- City of Lawrence Information Technology
- Douglas County Public Works
- Douglas County Emergency Communications Center
- KDOT Bureau of Transportation Planning
- Lawrence-Douglas County Fire Medical
- University of Kansas Parking and Transit

The purposes of these meetings were to:

- Interact with Core Stakeholders, some of whom who could not participate in the Workshop.
- Learn how ITS is currently used in the Region.
- Understand the transportation capabilities, roles and responsibilities of the Core Stakeholders.
- Identify the transportation needs of Core Stakeholders.

The information from these interviews was used to help refine and prioritize the Region's transportation needs. The information gathered during the interviews will also be used throughout the remainder of the L-DC Regional ITS Architecture Update Project to identify potential future ITS that have the support of the Region's Stakeholders and can be deployed, operated and maintained.

3.2 Lawrence-Douglas County Regional ITS Needs

Based on the Stakeholder input from the survey, workshop and interviews, the highest priority transportation needs for the Lawrence-Douglas County 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 multi-modal information.*** The Region's traveling public indicated a significant need for improved and coordinated information regarding all modes, including transit, bicycle, traffic, 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 more rapidly detect incidents as well as more rapidly gathering information in order 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.

The above list highlights the highest priority needs for the Region. However, there are many more needs identified by the Stakeholders. The remainder of this section lists those needs within service areas that parallel the service areas of the National ITS Architecture. The National ITS Architecture service areas are:

- Arterial Traffic Management
- Freeway Traffic Management
- Public Transportation
- Emergency Management
- Maintenance and Construction Operations
- Traveler Information
- Commercial Vehicle Operations

- Data Management and Integration

Within the service areas, the needs have been prioritized as high, medium or low. 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.

In the following tables, the ITS Service Packages that may be applicable to address each need are listed. Many ITS Service Packages address multiple needs. The ITS Service Packages provide the "building blocks" of ITS projects, and proposed ITS projects for the Lawrence-Douglas County Region will include the Service Packages that most effectively address the Region's needs. A more detailed description of ITS Service Packages is provided in *Technical Memorandum #1: L-DC Region ITS Inventory*. A complete listing of ITS Services can be found on the National ITS Architecture web site[5]. Each Service Package in the following tables is hyperlinked to its description and diagram in the National ITS Architecture.

3.2.1 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 2: L-DC Region Arterial / Traffic Management Needs

Arterial / Traffic Management Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve traffic flow at intersections through improved signal timing and control.	H	• ATMS01: Network Surveillance • ATMS03: Traffic Signal Control
Improve traffic information dissemination.	H	• ATMS06: Traffic Information Dissemination
Improve event management.	H	• ATMS07: Regional Traffic Management • ATMS08: Traffic Incident Management System

[5] National ITS Architecture: http://www.iteris.com/itsarch

Arterial / Traffic Management Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Implement or improve signal coordination.	H	• ATMS03: Traffic Signal Control
Improve incident detection.	H	• ATMS01: Network Surveillance • ATMS08: Traffic Incident Management System
Improve parking management and parking information.	M	• ATIS01: Broadcast Traveler Information • ATMS06: Traffic Information Dissemination • ATMS16: Parking Facility Management • ATMS17: Regional Parking Management
Improve information sharing among agencies.	M	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • ATMS06: Traffic Information Dissemination • ATMS07: Regional Traffic Management • MC10: Maintenance and Construction Activity Coordination
Improve system operation monitoring.	M	• AD2: ITS Data Warehouse
Improve arterial roadway traffic surveillance.	L	• ATMS01: Network Surveillance
Reduce transit vehicle delay at key intersections.	L	• APTS09: Transit Signal Priority
Reduce emergency vehicle delays at signals.	L	• ATMS03: Traffic Signal Control • EM02: Emergency Routing

3.2.2 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 3: L-DC Region Freeway Management Needs

Freeway Management Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve traffic information dissemination.	H	• ATMS06: Traffic Information Dissemination
Improve information sharing among agencies.	H	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • ATMS06: Traffic Information Dissemination • ATMS07: Regional Traffic Management • MC10: Maintenance and Construction Activity Coordination
Improve inter-agency coordination.	H	• AD2: ITS Data Warehouse • ATMS06: Traffic Information Dissemination • ATMS07: Regional Traffic Management • ATMS08: Traffic Incident Management System • MC10: Maintenance and Construction Activity Coordination
Improve incident detection.	M	• ATMS01: Network Surveillance • ATMS08: Traffic Incident Management System
Improve system operation monitoring.	M	• AD2: ITS Data Warehouse
Improve freeway traffic surveillance.	L	• ATMS01: Network Surveillance
Improve incident management in urban areas.	L	• ATMS07: Regional Traffic Management • ATMS08: Traffic Incident Management System

3.2.3 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 4: L-DC Region Public Transportation Needs

Public Transportation Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve multi-modal traveler information.	H	• ATIS01: Broadcast Traveler Information • ATIS02: Interactive Traveler Information • APTS07: Multi-modal Coordination • APTS08: Transit Traveler Information
Improve information sharing among agencies.	H	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • MC10: Maintenance and Construction Activity Coordination
Improve transit traveler information.	H	• APTS08: Transit Traveler Information
Reduce transit vehicle delay at key intersections.	M	• APTS09: Transit Signal Priority
Enable dissemination/display of real-time bus arrival times.	M	• APTS08: Transit Traveler Information
Improve service planning (scheduling and run-cutting).	M	• APTS02: Transit Fixed-Route Operations
Improve fare payment systems.	M	• APTS04: Transit Fare Collection Management
Improve regional and interregional trip planning.	L	• APTS11: Multimodal Connection Protection
Automate passenger counting.	L	• APTS10: Transit Passenger Counting
Improve fleet management.	L	• APTS06: Transit Fleet Management

3.2.4 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 5: L-DC Region Emergency Management Needs

Emergency Management Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve event management.	H	• ATMS07: Regional Traffic Management • ATMS08: Traffic Incident Management System
Improve incident response coordination between agencies.	H	• ATIS06: Transportation Operations Data Sharing • ATMS08: Traffic Incident Management System
Improve information sharing among agencies.	H	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • ATMS06: Traffic Information Dissemination • ATMS07: Regional Traffic Management • MC10: Maintenance and Construction Activity Coordination
Improve incident detection.	M	• ATMS01: Network Surveillance • ATMS08: Traffic Incident Management System
Improve incident response times and routing.	M	• ATMS03: Traffic Signal Control • EM02: Emergency Routing
Improve transportation system performance monitoring.	M	• AD2: ITS Data Warehouse
Improve road/weather condition information.	M	• MC03: Road Weather Data Collection • MC04: Weather Information Processing and Distribution
Improve bicycle/pedestrian warning systems.	M	• AVSS05: Intersection Safety Warning

Emergency Management Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve ability to monitor and provide information about flooding.	M	• MC03: Road Weather Data Collection • MC04: Weather Information Processing and Distribution
Improve access to regional cameras.	M	• ATIS06: Transportation Operations Data Sharing
Enable remote emergency control of signals.	L	• ATMS03: Traffic Signal Control • EM02: Emergency Routing
Monitor transit vehicle locations.	L	• APTS05: Transit Security

3.2.5 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 6: L-DC Region Maintenance and Construction Operations Needs

Maintenance and Construction Operations Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve coordination on construction notification and information distribution.	H	• ATIS06: Transportation Operations Data Sharing • MC10: Maintenance and Construction Activity Coordination
Provide quality real time congestion related information.	H	• ATMS06: Traffic Information Dissemination
Provide signal preemption for some maintenance fleet vehicles.	M	• EM02: Emergency Routing
Improve/enhance work zone traffic handling plans.	M	• MC08: Work Zone Management • MC09: Work Zone Safety Monitoring

Maintenance and Construction Operations Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Increase use of portable traffic control equipment (Dynamic Message Signs, Highway Advisory Radio, etc.).	M	• MC08: Work Zone Management
Improve maintenance response to incidents and requests.	M	• MC10: Maintenance and Construction Activity Coordination
Improve fleet information/management (maintenance schedules, mileage accumulations, tracking snow removal vehicles w/AVL).	L	• MC01: Maintenance and Construction Vehicle and Equipment Tracking
Interagency coordination on most advantageous placement of maintenance vehicles (prior to anticipated need).	L	• MC10: Maintenance and Construction Activity Coordination

3.2.6 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 7: L-DC Region Traveler Information Needs

Regional Traveler Information Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve multi-modal information.	H	• APTS08: Transit Traveler Information • ATIS01: Broadcast Traveler Information • ATIS02: Interactive Traveler Information
Improve traffic information dissemination.	H	• ATMS06: Traffic Information Dissemination

Regional Traveler Information Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Provide quality real time congestion related information.	M	• ATIS01: Broadcast Traveler Information • ATMS06: Traffic Information Dissemination
Expand traveler information delivery methods.	L	• ATIS01: Broadcast Traveler Information • ATIS02: Interactive Traveler Information
Provide better road construction information and notification.	L	• ATIS01: Broadcast Traveler Information • ATMS06: Traffic Information Dissemination
Improve weather and road condition information.	L	• ATIS01: Broadcast Traveler Information • MC03: Road Weather Data Collection • MC04: Weather Information Processing and Distribution

3.2.7 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.

Table 8: L-DC Commercial Vehicle Operations Needs

Commercial Vehicle Operations Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Disseminate better information regarding limited alternative routes.	M	• ATIS01: Broadcast Traveler Information • ATMS06: Traffic Information Dissemination

Commercial Vehicle Operations Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Provide interstate/inter-region traveler information covering a wide area (targeted to commercial vehicle operators).	M	• ATIS01: Broadcast Traveler Information
Improve congestion management during seasonal/local events.	M	• ATMS06: Traffic Information Dissemination
Improve truck routing in rural / small-towns.	L	• ATIS01: Broadcast Traveler Information • ATMS06: Traffic Information Dissemination
Provide quality real time congestion related information.	L	• ATMS07: Regional Traffic Management • ATMS08: Traffic Incident Management System
Improve truck storage/parking information (during major road closures).	L	• ATIS01: Broadcast Traveler Information

3.2.8 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 9: L-DC Region Integration Needs

Integration Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve information sharing among agencies.	H	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • ATMS06: Traffic Information Dissemination • ATMS07: Regional Traffic Management • MC10: Maintenance and Construction Activity Coordination

Integration Need	Relative Priority (High, Medium, Low)	Applicable ITS Service Packages
Improve fiber optic network.	M	No specific ITS Service Package, but the impact is relevant across all ITS data exchange.
Develop interagency governmental agreements that would allow sharing of information, etc.	M	No specific ITS Service Package, but agreements are required for the successful implementation of any multi-agency ITS project.
Improve system compatibility.	M	No specific ITS Service Package, but the use of data exchange standards recommended through the ITS Architecture will promote system compatibility.
Provide central information clearinghouse.	L	• AD2: ITS Data Warehouse

4. L-DC Region ITS Strategies

The ITS strategies are high-level descriptions of how ITS may be used to address the L-DC Region's needs. The strategies are generated with consideration for several factors, including:

1. Needs and their priorities: High priority needs are those that the strategies will most directly address. In many cases the strategies that address the highest priority needs also address other needs.
2. Feasibility: The strategies are developed to align with the unique characteristics of the Region and its Stakeholders. For example, strategies specifically do not describe solutions that are not supported or are not feasible for technical or institutional reasons. However, the strategies do complement existing transportation, infrastructure, services and ITS as well as the roles and responsibilities of the Stakeholders.
3. ITS Goals: The strategies, and subsequently the ITS projects, align with the Region's ITS Vision and Goals.

The ITS strategies have some overlap among the service areas, just as the needs and ITS Service packages that address them will have as well.

4.1 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.

4.2 Freeway Management Strategies

There are two operators of highways in the Region: KTA and KDOT. 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.

4.3 Public Transportation Strategies

Lawrence Transit (The T) 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 multi-modal 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.

4.4 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.

4.5 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 in order 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 snow plows for winter maintenance operations.
- Deploy smart work zone systems to better manage maintenance and construction zones.

4.6 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.
- Deploy a multi-modal trip planning tool the web and mobile devices.
- Centralize information from multiple agencies for coordination and sharing.

4.7 Commercial Vehicle Operations Strategies

Commercial Vehicle Operations (CVO) needs 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[6] (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.
- Deploy DMS for event, traffic and work zone information.

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

4.8 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 projects among agencies.
- Continue to engage Stakeholders to increase awareness in the Region of the planned and deployed ITS.

5. 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, in order 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 Turbo Architecture database. However, to provide an understanding of typical roles and responsibilities, **Table 10** lists the current and future roles and responsibilities for surface street management for the City of Lawrence Public Works. It should be noted **Table 10** represents only a small portion of the City of Lawrence Public Works' roles and responsibilities.

Table 10: Surface Street Management Roles and Responsibilities for the City of Lawrence Public Works

Role and Responsibility	Status
Collect traffic data, including speed and volumes.	Existing
Maintain and operate centralized traffic signal software.	Existing
Develop and operate coordinated signals within designated corridors.	Existing
Manage traffic control during emergency events, evacuation and reentry.	Existing
Manage traffic on city-owned arterials using traffic signals.	Existing
Monitor traffic via closed circuit television.	Existing
Operate and maintain the closed circuit camera system.	Existing
Operate and maintain traffic signals in the City and Shawnee County.	Existing
Operate and maintain the Traffic Operations Center.	Existing
Grant signal preemption to emergency vehicles.	Existing

Role and Responsibility	Status
Coordinate traffic control response to incidents with emergency responders and other transportation agencies.	Near-term
Share traffic operations information, including camera images with other Region agencies.	Near-term
Coordinate with other agencies for event and incident management.	Near-term
Operate DMS from the Traffic Operations Center and provide field maintenance to DMS.	Near-term
Provide access to traffic camera views for other selected agencies in the Region.	Near-term
Redistribute traffic images from local closed circuit television cameras.	Near-term
Exchange traffic information with emergency responders and other traffic agencies to support coordinated incident response.	Medium-term
Grant transit vehicles signal priority at key intersections.	Medium-term
Monitor work zone operations.	Medium-term
Operate and maintain work zone information and safety systems.	Medium-term
Collect parking information and use it to inform the public and manage facilities and event traffic.	Medium-term
Exchange transportation data with the local data warehouse.	Long-term
Maintain local data warehouse.	Long-term
Provide multi-modal information to the public.	Long-term
Operate and maintain pedestrian/bicycle warning systems.	Long-term
Equip maintenance vehicles with signal preemption equipment and grant signal pre-emption to during snow plowing.	Long-term
Monitor road-weather conditions and use the information to respond to weather incidents and inform the public.	Long-term

6. L-DC Region Candidate ITS Projects

This section describes the candidate ITS projects for the L-DC Region, as well as the process used to select them. ITS projects are the means of achieving the L-DC Region's ITS strategies. The projects listed in this section are in addition to the ITS services that exist in the Region.

ITS 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 would 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 projects as presented in this Technical Memorandum are described at a high level. More detail, such as costs and specific locations and quantities, will be provided in a later deliverable, the *Strategic Deployment Plan*.

6.1 Project Definition Process

The development of the ITS projects for the L-DC Region was performed in coordination with the Stakeholders, who provided needs, existing ITS inventory and their capabilities. As described in this Technical Memorandum, the first step involved mapping the needs to ITS services that can address them. The next step was to identify ITS strategies that aligned with their current capabilities and operations. Then, the strategies and ITS user services were reviewed in detail to define projects.

In some cases, a single strategy resulted in a project. In others, a single ITS project was defined to achieve several ITS strategies. The project definition stage was followed by the project sequencing process described in the following section.

6.2 Project Sequencing

To move forward in sequencing projects, each project has been designated as Near-Term, Medium-Term and Long-Term as defined in **Section 1.2.3**. This created groups of near-, medium- and long-term projects instead of attempting to establish specific decreasing priority ranking for all identified projects. This approach is preferable because it does not discretely identify near-term "Project A" as being a higher priority than near-term "Project B," which would potentially pit one project or agency against another when competing for funding. This method of sequencing projects also brings structure to the planning process and gives focus to eventual project selection and deployment without establishing a "pre-defined" funding priority for specific projects.

The project sequencing designations have been assigned to the respective projects based on several factors. For this Technical Memorandum, these factors are:

1. **Need** – The need for a particular ITS function for the Region is critical to the timing of a project. Information on High, Medium and Low priority needs identified in this study has been carried forward in the project sequencing process. The second factor is a logical ordering of projects

based on dependencies. For example, in order for emergency responders to be able to improve their incident response, they will need to be able to better monitor incidents. So, incident management projects benefit more from being planned after incident detection systems such as traffic cameras.

2. **Feasibility** – The feasibility of a project is based upon the maturity of the underlying technology and the ability of the Region's Stakeholders to operate and maintain the equipment. While some ITS solutions may address the Region's needs, they may not be based on mature technologies that can be reliably deployed. Similarly, some technologies may not be supported by the Region's communications network, the technical capabilities of the Stakeholders, or align with the Stakeholders' roles and responsibilities.
3. **Dependencies** – The success of some projects is dependent upon the technologies in other projects. For example, deploying a traveler information system in the Region would have limited success if it happened before there was a data warehouse from which the information can be collected and disseminated.

An additional factor is critical to project sequencing, and that is **Funding**. Funding is not considered at this point in the project, but will be a factor in the final project sequencing in the Strategic Deployment Plan to be delivered in April, 2015. At that time, projects with identified funding will be given priority because they can and should be implemented when funding is available.

It is important to understand that the prioritization of projects 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 a project identified as medium- or long-term can be shifted to the near-term to address the new 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 ITS Plan. Neither of these scenarios should preclude implementation of a medium- or long-term project before a near-term project, if it makes sense in the context of the local setting and changing priorities of local needs.

6.3 Candidate Projects

This section contains the sequenced ITS projects for the L-DC Region. **Table 11** provides the list of projects by the near-, medium- and long-term timeframe. The project descriptions provide the following:

- A brief description.
- The Stakeholders who will participate.
- The ITS Service Packages the project utilizes.
- The need(s) the project addresses.

Note that more detailed project descriptions will be developed for the *Strategic Deployment Plan*.

Table 11: Preliminary L-DC ITS Projects

Project	Stakeholders	ITS Service Packages	Needs Addressed
Near-term (0 to 3 years)			
Camera Deployment and Image Sharing This project will strategically increase the camera deployment in the City of Lawrence. Currently they are twenty cameras and this could add up to ten more owned by the City. The project will also improve the real-time sharing of images by providing the City with access to KTA's two cameras in the Region and by providing real-time images to the Region's emergency responders.	• City of Lawrence Police • City of Lawrence Public Works • Douglas County Emergency Communications • KTA	• ATMS01: Network Surveillance • ATIS06: Transportation Operations Data Sharing	• Improve arterial roadway traffic surveillance. • Improve access to regional cameras. • Improve incident detection. • Improve freeway traffic surveillance. • Improve information sharing among agencies.
Dynamic Message Signs This project will deploy approximately four permanent DMS at strategic locations in the Region to aid in managing congestion and event traffic. The signs will be operated by the City through its Traffic Operations Center. The DMS will provide event, detour, parking and other information to travelers as they enter the City of Lawrence. The signs would be on local roads and state highways, such as: - Southbound N. 3rd Street - 19th and Louisiana - Eastbound K-10 - Northbound US-59	• City of Lawrence Public Works • KDOT	• ATMS06: Traffic Information Dissemination	• 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.

Project	Stakeholders	ITS Service Packages	Needs Addressed
Transit Traveler Information Improvements This project will improve the information provided to transit passengers through improved delivery of transit vehicle arrival time information. This will include roadside electronic signs at key stops that display "next bus" arrival times, as well as improved real-time bus location information via travelers' personal electronic devices. In addition, the transit web site will be improved to show real-time bus locations.	• KU on Wheels • Lawrence Transit	• APTS08: Transit Traveler Information	• 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.
Inter-agency Information Sharing This project will provide a platform for the Region's agencies to share information about incidents and events that are occurring in real-time and are planned in the Region. The Region's agencies will use the platform to broadcast information about incidents that have been detected, how they are responding and, potentially, any support needed. In addition, agencies will be able to share information planned maintenance and construction activities with other agencies. The purpose will be to better share transportation information and facilitate coordinate responses. It is envisioned that the platform may be simple, but used by all key Stakeholders to share information.	• City of Lawrence Police • City of Lawrence Public Works • Douglas County Emergency Communications • Douglas County Public Works • Douglas County Sheriff's Office • KDOT • KTA • KU on Wheels • KU • Lawrence Transit • Local Cities • Local Cities Emergency Services	• ATIS06: Transportation Operations Data Sharing • ATMS08: Traffic Incident Management System • MC10: Maintenance and Construction Activity Coordination	• Improve information sharing among agencies. • Improve event management. • Improve inter-agency coordination. • Improve incident response coordination among agencies. • Improve incident response times and routing. • Improve coordination on construction notification and information distribution. • Interagency coordination on most advantageous placement of maintenance vehicles (prior to anticipated need).

Project	Stakeholders	ITS Service Packages	Needs Addressed
Signal Coordination and Control This project will expand the use of signal coordination in specific corridors in the City of Lawrence. The City is expanding its fiber optic network and will connect up to 19 more intersections to the Traffic Operations Center, for a total of 31. This project will enable signal coordination and adaptive control of signals at these intersections through control at the Traffic Operations Center.	• City of Lawrence	• ATMS03: Traffic Signal Control	• Improve traffic flow at intersections through improved signal timing and control. Implement or improve signal coordination. • Implement or improve signal coordination.
• **Medium-term (3 to 6 years)**			
Event and Incident Management Improvements The Event Management Improvements project will expand upon several near-term projects: the deployment of DMS, the increased collection and sharing of traffic images and the improved information sharing among agencies. This project will improve the real-time communication among emergency responders and traffic management to coordinate event traffic management plans, respond to incident in real-time and provide travelers with congestion, parking and alternative transportation mode information.	• City of Lawrence Police • City of Lawrence Public Works • Douglas County Emergency Communications • Douglas County Public Works • Douglas County Sheriff's Office • KDOT • KTA • KU on Wheels • KU • Lawrence Transit • Local Cities • Local Cities Emergency Services	• ATIS06: Transportation Operations Data Sharing • MC10: Maintenance and Construction Activity Coordination	• Improve incident management in urban areas. • 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.

Project	Stakeholders	ITS Service Packages	Needs Addressed
Lawrence Transit Signal Priority The Transit Signal Priority will equip Lawrence Transit buses with the ability to request an early or lengthened green light at specific intersections near the Lawrence Transit Center. The vehicle will only request priority under certain conditions, such as being behind schedule or needing to make a transfer connection. The signal controllers will receive the request and determine whether it can be granted based on signal phase and coordination with other signals.	• City of Lawrence Public Works • Lawrence Transit	• APTS09: Transit Signal Priority	• Reduce transit vehicle delay at key intersections.
Multi-modal Trip Planning Tool A multi-modal trip planner will be an online tool that allows travelers to plan trip using one or more modes, including personal vehicle, transit, bicycle and pedestrian. It can include information such as real-time parking availability and the costs of various modes to help travelers make informed decisions. The tool can be used to encourage travelers to use transit, carpool and use park-and-ride facilities for events, as well as making trips that combine modes. The tool will require reliable information on all modes of travel and parking from the Region's Stakeholders.	• City of Lawrence Public Works • Douglas County Public Works • KDOT • KTA • KU on Wheels • KU • Lawrence Transit • Local Cities	• ATIS01: Broadcast Traveler Information • ATIS02: Interactive Traveler Information • APTS07: Multi-modal Coordination • APTS08: Transit Traveler Information	• Improve multi-modal traveler information. • Provide interstate/inter-region traveler information covering a wide area (targeted to commercial vehicle operators). • Improve transit traveler information. • Improve multi-modal information. • Expand traveler information delivery methods.
Work Zone Management Work Zone Management will implement tools to improve the safety and efficiency of work zones through monitoring conditions in the work zone, providing better information to travelers about the work zone, and providing maintenance and construction crews improved control over traffic flow, including local signal control and advanced lane barrier systems.	• City of Lawrence Public Works	• MC08: Work Zone Management • MC09: Work Zone Safety Monitoring	• Improve/enhance work zone traffic handling plans. • Increase use of portable traffic control equipment (Dynamic Message Signs, Highway Advisory Radio, etc.).

Project	Stakeholders	ITS Service Packages	Needs Addressed
Parking Management Systems This project will improve the monitoring of parking availability and the pricing of parking. It will also improve sharing information about parking conditions at the regional level to help travelers make intelligent decisions. An additional value of improved parking management is data collection to help parking management agencies develop parking plans. Information generated by the Parking Management Systems can be shared by trip planning tools and through regional traveler information systems.	• City of Lawrence Public Works • KU Parking and Transit	• ATMS16: Parking Facility Management • ATMS17: Regional Parking Management	• Improve parking management and parking information.
• **Long-term (6 to 10 years)**			
Regional Data Warehouse This project will develop a centralized regional data warehouse that collects and centralizes traffic, maintenance, transit, emergency and incident information, including video images from the Region's transportation and emergency response Stakeholders. Authorized agencies can then use the information and images in real-time for managing traffic and incidents, and for maintenance planning and response. Key functions of the warehouse will be to collect, format and organize information in order to make it usable and to ensure that all regional Stakeholders are using the same information for their operations. The centralized data will also have the potential for sharing with the general public. While this project is important, it cannot be developed until the Region increases its ability to collect information through the projects identified in the near-, medium- and long-term.	• City of Lawrence Police • City of Lawrence Public Works • Douglas County Emergency Communications • Douglas County Public Works • Douglas County Sheriff's Office • KDOT • KTA • KU on Wheels • KU • Lawrence Transit • Local Cities • Local Cities Emergency Services	• AD2: ITS Data Warehouse • ATIS06: Transportation Operations Data Sharing • MC10: Maintenance and Construction Activity Coordination	• 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.

Project	Stakeholders	ITS Service Packages	Needs Addressed
Weather Monitoring This project will deploy road-weather sensors in the Region to improve the monitoring and response to weather conditions. The project will allow for more accurate monitoring of road conditions, including snow, ice and flooding, which will result in and improved maintenance response. A specific example of the type of device deployed may be a flooding detection system near Clinton Lake to inform of when a roadway becomes impassable.	• City of Lawrence Public Works • Douglas County Emergency Communications Center • Douglas County Public Works • KDOT	• MC03: Road Weather Data Collection • MC04: Weather Information Processing and Distribution	• Improve weather and road condition information. • Improve maintenance response to incidents and requests. • Improve ability to monitor and provide information about flooding.
Winter Maintenance Signal Preemption This project will provide winter maintenance vehicles with the ability to preempt signals while performing snow removal. This will improve the efficiency of maintenance operations and improve safety by reducing the start and stop of maintenance vehicles.	• City of Lawrence Public Works	• ATMS03: Traffic Signal Control • EM02: Emergency Routing	• Provide signal preemption for some maintenance fleet vehicles. • Improve maintenance response to incidents and requests.
Bicycle/pedestrian Warning Systems Bicycle-Pedestrian Warning Systems will provide traffic advanced notice of the presence of bicycles and pedestrians on or near the roadway. The systems may automatically detect bicyclists and pedestrians and provide a warning, or they may require the pedestrian or bicyclist to activate a warning for drivers to see. Likely locations for systems include urban corridors for pedestrians and bicyclists, and rural roads that are used by bicyclists and have limited sight range for drivers.	• City of Lawrence Public Works • Douglas County Public Works • KDOT	• AVSS05: Intersection Safety Warning	• Improve bicycle/pedestrian warning systems.

Project	Stakeholders	ITS Service Packages	Needs Addressed
Transit Management Improvements Transit Management Improvements will include systems that allow transit to better manage and plan its services. Passenger counting will better track usage by route, location and time. Improved software will help develop better scheduling and route plans. And electronic payment will simplify payment for many transit passengers, reduce cash handling for drivers, and as allow the transit agencies to collect more information about service usage.	• KU on Wheels • Lawrence Transit	• APTS02: Transit Fixed-Route Operations • APTS04: Transit Fare Collection Management • APTS10: Transit Passenger Counting • APTS06: Transit Fleet Management	• Improve inter-agency coordination. • Automate passenger counting. • Improve service planning (scheduling and run-cutting). • Improve fare payment systems.
Emergency Vehicle Signal Preemption Upgrade This project will improve the Douglas County Fire Medical vehicle ability to preempt signals by replacing the existing strobe-based system to a vehicle-to-signal controller wireless communication. This change will improve responsiveness and security of the signal preemption system.	• City of Lawrence Public Works • Douglas County Fire Medical	• ATMS03: Traffic Signal Control • EM02: Emergency Routing	• Reduce emergency vehicle delays at signals. • Enable remote emergency control of signals.

7. Project Next Steps

The Candidate ITS Projects in this Technical Memorandum should be considered a starting point for more detailed project definitions. In subsequent steps of this project, the Candidate ITS Projects will be presented to the Stakeholders. Stakeholders will be engaged to:

- Assess the applicability and timing of the Candidate ITS Projects.
- Provide more project details such as quantities, locations and specific technologies.
- Identify additional Candidate ITS Projects.
- Refine the lists of Stakeholders for Candidate ITS Projects.

The next steps in the development of the L-DC Regional ITS Architecture are then to:

- Model the ITS Projects in Turbo Architecture.
- Identify the functional requirements for each ITS Project.
- Define the information flows among ITS elements for the Region.
- Identify key interagency agreements needed to design, implement and operate ITS.
- Develop an ITS Architecture Use and Maintenance Plan for the L-DC Region.

The next major Project milestones and deliverables are:

- Stakeholder Workshop #2 where Candidate ITS Projects will be presented and Stakeho0lders will be able to provide feedback.
- L-DC Regional ITS Architecture modeled in Turbo Architecture and described in the ITS Architecture Report, which will be combined with the Strategic Deployment Plan.
- Strategic Deployment Plan, which will describe the Region's Candidate ITS Projects in more detail and provide a strategy for deploying the projects and using and maintaining the ITS Architecture.

APPENDIX A – Needs by Geographic Location as Identified by Stakeholders

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 aforementioned 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 sign posts 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