Regional ITS Architecture and Deployment Plan

Lawrence-Douglas County Region

Regional ITS Architecture

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AD	Archived Data
AMBER	America's Missing Broadcast Emergency Response
APTA	American Public Transportation Association
APTS	Advanced Public Transportation Systems
ASTM	American Society for Testing and Materials
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CCTV	Closed-Circuit Television
DMS	Dynamic Message Sign
DSRC	Dedicate Short Range Communications
EM	Emergency Management
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
HAR	Highway Advisory Radio
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
KBI	Kansas Bureau of Investigation
KDOT	Kansas Department of Transportation
KHP	Kansas Highway Patrol
KTA	Kansas Turnpike Authority
KU	University of Kansas
LRTP	Long Range Transportation Plan
MAC	Medium Access Control
MC	Maintenance and Construction
MDT	Mobile Data Terminal

LIST OF ACRONYMS

MPO	Metropolitan Planning Office
NEMA	National Electrical Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organizations
TCIP	Transit Communications Interface Profiles
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Plan
TMC	Transportation Management Center
TOC	Traffic Operations Center
TOMC	Transportation Operations and Management Center
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detection Systems
WAVE	Wireless Access in Vehicular Movements

PROJECT OVERVIEW

A regional intelligent transportation system (ITS) architecture is a very high level plan for how ITS can be used to address transportation needs in a region. There are four key parts to developing a regional ITS architecture:

- Identify regional transportation needs;
- Determine the appropriate ITS solutions that can address those needs;
- Identify the agencies and systems that need to be integrated together and the information that needs to be shared in order to implement the ITS solutions; and
- Identify a sequence of projects that should be considered for deployment in order to implement the ITS solutions.

Development of a regional ITS architecture is required by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) for a region to be eligible for federal funding of any ITS projects. Regions must show how an ITS project conforms to their regional ITS architecture during the design phase of the project if they are using federal funds. If a project does not conform, then either the project design or the regional ITS architecture needs to be modified so that conformity can be established.

In the Lawrence-Douglas County Region a series of four workshops were held with a broad group of stakeholders that included representatives from traffic management, maintenance and construction, emergency management, public safety, and transit. A detailed list of agencies and representatives that participated in the process can be found in **Table 1**.

The purpose of the workshops was to identify regional transportation needs and how ITS could potentially address those needs. Stakeholders were asked to consider ITS solutions and think in terms of what they would want the overall ITS system in the Region to look like using a 20 year vision. The Regional ITS Architecture is not a fiscally constrained plan; however, a greater emphasis was given to potential ITS solutions that appeared to offer the greatest cost benefit.

Intelligent Transportation Systems

Intelligent Transportation Systems are the application of electronic technologies and communications to improve the operations of roadways and transit systems.

Examples of ITS being considered in the Lawrence-Douglas County Region include:

- Traffic Signal Coordination
- Closed Circuit Television Cameras
- Dynamic message signs
- Flood and Ice Detection Systems
- Emergency Vehicle Signal Preemption
- Transit Vehicle Tracking

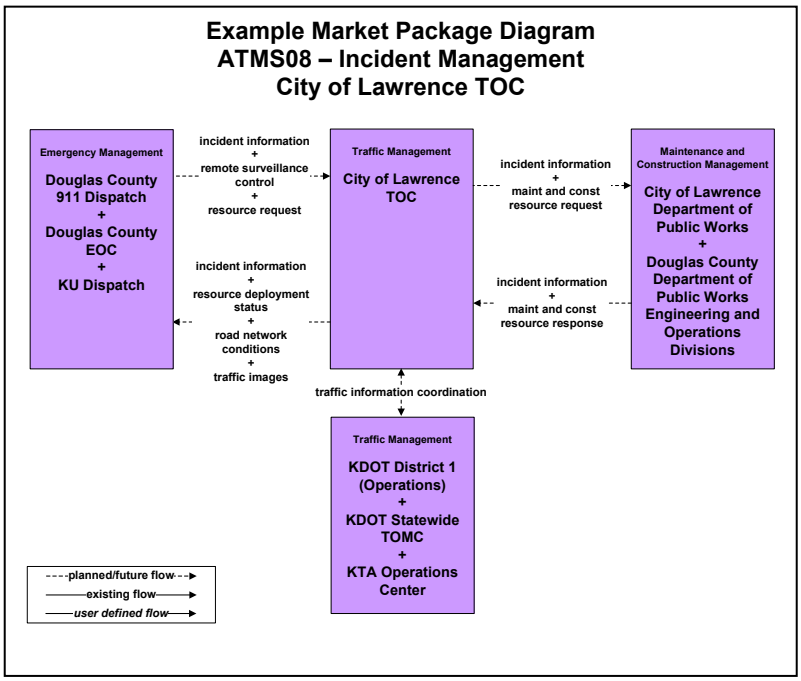
Stakeholders in the Lawrence-Douglas County Region identified several high priority needs including:

- Improving traffic signal coordination;
- Ability to bring closed-circuit television (CCTV) camera feeds from all agencies back to traffic operations centers and the Douglas County 911 Dispatch Center;
- Ability to collect road weather information;
- Automated notification of road closures due to incidents or maintenance to emergency management, public safety, and transit; and
- Transit vehicle tracking and real time bus information.

A complete list of all of the needs that were identified for the Region is included in **Table 2**.

An inventory of the existing and planned ITS elements in the Region was conducted. ITS elements include not only field devices such as traffic signal systems or dynamic message signs (DMS), but also centers and vehicles, such as traffic operations centers and fire vehicles, that would support or interact with the ITS system in the Region.

The National ITS Architecture groups ITS services into bundles that are called market packages. There are 91 market packages in the current version of the National ITS Architecture. The market packages and their definitions have been included in **Appendix A**. In August of 2007 regional stakeholders met to select the ITS services for the Lawrence-Douglas County Regional ITS Architecture that could help address local transportation needs. The Region selected 44 market packages to address transportation needs in the Region. These selected market packages were then customized for the Region and can be found in **Appendix B**. There is at least one market package diagram for each agency that may need the deployment of a selected market package. The diagrams graphically document which agencies will be involved in each market package and what type of information should be shared.



Of the market packages selected and customized, 21 were designated as a high priority for the Region. Stakeholders prioritized market packages based on regional needs, feasibility, likelihood of deployment, and overall contribution of the market package in meeting the goals and vision for ITS functionality in the Region. A full list of the selected ITS market packages and the priority assigned to each by the regional stakeholders is included in **Table 6**.

One of the primary purposes of the architecture is to standardize the exchanges of information. Standardization increases interoperability of systems and facilitates future expansion. The National ITS Architecture associates standards with most of the data flows in the architecture. When the desired ITS services are documented in accordance with the National ITS Architecture a list of applicable standards is developed based on the data flows selected. The applicable standards for the Lawrence-Douglas County Region can be found in **Table 8**.

As part of an operational concept for the Region, the roles and responsibilities of each agency in the operation of the regional ITS system have been identified and are included in **Table 9**. Roles and responsibilities are categorized across a range of transportation services such as surface street management, freeway management, incident management, or transit management.

The Regional ITS Architecture provides the foundation for the implementation of ITS in the Lawrence-Douglas County Region. The plan needs to be incorporated into the regional planning process so that the ITS vision for the Region is considered when implementing ITS projects and to ensure that the Region remains eligible for federal funding of ITS projects. To remain a useful planning tool, the ITS Architecture will require periodic maintenance. **Section 5** documents how the ITS Architecture will be updated and outlines a process for evaluating whether or not a project conforms to the Regional ITS Architecture.

A companion document to the Regional ITS Architecture has been developed to identify projects that can be implemented incrementally to deploy the ITS systems in the Lawrence-Douglas County Region. The Lawrence-Douglas County ITS Deployment Plan identifies projects for deployment in the Region and includes the agency responsible for implementation, an opinion of probable cost, and the time-frame for implementation. The market packages that each project will help to implement are also identified.

Lawrence-Douglas County Region
High Priority Market Packages

Traffic Management
ATMS01 Network Surveillance
ATMS03 Surface Street Control
ATMS06 Traffic Information Dissemination
ATMS08 Traffic Incident Management System
ATMS21 Roadway Closure Management

Emergency Management
EM01 Emergency Call-Taking and Dispatch
EM02 Emergency Routing
EM10 Disaster Traveler Information

Maintenance and Construction Management
MC03 Road Weather Data Collection
MC04 Weather Information Processing and Distribution
MC06 Winter Maintenance
MC07 Roadway Maintenance and Construction
MC08 Work Zone Management
MC10 Maintenance and Construction Activity Coordination

Public Transportation Management
APTS01 Transit Vehicle Tracking
APTS02 Transit Fixed-Route Operations
APTS03 Demand Response Transit Operations
APTS05 Transit Security
APTS08 Transit Traveler Information

Traveler Information
ATIS01 Broadcast Traveler Information
ATIS02 Interactive Traveler Information

1. INTRODUCTION

1.1 Project Description

Development of a regional ITS architecture is one of the most important steps in planning for and implementing ITS in a region. ITS architectures provide a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to plan for what they want their system to look like in the long-term and then break out the system into smaller pieces that can be implemented in the short-term.

ITS architectures satisfy the conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the FHWA issued a final rule and the FTA issued a final policy that required regions implementing any ITS project to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. Regions that had not yet deployed ITS were given four years to develop an ITS architecture after their first ITS project proceeded to final design.

In July 2007, the City of Lawrence began development of the Lawrence-Douglas County Regional ITS Architecture. The Regional ITS Architecture has the same geographic boundaries as Douglas County. In addition, a separate ITS Deployment Plan was developed to identify and prioritize specific ITS projects recommended for the Region in order to implement the ITS architecture.

The Lawrence-Douglas County Regional ITS Architecture was developed independently of the Kansas Statewide ITS Architecture. The goal of the Statewide ITS Architecture is to document ITS that will be deployed on a statewide basis while the scope of the Lawrence-Douglas County Regional ITS Architecture focuses primarily on the ITS that will be deployed within Douglas County to satisfy local needs.

The ITS Architecture and the ITS Deployment Plan were both developed with significant input from local, state, and federal officials. A series of four workshops was held to gather input from stakeholders and two presentations were given to the Metropolitan Planning Office (MPO)/Governing Bodies to ensure that policy makers were updated on the project.

The Regional ITS Architecture and Deployment Plan that has been developed reflect a snapshot of current ITS deployments and future ITS plans in the Region. However, needs and priorities of the Region will change over time, and, in order to renaming effective the Regional ITS Architecture and Deployment Plan should be periodically reviewed and updated.

1.2 Document Layout

The Lawrence-Douglas County Regional ITS Architecture is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the Lawrence-Douglas County Regional ITS Architecture and the key features and stakeholders in the Region.

Section 2 – Regional ITS Architecture Development Process

An overview of the key steps involved in developing the ITS architecture for the Lawrence-Douglas County Region is provided in this section. It includes a discussion of stakeholder involvement, architecture workshops, and the architecture development process.

Section 3 – Customization of the National ITS Architecture for Lawrence-Douglas County

This section contains a summary of regional needs and details the customization of the National ITS Architecture to meet the ITS vision for the Region. The market packages that were selected for the Region are included in this section and interconnects are presented, including the "sausage diagram" showing the relationships of the key subsystems and elements in the Region, system interfaces, and the physical subsystem architecture flows.

Section 4 – Application of the Regional ITS Architecture

Functional requirements and standards that apply to the Region, as indicated by the Regional ITS Architecture, are presented in Section 4. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified. The section also includes information on how the Region anticipates deploying ITS to achieve their vision.

Section 5 – Maintaining the Regional ITS Architecture

A maintenance plan for the Lawrence-Douglas County Regional ITS Architecture is included in this section. The plan outlines the procedure for updating the ITS architecture over time.

The Lawrence-Douglas County Regional ITS Architecture also contains four appendices:

- Appendix A – Market Package Definitions;
- Appendix B – Customized Market Packages;
- Appendix C – Element Functions; and
- Appendix D – ITS Architecture Maintenance Documentation Form.

1.3 Lawrence-Douglas County

1.3.1 Geographic Boundaries

The Lawrence-Douglas County Region encompasses the total geographic area of Douglas County in the northwest part of Kansas. Douglas County is the second fastest growing county in the state and has experienced a 12 percent growth between 2000 and 2006. Douglas County is the fifth largest County in Kansas according to the U.S. Census Bureau. There are four incorporated cities ranked by population from greatest to least: Lawrence, Eudora, Baldwin City, and Lecompton. The nearest major cities to the Region include Kansas City (Kansas and Missouri), Topeka (Kansas), and Wichita (Kansas).

Lawrence, Kansas has more than 80,000 residents and is home to the University of Kansas (KU), the largest university in the state with a student population of approximately 27,000. KU has two large special event facilities, Memorial Stadium primarily used for football games and the Allen Fieldhouse for basketball games. Haskell Indian Nations University, also located in Lawrence, has a smaller student population of over 1,000.

The Lawrence-Douglas County Region encompasses 474 square miles in eastern Kansas. **Figure 1** shows the boundaries of the Lawrence-Douglas County Region.

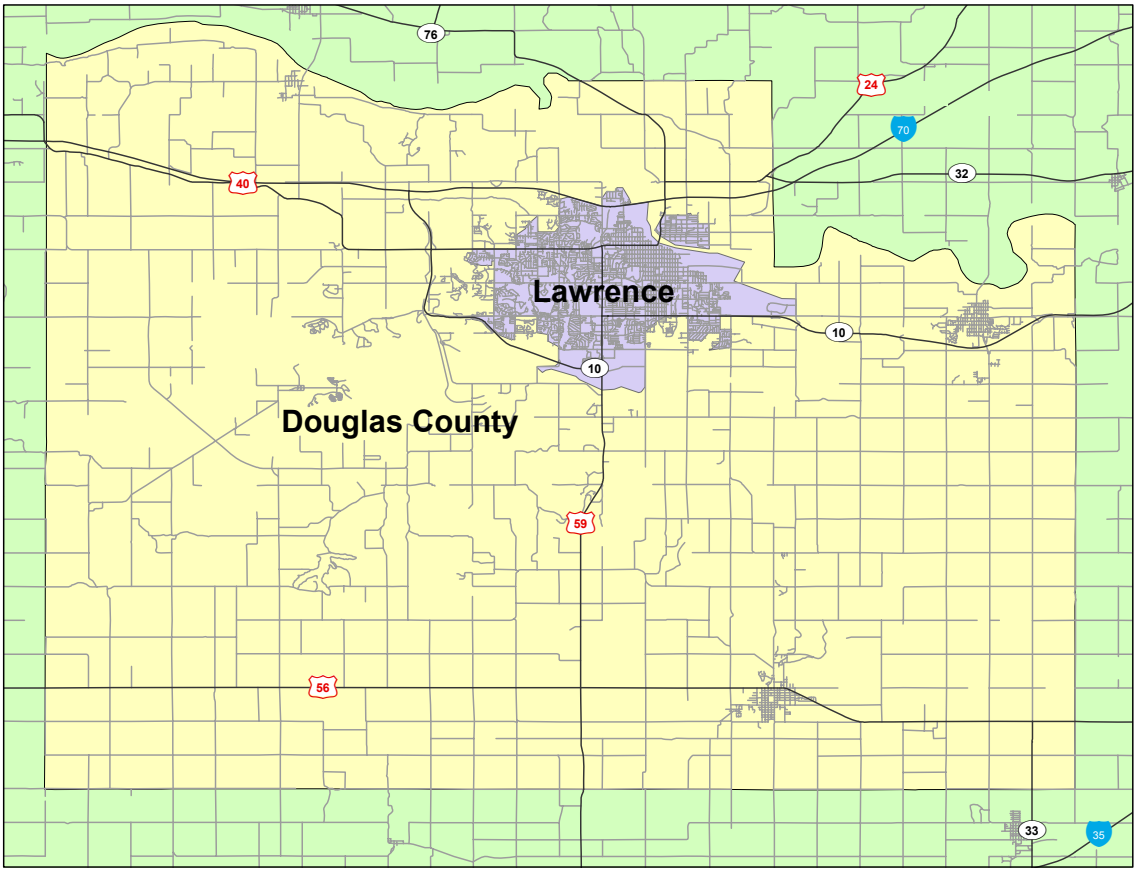


Figure 1 – Lawrence-Douglas County Regional Boundaries

1.3.2 Transportation Infrastructure

As illustrated in **Figure 1**, the Region is served by several State and US highways. The primary roadway facilities include I-70, US 24, US 40, US 56, US 59, and K-10.

I-70 extends from east to west across the entire state of Kansas. I-70 serves as the main route between Kansas City and Topeka. Between Kansas City and Lawrence, I-70 becomes a toll road and is operated by the Kansas Turnpike Authority (KTA).

US 24 and US 40 both extend east-west through the Region; US 24 north of I-70 and US 40 south of I-70. The two roads join together northeast of Lawrence and continue on towards Kansas City.

US 56 is an east-west road located in southern Douglas County. It extends from I-35 through Douglas County and traverses the City of Baldwin. US 59 is the primary north-south roadway in the County passing through Lawrence.

K-10 extends from I-70 west of Lawrence to Kansas City, Kansas, passing through Lawrence and Eudora. As it passes through Lawrence the route includes portions of Iowa and 23rd Streets. Future plans for K-10 involve a new highway section on the south side of Lawrence to avoid utilizing City streets as part of the route; however this project has been delayed.

1.3.3 Lawrence-Douglas County Region ITS Plans

It is important to recognize the initial deployment of ITS infrastructure in a region because as of April 2005, in order for a region to receive funding for ITS projects from the Highway Trust Fund, the United States Department of Transportation (USDOT) requires that the region have an ITS architecture developed. This requirement only applies to regions with existing ITS infrastructure deployed. For regions that do not have any ITS infrastructure deployed, the USDOT requires that they have an ITS architecture within four years of their first ITS project entering final design.

The Lawrence-Douglas County Region has several ITS components deployed in the field, including video image vehicle detection systems (VIVDS) on arterial streets and emergency vehicle signal preemption at signalized intersections throughout Lawrence. The emergency vehicle signal preemption was implemented in the fall of 2004 and was considered the initial deployment of ITS infrastructure in Lawrence. Therefore, based on the Final Rule from FHWA and FTA the Region must have an ITS architecture developed within four years, by the fall of 2008, in order to remain eligible to receive federal funds on ITS projects.

1.3.4 Stakeholders

Due to the fact that ITS often extends beyond traditional transportation infrastructure, it is important to involve non-traditional stakeholders in the architecture development process. Input from these stakeholders, both public and private, is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region.

Table 1 contains a list of stakeholders in the Lawrence-Douglas County Region who participated in the project workshops or provided input as to the needs and issues that should be considered as part of the Lawrence-Douglas County Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided minutes of workshops and copies of reports to enable them to participate as much as possible.

Table 1 – Lawrence-Douglas County Stakeholder Agencies and Contacts

Stakeholder Agency	Address	Contact
City of Eudora	4 E 7th Street Eudora, KS 66025	Cheryl Beatty
City of Lawrence City Manager's Office	PO Box 708 Lawrence, KS 66044	Lisa Patterson
City of Lawrence Public Works Department	PO Box 708 Lawrence, KS 66044	James Risner
City of Lawrence Public Works Department	PO Box 708 Lawrence, KS 66044	Chuck Soules
City of Lawrence Public Works Department	PO Box 708 Lawrence, KS 66044	Shoeb Uddin
City of Lawrence Public Works Department	PO Box 708 Lawrence, KS 66044	David Woosley
City of Lawrence Information Systems	PO Box 708 Lawrence, KS 66044	John Williams
City of Lawrence Information Systems	6 E 6th Street Lawrence, KS 66044	Jim Wisdom
City of Lawrence Fire Department/EMS	1911 Stewart Avenue Lawrence, KS 66046	Bill Stark
City of Lawrence Police Department	111 E 11th Street Lawrence, KS 66044	William Cory
City of Lawrence Police Department	111 E 11th Street Lawrence, KS 66044	Ron Olin
Douglas County Information Technology	111 E 11th Street Lawrence, KS 66044	Jim Lawson
Douglas County 911	111 E 11th Street Lawrence, KS 66044	Jim Denney
Douglas County Emergency Management Agency	111 E 11th Street Lawrence, KS 66044	Jillian Blair
Douglas County Emergency Management Agency	111 E 11th Street Lawrence, KS 66044	Teri Smith
Douglas County Public Works	1242 Massachusetts Street Lawrence, KS 66044	Keith Browning
Douglas County Public Works	1242 Massachusetts Street Lawrence, KS 66044	Terese Gorman
Douglas County Sheriff's Office	111 E 11th Street Lawrence, KS 66044	Ken McGovern
Douglas County Sheriff's Office	111 E 11th Street Lawrence, KS 66044	Steve Rector
Federal Highway Administration	6111 SW 29th Street Suite 100 Topeka, KS 66614	Bob Alva
Federal Highway Administration	6111 SW 29th Street Suite 100 Topeka, KS 66614	Byron Low
Federal Transit Administration	901 Locust Street, Suite 404 Kansas City, MO 64106	Bill Kalt

Table 1 – Lawrence-Douglas County Stakeholder Agencies and Contacts (continued)

Stakeholder Agency	Address	Contact
Kansas Turnpike Authority	3939 SW Topeka Boulevard Topeka, KS 66609	David Jacobson
KDOT	700 SW Harrison Street, 2 West Topeka, KS 66612	Barb Blue
KDOT	P.O. Box 74 Lawrence, KS 66044	Mike Daniel
KDOT	700 SW Harrison Street Topeka, KS 66603	Karen Gilbertson
KDOT	700 SW Harrison Street Topeka, KS 66603	Joel Skelley
KDOT	700 SW Harrison Street Topeka, KS 66603	Allison Smith
KDOT	700 SW Harrison Street, 2 West Topeka, KS 66612	Leslie Spencer Fowler
KU on Wheels	410 Kansas Union Lawrence, KS 66045	May Davis
KU Parking and Transit	1501 Irving Hill Road Lawrence, KS 66045	Danny Kaiser
KU Parking and Transit	1501 Irving Hill Road Lawrence, KS 66045	Jessica Mortinger
KU Public Safety Office	1501 Crestline Drive Suite 120 Lawrence, KS 66049	Chris Keary
Lawrence Freenet	4105 W 6th Street Lawrence, KS 66049	Michael Courtney
Lawrence Freenet	4105 W 6th Street Lawrence, KS 66049	Michael Moore
Lawrence Transit System	PO Box 708 Lawrence, KS 66044	Cliff Galante
Lawrence-Douglas County MPO	1430 N 1680 Road Lawrence, KS 66049	Grant Eichhorn
Lawrence-Douglas County Planning	PO Box 708 Lawrence, KS 66044	Anson Gock
Lawrence-Douglas County Planning	6 E 6th Street Lawrence, KS 66044	Davonna Morgan
Lawrence-Douglas County Planning	PO Box 708 Lawrence, KS 66044	Sheila Stogsdill
Lecompton Fire/Rescue/EMS	PO Box 154 Lecompton, KS 66050	H. Wayne Riley
University of Kansas – Department of Civil, Environmental and Architectural Engineering	2159B Learned Hall 1530 W. 15th Street Lawrence, KS 66045-7609	Steven Schrock
USD 497 – Laidlaw Transportation	1548 E 23rd Street Suite B Lawrence, KS 66046	Barbara VanCortlandt

2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

Development of the Regional ITS Architecture and Deployment Plan for Lawrence-Douglas County relied heavily on stakeholder input to ensure that the ITS Architecture reflected local needs. The process followed for the Lawrence-Douglas County Region was designed to ensure that stakeholders could provide input and review for the development of the Region's ITS Architecture and Deployment Plan. **Figure 2** illustrates the process followed.

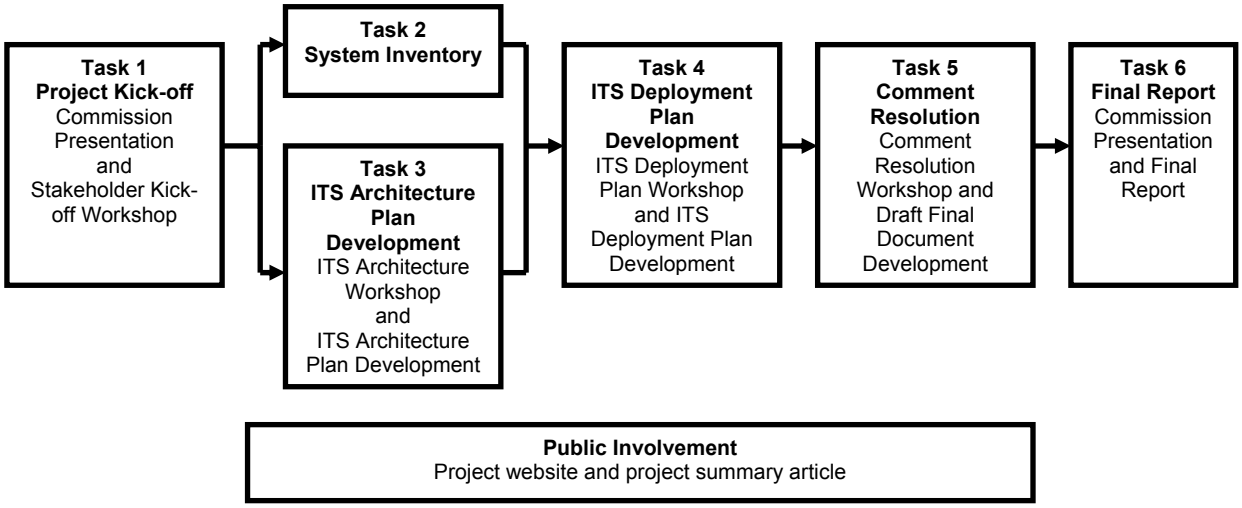


Figure 2 – ITS Architecture and Deployment Plan Development Process

2.1 Stakeholder Workshops

A total of four workshops with stakeholders were used to gather input and develop the Lawrence-Douglas County Regional ITS Architecture and Deployment Plan. These workshops included:

- Stakeholder Kick-off Workshop;
- Regional ITS Architecture Workshop;
- ITS Deployment Plan Workshop; and
- Stakeholder Comment Resolution Workshop.

In addition to the stakeholder workshops, a presentation on the project was given to the City/ County/Planning Commission at the beginning and the end of the project.

Copies of documents were made available to stakeholders for review and comment. Key components of the process are described below:

Task 1 – Project Kick-Off Commission Presentation and Stakeholder Kick-Off Workshop: A stakeholder group was identified that included representatives from regional transportation, transit, and emergency management agencies. The group was invited to the project Kick-off Workshop where ITS needs for the Region were identified. A second kick-off presentation was made to the City/County/Planning Commission to outline the goals for the project and the process that would be followed.

Task 2 – System Inventory: Collecting information for the system inventory began at the kick-off workshop through discussions with the stakeholders to determine existing and planned ITS elements in the Region. After the kick-off workshop, follow-up calls were conducted with a number of local stakeholders to gather additional input. To complete the inventory, stakeholders were presented with a draft inventory at the Regional ITS Architecture Workshop for modification (described in Task 3).

Task 3 – ITS Architecture Workshop and ITS Architecture Plan Development: The purpose of the Regional ITS Architecture Workshop was to review the system inventory with stakeholders and develop the Lawrence-Douglas County Regional ITS Architecture. Training on the National ITS Architecture was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and editing of these elements. The workshop was broken into three separate sessions over the course of two days. The sessions were as follows: Transit Workshop, Traffic and Traveler Information Workshop, and Emergency Management Workshop. Each of these workshop sessions attracted different stakeholder groups who were focused on the needs of each of their respective architecture areas. The result of the Regional ITS Architecture Workshop was a draft ITS architecture for the Lawrence-Douglas County Region that included a system inventory, interconnect diagram, customized market packages, functional requirements, and relevant ITS standards.

Task 4 – ITS Deployment Plan Workshop and ITS Deployment Plan Development: A draft list of recommended ITS projects for the Region was presented to stakeholders at the Regional ITS Deployment Plan Workshop. Stakeholders were asked to provide input on the recommended projects, responsible agencies, associated costs, and deployment timeframe. Following the workshop, a Draft Regional ITS Deployment Plan document was prepared and sent to stakeholders for review and comment.

Task 5 – Comment Resolution Workshop and Draft Final Document Development: A Comment Resolution Workshop was held with stakeholders to review the Draft Regional ITS Architecture and the Draft Regional ITS Deployment Plan. Next steps for the Region and the process for updating the Regional ITS Architecture and ITS Deployment Plan were also discussed. Input from the Comment Resolution Workshop was incorporated into the documents and a Revised Draft Regional ITS Architecture and Regional ITS Deployment Plan were developed.

Task 6 – Commission Presentation and Final Report: A presentation was given to the Planning Commission to provide an overview of the completed project. Following a comment period, the final Regional ITS Architecture and Deployment Plan incorporating any additional stakeholder feedback was developed.

Task 7 – Public Involvement: A project website was developed within the City of Lawrence website where project documents were posted for review. A project summary article was also prepared after the Draft Regional ITS Architecture was developed to be sent to citizens in the City of Lawrence utility bills.

2.2 Turbo Architecture

Turbo Architecture Version 4.0 was used in the development of the Lawrence-Douglas County Regional ITS Architecture. Turbo Architecture is a software application that was developed by the USDOT to be used as a tool for documenting and maintaining ITS architectures. Version 4.0 of Turbo Architecture was released in October 2007 and was developed to support Version 6.0 of

the National ITS Architecture. Use of the Turbo Architecture software in development of the regional ITS architectures is recommended by both the FHWA and the FTA.

In the Lawrence-Douglas County Region the Turbo Architecture database that was developed was based on the ITS market packages which are provided in Appendix B of this report. The ITS market packages provide a graphical representation of the services stakeholders in the Region would like ITS to provide. In each market package the elements, such as a Traffic Management Center (TMC) or a Road Weather Information System (RWIS) Sensor, and the data that is shared between them are shown. Turbo Architecture allows the Region to document all of the elements and data flows that exist or are planned in the Region. Turbo Architecture also allows the user to quickly access any standards that are associated with the data flows as well as generate reports and diagrams to assist in reviewing the data. Some examples of the useful reports and diagrams that may be generated using the Turbo Architecture software are included in **Table 2**.

Table 2 – Turbo Architecture Report and Diagrams

Report or Diagram Name	Functions
Stakeholder Report	Provides a description of the stakeholder and the associated elements for each stakeholder in the Regional ITS Architecture.
Inventory Report	Provides a description and status for each element in the Regional ITS Architecture.
Market Packages Report	Identifies each of the market packages selected for the Region and the elements associated with each market package.
Functional Requirements Report	Identifies the functions that each element provides.
Interconnects Report	Identifies for each element all of the other elements that are connected and the status of each connection.
Standards Activities Report	Identifies relevant standards associated with each of the data flows used in the Regional ITS Architecture.
Subsystem Diagram	Identifies the subsystems from the National ITS Architecture that are included in the Regional ITS Architecture.
Interconnect Diagrams	Identifies for each element all of the other elements that are connected and the status of each connection. The Interconnect Diagrams can be customized to show all elements in the Regional ITS Architecture or a single element can be selected so that only the connections it has with other elements are shown. Interconnect Diagrams can also be viewed by individual market packages to view all of the elements and connections in each market package.
Flow Diagrams	Flow Diagrams are similar to Interconnect Diagrams; however, the actual data flows that are part of each connection between elements are also shown.

Turbo Architecture saves data in Microsoft Access compatible data files. Turbo Architecture files can be accessed using Microsoft Access although use of Access will not provide nearly the same amount of capabilities as accessing the files using the Turbo Architecture software. With the release of Version 4.0 of Turbo Architecture the USDOT began offering the Turbo Architecture software free of charge and provides a link for downloading the software on the National ITS Architecture website. At the time this report was written that site was located at www.iteris.com/itsarch/.

3. CUSTOMIZATION OF THE NATIONAL ITS ARCHITECTURE FOR THE LAWRENCE-DOUGLAS COUNTY REGION

3.1 Systems Inventory

An important initial step in the architecture development process is to establish an inventory of existing ITS elements. At the Kick-off Workshop and through subsequent discussions with agency representatives throughout the Region, Lawrence-Douglas County stakeholders provided the team with a list of existing and planned systems that will play a role in the Region's ITS architecture.

Existing and planned systems in the Lawrence-Douglas County Region were identified in the following categories:

- ***Travel and Traffic Management*** – includes future traffic management and/or operations centers, vehicle detection systems, fixed and portable DMS, and CCTV cameras.
- ***Emergency Management*** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, traffic signal preemption, transportation infrastructure protection, and wide-area alerts.
- ***Maintenance and Construction Management*** – includes road weather data collection, work zone management, and roadway maintenance and construction information.
- ***Public Transportation Management*** – includes transit and paratransit automated vehicle location (AVL), electronic fare management, transit security, multi-modal coordination, and transit traveler information systems.
- ***Traveler Information*** – includes broadcast traveler information and other related technologies such as the Internet.
- ***Archived Data Management*** – includes electronic data management and archiving systems.

3.2 Regional Needs

Needs from the Region were identified by stakeholders at the Kick-off Workshop held on July 11, 2007. **Table 3** documents both the needs discussed at the Kick-off Workshop as well as any additional needs gathered during the development of the architecture document.

Table 3 – Lawrence-Douglas County Region: ITS Needs Summary

Travel and Traffic Management Needs
- Need coordinated and closed loop signal system
- Need to coordinate upcoming signal system interconnect project with the fiber backbones of the City and Douglas County
- Need improved dissemination of incident information to emergency management, transit, and school bus dispatch
- Need to develop alternate traffic signal timing plans for use during KU events

Emergency Management Needs
- Need emergency vehicle signal preemption for City of Lawrence Police
- Need to be able to view any closed circuit television (CCTV) camera deployments (including toll roads) at Douglas County 911 Dispatch
- Need to be able to bring back incident information and other data from police mobile data terminals (MDTs)
- Need reverse calling emergency alert system in additional areas
- Need to be able to get real-time information and video images from helicopters to emergency dispatchers

Maintenance and Construction Management Needs
- Need additional weather detection
- Need flood and ice detection at locations in both the City and the County and to be able to share this information with emergency management, transit, and school bus dispatch
- Need automated road closure capabilities for remote locations prone to flooding or icing
- Need improved dissemination of road closure information to emergency management, transit, and school bus dispatch

Public Transportation Management Needs
- Need automated vehicle location (AVL) capability for Lawrence Transit vehicles
- Need video camera surveillance on Lawrence Transit vehicles (local record only initially, but in the future might be interested in real time feeds)
- Need automated passenger counters for Lawrence Transit
- Need electronic fare collection for Lawrence Transit
- Need improved transit traveler information for Lawrence Transit including real-time next bus arrival information
- Need signal priority for Lawrence Transit vehicles
- Need automated passenger counters for KU Transit

3.3 Element Customization

The inventory and needs documented at the Kick-off Workshop were the starting point for customizing the National ITS Architecture and developing an architecture for the Lawrence-Douglas County Region.

3.3.1 Subsystems and Terminators

Each identified system or component in the Lawrence-Douglas County Regional ITS inventory was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators are the 'entities' that represent systems in ITS. Subsystems are the highest level building blocks of the physical architecture, and the National ITS

Architecture groups them into four major classes: Centers, Field, Vehicles, and Travelers. Each of these major classes includes various subsystems that represent a set of transportation functions (or processes) that are likely to be collected together under one agency, jurisdiction, or location, and correspond to physical elements, such as traffic operations centers, traffic signals, or vehicles. **Figure 3** shows the National ITS Architecture subsystems. This figure, also known as the "sausage diagram," shows the relationships of the various subsystems within the architecture; a customized interconnect diagram for the Lawrence-Douglas County Region is shown later in **Figure 4**. Ovals represent the communication functions between the subsystems. Fixed-point to fixed-point communications include not only twisted pair and fiber optic technologies, but also such wireless technologies as microwave and spread spectrum.

Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. They help to define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include drivers, traffic operations personnel, and weather service providers.

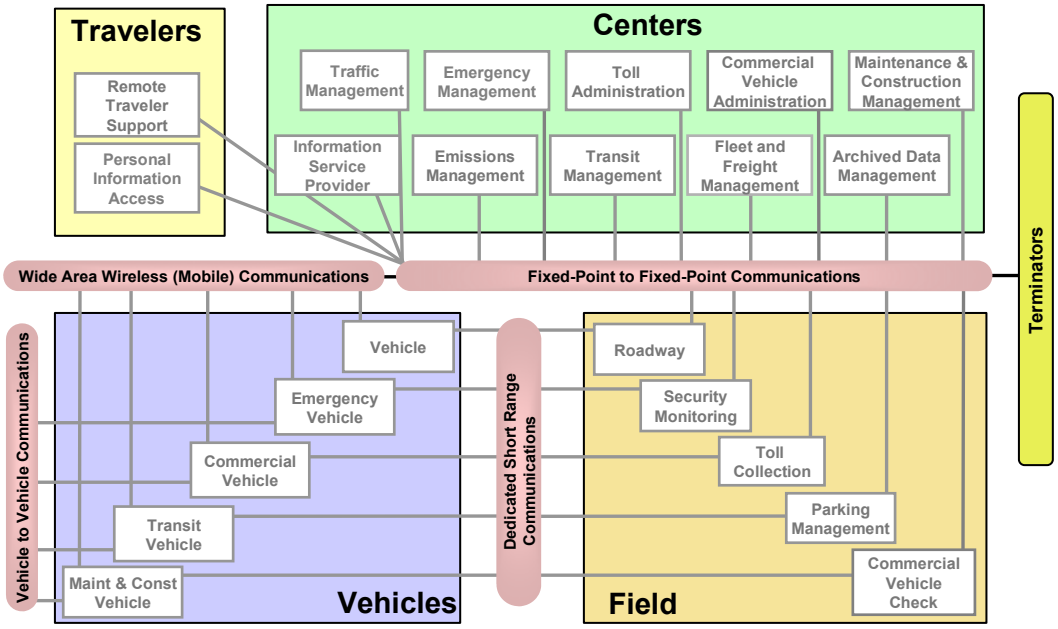


Figure 3 – National ITS Architecture Physical Subsystem Interconnect Diagram

3.3.2 ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements (subsystems and terminators) that make up the transportation system in the Lawrence-Douglas County Region. **Table 4** contains a listing of stakeholders identified in the architecture and a brief description of each. Rather than individually documenting each of the smaller municipalities in the Region, a single stakeholder was created for municipal government which represents the cities and towns not specifically called out in the architecture.

Table 5 contains the ITS inventory elements for the Region sorted by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated

with their agency. The table includes the status of the element. In many cases an element classified as existing might still need enhancement to attain the service level desired by the Region.

Table 4 – Lawrence-Douglas County Stakeholder Descriptions

Stakeholder	Stakeholder Description
City of Lawrence	Municipal government for the City of Lawrence, Kansas. Covers all city departments including those that deal with traffic and public safety.
Douglas County	County government for Douglas County. Covers all county departments including Public Works, Emergency Medical Services (EMS), Fire, Sheriff, Emergency Management, and Emergency Communications – 911 Dispatch.
Financial Institution	Handles exchange of money for transit and toll electronic fare collection.
Johnson County Transit	Transit provider that operates both fixed route and paratransit service within Johnson County.
Kansas Bureau of Investigation	Statewide law enforcement agency responsible for issuing statewide AMBER Alerts in Kansas.
KDOT	The Kansas Department of Transportation is the agency responsible for the construction, maintenance, and operation of roadways in the State of Kansas.
KHP	The Kansas Highway Patrol is the state law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.
KTA	The Kansas Turnpike Authority is the toll authority responsible for operating, maintaining, and collecting tolls for toll roads in the State of Kansas.
KU	University of Kansas.
KU on Wheels	Transit provider that operates both fixed route and paratransit service on the KU campus and within the City of Lawrence.
Lawrence Transit System	Transit provider that operates both fixed route and paratransit service within the City of Lawrence.
Media	Local media outlets. This can include television stations, newspapers, radio stations and their associated websites.
Municipal Government	Municipal government for the City of Eudora, Baldwin City, Lecompton, and other municipalities within the Region that are not specifically called out. Covers all city departments including those that deal with traffic and public safety.
NOAA	The National Oceanic and Atmospheric Administration is the agency that gathers weather information and issues severe weather warnings.
Other Agencies	This stakeholder represents a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.
Private Information Service Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Rail Operators	Companies that operate trains and/or are responsible for the maintenance and operations of railroad tracks.
System Users	All of the users of the transportation system.
Topeka Bus System	Transit provider that operates both fixed route and paratransit service within Topeka.

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators

Stakeholder	Element Name	Element Description	Status
City of Lawrence	City of Lawrence Automated Road Flood and Ice Closure Gates	Automated gates operated by the City of Lawrence that close when flood or ice conditions make a roadway hazardous.	Planned
	City of Lawrence CCTV Cameras	Closed circuit television cameras operated by the City of Lawrence for traffic condition monitoring and management of incidents.	Planned
	City of Lawrence City Engineer's Office	Office responsible for administration of maintenance and construction projects within the City.	Existing
	City of Lawrence Department of Public Works	Department responsible for the engineering and maintenance of streets, traffic signals, and storm water facilities as well as operation of the city vehicle maintenance garage and management of city facilities and buildings.	Existing
	City of Lawrence Department of Public Works Data Archive	The traffic data archive system for the City of Lawrence.	Planned
	City of Lawrence Department of Public Works Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by the City of Lawrence.	Existing
	City of Lawrence DMS	Dynamic message signs (DMS) operated by the City of Lawrence to provide information to drivers such as lane closures or alternate routes.	Planned
	City of Lawrence Fire Department and EMS Vehicles	Fire and EMS vehicles owned and operated by the City of Lawrence Fire Department.	Existing
	City of Lawrence Maintenance Management System	System to track the status of maintenance projects within the City of Lawrence.	Planned
	City of Lawrence Police Department	Law enforcement agency within the City of Lawrence.	Existing
	City of Lawrence Police Vehicles	Patrol vehicles owned and operated by the City of Lawrence Police Department.	Existing
	City of Lawrence RWIS Sensors	Road weather information system (RWIS) operated by the City of Lawrence. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Planned
	City of Lawrence Speed Monitoring Equipment	Speed monitoring equipment operated by the City of Lawrence.	Planned

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
City of Lawrence (continued)	City of Lawrence TOC	Lawrence traffic operations center responsible for the operation of the signal system, CCTV cameras, DMS, and any other ITS deployments in the City of Lawrence.	Planned
	City of Lawrence Traffic Management System Field Equipment	Equipment used to monitor traffic and road conditions, identify incidents, and collect data for long range planning within the City of Lawrence.	Planned
	City of Lawrence Traffic Signals	Traffic signal system operated by the City of Lawrence.	Existing
	City of Lawrence Website	Transportation information website for the City of Lawrence. In the future the site could include real-time construction, work zone, special event, incident, and traffic information.	Existing
	Lawrence-Douglas County MPO Data Warehouse	Data warehouse that serves as a repository for traffic information in the Region and is operated by the Lawrence-Douglas County Metropolitan Planning Office.	Planned
Douglas County	Douglas County 911 Dispatch	Answers all 911 calls made from within the county, except calls made from the KU campus, and dispatches appropriate emergency response. The 911 Dispatch center serves as primary dispatch for the City of Lawrence, Eudora, Baldwin City, and Lecompton and can also dispatch KU Police.	Existing
	Douglas County Automated Road Flood and Ice Closure Gates	Automated gates operated by Douglas County that close when flood or ice conditions make a roadway hazardous.	Planned
	Douglas County Department of Public Works Engineering and Operations Divisions	Department responsible for the maintenance of roadways in Douglas County.	Existing
	Douglas County Department of Public Works Engineering and Operations Divisions Data Archive	Data archive system for Douglas County Public Works.	Planned
	Douglas County Department of Public Works Engineering and Operations Divisions Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by Douglas County.	Existing
	Douglas County Engineer's Office	Office responsible for administration of maintenance and construction projects within the County.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Douglas County (continued)	Douglas County EOC	Emergency operations center (EOC) for Douglas County. Responsible for communications and coordination of local resources during a disaster or large scale incident.	Existing
	Douglas County Infrastructure Monitoring Data Collection Equipment	Data collection equipment operated by Douglas County that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned
	Douglas County Maintenance Management System	Management system to track the status of maintenance projects within Douglas County.	Planned
	Douglas County RWIS Sensors	RWIS operated by Douglas County. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Planned
	Douglas County Sheriff Vehicles	Patrol vehicles owned and operated by the Douglas County Sheriff's department.	Existing
	Douglas County Website	Website for Douglas County. This website is currently static but in the future it could provide real-time information.	Existing
	Reverse Calling Systems	Automated system that delivers outbound notifications on a large scale basis. Douglas County is interested in deploying a reverse calling system for use during emergencies. Several school districts already have isolated systems for notifying students of school closures.	Planned
	Douglas County Traffic Management System Field Equipment	Equipment used to monitor traffic and road conditions, identify incidents, and collect data for long range planning within Douglas County.	Planned
Financial Institution	Financial Service Provider	Provider that handles exchange of money for transit and toll electronic payment collection.	Existing
	Service Agency	Agency responsible for payment of transit fares for medical transportation as part of government subsidized medical care. This includes Medicare, and Veteran's Administration programs.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Johnson County Transit	Johnson County Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operated by Johnson County Transit. Also operates a fixed route with a transfer point for Lawrence Transit and KU on Wheels in Lawrence.	Existing
Kansas Bureau of Investigation	Kansas Bureau of Investigation	Agency responsible for the collection and dissemination of criminal justice information to public and private agencies. Kansas Bureau of Investigation (KBI) is also responsible for issuing statewide AMBER alerts.	Existing
KDOT	KC Scout	Traffic management center for Kansas City, Kansas and Kansas City, Missouri. Responsible for operations of the traffic signal system, CCTV cameras, and DMS. The center is a joint effort between KDOT and Missouri DOT.	Existing
	KDOT 511 Telephone Information System	511 telephone system that provides callers with up-to-date traveler information about road conditions, construction detours, and travel weather information.	Existing
	KDOT 511 Text Message System	System to send text message updates on road conditions, construction detours, and travel weather information for specific routes.	Existing
	KDOT Accident Database (KARS)	Accident database operated by the KDOT Bureau of Transportation Planning, the database contains crash data reported by law enforcement agencies.	Existing
	KDOT Anti-Icing and De-Icing Field Equipment	Equipment operated by KDOT for anti-icing and de-icing of roads and bridges.	Existing
	KDOT Bureau of Construction and Maintenance	Bureau responsible for plans and proposals, specifications, special provisions and maintenance management in Kansas.	Existing
	KDOT CCTV Cameras	Closed circuit television cameras operated by KDOT for traffic surveillance and incident management.	Planned
	KDOT Construction and Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by KDOT.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KDOT (continued)	KDOT District 1 (Construction and Maintenance)	Responsible for the construction and maintenance activities on KDOT roadways in KDOT District 1.	Existing
	KDOT District 1 (Operations)	Responsible for traffic operations on KDOT roadways in KDOT District 1.	Existing
	KDOT District 1 Engineer's Office	Responsible for administration of KDOT maintenance and construction projects in KDOT District 1.	Existing
	KDOT DMS	DMS operated by KDOT to provide traffic information dissemination.	Planned
	KDOT Environmental Data Collection Equipment	Data collection equipment that gathers environmental conditions using KDOT maintenance vehicles as probes.	Planned
	KDOT HAR	Highway advisory radio (HAR) operated by KDOT for traffic information dissemination.	Planned
	KDOT Infrastructure Monitoring Data Collection Equipment	Equipment operated by KDOT that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned
	KDOT KanRoad Reporting System	System that allows information to be input into an internal traveler information system central database and then supplied to the KDOT KanRoad/511 Traveler Information Website.	Existing
	KDOT KanRoad/511 Traveler Information Website	Website operated by KDOT that provides real time information to users about road conditions, construction detours and travel weather information for specific routes.	Existing
	KDOT Planning Archive	Traffic data archive system for KDOT.	Planned
	KDOT RWIS Database	Central database to store data gathered by KDOT RWIS sensors system.	Existing
	KDOT RWIS Sensors	RWIS operated by KDOT. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KDOT (continued)	KDOT Statewide TOMC	Transportation operations and management center (TOMC) operated by KDOT that is responsible for traffic management on state routes in areas without a local TMC. The TOMC could also serve as the backup TMC for KC Scout and other future regional centers in the State.	Planned
	KDOT Telecommunications Infrastructure GIS Database	Database for the sharing of geographic information system (GIS) data within Kansas.	Existing
	KDOT Traffic Management System Field Equipment	Traffic management equipment operated by KDOT used to detect vehicle volumes and/or speeds.	Planned
	KDOT Traffic Signals	Traffic signal systems operated by KDOT.	Planned
	KDOT Transportation Database (KANSYS)	Statewide database operated by KDOT to hold transportation related information, including traffic volumes, along KDOT roadways.	Existing
	KDOT Traveler Information Kiosks	Kiosks operated by KDOT for dissemination of traveler information. Kiosks are typically located in rest areas.	Existing
	KDOT Work Zone Safety Monitoring Equipment	Workzone monitoring and alerting equipment operated by KDOT to improve the safety of workers.	Planned
KHP	KHP Communications Center	Center for the operation of the KHP radio communication system.	Existing
	KHP Troop G	Special KHP Troop responsible for 24 hour patrol along Kansas Turnpike Authority roadways.	Existing
	KHP Troop G Vehicles	Vehicles used by the KHP Troop G. Includes patrol cars and service patrol vehicles.	Existing
KTA	KTA Construction and Maintenance Vehicles	Maintenance vehicles used in maintenance operations and snow removal that are owned and operated by KTA.	Existing
	KTA Database	Central database for KTA traffic information.	Planned
	KTA DMS	DMS operated by KTA for traffic information dissemination.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KTA (continued)	KTA Infrastructure Monitoring Data Collection Equipment	Equipment operated by KTA that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned
	KTA Maintenance Dispatch	Dispatch center responsible for receiving calls and dispatching maintenance personnel to respond to maintenance issues along the Kansas Turnpike.	Existing
	KTA Operations Center	KTA operations center is responsible for the daily operations of the turnpike.	Existing
	KTA RWIS Sensors	RWIS operated by KTA. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Existing
	KTA Security/Traffic Cameras	Cameras operated by KTA used for traffic surveillance, incident management, and toll enforcement.	Existing
	KTA Service Area Kiosks	Kiosks operated by KTA for dissemination of traveler information.	Planned
	KTA Toll Plazas	Toll collection locations for use by KTA.	Existing
	KTA Traffic Management System Field Equipment	Traffic data collection equipment operated by KTA.	Planned
	KTA Traveler Advisory Radio	Radio broadcast system operated by KTA to provide current weather and traffic information along the Kansas Turnpike. KTA has recently upgraded the transmission equipment on I-70 to improve the range and coverage of the traveler advisory radio.	Existing
	KTA Traveler Card	Electronic toll payment medium for KTA.	Existing
	KTA Traveler Information Website	Website operated by KTA for the dissemination of traveler information. Currently static, but at some point in the future could provide real time information to users about road conditions, construction detours and travel weather information for specific routes.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KU	KU Design and Construction Management	Office responsible for the planning, design, and management of consultant services and construction on the KU campus, including roads.	Existing
	KU Dispatch	Dispatch center that answers all 911 calls made from the KU campus and dispatches KU Police and City of Lawrence Fire/EMS as appropriate. The dispatch center serves as the backup center for Douglas County 911 Dispatch.	Existing
	KU Events Committee	Committee that approves any special event on campus. The Events Committee then notifies appropriate agencies of any resulting road closures.	Existing
	KU Maintenance Department	Department responsible for construction and maintenance on the KU campus, including roads.	Existing
	KU Parking Card	Parking card provides pre-paid access to KU parking lots.	Existing
	KU Parking Lot Management System	Monitors parking availability in lots on the KU campus and provides real-time parking information to patrons.	Existing
	KU Parking Payment System	KU system for the collection of parking fees.	Existing
	KU Police Vehicles	Patrol vehicles owned and operated by KU police.	Existing
	KU Website	Website for the University of Kansas.	Existing
KU on Wheels	KU on Wheels CCTV Camera Surveillance	CCTV camera surveillance on KU on Wheels fixed route and paratransit vehicles.	Planned
	KU on Wheels Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operated by KU on Wheels, including SafeRide.	Existing
	KU on Wheels Electronic Fare Payment Card	Payment card used for collection of transit fares electronically on KU on Wheels buses.	Planned
	KU on Wheels Fixed Route Vehicles	Fixed route transit vehicles owned and operated by KU on Wheels.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KU on Wheels (continued)	KU on Wheels Kiosks	Kiosks operated by KU for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
	KU on Wheels Lift Van Paratransit Vehicles	Paratransit vehicles owned and operated by KU on Wheels.	Existing
	KU on Wheels Website	Website for KU on Wheels with information about fares and schedules. Currently static information only.	Existing
	KU Safe Ride Vehicles	A fare-free transportation service for KU students showing a valid KU ID that provides door-to-door service between 10:30 AM and 2:30 AM.	Existing
Lawrence Transit System	Lawrence Transit System CCTV Camera Surveillance	CCTV camera surveillance on Lawrence Transit fixed route and paratransit vehicles as well as at the maintenance facility.	Existing
	Lawrence Transit System Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operated by Lawrence Transit.	Existing
	Lawrence Transit System DMS	DMS operated by Lawrence Transit at transfer points to post real time transit travel information.	Planned
	Lawrence Transit System Electronic Fare Payment Card	Payment card used for collection of transit fares electronically on Lawrence Transit vehicles.	Planned
	Lawrence Transit System E-Routes Email System	Subscription e-mail service provided by the Lawrence Transit System and the City of Lawrence that provides updates on Lawrence Transit System reroutes to subscribers.	Existing
	Lawrence Transit System Fixed Route Vehicles	Fixed route transit vehicles operated by Lawrence Transit.	Existing
	Lawrence Transit System Kiosks	Kiosks operated by Lawrence Transit for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
	Lawrence Transit System TLift Paratransit Vehicles	Paratransit vehicles operated by Lawrence Transit.	Existing
	Lawrence Transit System Website	Website operated by Lawrence Transit with information about fares and schedules. Currently static information only.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Media	Local Print and Broadcast Media	Local media that provides traffic or incident information to the public.	Existing
Municipal Government	Municipal Department of Public Works	Public works departments responsible for the maintenance of roadways in municipalities not specifically called out in the Regional ITS Architecture.	Existing
	Municipal Emergency Vehicles	Local law enforcement, fire, and EMS vehicles not specifically called out in the Regional ITS Architecture.	Existing
	Municipal Website	Local municipal websites not specifically called out in the Regional ITS Architecture.	Existing
NOAA	National Weather Service	Service that provides official US weather, marine, fire and aviation forecasts and warnings.	Existing
Other Agencies	School Bus System	Local school bus fleets. These are frequently contracted services.	Existing
	Unified School District	School districts that represent elementary, secondary, and high schools in the Region.	Existing
Private Information Service Provider	Private Concierge Providers	Private entities that provide customized services to travelers. This is usually a subscription based service such as On-Star.	Existing
	Private Sector Traveler Information Services	Websites sponsored by a private entity. Often this information is provided through a subscription service.	Existing
Rail Operators	Rail Operator Wayside Equipment	Equipment owned by rail operators that is located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Existing
System Users	Archived Data Users	System users that request information from an archive data system in the Region.	Planned
	Commercial Vehicles	Privately owned commercial vehicles that travel throughout the Region.	Existing
	Driver	Automobile users of the roadway network.	Existing

Table 5 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
System Users (continued)	Maintenance and Construction Field Personnel	Individuals working at a maintenance or construction site in the Region.	Existing
	Pedestrians	People who travel on foot in the Region.	Existing
	Private Traveler Personal Computing Devices	Computing devices that travelers use to access public information in the Region.	Existing
	Private Vehicles	Vehicles operated by a private individual in the Region.	Existing
	Traveler	Users of the transportation system, including roadways, transit or other services such as 511 traveler information in the Region.	Existing
Topeka Bus System	Topeka Bus System Dispatch	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operated by the Topeka Bus System.	Planned

3.3.3 Top Level Regional System Interconnect Diagram

A system interconnect diagram, or "sausage diagram" shows the systems and primary interconnects in the Region. The National ITS Architecture interconnect diagram, shown previously in **Figure 3**, has been customized for the Lawrence-Douglas County Region based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the ITS elements for the Lawrence-Douglas County Region in the context of a physical interconnect. Subsystems and elements specific to the Region are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to one of the four major classes the subsystems are associated with.

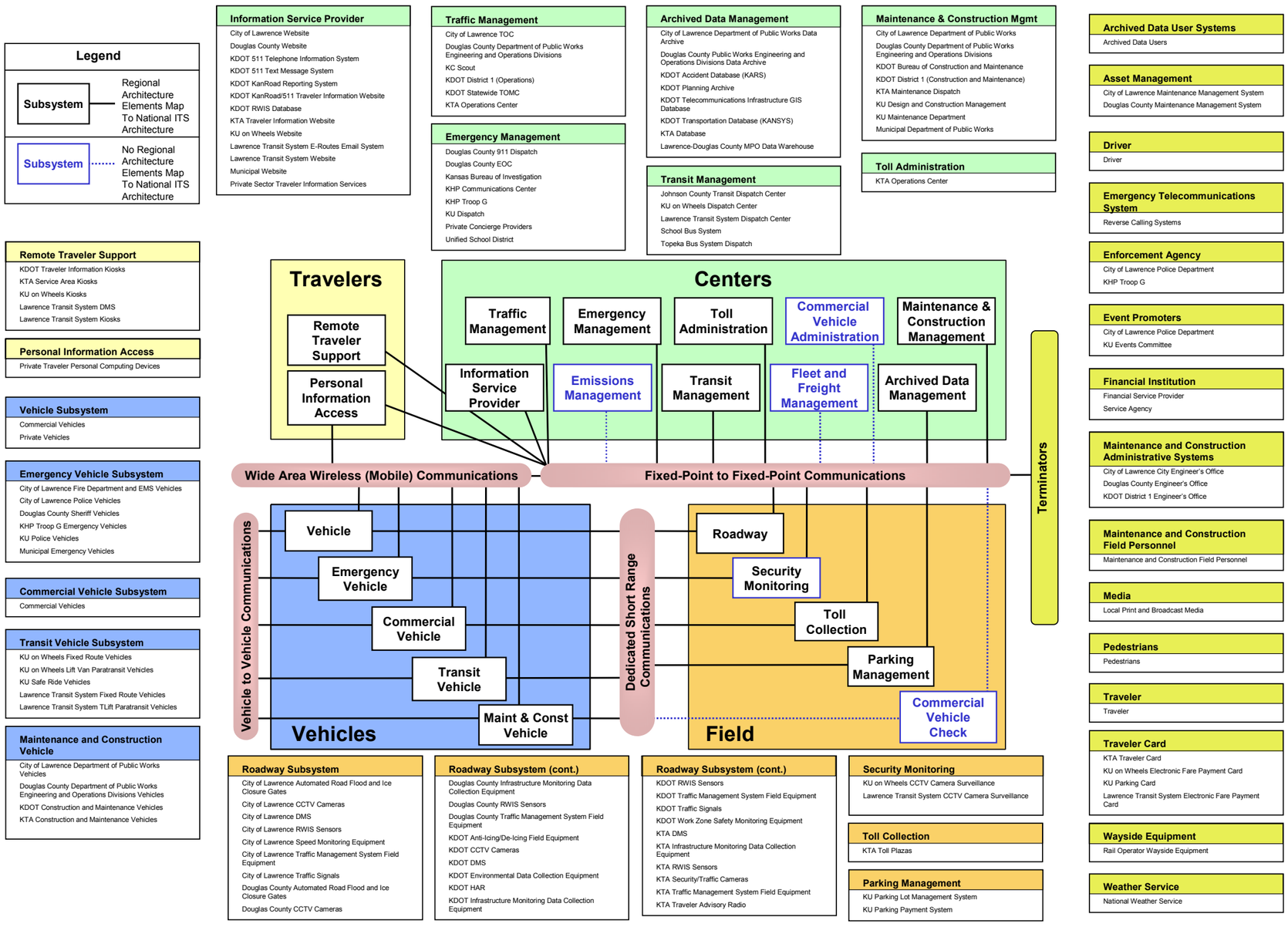


Figure 4 – Lawrence-Douglas County Regional System Interconnect Diagram

3.4 Market Packages

Upon completion of the system inventory, the next step in the development of the architecture was to identify the transportation services that are important to the Lawrence-Douglas County Region. In the National ITS Architecture, services are referred to as market packages. Market packages can include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently 91 market packages identified in the National ITS Architecture Version 6.0.

3.4.1 Selection and Prioritization of Regional Market Packages

Stakeholders reviewed and selected market packages from the National ITS Architecture based on the relevance of the service that the market package could provide for the Lawrence-Douglas County Region. Forty-four market packages were selected for implementation in the Region as shown in **Table 6**. The table organizes the market packages into service areas and priority groupings based on stakeholder input.

In several cases, multiple stakeholders in the Region provide the same service at different levels. For example, Winter Maintenance (MC06) could be provided on roadways by KDOT, the City of Lawrence, or Douglas County.

Upon selecting the market packages that were applicable for the Region, stakeholders then reviewed and customized each market package and the associated elements. This customization is discussed further in the following section.

Table 6 – Lawrence-Douglas County Market Package Prioritization by Functional Area

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Traffic Management		
ATMS01 Network Surveillance ATMS03 Surface Street Control ATMS06 Traffic Information Dissemination ATMS08 Traffic Incident Management System ATMS21 Roadway Closure Management	ATMS07 Regional Traffic Management ATMS10 Electronic Toll Collection ATMS13 Standard Railroad Grade Crossing ATMS16 Parking Facility Management ATMS19 Speed Monitoring	ATMS02 Traffic Probe Surveillance
Emergency Management		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM10 Disaster Traveler Information	EM04 Roadway Service Patrols EM08 Disaster Response and Recovery	EM03 Mayday and Alarms Support EM06 Wide-Area Alert EM09 Evacuation and Reentry Management

Table 6 – Lawrence-Douglas County Market Package Prioritization by Functional Area (continued)

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Maintenance and Construction Management		
MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC06 Winter Maintenance MC07 Roadway Maintenance and Construction MC08 Work Zone Management MC10 Maintenance and Construction Activity Coordination	MC01 Maintenance and Construction Vehicle and Equipment Tracking MC09 Work Zone Safety Monitoring MC11 Environmental Probe Surveillance	MC05 Roadway Automated Treatment MC12 Infrastructure Monitoring
Public Transportation Management		
APTS01 Transit Vehicle Tracking APTS02 Transit Fixed-Route Operations APTS03 Demand Response Transit Operations APTS05 Transit Security APTS08 Transit Traveler Information	APTS04 Transit Fare Collection Management APTS06 Transit Fleet Management APTS07 Multi-modal Coordination	APTS09 Transit Signal Priority APTS10 Transit Passenger Counting
Traveler Information		
ATIS01 Broadcast Traveler Information ATIS02 Interactive Traveler Information		
Archived Data Management		
	AD1 ITS Data Mart AD2 ITS Data Warehouse	

3.4.2 Customized Market Packages

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Lawrence-Douglas County Region. Each market package is shown graphically with the market package name, local agencies involved, and desired data flows included.

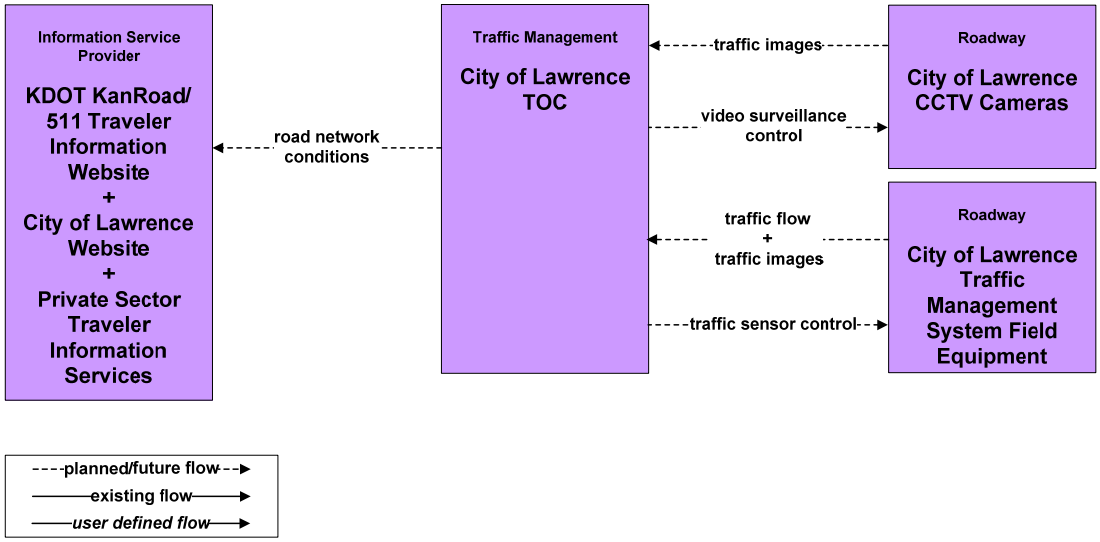


Figure 5 – Example Market Package Diagram: ATMS01-Network Surveillance

Figure 5 is an example of a customized ATMS market package for Network Surveillance for the City of Lawrence. This market package shows the three subsystems, Traffic Management, Information Service Provider, and Roadway. The market package additionally shows the associated entities (City of Lawrence TOC, KDOT KanRoad/511 Traveler Information Website, City of Lawrence Website, Private Traveler Information Services, City of Lawrence CCTV, and City of Lawrence Traffic Management System Field Equipment). Data flows between the subsystems indicate what information is being shared.

Customized market packages for the Lawrence-Douglas County Region are shown in **Appendix B**.

3.4.3 Regional ITS Needs and Customized Market Packages

The regional ITS needs gathered from stakeholders through the various workshops conducted, shown earlier in **Table 3**, drove the market package customization. Those needs are matched to their respective market package(s) in **Table 7**. Not all market packages included in the architecture are matched to needs in **Table 7** because some market packages already exist or there is not an immediate need in the Region that is encompassed by the market package.

Table 7 – ITS Needs and Corresponding Market Packages

ITS Need	Market Package
Traffic Management	
Need a coordinated and closed loop signal system in the City of Lawrence.	ATMS03
Need to coordinated upcoming signal system interconnect project with the fiber backbones of the City of Lawrence and Douglas County.	ATMS03
Need improved dissemination of incident information to emergency management, transit, and school bus dispatch.	ATMS08
Need to develop alternate traffic signal timing plans for use during KU events.	ATMS03
Traveler Information	
Need to add roadside traveler information systems throughout the Region, including DMS.	ATMS06
Need to provide real time information on websites for travelers.	ATMS08 ATIS01 ATIS02
Emergency Management	
Need emergency vehicle signal preemption for the City of Lawrence Police.	ATMS03 EM02
Need to be able to view any CCTV camera deployments (including toll roads) at Douglas County 911 Dispatch.	ATMS08
Need to be able to bring back incident information and other data from police MDTs.	EM01
Need reverse calling emergency alert system in additional areas.	EM06 EM10
Need to be able to get real-time information and video images from helicopters to emergency dispatchers.	EM01
Maintenance and Construction Management	
Need additional weather detection.	MC03
Need flood and ice detection at locations in both the City and the County and to be able to share this information with emergency management, transit, and school bus dispatch.	MC03 MC04
Need automated road closure capabilities for remote locations prone to flooding or icing.	ATMS21
Need improved dissemination of road closure information to emergency management, transit, and school bus dispatch.	ATMS08 MC04 MC10
Public Transportation Management	
Need AVL for Lawrence Transit Vehicles.	APTS01
Need video camera surveillance on Lawrence Transit vehicles, local record only initially, but in the future might be interested in real time feeds.	APTS05
Need automated passenger counters for Lawrence Transit.	APTS10
Need electronic fare collection for Lawrence Transit.	APTS04
Need improved transit traveler information for Lawrence Transit including real-time next bus arrival information.	APTS01 APTS08
Need signal priority for Lawrence Transit vehicles.	APTS09
Need automated passenger counters for KU Transit.	APTS10
Archived Data Management	
Need to consider data archiving as ITS technologies are implemented and data becomes more available.	AD1 AD2

3.5 Architecture Interfaces

While it is important to identify the various systems and stakeholders as part of the Regional ITS Architecture, a primary purpose of the architecture is to identify the connectivity between transportation systems in the Lawrence-Douglas County Region. The interconnect diagram shown previously in **Figure 4** documents the high-level relationships of the subsystems and terminators in the Lawrence-Douglas County Region and the associated local projects and systems. The customized market packages represent services that can be deployed as an integrated capability, and the market package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the market packages. How these systems interface with each other is an integral part of the overall ITS architecture.

3.5.1 Element Connections

There are a large number of elements identified as part of the Lawrence-Douglas County Regional ITS Architecture. These elements include a traffic operations center, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others – essentially, all of the existing and planned physical components that contribute to the regional ITS. Interfaces have been identified for each element in the Lawrence-Douglas County Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface.

An example of one of the interconnect diagrams is shown in **Figure 6**. This graphic shows the City of Lawrence Traffic Signals and planned interfaces with other elements throughout the Region. These interfaces are shown as existing or planned.

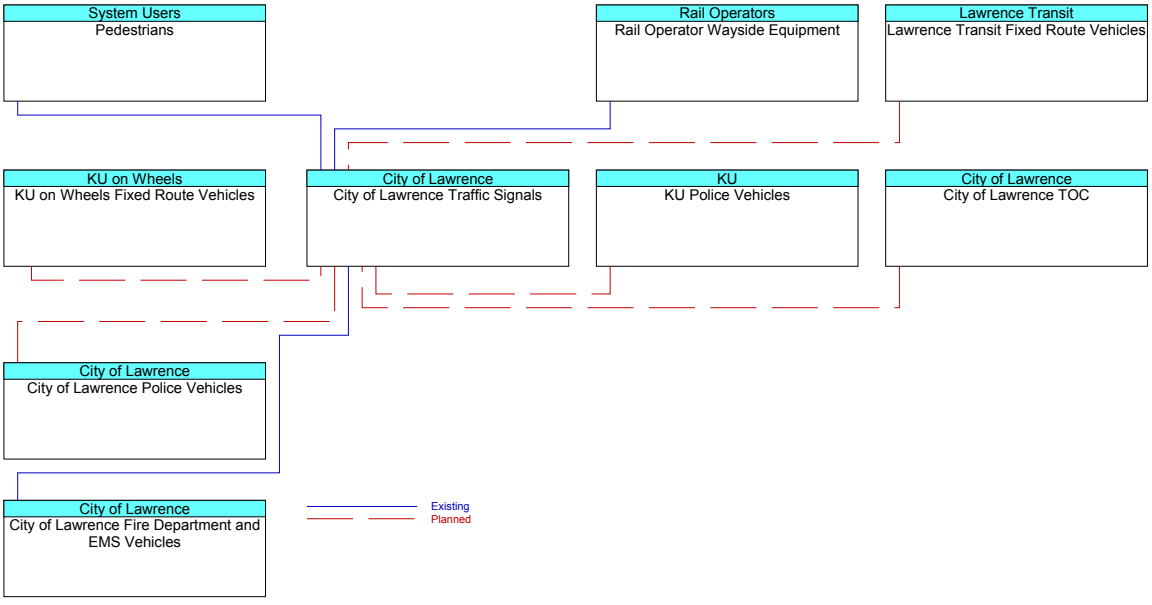


Figure 6 – Example Interconnect Diagram: City of Lawrence Traffic Signals

3.5.2 Data Flows Between Elements

In the market package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of the exchange. The data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. Turbo Architecture can be used to output flow diagrams and can be filtered by market package for ease of interpretation. However, it is important to remember that custom data flows will not show up in diagrams that are filtered by market package. An example of a flow diagram for the City of Lawrence that has been filtered for ATMS01 – Network Surveillance is shown in **Figure 7**.

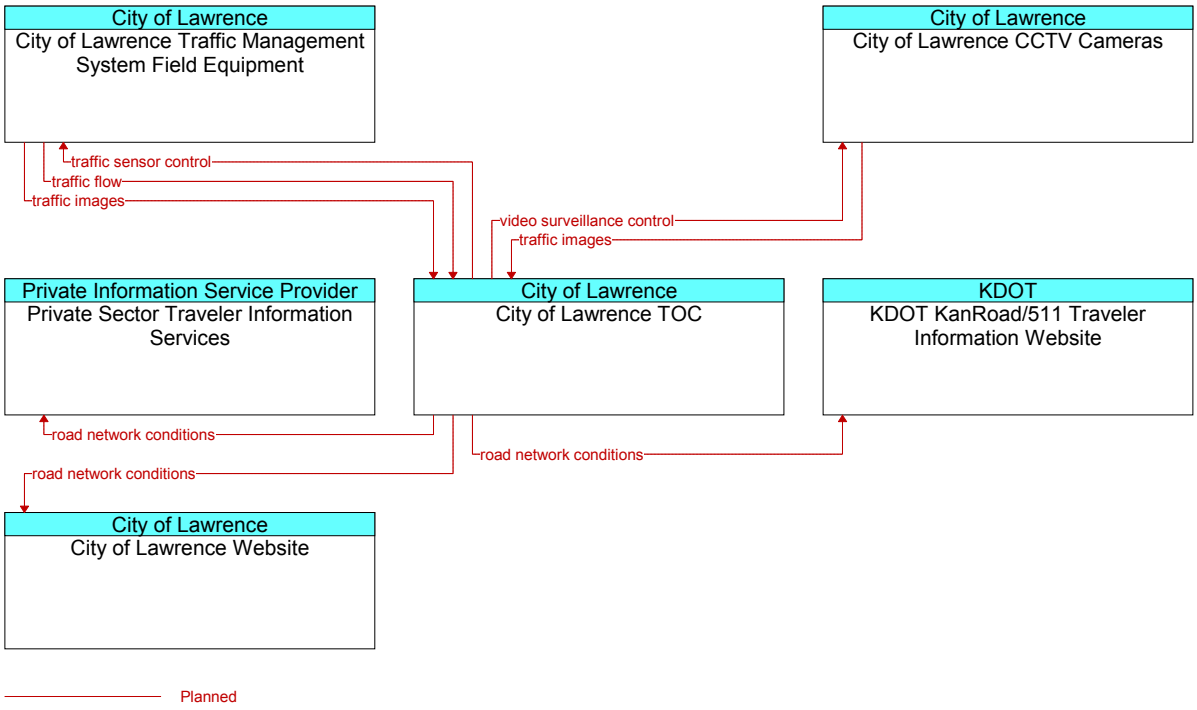


Figure 7 – Example Flow Diagram: ATMS01 – Network Surveillance

4. APPLICATION OF THE REGIONAL ITS ARCHITECTURE

Once a region has identified the desired components of ITS for their area and established which agencies and systems need to be connected, the structure of the National ITS Architecture assists with the region's planning and implementation. This section addresses the application of the Regional ITS Architecture in the Lawrence-Douglas County Region. The National ITS Architecture provides recommendations for standards and functional requirements for consideration when implementing ITS elements. In addition, an operational concept has been developed for the Region and documents the roles and responsibilities of stakeholders in the operation of the Regional ITS Architecture. The implementation of ITS in the Lawrence-Douglas County Region will likely require interagency agreements. Potential agreements have been identified based on the desired data flows identified in the Lawrence-Douglas County Region. The ITS Architecture and ITS Deployment Plan which were developed as part of this process will be incorporated into the existing planning process, ensuring that the Region will achieve the maximum benefit from the development effort.

4.1 Functional Requirements

Functions are a description of what the system has to do. In the National ITS Architecture, functions are defined at several different levels, ranging from general subsystem descriptions through somewhat more specific equipment package descriptions to process specifications that include substantial detail. Guidance from the USDOT on developing a Regional ITS Architecture recommends that each Region determine the level of detail of the functional requirements for their Region. In the Lawrence-Douglas County Region, it is recommended that the development of detailed functional requirements such as the "shall" statements included in process specifications for a system be developed at the project level. These detailed "shall" statements identify all functions that a project or system needs to perform.

For the Lawrence-Douglas County Regional ITS Architecture, functional requirements have been chosen at two levels. The customized market packages, discussed previously in Section 3.4.2, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what the ITS system in the Region has to do and the data that needs to be shared among elements.

Functional requirements, at a more detailed level, describe functions that each element in the architecture performs or will perform in the future. **Appendix C** contains a table that summarizes the functions by element for the Lawrence-Douglas County Region.

4.2 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Lawrence-Douglas County Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States.

Table 8 identifies each of the ITS standards that could apply to ITS deployments in the Lawrence-Douglas County Region. These standards are based on the physical subsystem architecture flows previously identified in Section 3.5.2.

Table 8 – Lawrence-Douglas County Applicable ITS Standards

SDO	Document ID	Title
AASHTO/ITE	ITE TMDD 2.1	Traffic Management Data Dictionary (TMDD) and Message Sets for External TMC Communication
AASHTO/ITE/NEMA	NTCIP 1102	Octet Encoding Rules Base Protocol
	NTCIP 1103	Transportation Management Protocols
	NTCIP 1104	Center-to-Center Naming Convention Specification
	NTCIP 1201	Global Object Definitions
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units
	NTCIP 1203	Object Definitions for dynamic message signs (DMS)
	NTCIP 1204	Object Definitions for Environmental Sensor Stations
	NTCIP 1205	Object Definitions for closed-circuit television (CCTV) Camera Control
	NTCIP 1206	Object Definitions for Data Collection and Monitoring Devices
	NTCIP 1208	Object Definitions for CCTV Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile
	NTCIP 2102	Point to Multi-Point Protocol Using Frequency Shift Keying Modem Subnetwork Profile
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile
	NTCIP 2104	Ethernet Subnetwork Profile
	NTCIP 2201	Transportation Transport Profile
	NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile
	NTCIP 2301	Simple Transportation Management Framework Application Profile
	NTCIP 2302	Trivial File Transfer Protocol Application Profile
	NTCIP 2303	File Transfer Protocol Application Profile
	NTCIP 2304	Application Profile for DATEX-ASN
	NTCIP 2306	Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications
APTA	APTA TCIP-S-001 3.0.0	Standard for Transit Communications Interface Profiles (TCIP)
ASTM	ASTM E2213-03	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer Specifications
	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems
	ASTM WK7604	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data

Table 8 – Lawrence-Douglas County Applicable ITS Standards (continued)

SDO	Document ID	Title
IEEE	IEEE 1459-1999	Standard for Message sets for Vehicle/Roadside Communications
	IEEE 1512-2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers
	IEEE 1512.1-2006	Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers
	IEEE 1512.2-2004	Standard for Public Safety Traffic Management Message Sets for use by Emergency Management Centers
	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Sets for Use by Emergency Management Centers
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Set for Use in Entities External to Centers
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE 1609.1-2006	Standard for Wireless Access in Vehicular Environments (WAVE) – Resource Manager
	IEEE 1609.2-2006	Standard for WAVE – Security Services for Applications and Management Messages
	IEEE 1609.4-2006	Standard for WAVE – Multi-Channel Operation
	IEEE P1609.3	Standard for WAVE – Networking Services
	IEEE P802.11p	Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part II: Wireless LAN MAC and Physical Layer Specifications
SAE	SAE J2266	Location Referencing Message Specification
	SAE J2313	On-Board Land Vehicle Mayday Reporting Interface
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	Radio Data System Phrase Lists
	SAE J2540/2	International Traveler Information Systems Phrase Lists
	SAE J2540/3	National Names Phrase List

4.3 Operational Concept

An Operational Concept documents each stakeholder's current and future roles and responsibilities in the operation of the regional ITS. The operational concept documents these roles and responsibilities across a range of transportation services. The services covered are:

- ***Surface Street Management*** – The development of signal systems that react to changing traffic conditions and provide coordinated intersection timing along a corridor. Arterial management will also include network surveillance capabilities such as detectors and CCTV cameras.
- ***Freeway Management*** – The development of systems to monitor freeway traffic flow and roadway conditions, and provide strategies to improve the flow of traffic on the freeway. Includes systems to provide information to travelers on the roadway.
- ***Incident Management*** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.
- ***Emergency Management*** – The development of systems to provide emergency call taking, public safety dispatch, and EOC operations.
- ***Transit Management*** – The development of systems to more efficiently manage fleets of transit vehicles. Includes systems to provide transit traveler information both pre-trip and during the trip.
- ***Traveler Information*** – The development of systems to provide static and real-time transportation information to travelers.
- ***Maintenance and Construction Management*** – The development of systems to manage the maintenance of roadways in the Region. Includes the managing of construction and winter maintenance operations.
- ***Archived Data Management*** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

Table 9 identifies the roles and responsibilities of key stakeholders in each of these transportation services.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management	City of Lawrence	Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Operate traffic signal systems within the City.
		Provide signal preemption for emergency vehicles.
		Provide traffic information to travelers through city owned DMS.
		Provide road closures on city owned roadways for flooding and winter weather.
		Provide construction and traffic information reports to regional and private information service providers, as well as the Kansas 511 system.
		Coordinate traffic information with the KDOT TOMC and KTA.
		Provide speed monitoring on city owned roadways
Freeway Management	KDOT	Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
		Operate DMS and HAR for the distribution of traffic information and roadway conditions to travelers on the roadway.
		Provide construction and traffic information reports to regional and private information service providers, as well as the Kansas 511 system.
		Coordinate traffic information with the City of Lawrence TOC and KTA.
	KTA	Operate network surveillance equipment including CCTV cameras and vehicle detection on the turnpike.
		Operate DMS and HAR for the distribution of traffic information and roadway conditions to travelers on the roadway.
		Collect tolls from agency toll plazas.
		Provide construction and traffic information reports to regional and private information service providers, as well as the Kansas 511 system.
		Coordinate traffic information with the City of Lawrence TOC and KDOT.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Traffic)	City of Lawrence	Operate network surveillance equipment including CCTV cameras and vehicle detection for detection and verification of incidents on city streets.
		Operate DMS for the distribution of incident information to travelers on the roadway.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	KDOT	Operate network surveillance equipment including CCTV cameras and vehicle detection for detection and verification of incidents on KDOT routes.
		Operate DMS and HAR for the distribution of incident information to travelers on the roadway.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	KTA	Operate network surveillance equipment including CCTV cameras and vehicle detection for detection and verification of incidents on the turnpike.
		Operate DMS and HAR for the distribution of incident information to travelers on the roadway.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	Municipalities	Operate network surveillance equipment including vehicle detection for detection and verification of incidents on municipal streets.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Emergency)	Douglas County 911 Dispatch	Dispatch public safety vehicles for incidents.
		Coordinate incident response with other public safety agencies and traffic management for incidents.
	Kansas Highway Patrol (KHP)	Dispatch KHP vehicles for highway incidents.
		Coordinate incident response with other public safety and traffic management agencies.
Emergency Management	Douglas County 911 Dispatch	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Receive AMBER Alert and other Wide Area Alert information from KBI.
		Provide back-up dispatching function for KU dispatch.
	Kansas Bureau of Investigation (KBI)	Responsible for the initiation of AMBER Alerts.
	Kansas Highway Patrol (KHP)	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Receive AMBER Alert and other Wide Area Alert information from KBI.
	KU Dispatch	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Receive AMBER Alert and other Wide Area Alert information from KBI.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management	KU on Wheels	Operates paratransit and fixed route transit services from a central dispatch facility responsible for tracking their location and status.
		Provide transit passenger electronic fare payment on fixed route and paratransit transit vehicles.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Coordinate transit service with other regional transit providers.
		Provide schedule and fare information on transit kiosks.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Kansas 511 system.
		Operate on-board systems to provide next stop annunciation.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Lawrence Transit System	Operates paratransit and fixed route transit services from a central dispatch facility responsible for tracking their location and status.
		Provide transit passenger electronic fare payment on fixed route and paratransit transit vehicles.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Coordinate transit service with other regional transit providers.
		Provide schedule and fare information on transit kiosks.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Kansas 511 system.
		Operate on-board systems to provide next stop annunciation.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
Traveler Information	City of Lawrence	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	Douglas County	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	KDOT	Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event and weather information to travelers via the 511 Traveler Information System.
		Provide transportation information to travelers via traveler information kiosks.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Traveler Information (continued)	KTA	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
		Provide transportation information to travelers via traveler information kiosks.
Maintenance and Construction Management	City of Lawrence	Monitors environmental sensors and distributes information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Support coordinated response to incidents.
		Support work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.
		Disseminate work zone activity schedules and current asset restrictions to other agencies.
	Douglas County	Monitors environmental sensors and distributes information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Support coordinated response to incidents.
		Support work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.
		Disseminate work zone activity schedules and current asset restrictions to other agencies.
	KDOT	Monitor environmental sensors and distribute information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Support coordinated response to incidents.
		Support work zone activities including the dissemination of work zone information through portable DMS, HAR, and sharing of information with other groups.
		Disseminate work zone activity schedules and current asset restrictions to other agencies.
	KTA	Monitor environmental sensors and distributes information about road weather conditions.
		Support coordinated response to incidents.
		Support work zone activities including the dissemination of work zone information through portable DMS, HAR, and sharing of information with other groups.
		Disseminate work zone activity schedules and current asset restrictions to other agencies.

Table 9 – Lawrence-Douglas County Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	Municipal	Support coordinated response to incidents.
		Support work zone activities including the dissemination of work zone information through sharing of information with other groups.
		Disseminate work zone activity schedules and current asset restrictions to other agencies.
Archived Data Management	City of Lawrence	Collect and archive transportation data for the City of Lawrence.
	Douglas County	Collect and archive transportation data for Douglas County.
	KDOT	Collect and archive transportation data for KDOT roadways.
	KTA	Collect and archive transportation and emergency data and information for KTA.
	Lawrence-Douglas County MPO	Collect and archive information from regional traffic management providers, regional transit agencies, and maintenance agencies.
		Serve as a data warehouse for regional traffic, maintenance, and transit agencies.

4.4 Potential Agreements

The Regional ITS Architecture for the Lawrence-Douglas County Region has identified agency interfaces, information exchanges, and integration strategies that would be needed to provide the ITS services and systems identified by the stakeholders in the Region. Interfaces and data flows among public and private entities in the Lawrence-Douglas County Region will require agreements among agencies that establish parameters for sharing agency information to support traffic and incident management, provide traveler information, and perform other functions identified in the Regional ITS Architecture.

With the implementation of ITS technologies, integrating systems from one or more agencies, and the anticipated level of information exchange identified in the architecture, it is likely that formal agreements between agencies will be needed in the future. These agreements, while perhaps not requiring a financial commitment from agencies in the Region, should outline specific roles, responsibilities, data exchanges, levels of authority, and other facets of regional operations. Some agreements will also outline specific funding responsibilities, where appropriate and applicable.

Table 10 provides a list of potential agreements for the Lawrence-Douglas County Region based on the interfaces identified in the Regional ITS Architecture. It is important to note that as ITS services and systems are implemented in the Region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Table 10 – Lawrence-Douglas County Region Potential Agreements

Status	Agreement and Agencies	Agreement Description
Future	**Data Sharing and Usage (Public-Private)** – (City of Lawrence, Douglas County, KDOT, Media)	Agreement would allow private sector media and information service providers to access and broadcast public transportation agency CCTV camera video feeds, real time traffic speed and volume data, and incident data. Agreements should specify the control priority to allow traffic agencies first priority to control cameras during incidents or other events. The ability of the traffic agency to deny access to video and data feeds if a situation warrants such action should also be part of the agreement.
Future	**Data Sharing and Usage (Public-Public)** – (City of Lawrence, Douglas County, KDOT)	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between the public sector agencies. Similar to data sharing and usage agreements for public-private agencies, the agency that owns the equipment should have first priority of the equipment and the ability to discontinue data sharing if a situation warrants such action.
Future	**Incident Data Sharing and Usage** – (City of Lawrence, Douglas County 911 Dispatch, KDOT, KHP, KTA)	Agreement would define the parameters, guidelines, and policies for inter-agency sharing of incident data between transportation and emergency management agencies in the Region. Incident information could be sent directly to computer-aided dispatch systems and include information on lane closures, travel delays, and weather.
Future	**Joint Operations Agreements –** (City of Lawrence, Douglas County, KDOT)	Agreement to operate the system from a shared control facility that could include traffic, transit, and emergency management. Examples could include a regional TOC or a combined TOC and EOC. Agreement will need to identify such issues as sharing of data and control of devices, cost sharing of the facilities, and standard operating procedure. Shared field equipment, such as a CCTV camera that can be accessed by multiple agencies could also be covered under this type of agreement.
Future	**Maintenance Agreements** – (City of Lawrence, Douglas County, KDOT, KTA)	Agreement that would allow multiple public agencies to pull their funding together to hire a single maintenance contractor to maintain ITS devices throughout the Region.

4.5 Phases of Implementation

The Regional ITS Architecture will be implemented through a series of projects led by both public sector and private sector agencies. Key foundation systems will need implementation in order to support other systems that have been identified in the Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and their respective time frames have been identified in the Lawrence-Douglas County Regional ITS Deployment Plan. These projects have been sequenced over a 20-year period, with projects identified for deployment in 5-, 10-, and 20-year timeframes.

Some of the key market packages that will provide the functions for the foundation systems in the Lawrence-Douglas County Region are listed below. Projects associated with these and other market packages identified for the Region have been included in the Lawrence-Douglas County Regional ITS Deployment Plan.

- Network Surveillance;
- Surface Street Control;
- Traffic Information Dissemination;
- Traffic Incident Management System;
- Emergency Call Taking and Dispatch;
- Road Weather Data Collection;
- Emergency Routing;
- Maintenance and Construction Activity Coordination;
- Transit Vehicle Tracking; and
- Transit Fixed Route Operations.

4.6 Incorporation into the Regional Planning Process

Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture and Regional ITS Deployment Plan for the Lawrence-Douglas County Region. The plans need to be incorporated into the regional planning process so that the ITS vision for the Region is considered when implementing ITS projects and to ensure that the Region remains eligible for federal funding for implementation of the projects.

Figure 8 documents the relationship between the Regional ITS Architecture and Deployment Plan and the Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP).

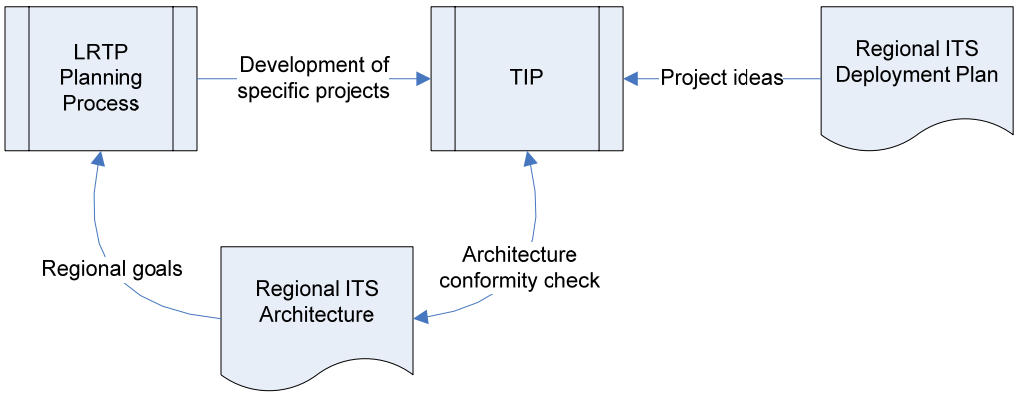


Figure 8 – Incorporation into the Regional Planning Process

The Regional ITS Architecture documents the Region's goals for ITS and identifies general regional needs for ITS implementations. These objectives should be captured and documented in the LRTP. The LRTP and the Regional ITS Deployment Plan are sources for specific projects to include in the TIP.

As projects are added to the TIP each project should be evaluated to determine if the project includes any ITS elements. If the project contains an ITS element, then the Regional ITS Architecture needs to be reviewed to ensure that the project is in conformance. The Lawrence-

Douglas County MPO will perform this examination as part of the planning process using the procedure outlined in Section 4.6.1.

4.6.1 Process for Determining Architecture Conformity

The Lawrence-Douglas County Regional ITS Architecture documents the customized market packages that were developed as part of the ITS architecture process. To satisfy federal requirements and remain eligible to use federal funds, a project must be accurately documented. The steps of the process are as follows:

- Identify the ITS components in the project;
- Identify the corresponding market packages(s) from the Regional ITS Architecture;
- Locate the component within the market package;
- Compare the connections to other agencies or elements documented in the ITS architecture as well as the information flows between them to the connections that will be part of the project; and
- Document any changes necessary to the ITS Architecture or the project to ensure there is conformance.

Identifying the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments but could also be included in other types of projects. For example, an arterial widening project could include the installation of traffic signal system interconnect, traffic signal upgrades, and the incorporation of the traffic signals in the project limits into the City's closed loop signal system. These are all ITS deployments and should be included in the ITS architecture.

Identifying the Corresponding Market Packages

If a project was included in the project tables in the ITS Deployment Plan, then the applicable market package(s) for that project are identified in a column of the table. However, ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, market packages might need to be identified without the assistance of an ITS Deployment Plan. In that case, the market packages selected and customized for the Lawrence-Douglas County Region are identified in **Table 6** of this document and detailed market package definitions are located in **Appendix A**.

Identifying the Component within the Market Package

The customized market packages for the Lawrence-Douglas County Region are located in **Appendix B**. Once the element is located on the market package, the evaluator may determine that the element name should be modified. For example, an element called the City of Lawrence TOC was included in the architecture, but at the time of deployment, the City might decide to call the center by a new name. This name change should be documented using the process outlined in Section 5.2.

Evaluating the Connections and Flows

The connections and architecture flows documented in the market package diagrams were selected based on the information available at the time the plan was developed. As the projects are designed, decisions will be made on the system layout that might differ from

what is shown in the market package. These changes in the project should be documented in the ITS market packages using the process outlined in Section 5.2.

Documenting Required Changes

If any changes are needed to accommodate the project under review, Section 5.2 describes how those changes should be documented. Any changes will be incorporated during the next architecture update. Conformance will be accomplished by documenting how the market package(s) should be modified so that the connections and data flows are consistent with the project.

5. MAINTAINING THE REGIONAL ITS ARCHITECTURE

The ITS Architecture developed for the Lawrence-Douglas County Region addresses the Region's vision for ITS implementation at the time the plan was developed. With the growth of the Region, needs will change and as technology progresses new ITS opportunities will arise. For example, at the time this architecture was developed Lawrence Transit System and KU on Wheels operated independent transit systems. A study was underway to evaluate the possibility of combining the two agencies at some point in the future. If this were to happen, architecture modifications would be needed to document the consolidation. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Lawrence-Douglas County Regional ITS Architecture be updated to remain a useful resource for the Region.

5.1 Maintenance Process

The City of Lawrence will be responsible for leading the process to update the Lawrence-Douglas County Regional ITS Architecture and Deployment Plan in coordination with the Lawrence-Douglas County MPO. **Table 11** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 11 – Regional ITS Architecture and Deployment Plan Maintenance Summary

Maintenance Details	Regional ITS Architecture		Regional ITS Deployment Plan	
	Minor Update	**Major Update**	**Minor Update**	**Major Update**
Timeframe for Updates	As needed	Year prior to the Long Range Transportation Plan Update	Semi-Annually	Year prior to the Long Range Transportation Plan Update
Scope of Update	Update market packages to satisfy architecture compliance requirements of projects or to document other changes that impact the ITS Architecture	Entire ITS Architecture	Update project status and add or remove projects as needed	Entire ITS Deployment Plan
Lead Agency	Lawrence-Douglas County MPO	City of Lawrence/ Lawrence-Douglas County MPO	City of Lawrence/ Lawrence-Douglas County MPO	
Participants	Stakeholders impacted by market package modifications	Entire stakeholder group	Entire stakeholder group	
Results	Market package or other change(s) documented for next complete update	Updated Lawrence-Douglas County Regional ITS Architecture document, Appendices, and Turbo Architecture database	Updated project tables	Updated Lawrence-Douglas County Regional ITS Deployment Plan document

Modifications to the Regional ITS Architecture will often be necessitated by ITS projects that are receiving federal funding but do not conform to the Regional ITS Architecture. The Lawrence-Douglas County MPO will take the lead in working with agencies that receive federal funding for ITS projects and will keep a record of any changes that are needed to the Regional ITS Architecture. Complete updates to the Regional ITS Architecture will occur approximately every four years in the year preceding the Long Range Transportation Plan update and will be led by the City of Lawrence and Lawrence-Douglas County MPO.

Stakeholder recommended that the Regional ITS Deployment Plan be reviewed at a minimum once per year although most preferred that a semi-annual meeting be held to review the plan. The stakeholder agencies that developed the Regional ITS Architecture and Deployment Plan should be included in the review meeting. The review should consist primarily of updates to the recommended projects, including identification of any projects in the plan that have been deployed and any new projects that should be added to the plan. This effort will be led by the City of Lawrence and the Lawrence-Douglas County MPO. A complete update of the ITS Deployment Plan should occur every four years as part of the Regional ITS Architecture Update.

Additional information on the procedure for submitting minor architecture changes is included in Section 5.2 of this document.

5.2 Procedure for Submitting ITS Architecture Changes Between Major Updates

Updates to the Lawrence-Douglas County Regional ITS Architecture will occur on a regular basis as described in Section 5.1 to maintain the architecture as a useful planning tool. Between major plan updates smaller modifications will likely be required to accommodate ITS projects in the Region. Section 4.6.1 contains step by step guidance for determining whether or not a project requires architecture modifications.

For situations where a change is required, an Architecture Maintenance Documentation Form was developed and is included in **Appendix D**. This form should be completed and submitted to the architecture maintenance contact person whenever a change to the Regional ITS Architecture is proposed.

The Maintenance Documentation form identifies three levels of modifications. They include:

Level 1 – Basic changes that do not affect the structure of the architecture
Examples include: Changes to stakeholder or element name, element status, or data flow status

Level 2 – Structural changes that impact only one agency
Examples include: Addition of a new market package or modifications to an existing market package that affects only one agency

Level 3 – Structural changes that have the potential to impact multiple agencies
Examples include: Addition of a new market package or modifications to an existing market package that involves multiple agencies or incorporation of a new stakeholder into the architecture

In the process of documenting the change, the stakeholder proposing the change should contact any other agency that will be impacted by the modification to obtain feedback. This communication between agencies will simplify the process of performing a major plan update. The Lawrence-Douglas County Metropolitan Planning Office will review and accept the proposed changes. When a major update is performed all of the documented changes will be incorporated into the architecture.

APPENDIX A – MARKET PACKAGE DEFINITIONS

Market Package	Market Package Name	Description
Traffic Management Service Area		
ATMS01	Network Surveillance	Includes traffic detectors, CCTV cameras, other surveillance equipment, supporting field equipment and fixed point to point communications to transmit the collected data back to a traffic management center.
ATMS02	Traffic Probe Surveillance	Provides an alternative approach for surveillance of the roadway network. Probe vehicles are tracked, and the vehicle's position and speed information are utilized to determine road network conditions such as average speed and congestion conditions.
ATMS03	Surface Street Control	Provides the central control and monitoring equipment, communication links and signal control equipment that support local street and/or arterial traffic management. This market package is consistent with typical urban traffic signal control systems.
ATMS04	Freeway Control	Provides the communications and roadside equipment to support ramp control, lane controls and interchange control for freeways. This market package is consistent with typical urban traffic freeway control systems. Also includes the capability to utilize surveillance information for detection of incidents.
ATMS05	HOV Lane Management	Manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals.
ATMS06	Traffic Information Dissemination	Provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. Information can include traffic and road conditions, closure and detour information, incident information, emergency alerts and driver advisories.
ATMS07	Regional Traffic Management	Sharing of traffic information and control among traffic management centers to support a regional management strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions.
ATMS08	Traffic Incident Management System	Manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. This market package includes incident detection capabilities and coordination with other agencies. It supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel.
ATMS09	Traffic Forecast and Demand Management	Includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecasts of the roadway network performance.
ATMS10	Electronic Toll Collection	Provides toll operators with the ability to collect tolls electronically and detect and process violations.
ATMS11	Emissions Monitoring and Management	Monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data.
ATMS12	Roadside Lighting System Control	Manages electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside.
ATMS13	Standard Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where rail operational speeds are less than 80 mph.
ATMS14	Advanced Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where operational speeds are greater than 80 mph. Augments Standard Railroad Grade Crossing market package with additional safety features to mitigate the risks associated with higher rail speeds.
ATMS15	Railroad Operations Coordination	Provides an additional level of strategic coordination between freight rail operations and traffic management centers. Could include train schedules, maintenance schedules or any other anticipated HRI closures.

Market Package	Market Package Name	Description
Traffic Management Service Area (continued)		
ATMS16	Parking Facility Management	Provides enhanced monitoring and management of parking facilities. Market package assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees.
ATMS17	Regional Parking Management	Supports coordination between parking facilities to enable regional parking management strategies.
ATMS18	Reversible Lane Management	Provides for the management of reversible lane facilities and includes the field equipment, physical lane access controls, and associated control electronics.
ATMS19	Speed Monitoring	Monitors the speeds of vehicles traveling through a roadway system.
ATMS20	Drawbridge Management	Supports systems that manage drawbridges at rivers and canals and other multimodal crossings. Includes control devices as well as traveler information systems.
ATMS21	Roadway Closure Management	Closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, or other situations. Market package covers general road closures applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other market packages.
Emergency Management Service Area		
EM01	Emergency Call-Taking and Dispatch	Provides basic public safety call-taking and dispatch services. Includes emergency vehicle equipment, equipment used to receive and route emergency calls, wireless communications and coordination between emergency management agencies.
EM02	Emergency Routing	Supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions and suggested routing information are provided to enhance emergency vehicle routing. Includes signal preemption and priority applications.
EM03	Mayday and Alarms Support	Allows the user to initiate a request for emergency assistance and enables the emergency management subsystem to locate the user, gather information about the incident and determine the appropriate response.
EM04	Roadway Service Patrols	Supports the roadway service patrol vehicles that aid motorists, offering rapid response to minor incidents (flat tire, crashes, out of gas) to minimize disruption to the traffic stream. This market package monitors service patrol vehicle locations and supports vehicle dispatch.
EM05	Transportation Infrastructure Protection	Includes the monitoring of transportation infrastructure (e.g. bridges, tunnels and management centers) for potential threats using sensors, surveillance equipment, barriers and safeguard systems to preclude an incident, control access during and after an incident or mitigate the impact of an incident. Threats can be acts of nature, terrorist attacks or other incidents causing damage to the infrastructure.
EM06	Wide-Area Alert	Uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather, civil emergencies or other situations that pose a threat to life and property.
EM07	Early Warning System	Monitors and detects potential, looming and actual disasters including natural, technological and man-made disasters.
EM08	Disaster Response and Recovery	Enhances the ability of the surface transportation system to respond to and recover from disasters. Supports coordination of emergency response plans, provides enhanced access to the scene and better information about the transportation system in the vicinity of the disaster, and maintains situation awareness.

Market Package	Market Package Name	Description
Emergency Management Service Area (continued)		
EM09	Evacuation and Reentry Management	Supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. This market package supports both anticipated, well-planned and orderly evacuations such as for a hurricane, as well as sudden evacuations with little or no time for preparation or public warning such as a terrorist act. Employs a number of strategies to maximize capacity along an evacuation route including coordination with transit.
EM10	Disaster Traveler Information	Use of ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster.
Maintenance and Construction Management Service Area		
MC01	Maintenance and Construction Vehicle and Equipment Tracking	Tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities.
MC02	Maintenance and Construction Vehicle Maintenance	Performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities. Includes on-board sensors capable of automatically performing diagnostics.
MC03	Road Weather Data Collection	Collects current road weather conditions using data collected from environmental sensors deployed on and about the roadway.
MC04	Weather Information Processing and Distribution	Processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators can make decisions on corrective actions to take.
MC05	Roadway Automated Treatment	Automatically treats a roadway section based on environmental or atmospheric conditions. Includes the sensors that detect adverse conditions, automated treatment (such as anti-icing chemicals), and driver information systems.
MC06	Winter Maintenance	Supports winter road maintenance. Monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities.
MC07	Roadway Maintenance and Construction	Supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.
MC08	Work Zone Management	Directs activity in work zones, controlling traffic through portable dynamic message signs and informing other groups of activity for better coordination management. Also provides speed and delay information to motorists prior to the work zone.
MC09	Work Zone Safety Monitoring	Includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. Detects vehicle intrusions in work zones and warns workers and drivers of safety hazards when encroachment occurs.
MC10	Maintenance and Construction Activity Coordination	Supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations. (i.e., traffic management, transit, emergency management)
MC11	Environmental Probe Surveillance	Collects data from vehicles in the road network that can be used to directly measure on infer current environmental conditions.
MC 12	Infrastructure Monitoring	Monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure using both fixed and vehicle-based infrastructure monitoring sensors. Monitors vehicle probes used to determine current pavement conditions.

Market Package	Market Package Name	Description
Public Transportation Service Area		
APTS01	Transit Vehicle Tracking	Monitors current transit vehicle location using an automated vehicle location system. Location data may be used to determine real time schedule adherence and update the transit system's schedule in real time.
APTS02	Transit Fixed-Route Operations	Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for fixed-route and flexible-route transit services.
APTS03	Demand Response Transit Operations	Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for demand responsive transit services.
APTS04	Transit Fare Collection Management	Manages transit fare collection on-board transit vehicles and at transit stops using electronic means. Allows the use of a traveler card or other electronic payment device.
APTS05	Transit Security	Provides for the physical security of transit passengers and transit vehicle operators. Includes on-board security cameras and panic buttons.
APTS06	Transit Fleet Management	Supports automatic transit maintenance scheduling and monitoring for both routine and corrective maintenance.
APTS07	Multi-modal Coordination	Establishes two way communications between multiple transit and traffic agencies to improve service coordination.
APTS08	Transit Traveler Information	Provides transit users at transit stops and on board transit vehicles with ready access to transit information. Services include stop annunciation, imminent arrival signs and real-time transit schedule displays. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.
APTS09	Transit Signal Priority	Determines the need for transit priority on routs and at certain intersections and requests transit vehicle priority at these locations to improve on-time performance of the transit system.
APTS10	Transit Passenger Counting	Counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center.
Commercial Vehicle Operations Service Area		
CVO01	Fleet Administration	Provides the capabilities to manage a fleet of commercial vehicles. Vehicle routing and tracking as well as notification of emergency management of any troublesome route deviations (such as a HAZMAT vehicle) are part of this market package.
CVO02	Freight Administration	Tracks the movement of cargo and monitors the cargo condition.
CVO03	Electronic Clearance	Provides for automatic clearance at roadside check facilities. Allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short range communications to the roadside.
CVO04	CV Administrative Processes	Provides for electronic application, processing, fee collection, issuance and distribution of CVO credentials and tax filing.
CVO05	International Border Electronic Clearance	Provides for automated clearance at international border crossings.
CVO06	Weigh-In-Motion	Provides for high speed weigh-in-motion with or without automated vehicle identification capabilities.
CVO07	Roadside CVO Safety	Provides for automated roadside safety monitoring and reporting. Automates commercial vehicle safety inspections at the roadside check facilities.
CVO08	On-board CVO and Freight Safety and Security	Provides for on-board commercial vehicle safety monitoring and reporting as well as roadside support for reading on-board safety data via tags.
CVO09	CVO Fleet Maintenance	Supports maintenance of CVO fleet vehicles with on-board monitoring equipment and automated vehicle location capabilities.
CVO10	HAZMAT Management	Integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents.

Market Package	Market Package Name	Description
Commercial Vehicle Operations Service Area (continued)		
CVO11	Roadside HAZMAT Security Detection and Mitigation	Provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT.
CVO12	CV Driver Security Authentication	Provides the ability for fleet and freight management to detect when an unauthorized commercial vehicle driver attempts to drive a vehicle based on stored identity information. If an unauthorized driver has been detected the commercial vehicle can be disabled.
CVO13	Freight Assignment Tracking	Provides for the planning and tracking of the commercial vehicle, freight equipment and the commercial vehicle driver.
Traveler Information Service Area		
ATIS01	Broadcast Traveler Information	Collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadly disseminates this information through existing infrastructures (radio, cell phones, etc.).
ATIS02	Interactive Traveler Information	Provides tailored information in response to a traveler request. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information.
ATIS03	Autonomous Route Guidance	Using vehicle location and other information, this market package enables route planning and detailed route guidance based on static, stored information.
ATIS04	Dynamic Route Guidance	Offers advanced route planning and guidance that is responsive to current conditions.
ATIS05	ISP Based Trip Planning and Route Guidance	Offers the user pre-trip route planning and en-route guidance services. Routes may be based on static or real time network conditions.
ATIS06	Transportation Operations Data Sharing	Collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes the information available to transportation system operators.
ATIS07	Yellow Pages and Reservation	Provides yellow pages and reservations services to the user.
ATIS08	Dynamic Ridesharing	Provides dynamic ridesharing/ride matching services to travelers.
ATIS09	In Vehicle Signing	Supports the distribution of traffic and travel advisory information to drivers through in-vehicle devices.
ATIS10	VII Traveler Information	Provides location specific information to travelers in vehicles using Vehicle Infrastructure Integration (VII).
Archived Data Management Service Area		
AD1	ITS Data Mart	Provides a focused archive that houses data collected and owned by a single agency or other organization. Focused archive typically covers a single transportation mode and one jurisdiction.
AD2	ITS Data Warehouse	Includes all the data collection and management capabilities of the ITS Data Mart. Adds the functionality to allow collection of data from multiple agencies and data sources across modal and jurisdictional boundaries.
AD3	ITS Virtual Data Warehouse	Provides the same broad access to multimodal, multidimensional data from varied sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed.

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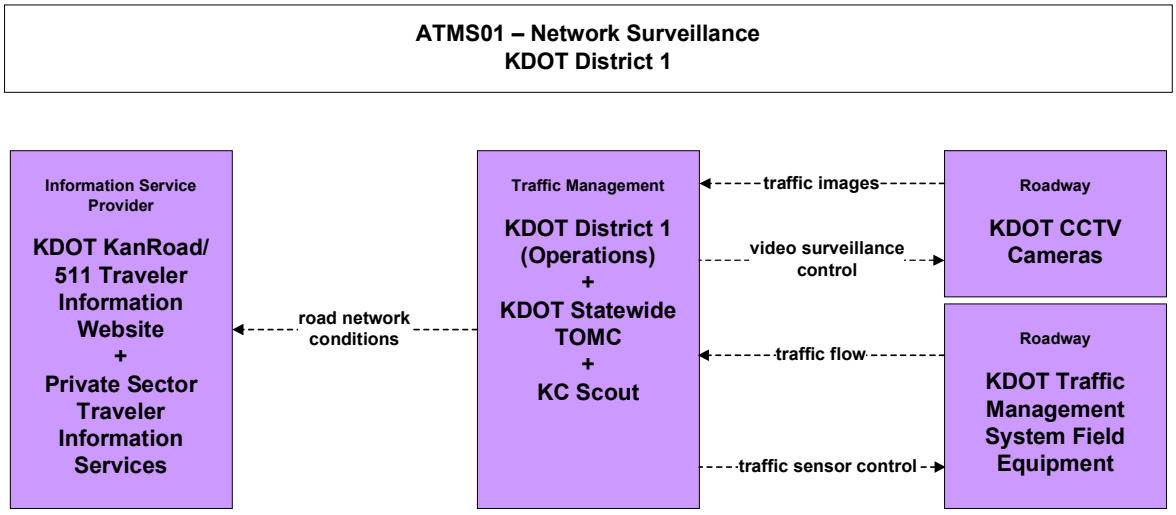
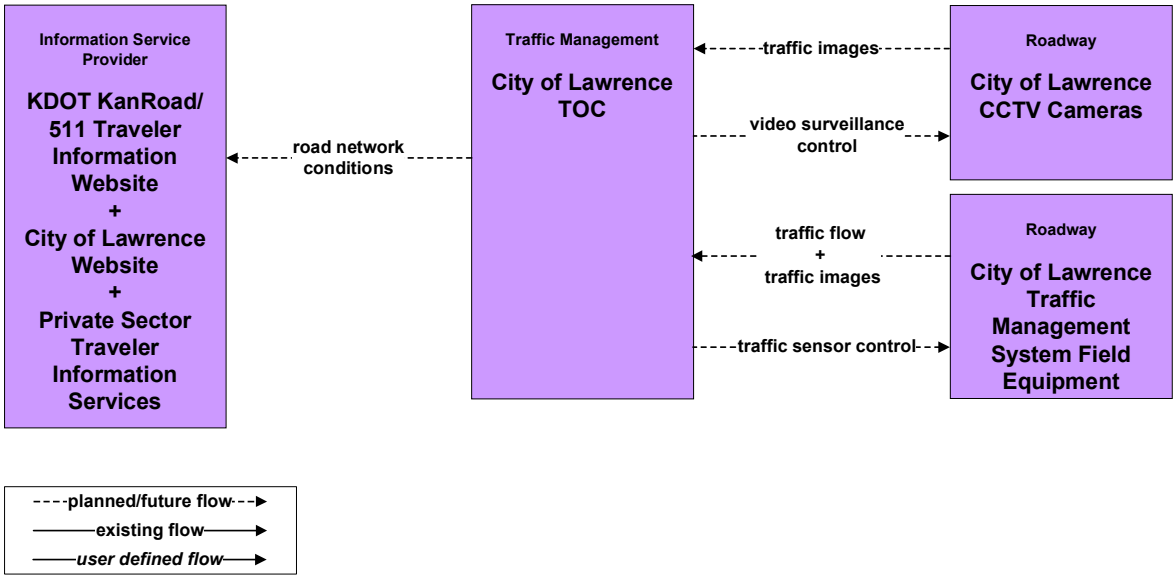
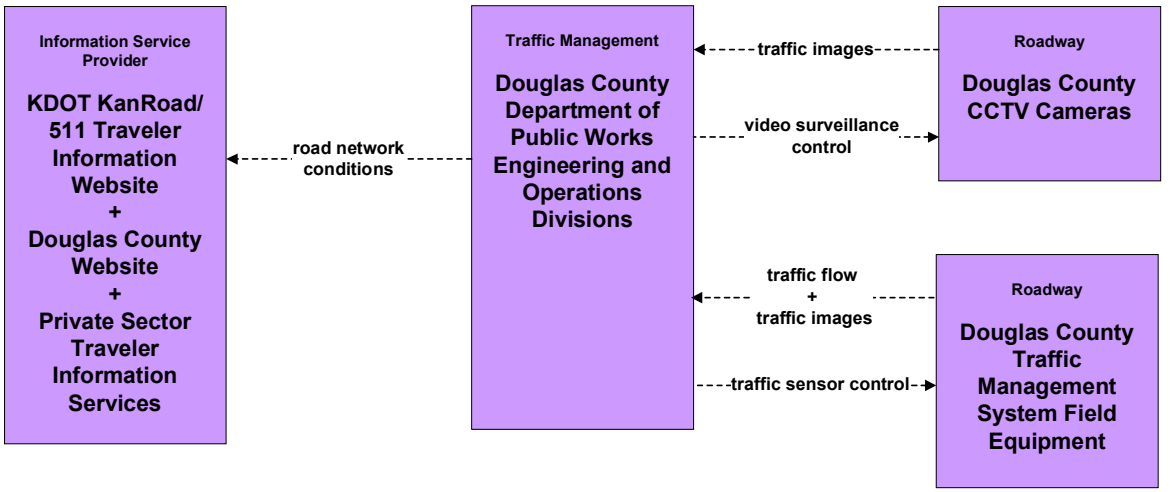
Advanced Traffic Management System

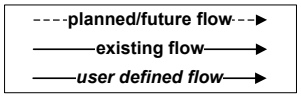


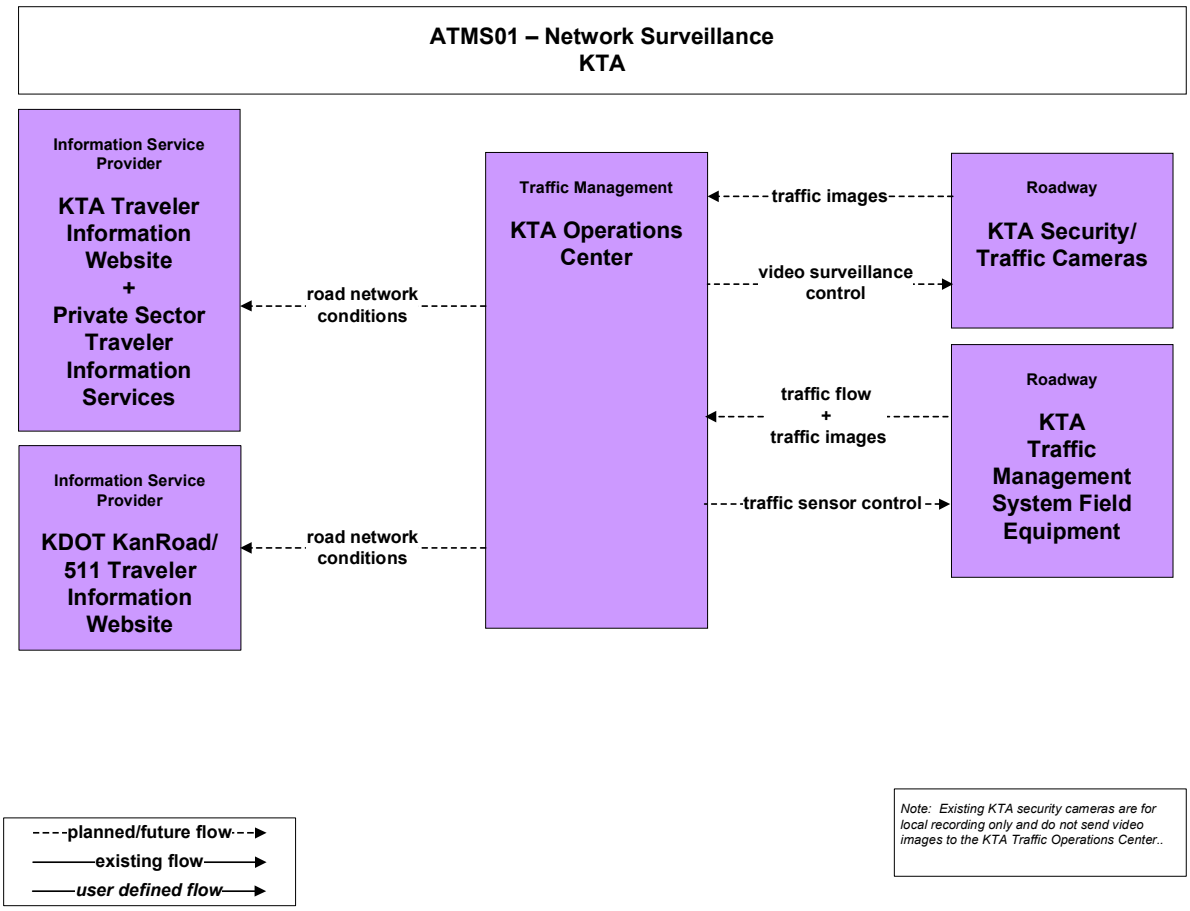
ATMS01 – Network Surveillance
City of Lawrence

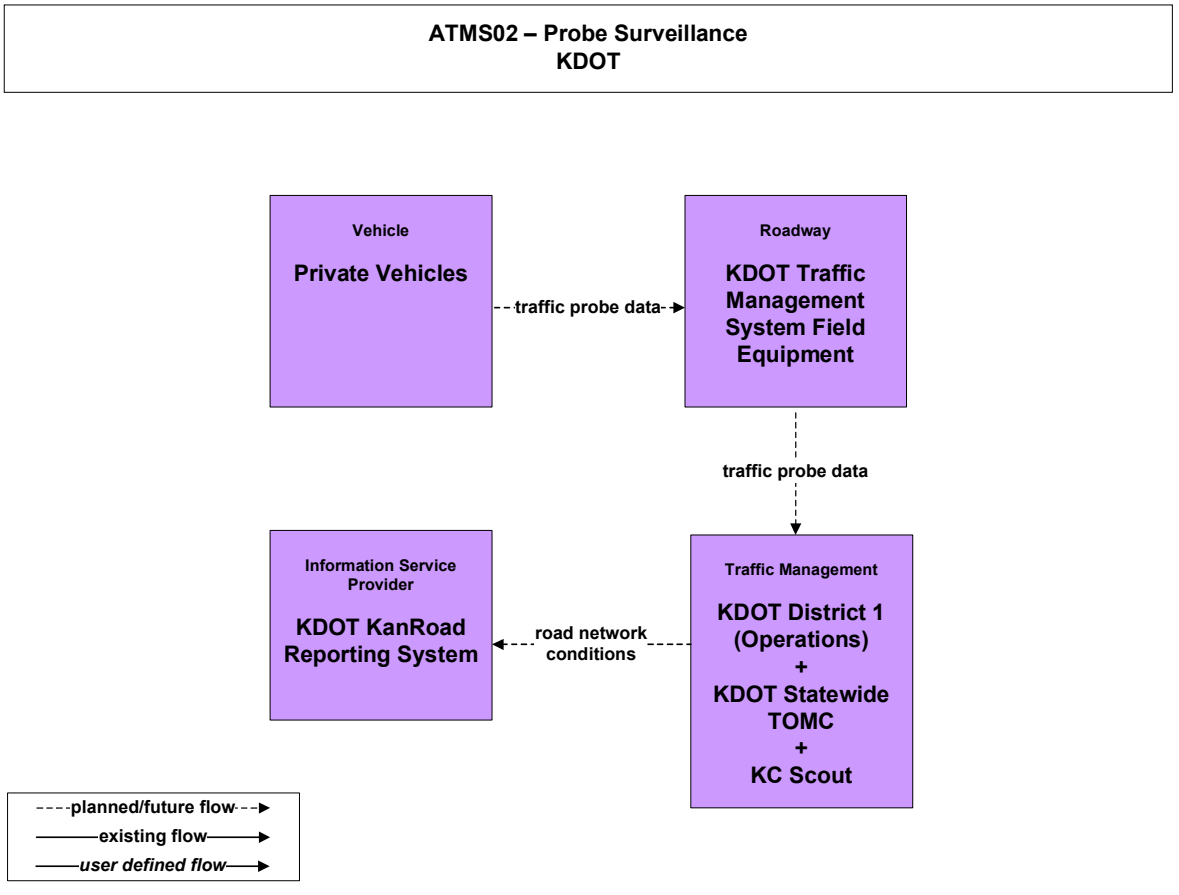


ATMS01 – Network Surveillance
Douglas County






ATMS01 – Network Surveillance
KTA
Information Service Provider
KTA Traveler Information Website
+
Private Sector Traveler Information Services
Information Service Provider
KDOT KanRoad/ 511 Traveler Information Website
road network conditions
road network conditions
Traffic Management
KTA Operations Center
traffic images
video surveillance control
traffic flow
+
traffic images
traffic sensor control
Roadway
KTA Security/ Traffic Cameras
Roadway
KTA Traffic Management System Field Equipment
planned/future flow
existing flow
user defined flow
Note: Existing KTA security cameras are for local recording only and do not send video images to the KTA Traffic Operations Center..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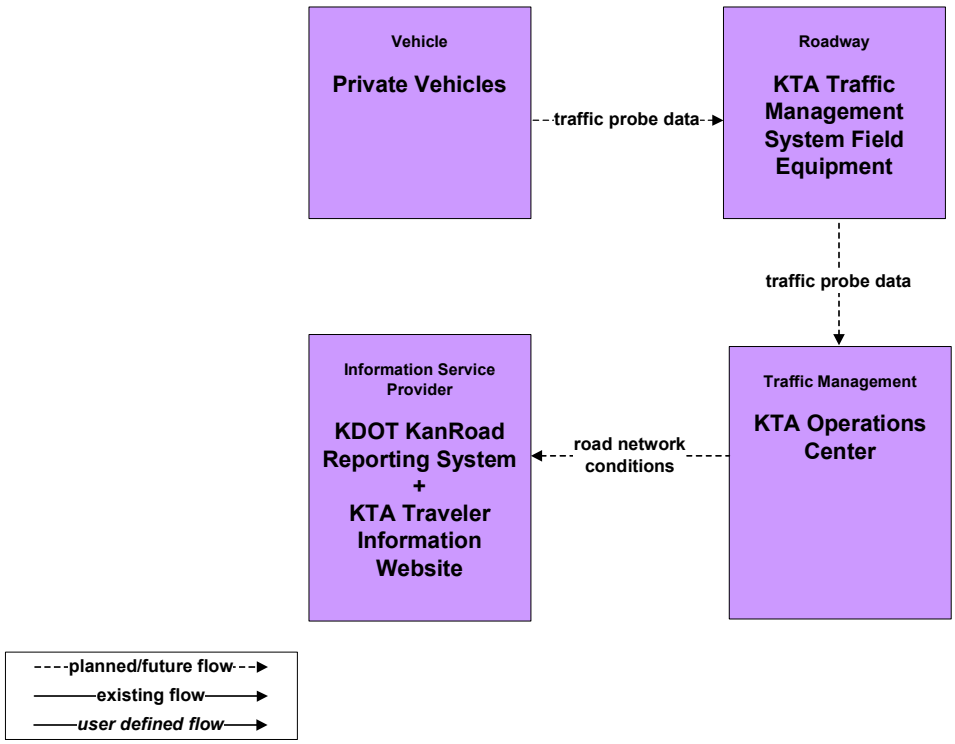
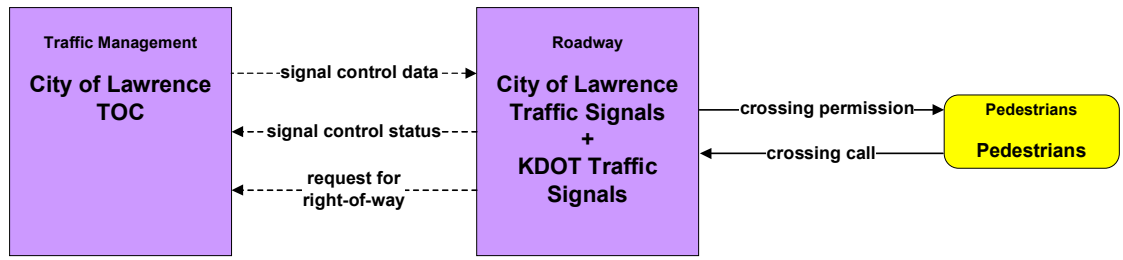
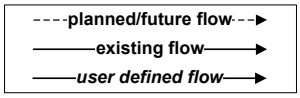
KDOT
Vehicle
Private Vehicles
traffic probe data
Roadway
KDOT Traffic Management System Field Equipment
traffic probe data
Information Service Provider
KDOT KanRoad Reporting System
road network conditions
Traffic Management
KDOT District 1 (Operations)
+
KDOT Statewide TOMC
+
KC Scout
planned/future flow
existing flow
user defined flow

ATMS02 – Probe Surveillance
KTA



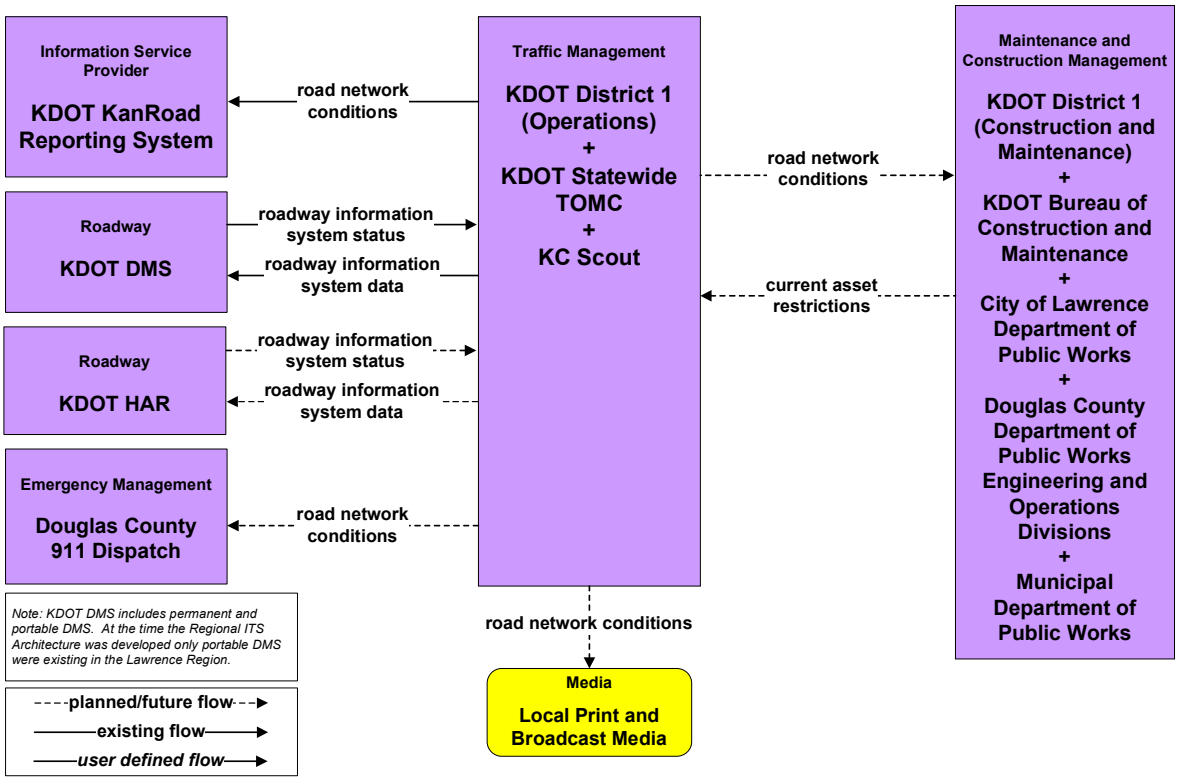
ATMS03 – Surface Street Control
City of Lawrence Signal System



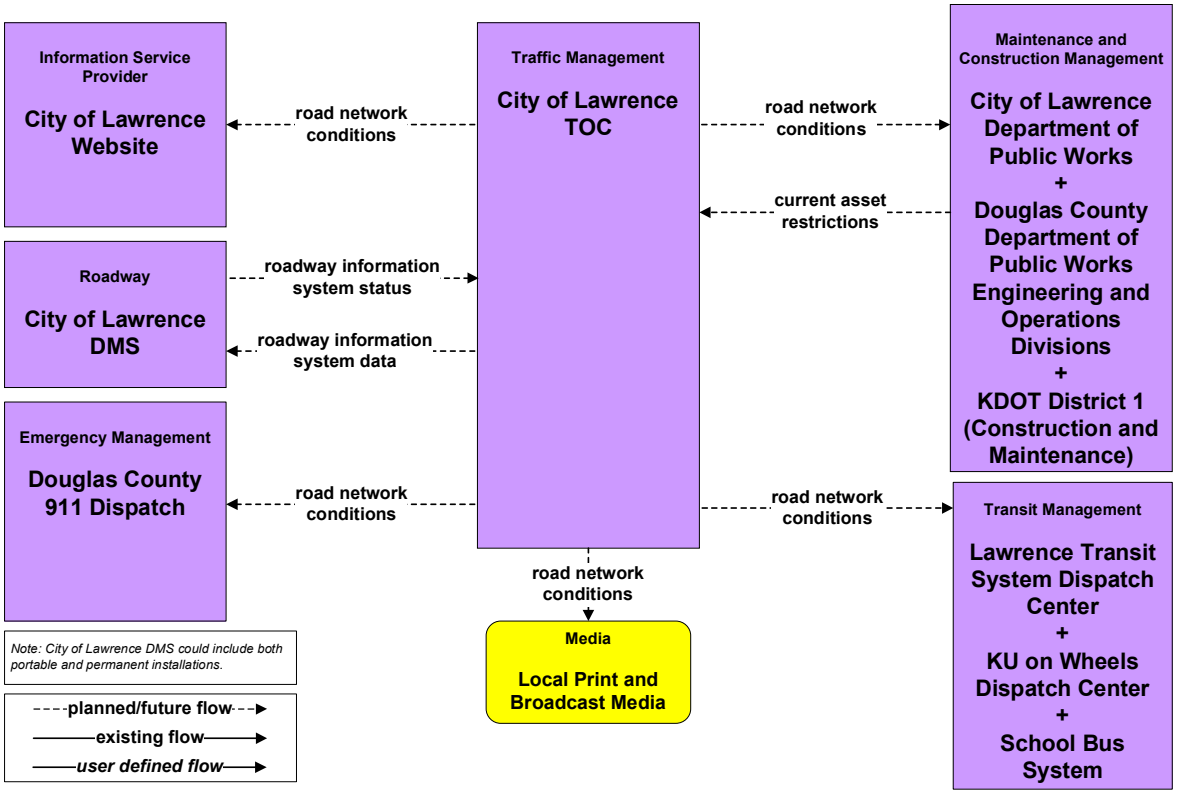


Note: The City of Lawrence will operate and maintain any future KDOT traffic signals located within the City of Lawrence.

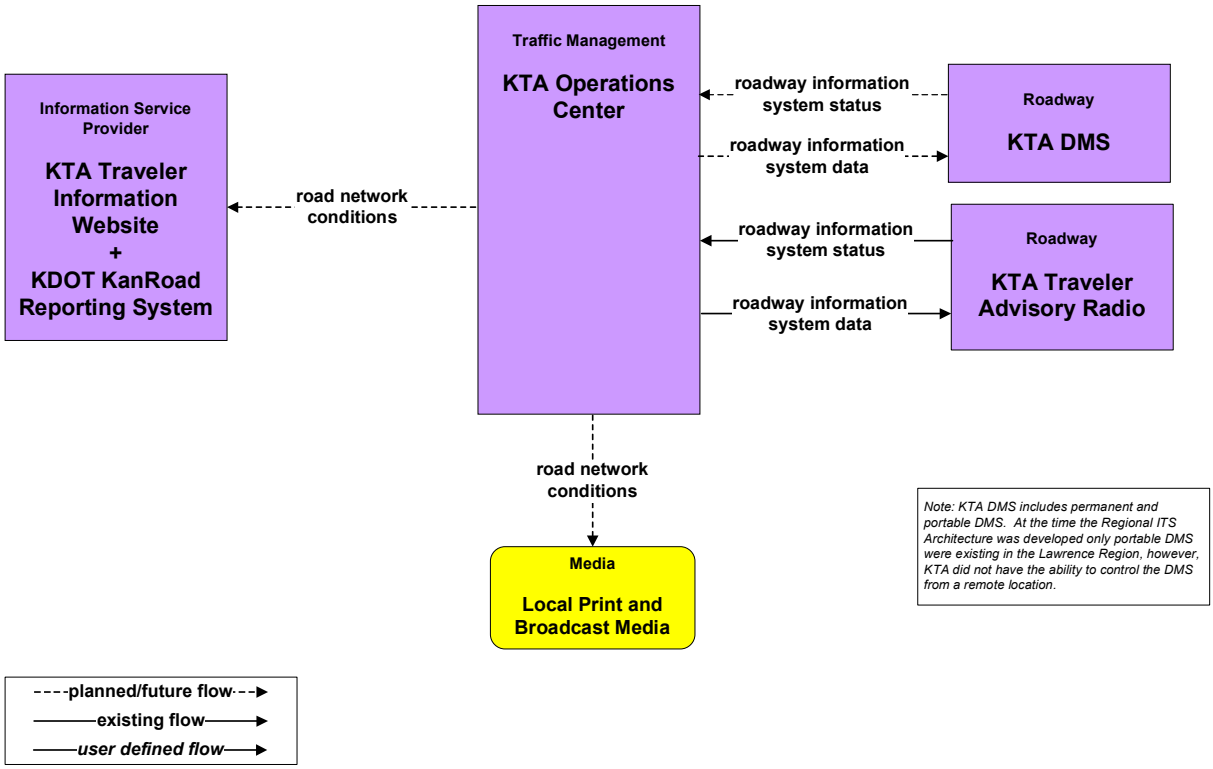
ATMS06 – Traffic Information Dissemination
KDOT District 1



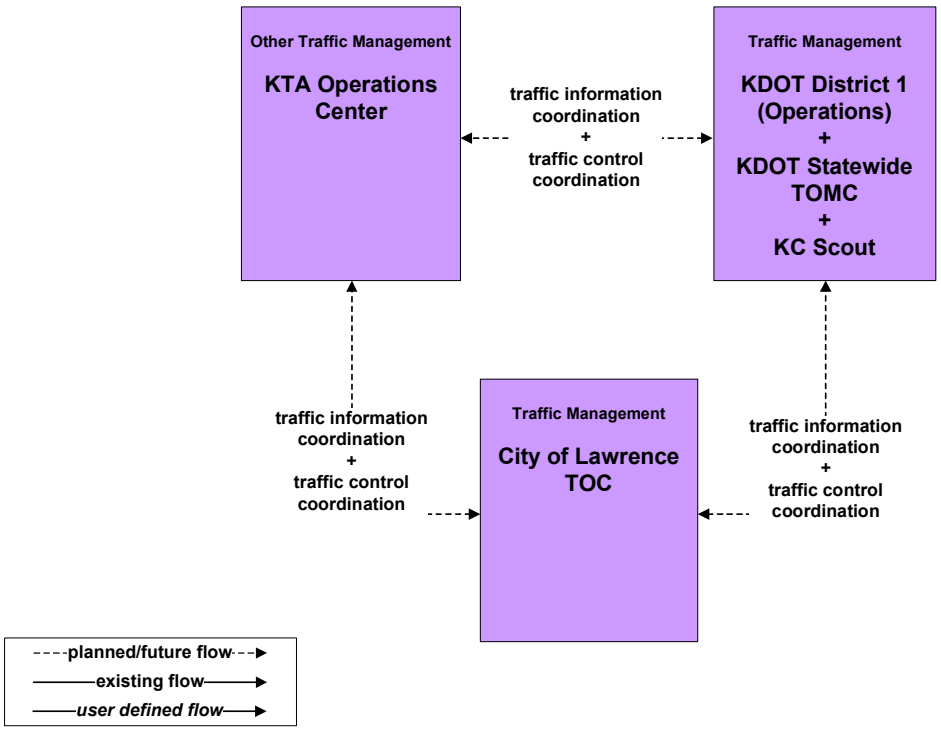
ATMS06 – Traffic Information Dissemination
City of Lawrence



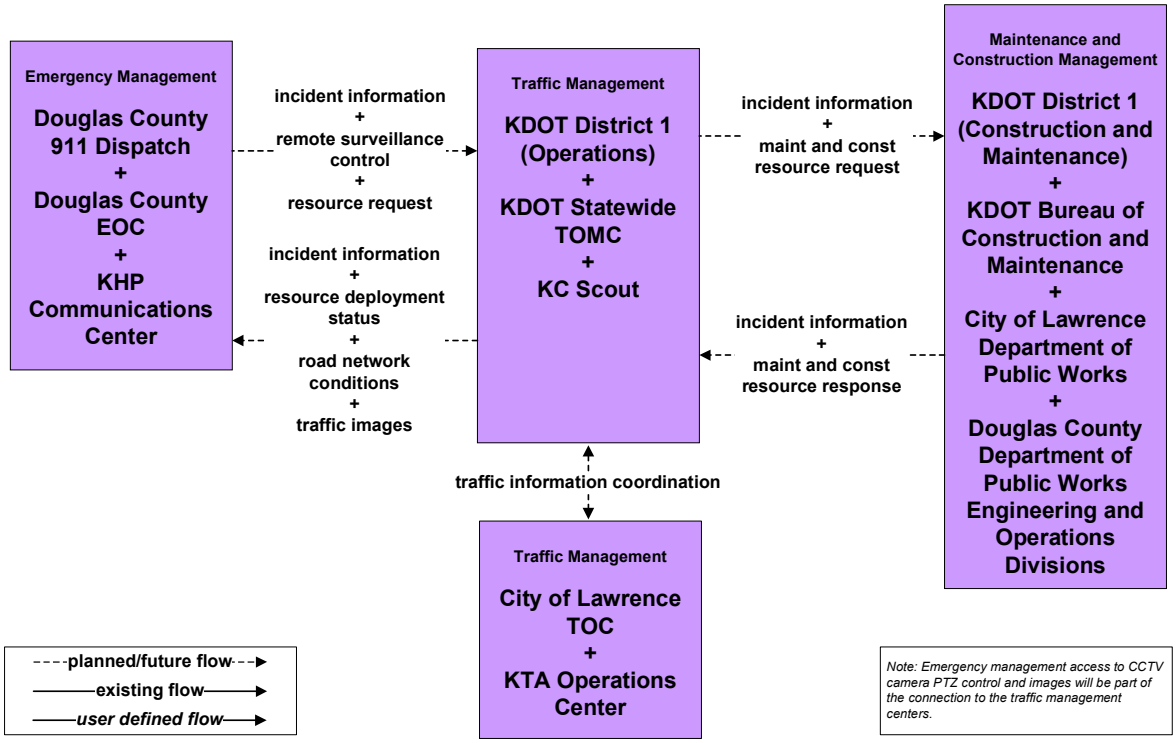
ATMS06 – Traffic Information Dissemination
KTA



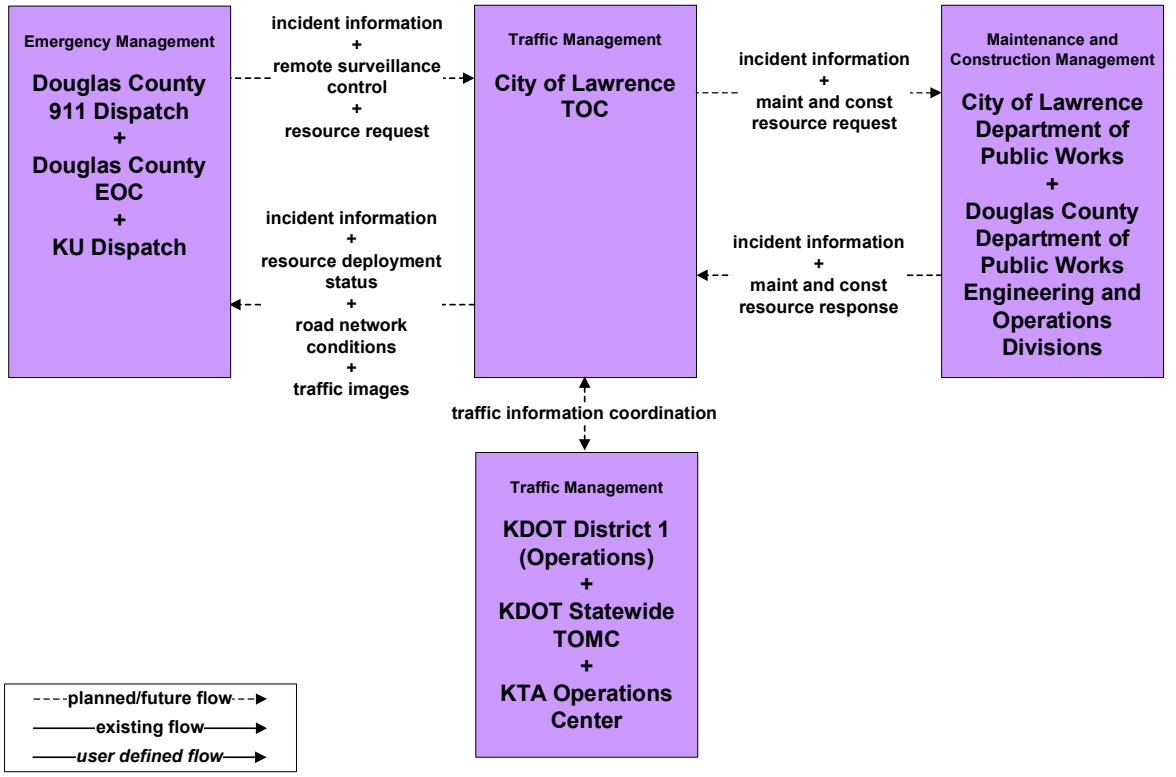
ATMS07 – Regional Traffic Control
Lawrence-Douglas County Region



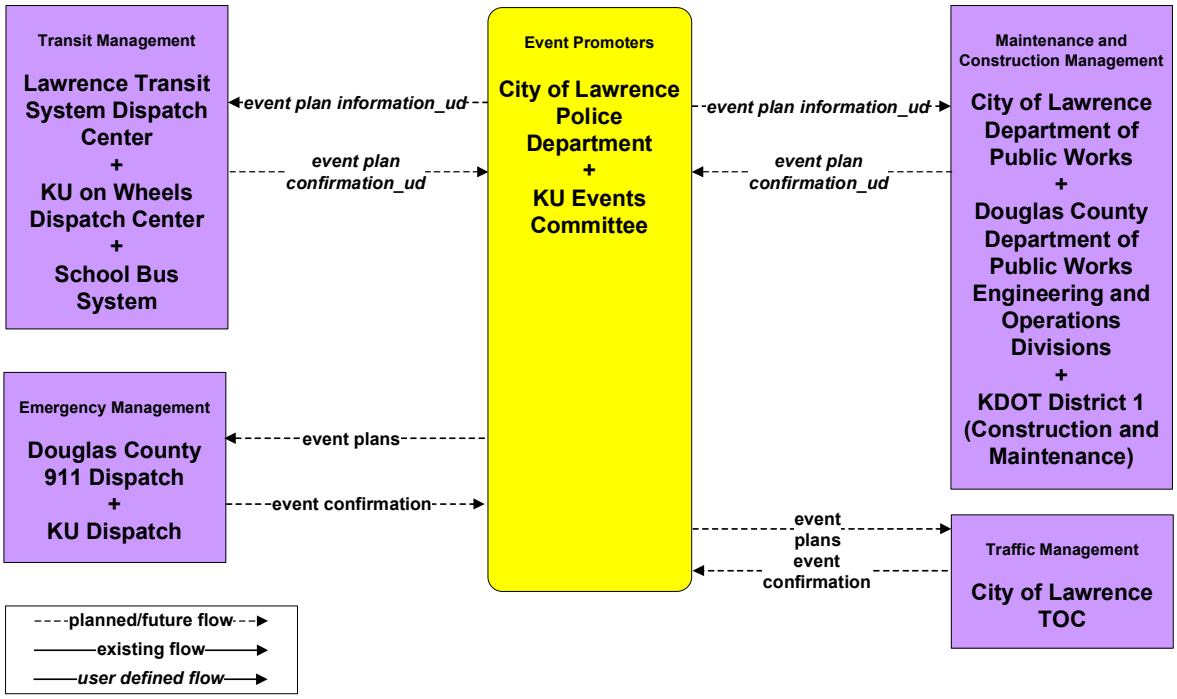
ATMS08 – Traffic Incident Management
KDOT District 1



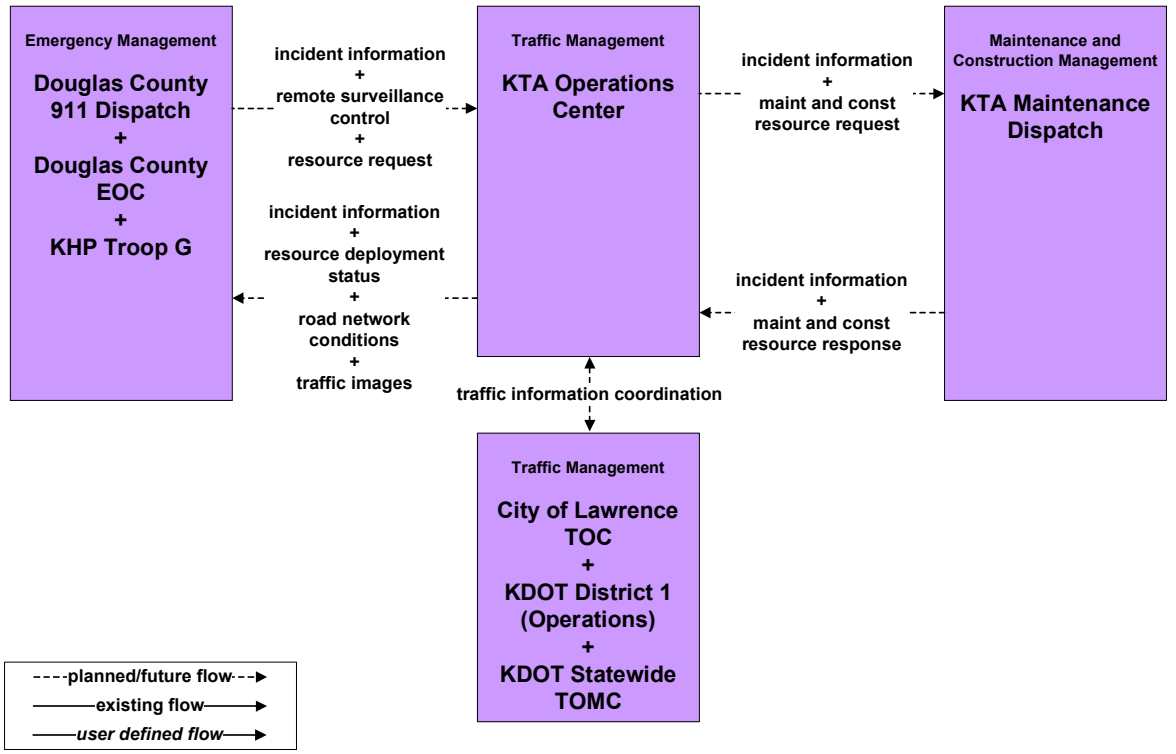
ATMS08 – Traffic Incident Management
City of Lawrence TOC



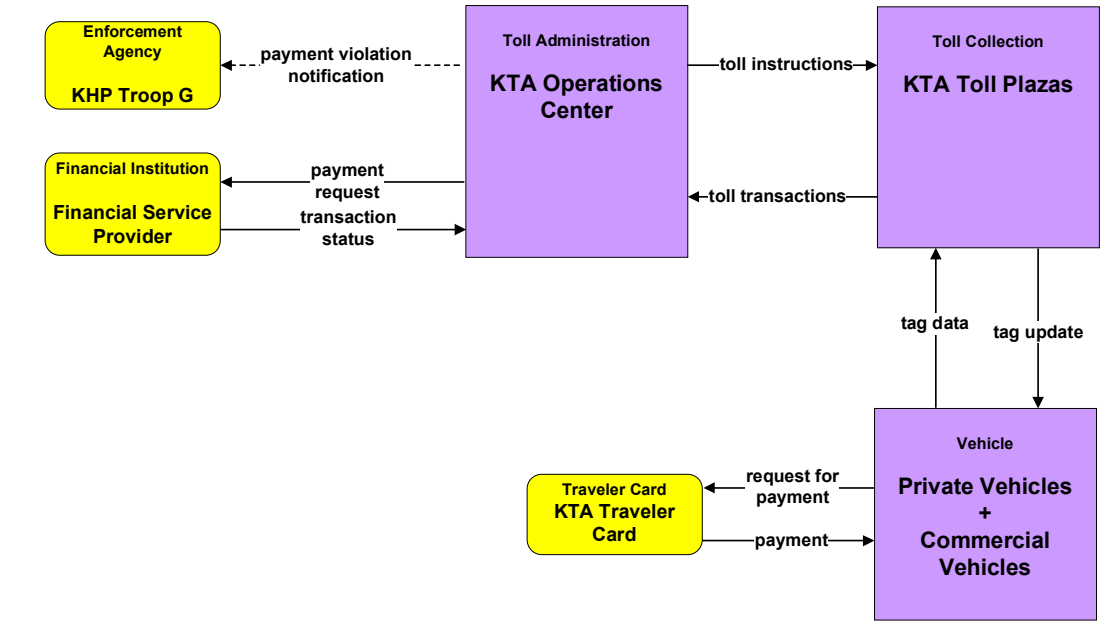
ATMS08 – Traffic Incident Management
City of Lawrence Special Event Management



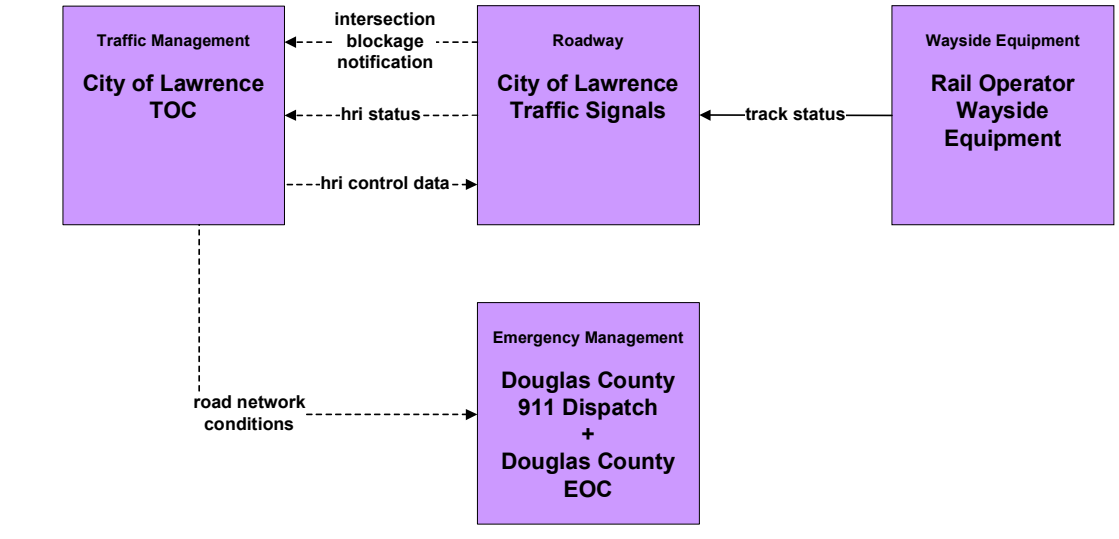
ATMS08 – Traffic Incident Management
KTA



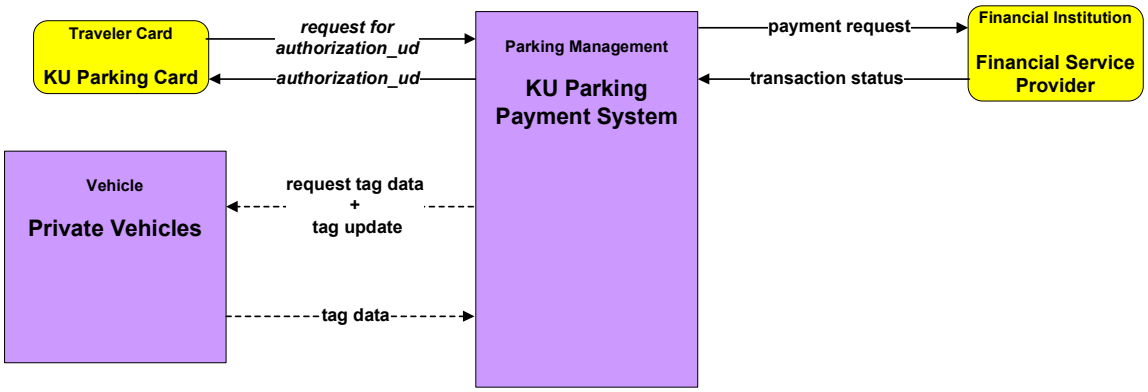
ATMS10 – Electronic Toll Collection
KTA

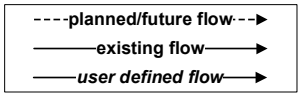


ATMS13 – Standard Railroad Grade Crossing
City of Lawrence

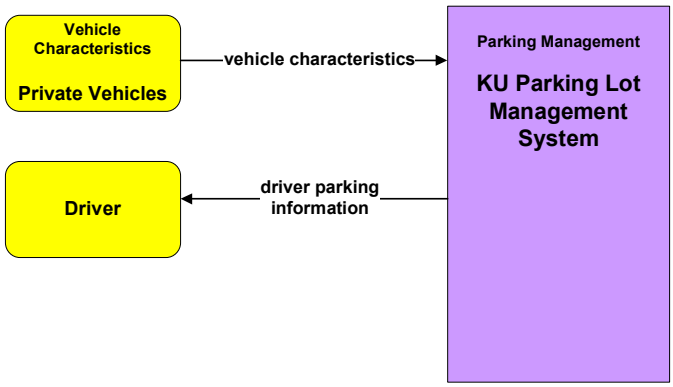


ATMS16 – Parking Facility Management
KU Parking Payment System

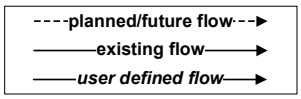




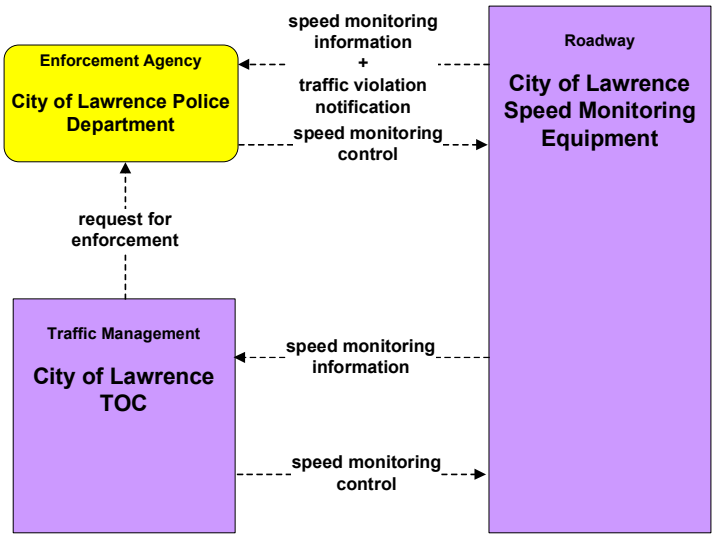
ATMS16 – Parking Facility Management
KU Parking Lot Management System

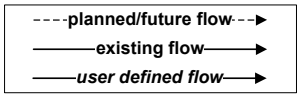


Note: The parking lot management system currently in use at the KU park and ride express lot uses counters to determine space occupancy and dynamic parking information sings to notify drivers of lot status.

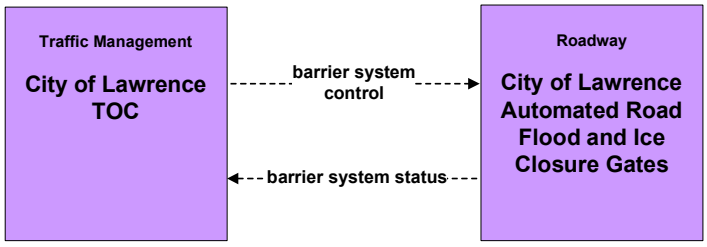


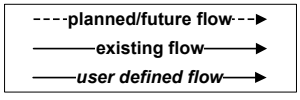
ATMS19 – Speed Monitoring
City of Lawrence





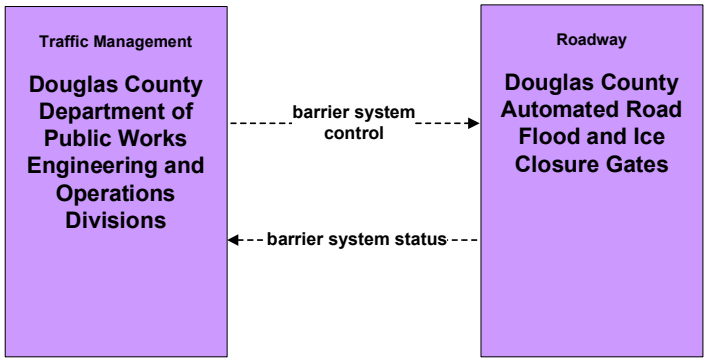
ATMS21 – Roadway Closure Management
City of Lawrence Flood and Ice Closure System





Note: See MC03 – Road Weather Data Collection market package for associated road weather data collection functions.

ATMS21 – Roadway Closure Management
Douglas County Flood and Ice Closure System

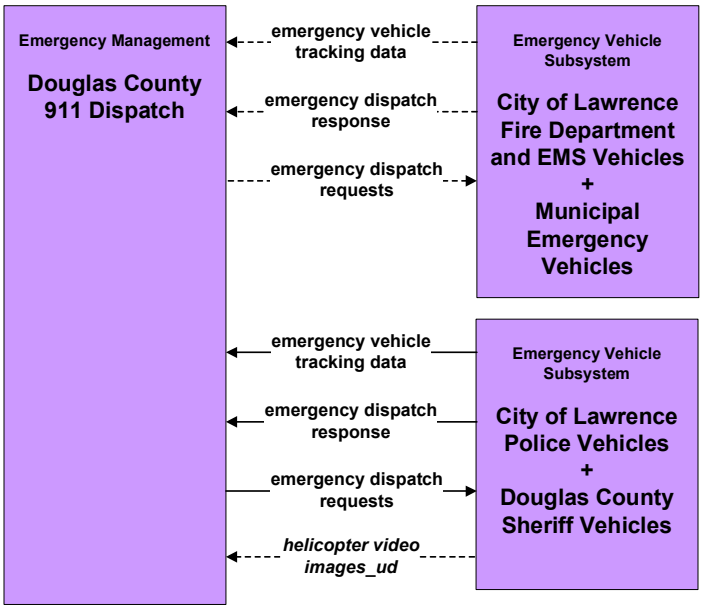


planned/future flow
existing flow
user defined flow

Note: See MC03 – Road Weather Data Collection market package for associated road weather data collection functions.

Emergency Management

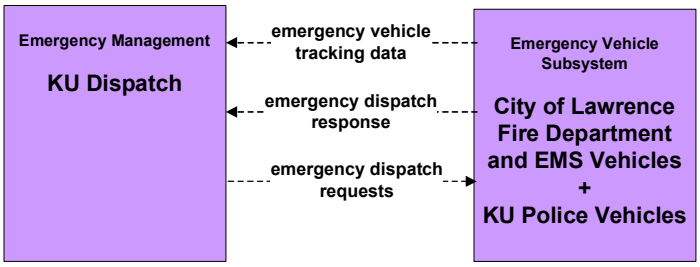
EM01 – Emergency Call-Taking and Dispatch
Douglas County 911 Dispatch



----planned/future flow--►
————existing flow————►
——*user defined flow*——►

Note: KU Dispatch is the backup call taking center for Douglas 911 Dispatch and vice versa.

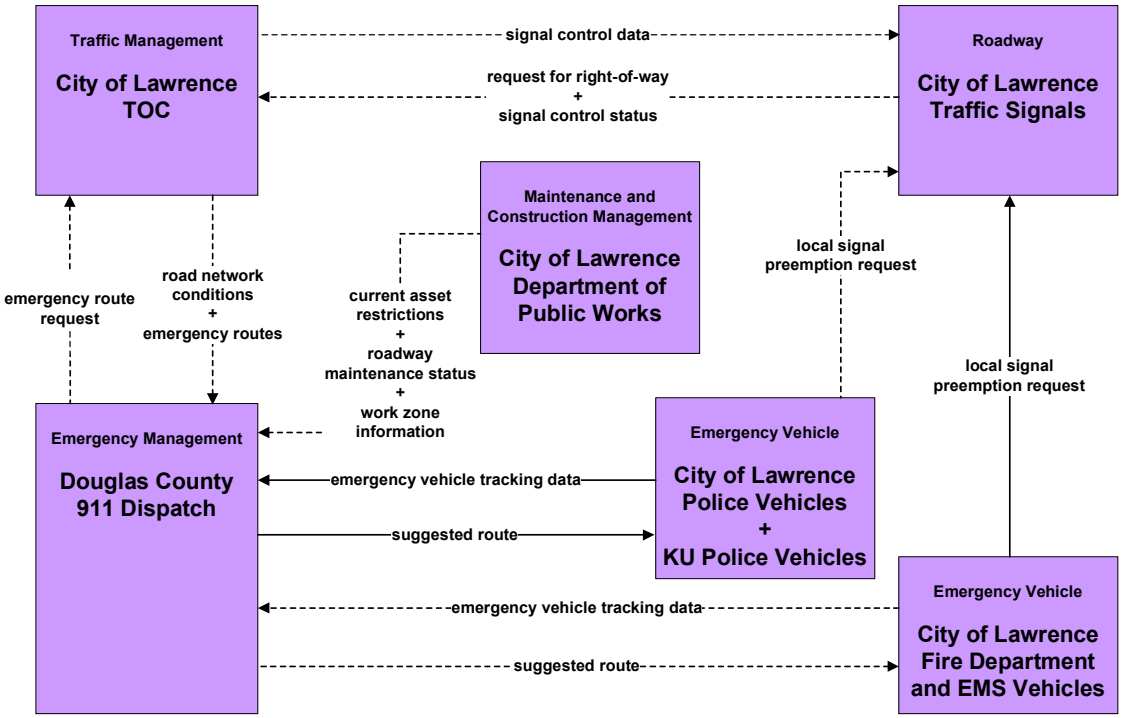
EM01 – Emergency Call-Taking and Dispatch
KU Dispatch



planned/future flow
existing flow
user defined flow

Note: Douglas County 911 Dispatch is the backup call taking center for KU Dispatch and vice versa.

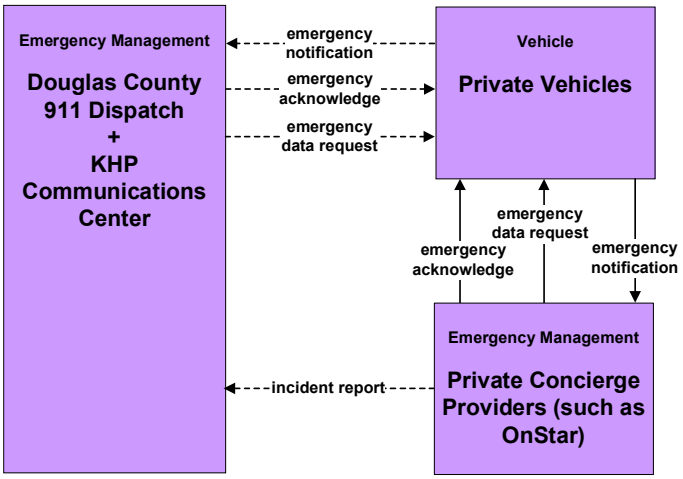
EM02 – Emergency Routing
City of Lawrence and KU

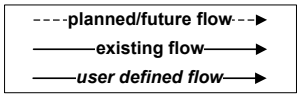


planned/future flow
existing flow
user defined flow

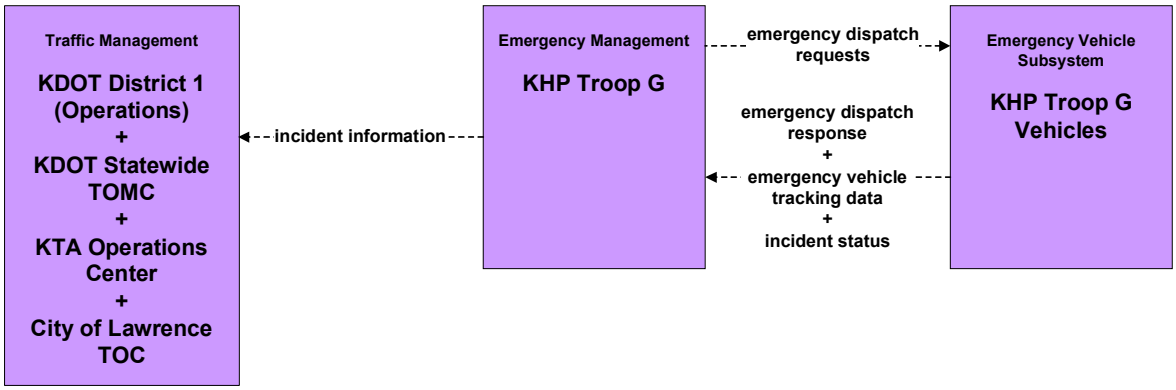
Note: Connections between emergency vehicles and Douglas County 911 Dispatch are existing for City of Lawrence Police Vehicles only.

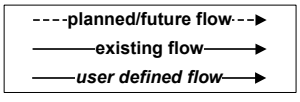
EM03 – Mayday and Alarms Support
Douglas County and KHP Public Safety

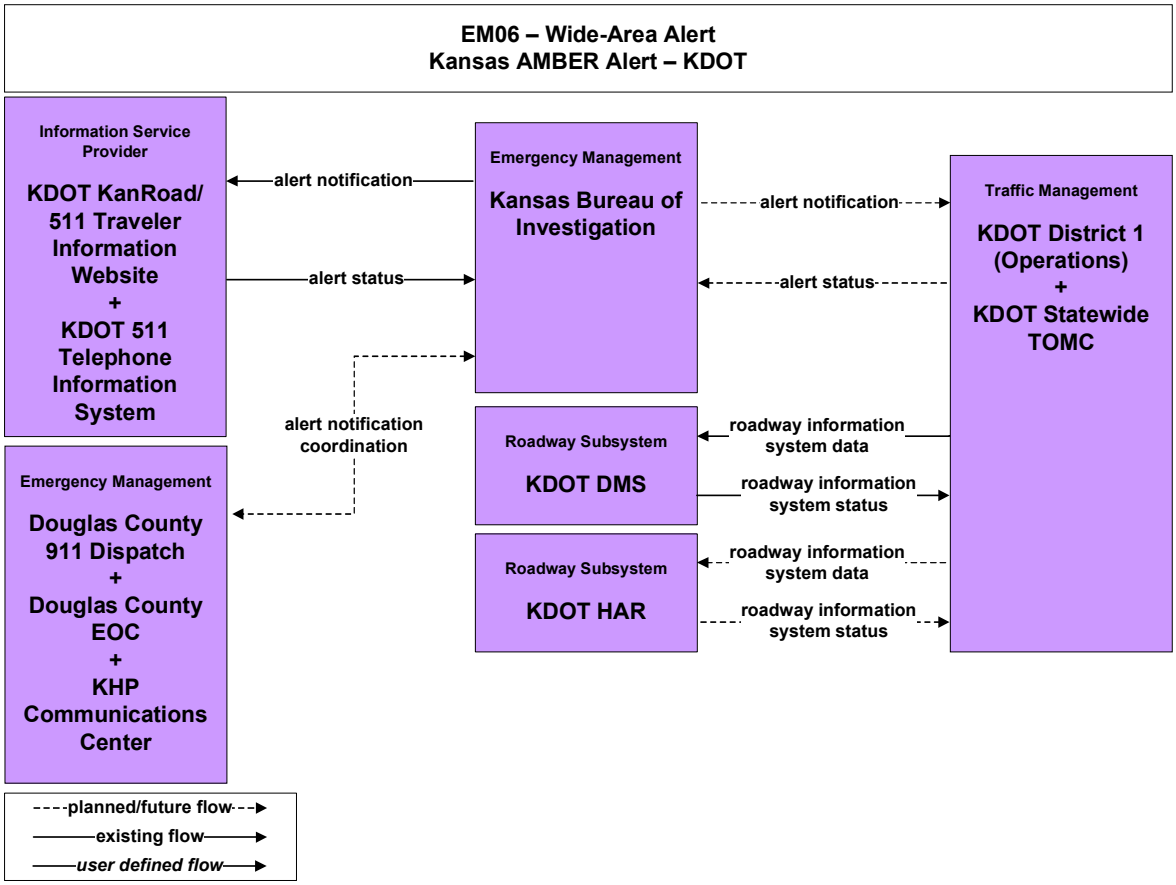


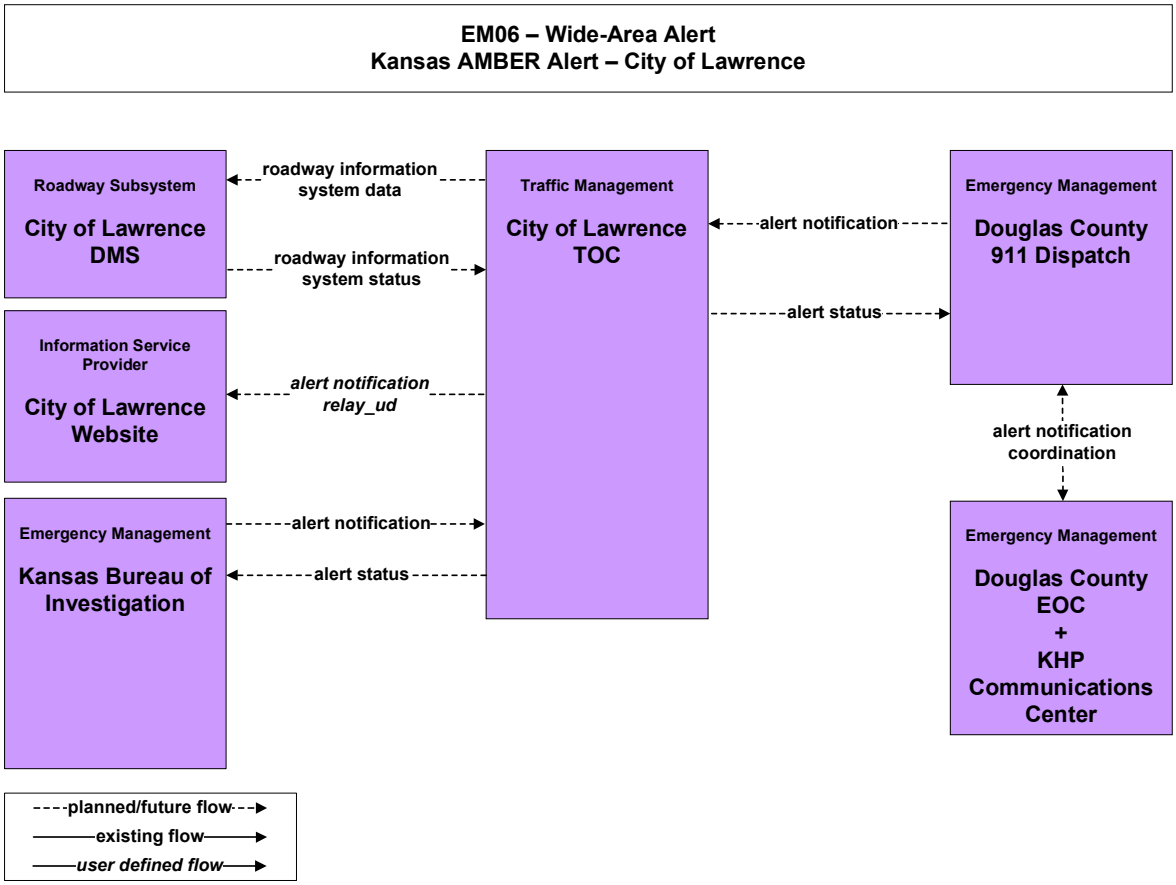


EM04 – Roadway Service Patrols
KHP Motorist Assistance

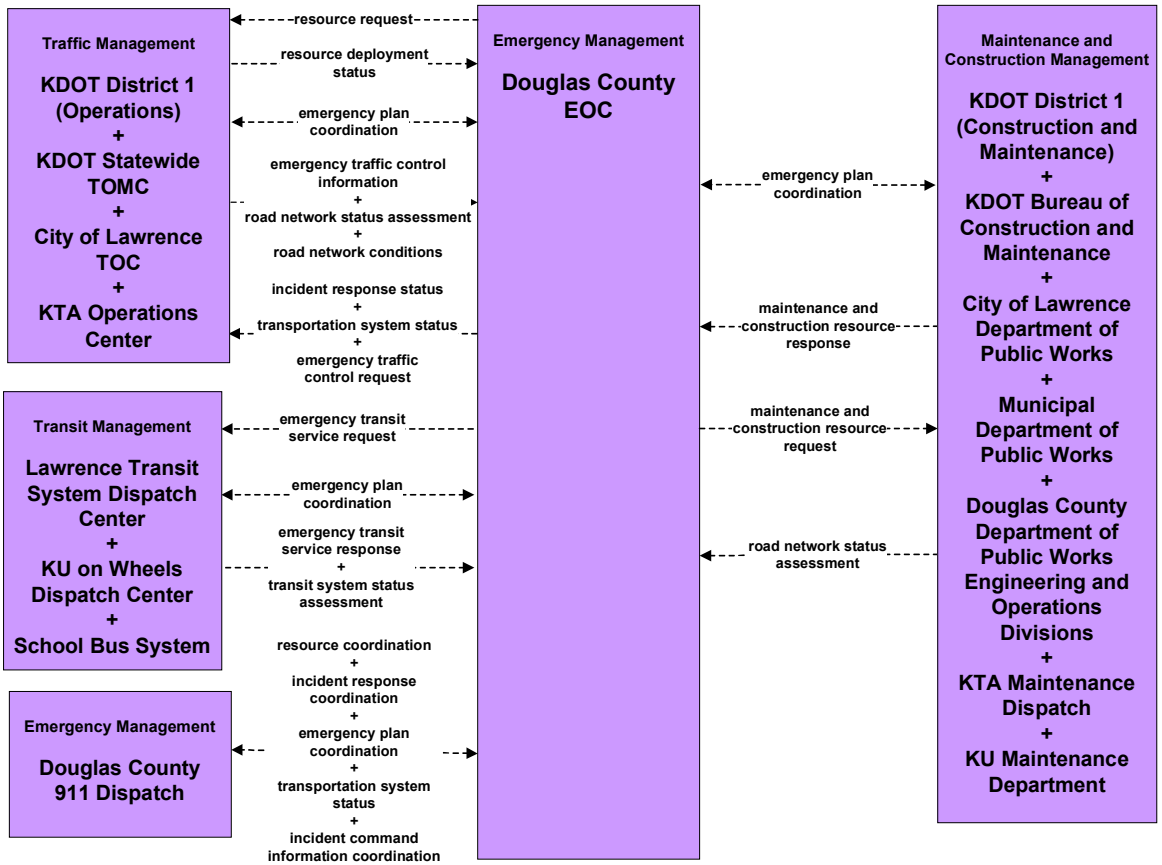




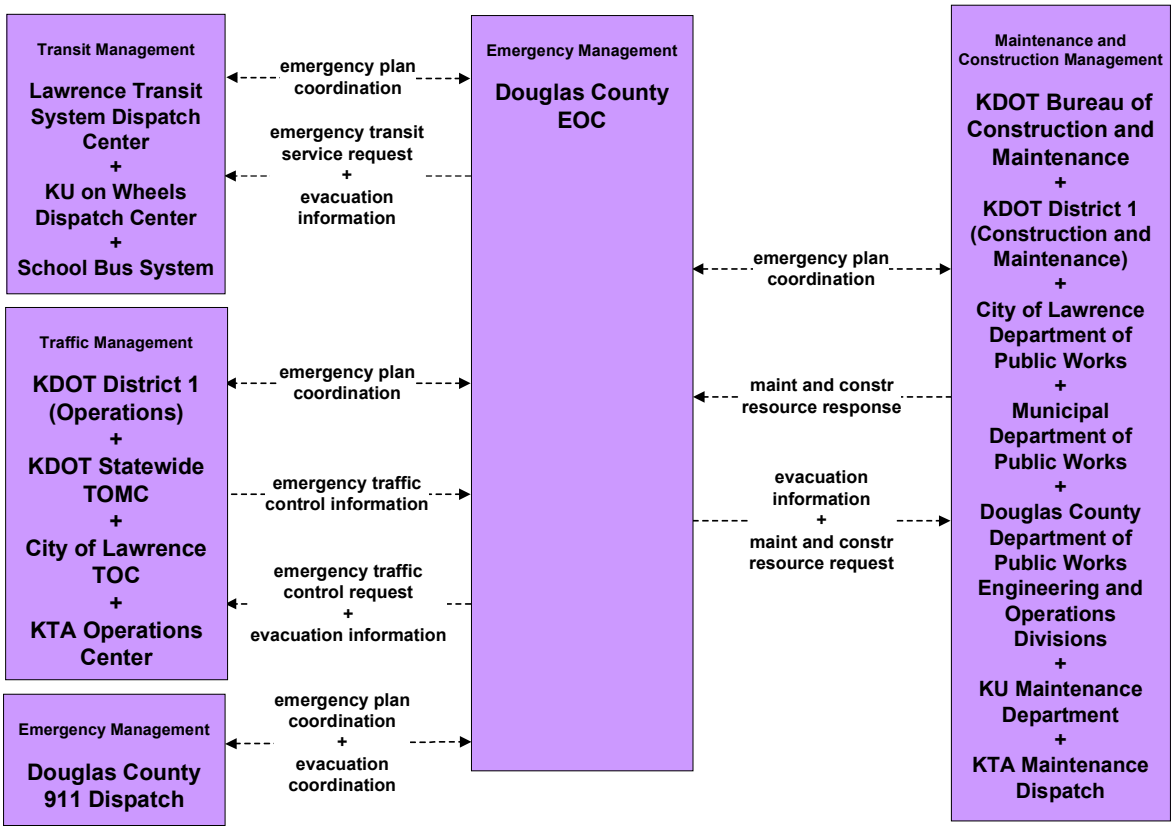

EM06 – Wide-Area Alert
Kansas AMBER Alert – KDOT
Information Service Provider
KDOT KanRoad/ 511 Traveler Information Website + KDOT 511 Telephone Information System
alert notification
alert status
Emergency Management
Kansas Bureau of Investigation
alert notification
alert status
Traffic Management
KDOT District 1 (Operations) + KDOT Statewide TOMC
alert notification coordination
Emergency Management
Douglas County 911 Dispatch + Douglas County EOC + KHP Communications Center
Roadway Subsystem
KDOT DMS
roadway information system data
roadway information system status
Roadway Subsystem
KDOT HAR
roadway information system data
roadway information system status
planned/future flow
existing flow
user defined flow


EM06 – Wide-Area Alert
Kansas AMBER Alert – City of Lawrence
Roadway Subsystem
City of Lawrence DMS
roadway information system data
roadway information system status
Traffic Management
City of Lawrence TOC
alert notification
alert status
Emergency Management
Douglas County 911 Dispatch
Information Service Provider
City of Lawrence Website
alert notification relay_ud
alert notification coordination
Emergency Management
Kansas Bureau of Investigation
alert notification
alert status
Emergency Management
Douglas County EOC + KHP Communications Center
planned/future flow
existing flow
user defined flow

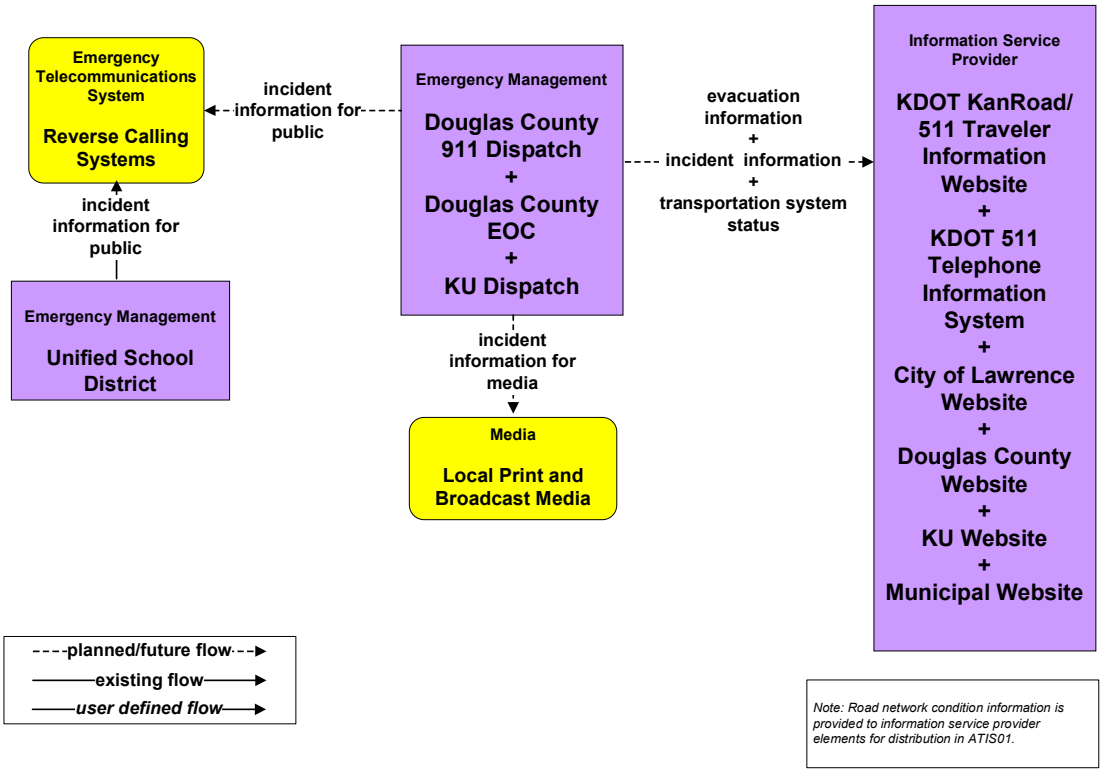
EM08 – Disaster Response and Recovery
Douglas County EOC



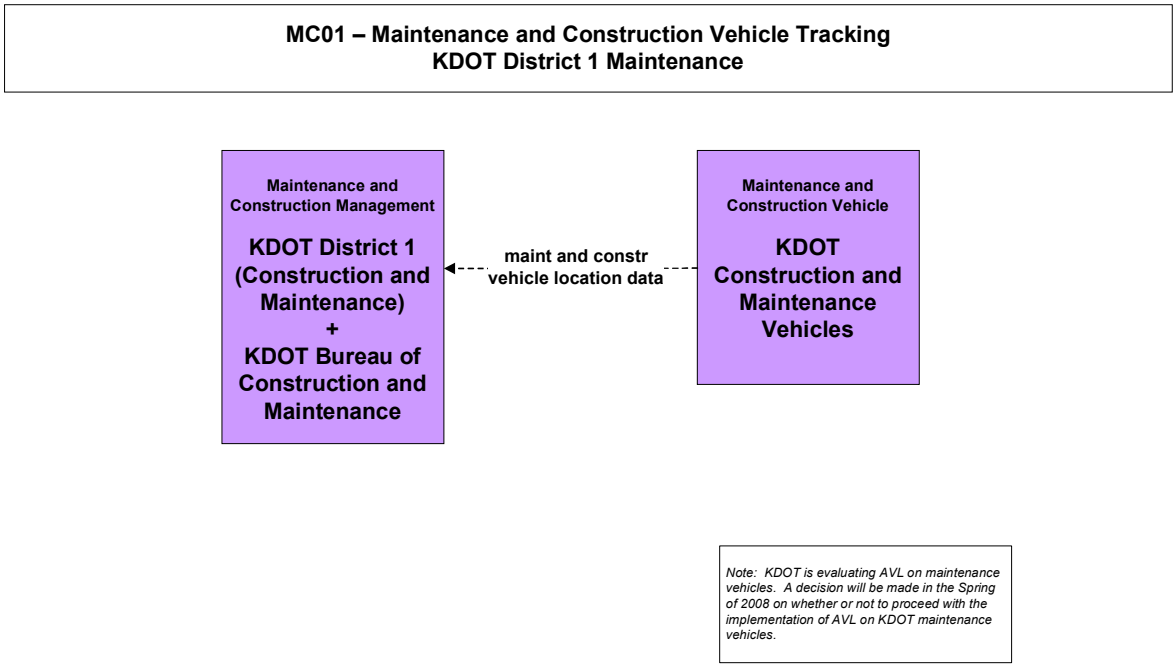
EM09 – Evacuation and Reentry Management
Douglas County EOC



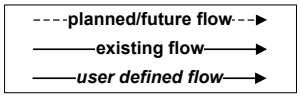
EM10 – Disaster Traveler Information



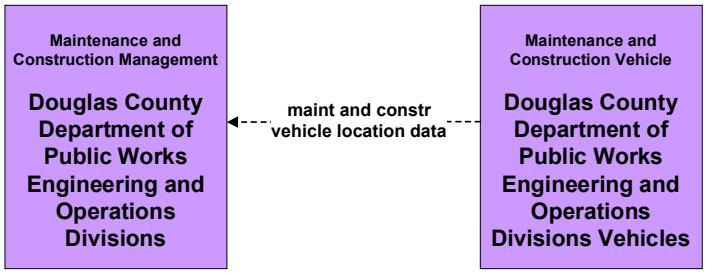
Maintenance and Construction Management

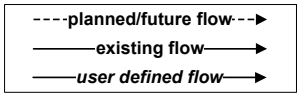


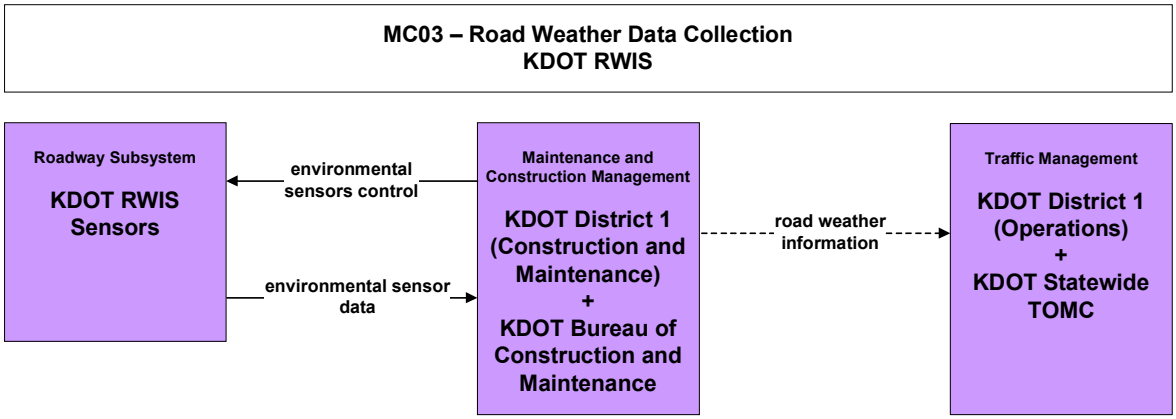
MC01 – Maintenance and Construction Vehicle Tracking
City of Lawrence

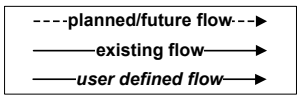


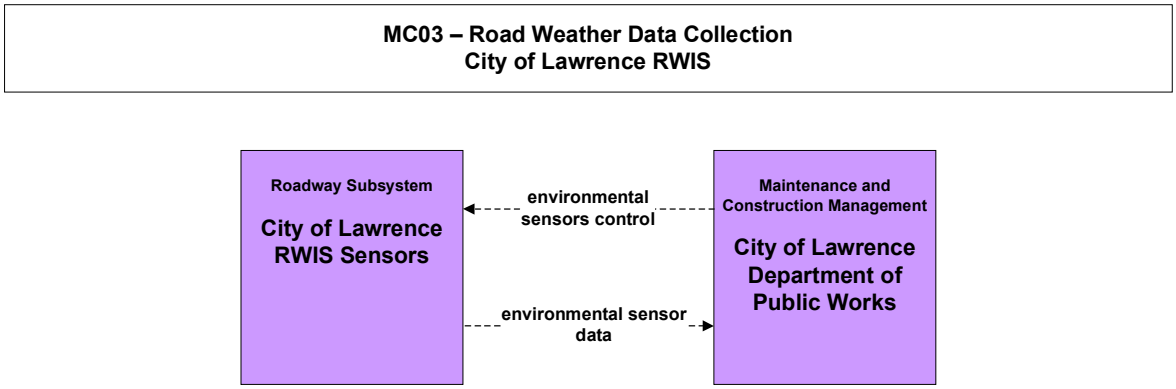
MC01 – Maintenance and Construction Vehicle Tracking
Douglas County

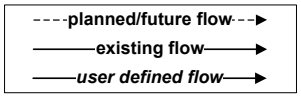




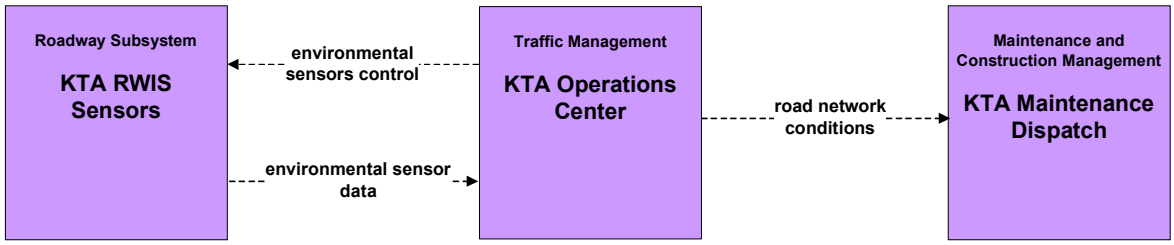

MC03 – Road Weather Data Collection
KDOT RWIS
Roadway Subsystem
KDOT RWIS Sensors
environmental sensors control
environmental sensor data
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance) + KDOT Bureau of Construction and Maintenance
road weather information
Traffic Management
KDOT District 1 (Operations) + KDOT Statewide TOMC

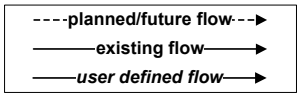

planned/future flow
existing flow
user defined flow


MC03 – Road Weather Data Collection
City of Lawrence RWIS
Roadway Subsystem
City of Lawrence RWIS Sensors
environmental sensors control
environmental sensor data
Maintenance and Construction Management
City of Lawrence Department of Public Works

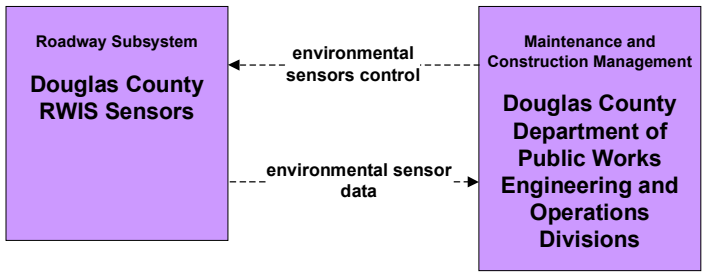

planned/future flow
existing flow
user defined flow

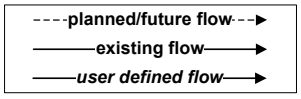
MC03 – Road Weather Data Collection
KTA RWIS Sensors

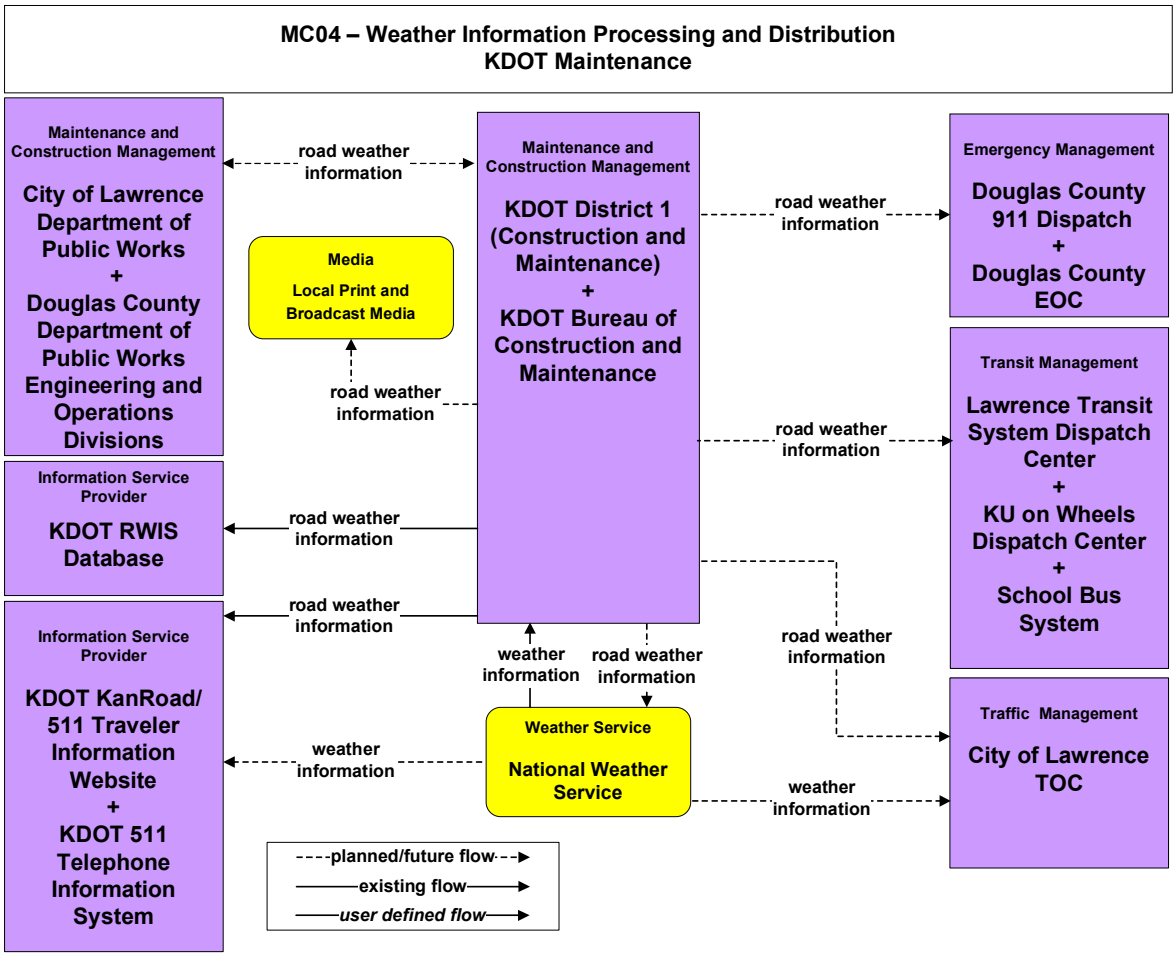


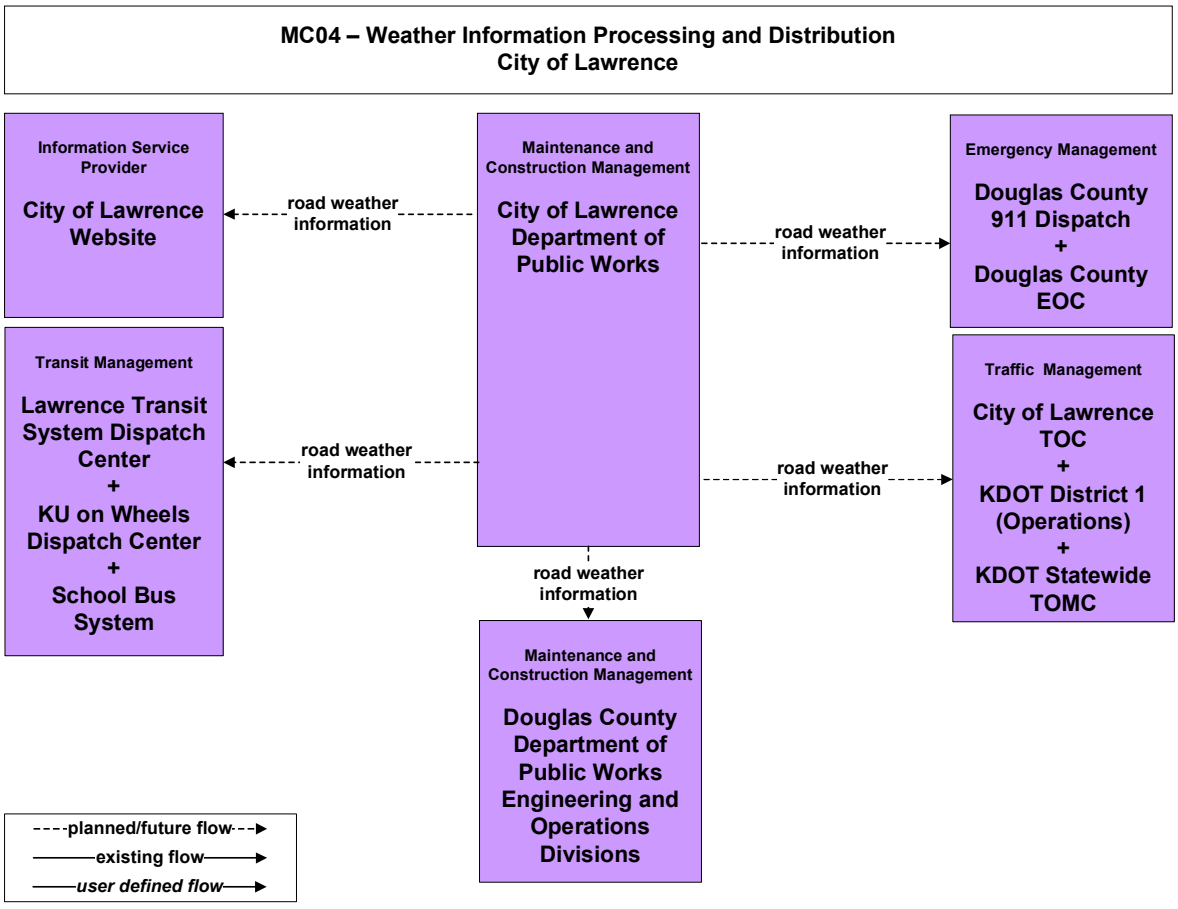


MC03 – Road Weather Data Collection
Douglas County Flood and Ice Detection

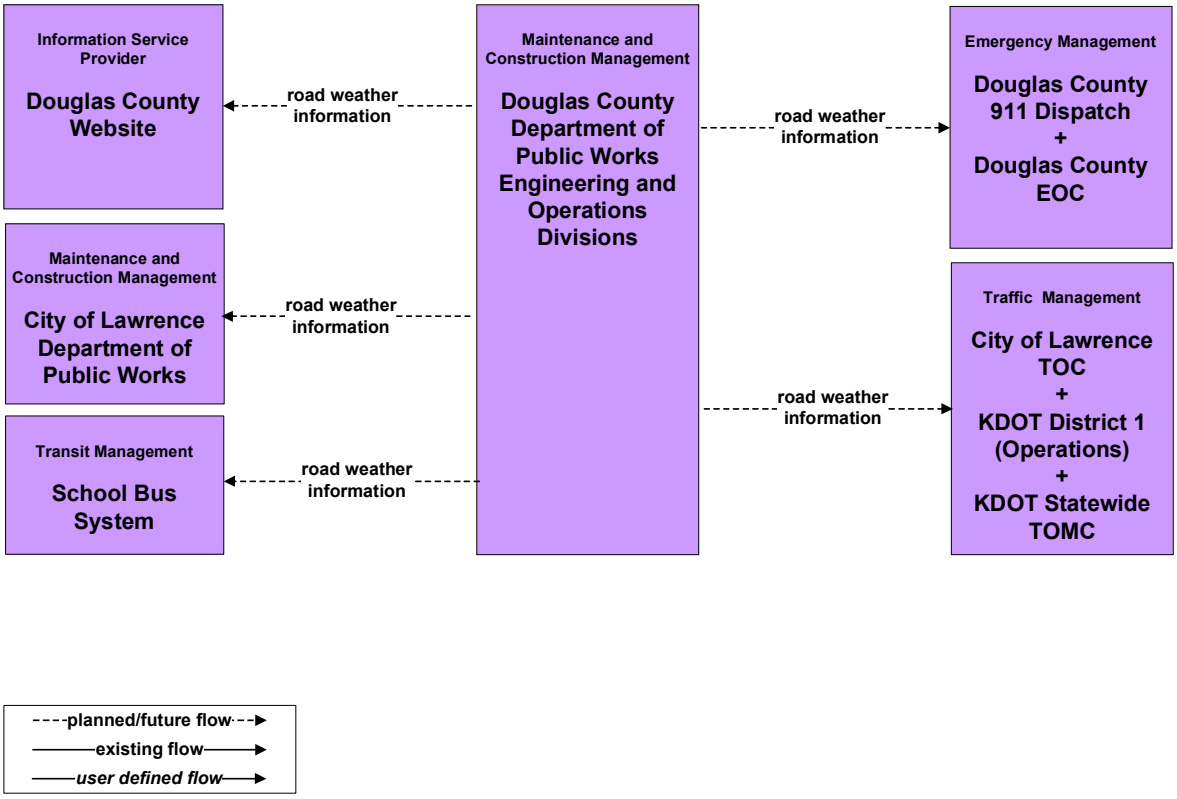




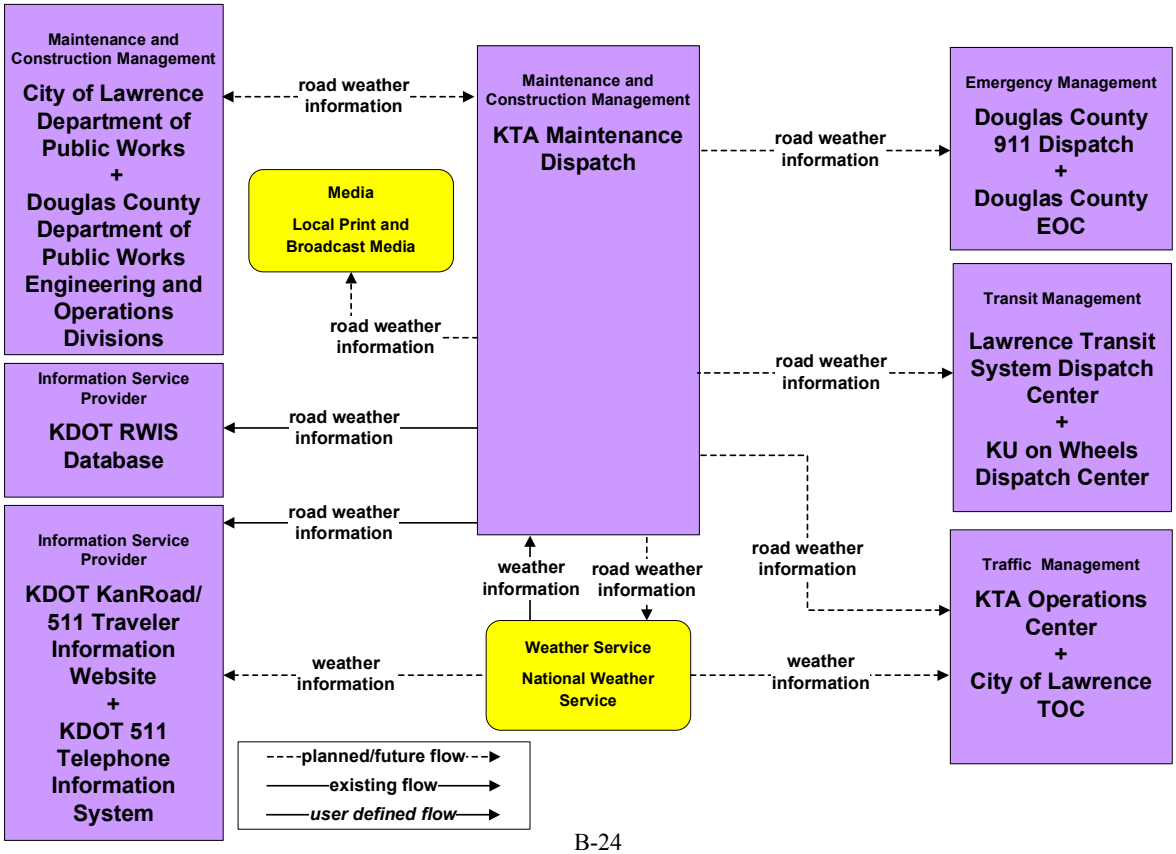

MC04 – Weather Information Processing and Distribution
KDOT Maintenance
Maintenance and Construction Management
City of Lawrence Department of Public Works
+
Douglas County Department of Public Works Engineering and Operations Divisions
road weather information
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance)
+
KDOT Bureau of Construction and Maintenance
Emergency Management
Douglas County 911 Dispatch
+
Douglas County EOC
Media
Local Print and Broadcast Media
road weather information
Transit Management
Lawrence Transit System Dispatch Center
+
KU on Wheels Dispatch Center
+
School Bus System
Information Service Provider
KDOT RWIS Database
Information Service Provider
KDOT KanRoad/ 511 Traveler Information Website
+
KDOT 511 Telephone Information System
weather information
Weather Service
National Weather Service
Traffic Management
City of Lawrence TOC
planned/future flow
existing flow
user defined flow


MC04 – Weather Information Processing and Distribution
City of Lawrence
Information Service Provider
City of Lawrence Website
road weather information
Maintenance and Construction Management
City of Lawrence Department of Public Works
Emergency Management
Douglas County 911 Dispatch
+
Douglas County EOC
Transit Management
Lawrence Transit System Dispatch Center
+
KU on Wheels Dispatch Center
+
School Bus System
Traffic Management
City of Lawrence TOC
+
KDOT District 1 (Operations)
+
KDOT Statewide TOMC
Maintenance and Construction Management
Douglas County Department of Public Works Engineering and Operations Divisions
planned/future flow
existing flow
user defined flow

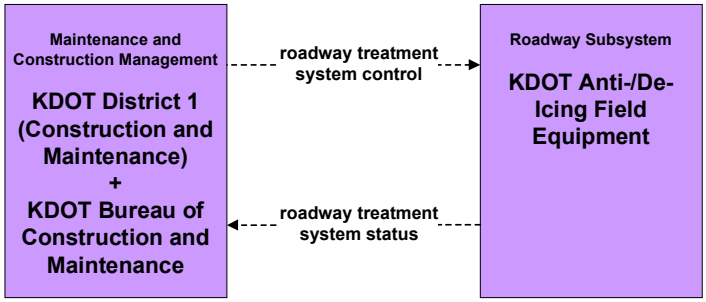
MC04 – Weather Information Processing and Distribution
Douglas County

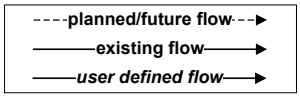


MC04 – Weather Information Processing and Distribution
KTA

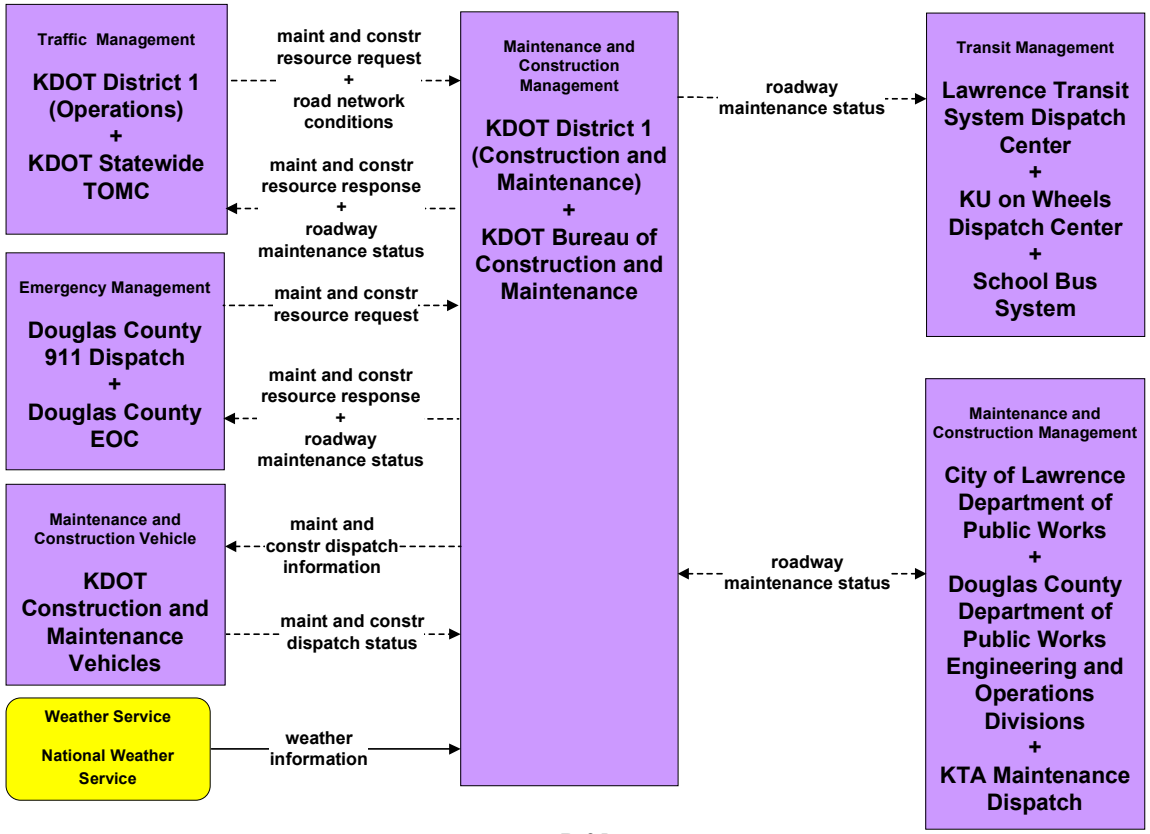


MC05 – Roadway Automated Treatment
KDOT

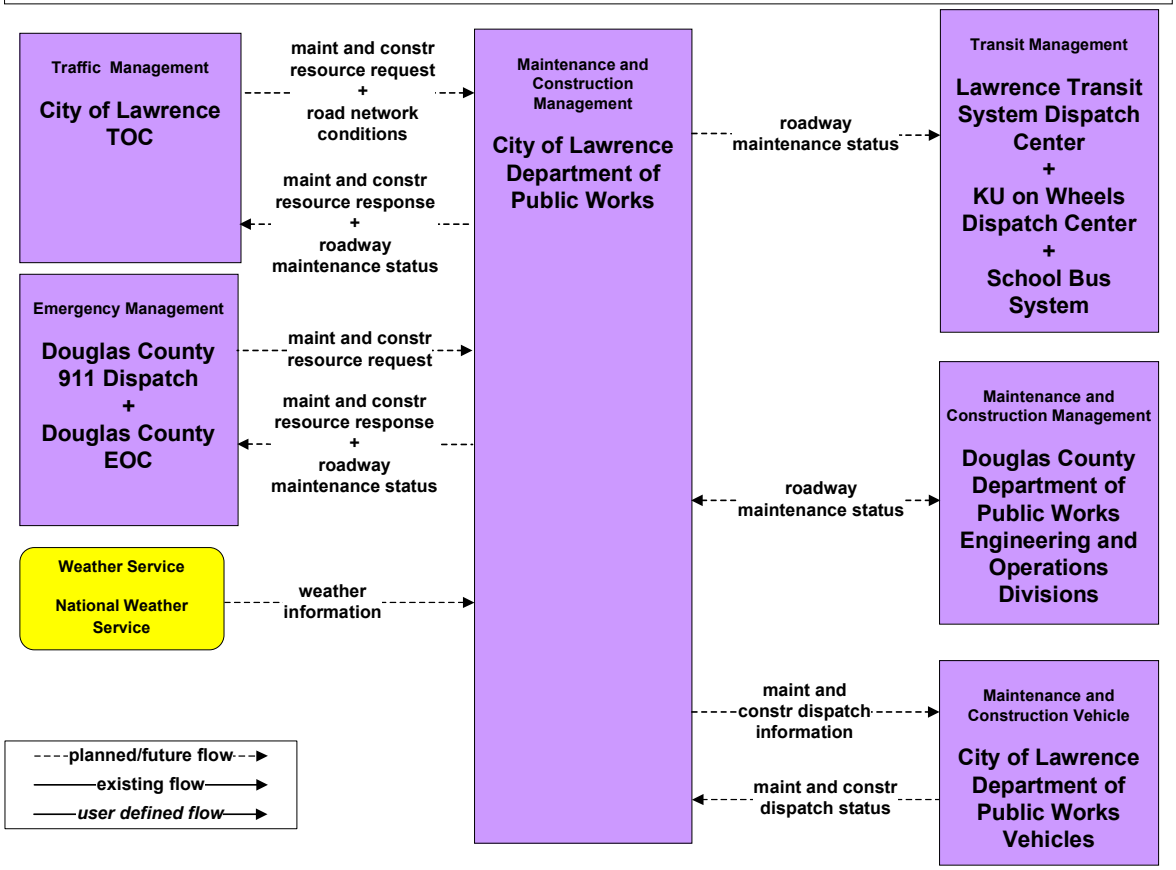




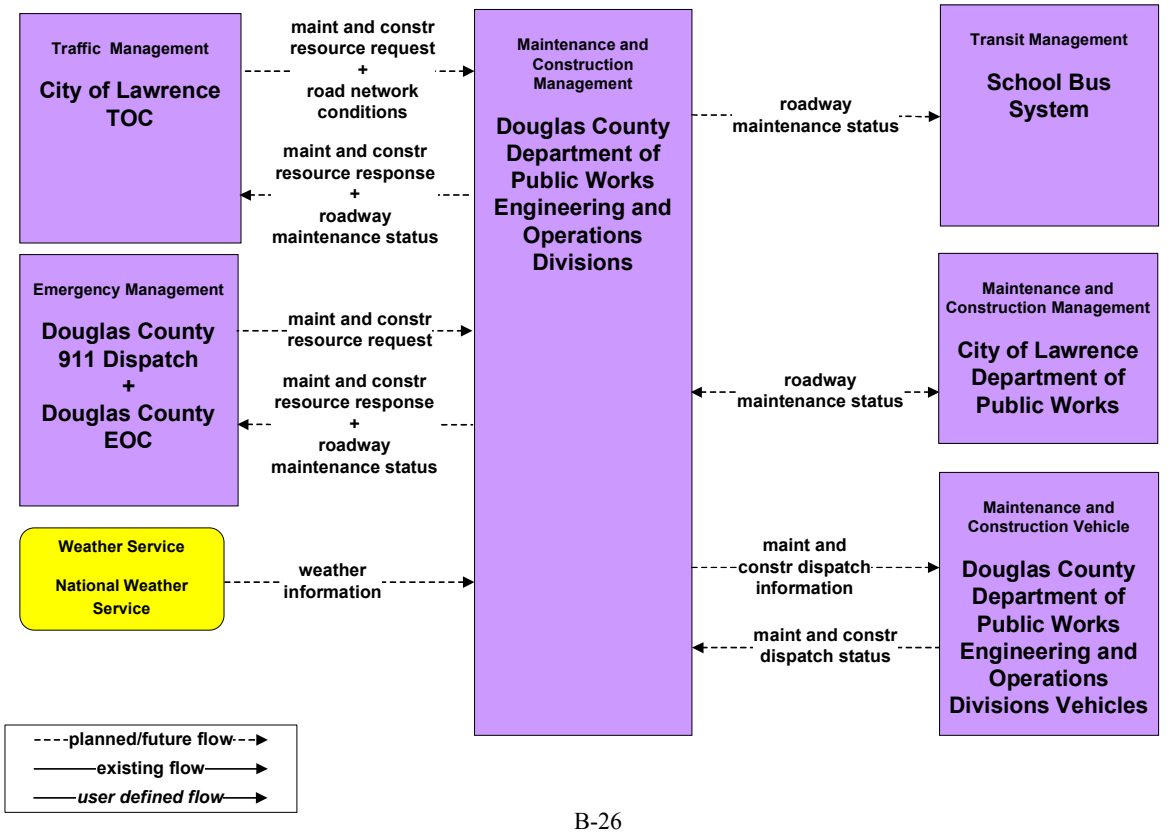
MC06 – Winter Maintenance
KDOT



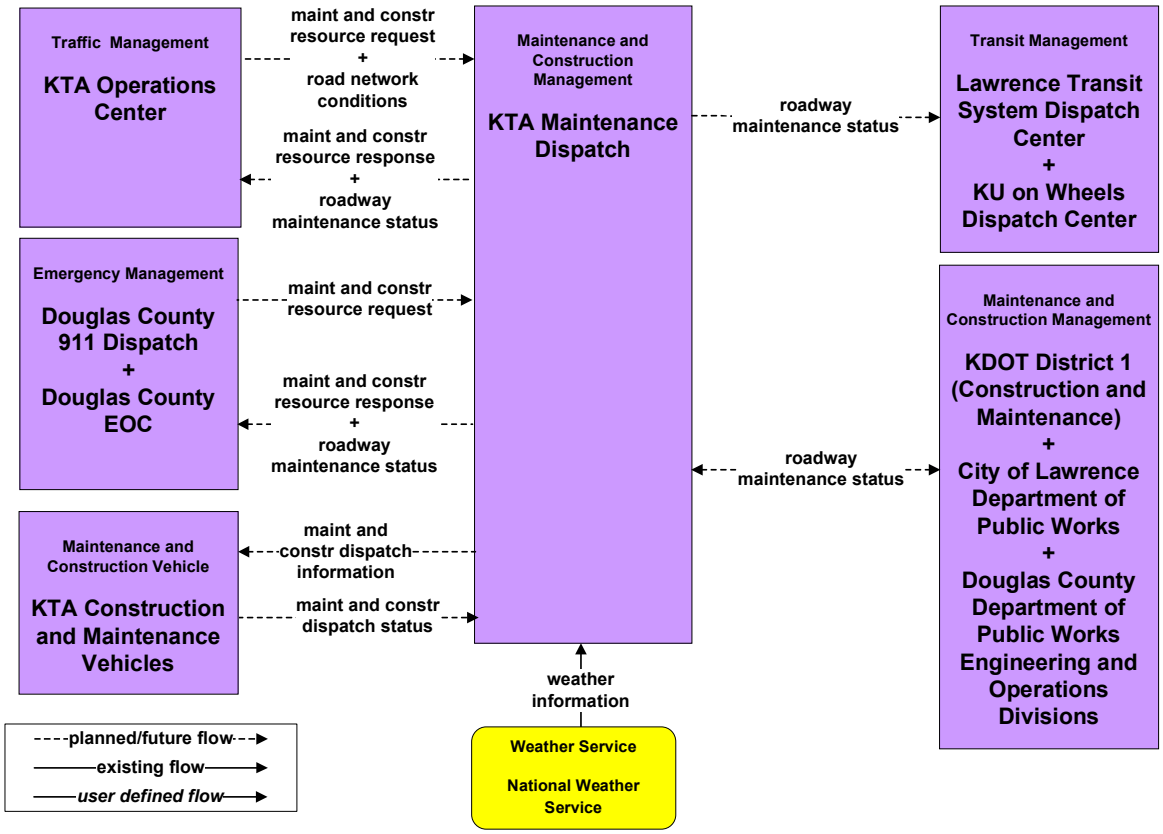
MC06 – Winter Maintenance
City of Lawrence



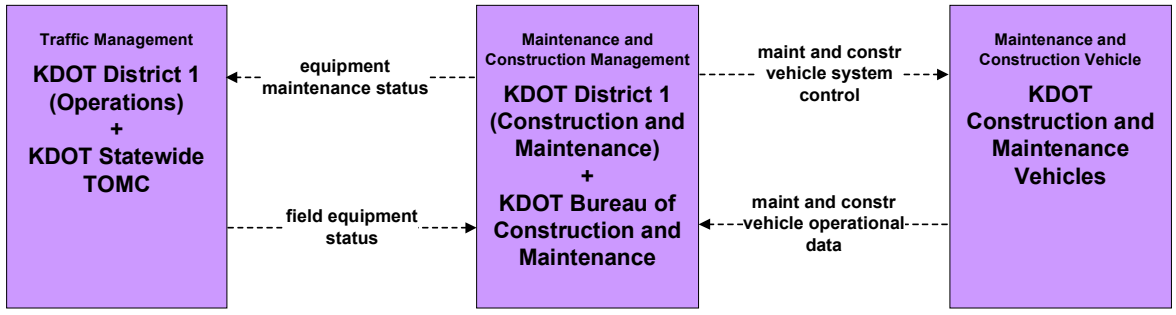
MC06 – Winter Maintenance
Douglas County

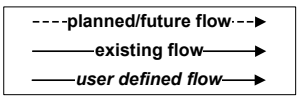


MC06 – Winter Maintenance
KTA

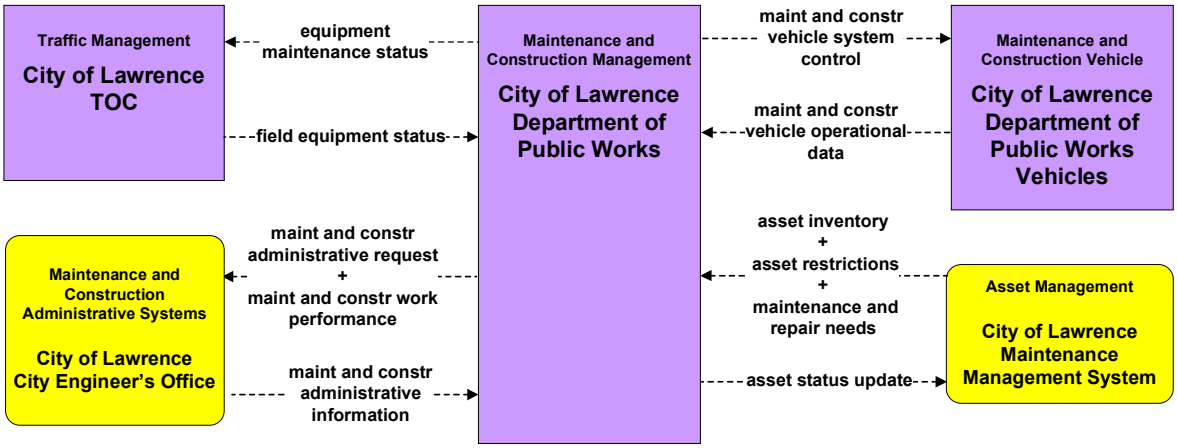


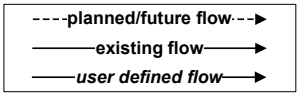
MC07 – Roadway Maintenance and Construction
KDOT



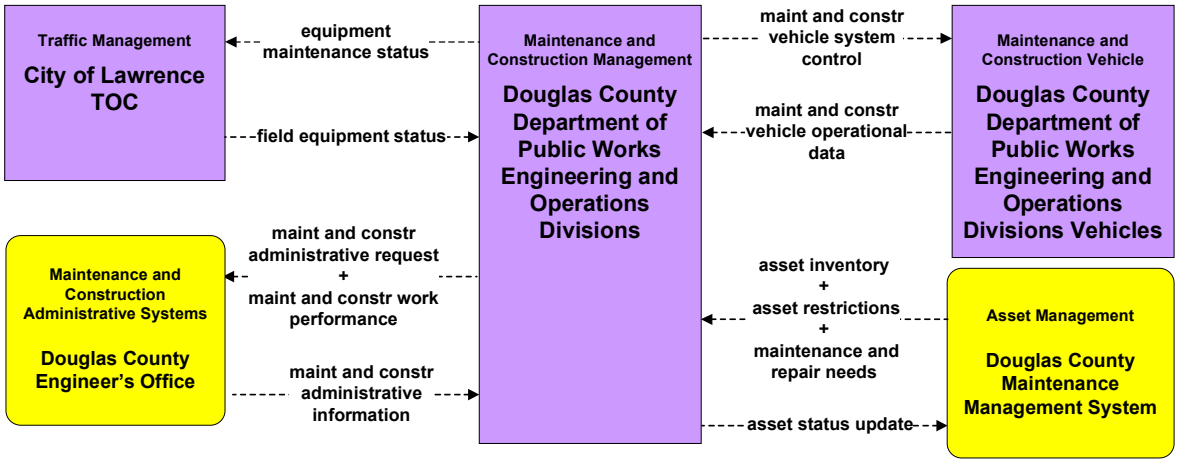


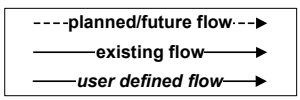
MC07 – Roadway Maintenance and Construction
City of Lawrence

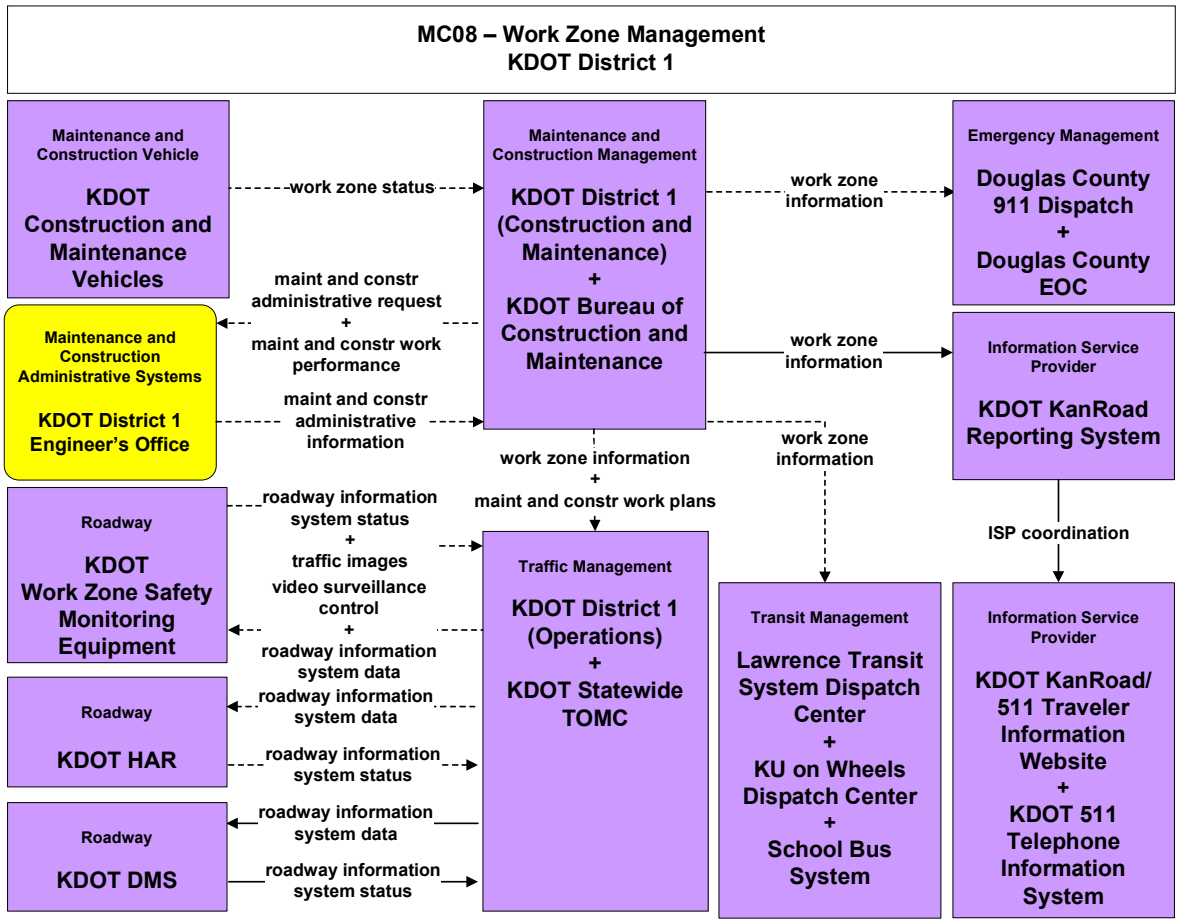


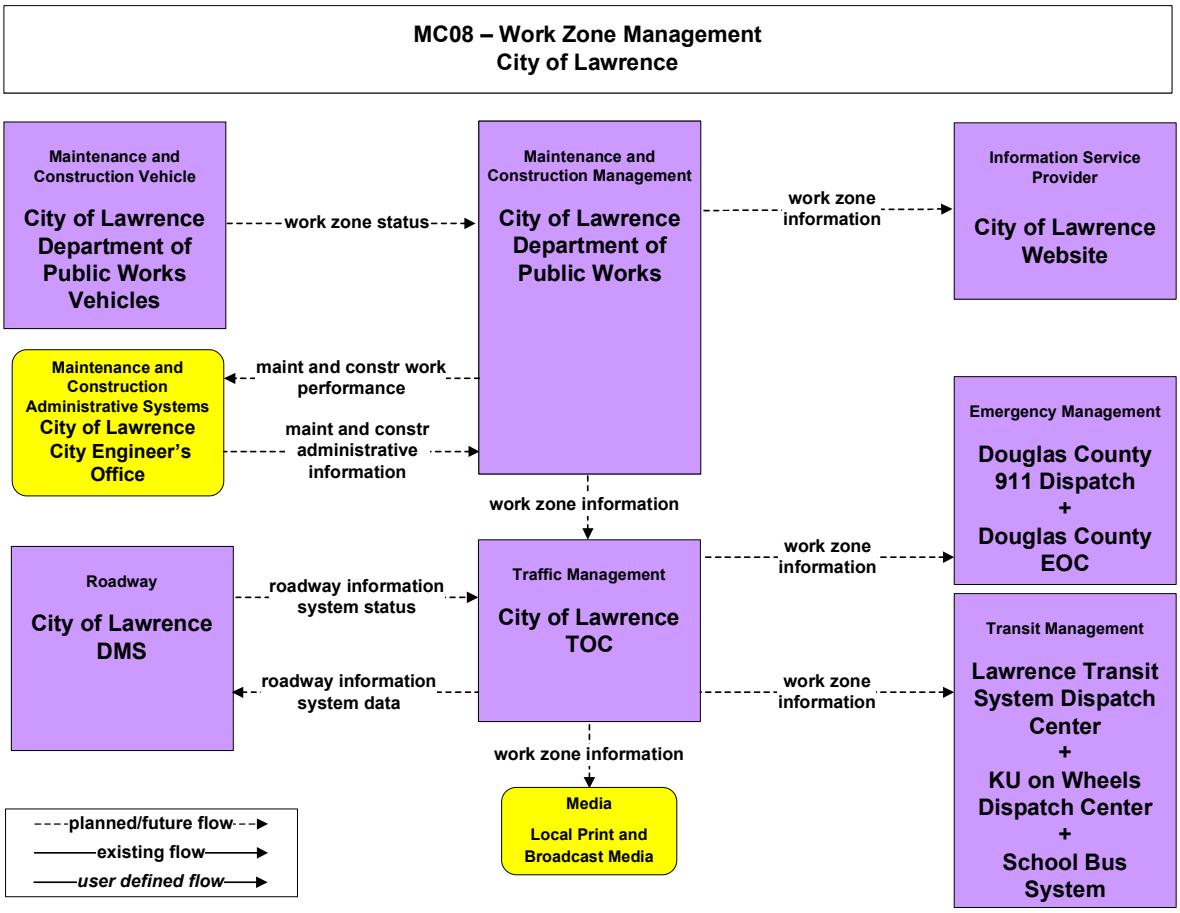


MC07 – Roadway Maintenance and Construction
Douglas County

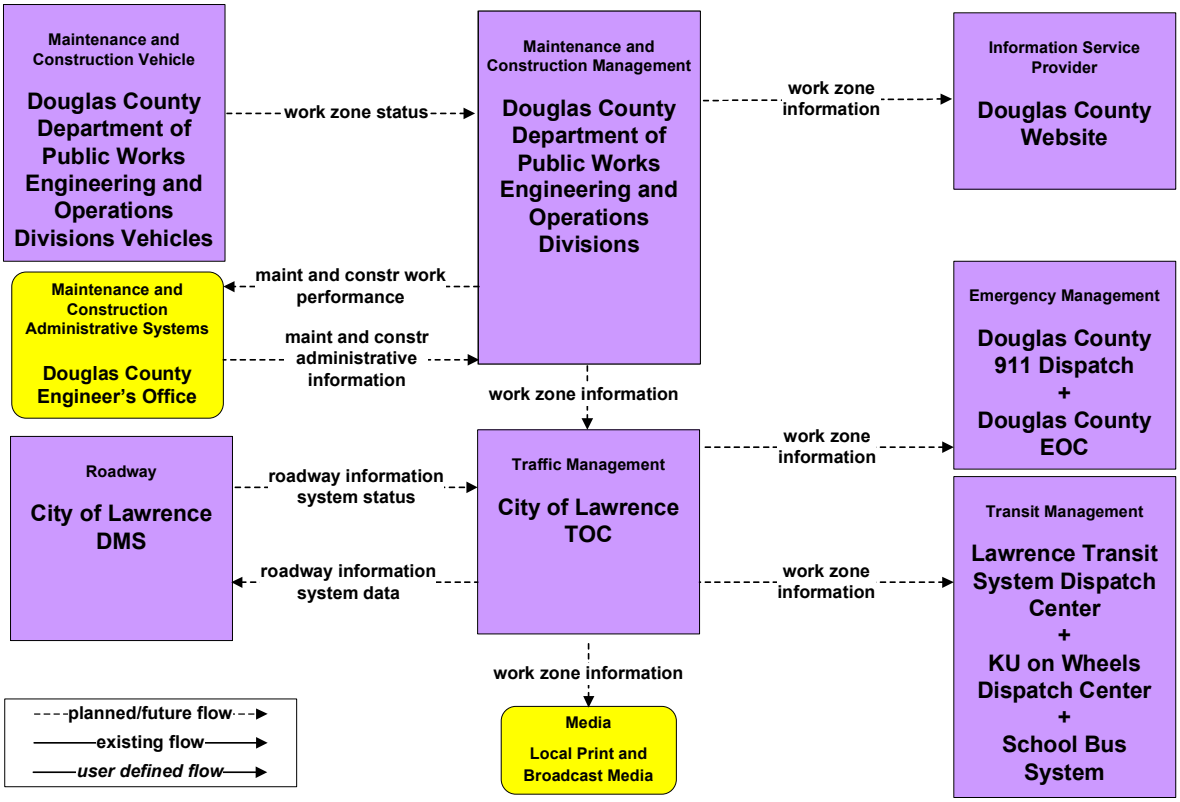




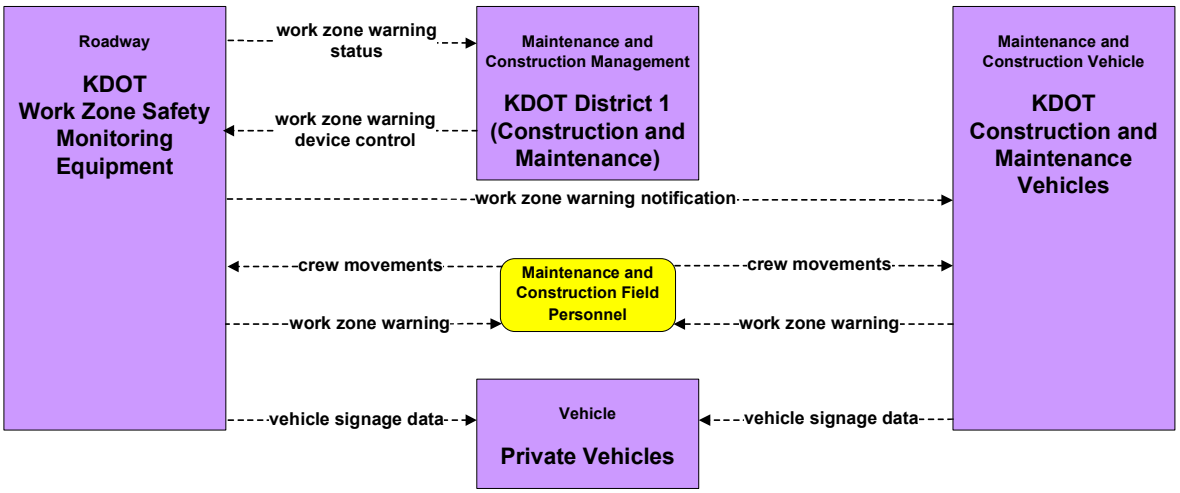

MC08 – Work Zone Management
KDOT District 1
Maintenance and Construction Vehicle
KDOT Construction and Maintenance Vehicles
work zone status
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance) + KDOT Bureau of Construction and Maintenance
work zone information
Emergency Management
Douglas County 911 Dispatch + Douglas County EOC
maint and constr administrative request + maint and constr work performance
Maintenance and Construction Administrative Systems
KDOT District 1 Engineer's Office
maint and constr administrative information
work zone information
Information Service Provider
KDOT KanRoad Reporting System
work zone information + maint and constr work plans
work zone information
Roadway
KDOT Work Zone Safety Monitoring Equipment
roadway information system status + traffic images
video surveillance control + roadway information system data
Traffic Management
KDOT District 1 (Operations) + KDOT Statewide TOMC
ISP coordination
Transit Management
Lawrence Transit System Dispatch Center + KU on Wheels Dispatch Center + School Bus System
Information Service Provider
KDOT KanRoad/ 511 Traveler Information Website + KDOT 511 Telephone Information System
Roadway
KDOT HAR
roadway information system data
roadway information system status
Roadway
KDOT DMS
roadway information system data
roadway information system status

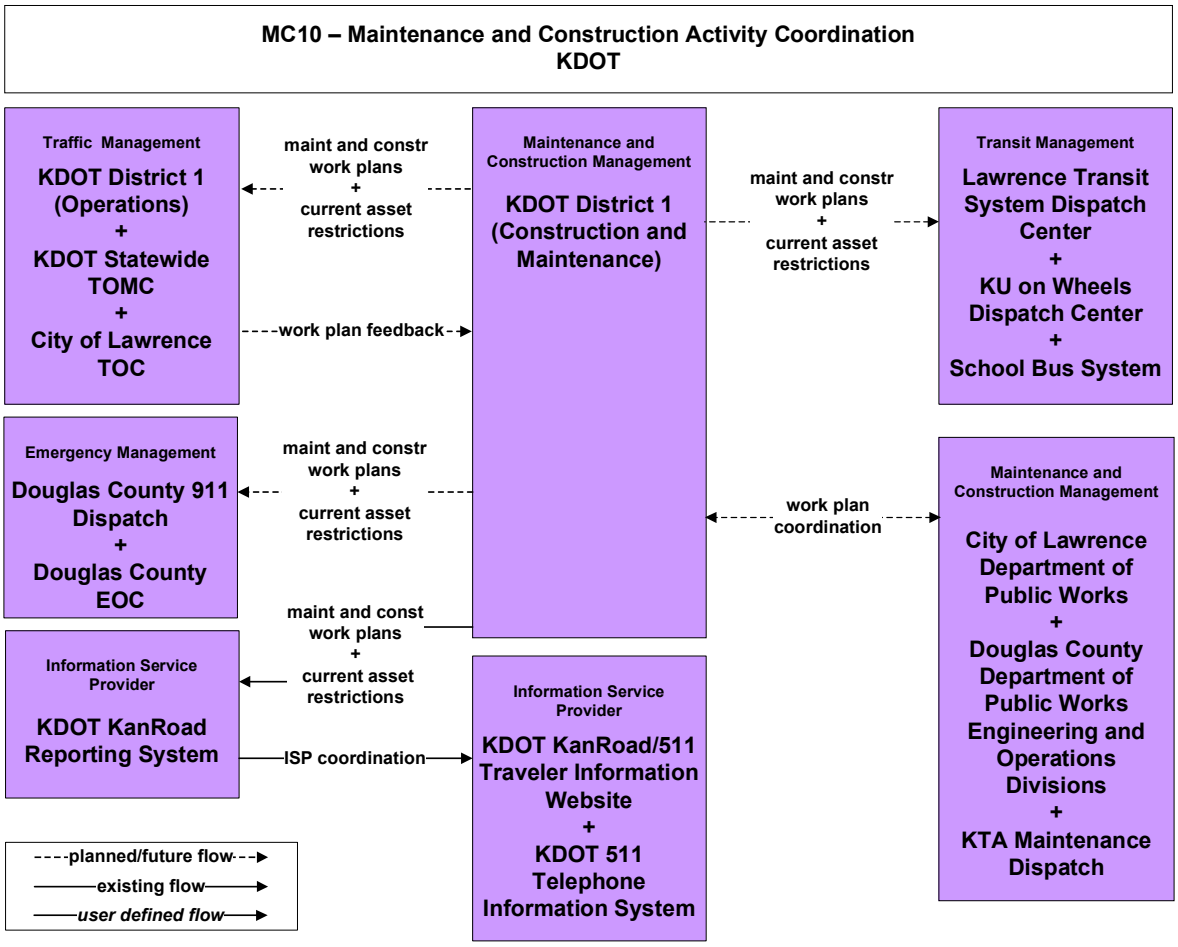

MC08 – Work Zone Management
City of Lawrence
Maintenance and Construction Vehicle
City of Lawrence Department of Public Works Vehicles
work zone status
Maintenance and Construction Management
City of Lawrence Department of Public Works
work zone information
Information Service Provider
City of Lawrence Website
Maintenance and Construction Administrative Systems
City of Lawrence City Engineer's Office
maint and constr work performance
maint and constr administrative information
work zone information
Emergency Management
Douglas County 911 Dispatch + Douglas County EOC
Roadway
City of Lawrence DMS
roadway information system status
roadway information system data
Traffic Management
City of Lawrence TOC
work zone information
work zone information
Transit Management
Lawrence Transit System Dispatch Center + KU on Wheels Dispatch Center + School Bus System
work zone information
Media
Local Print and Broadcast Media
planned/future flow
existing flow
user defined flow

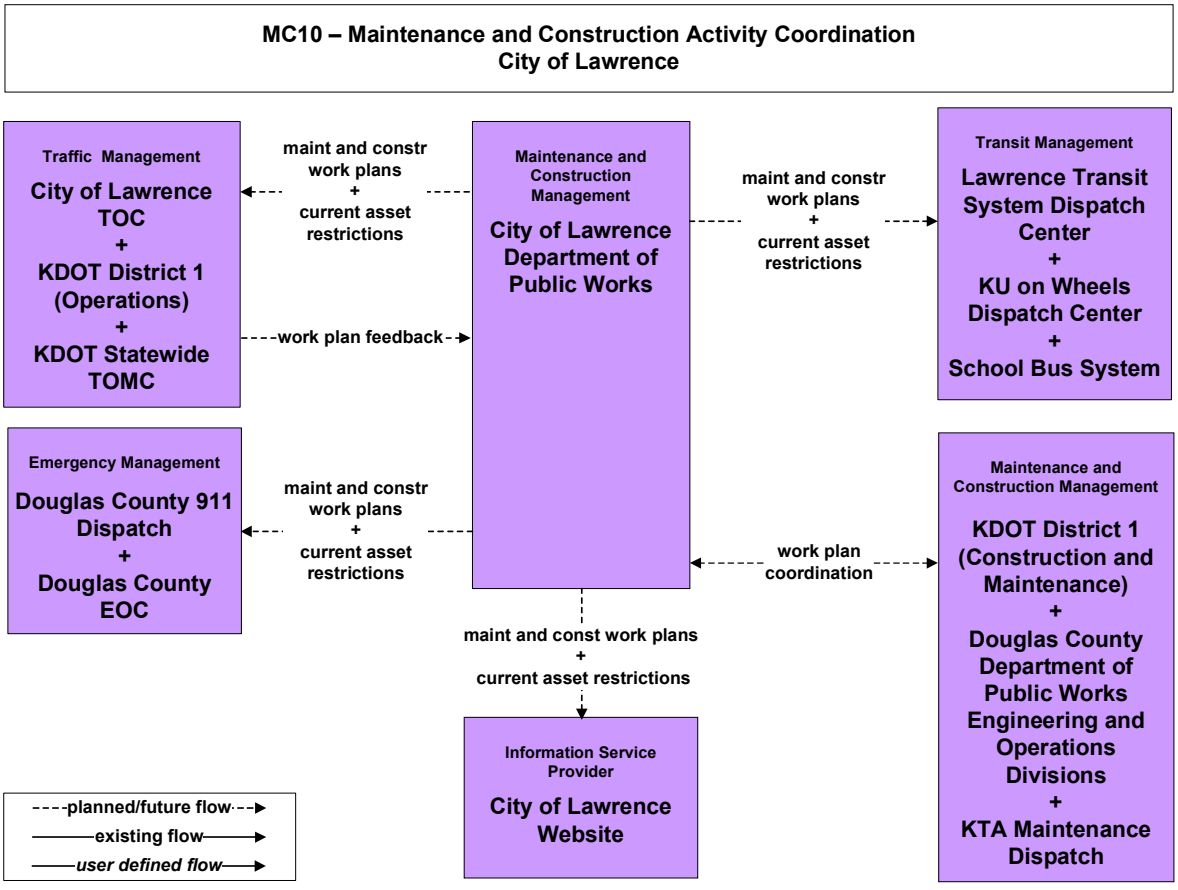
MC08 – Work Zone Management
Douglas County

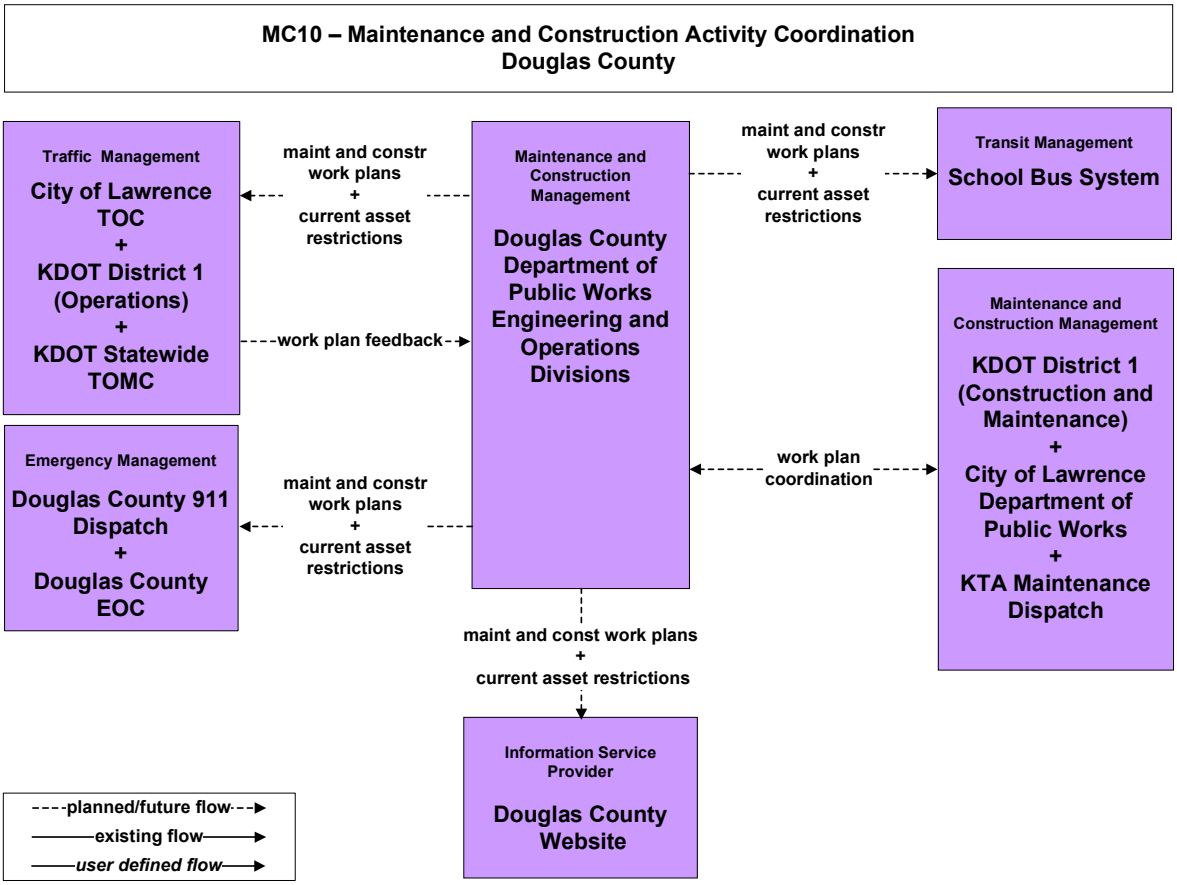


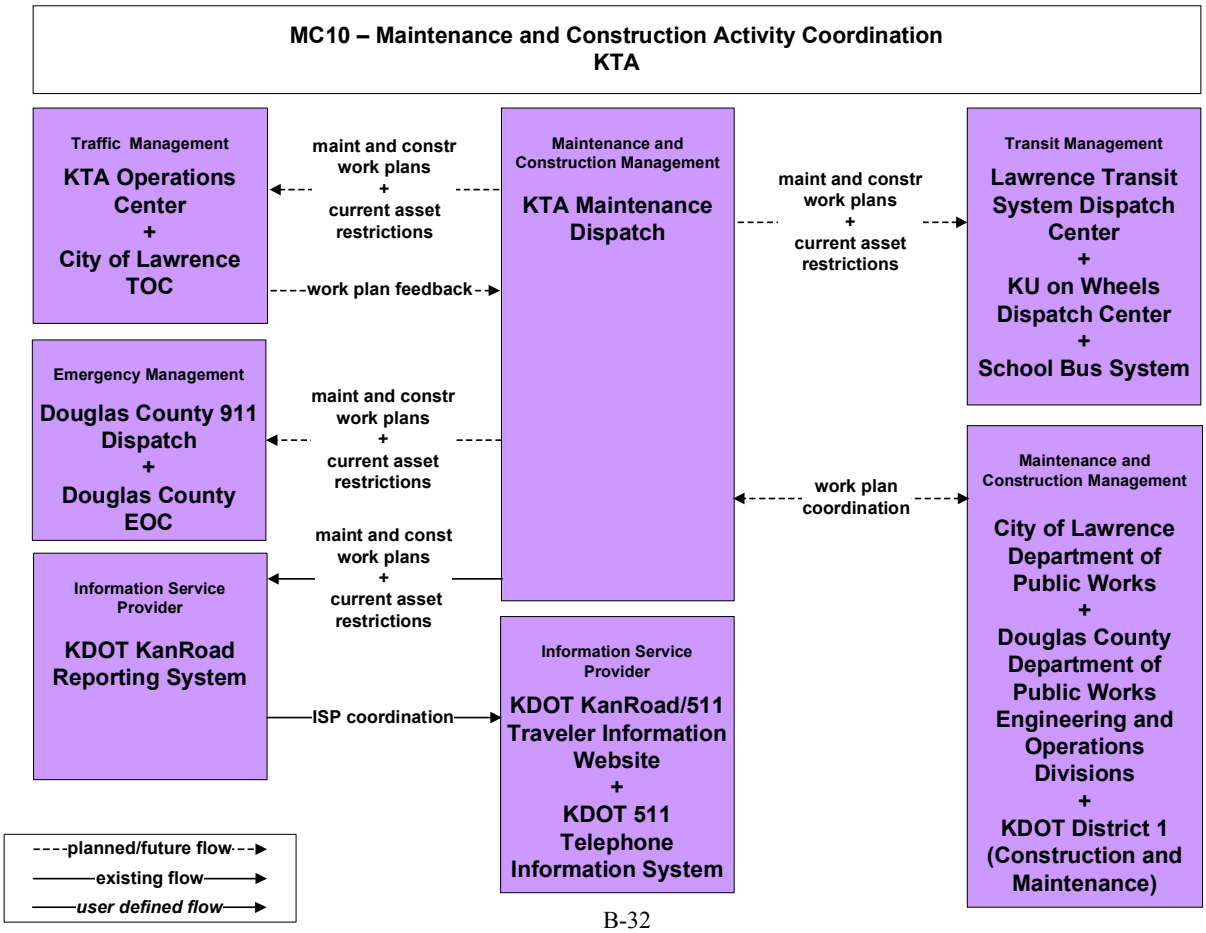
MC09 – Work Zone Safety Monitoring
KDOT



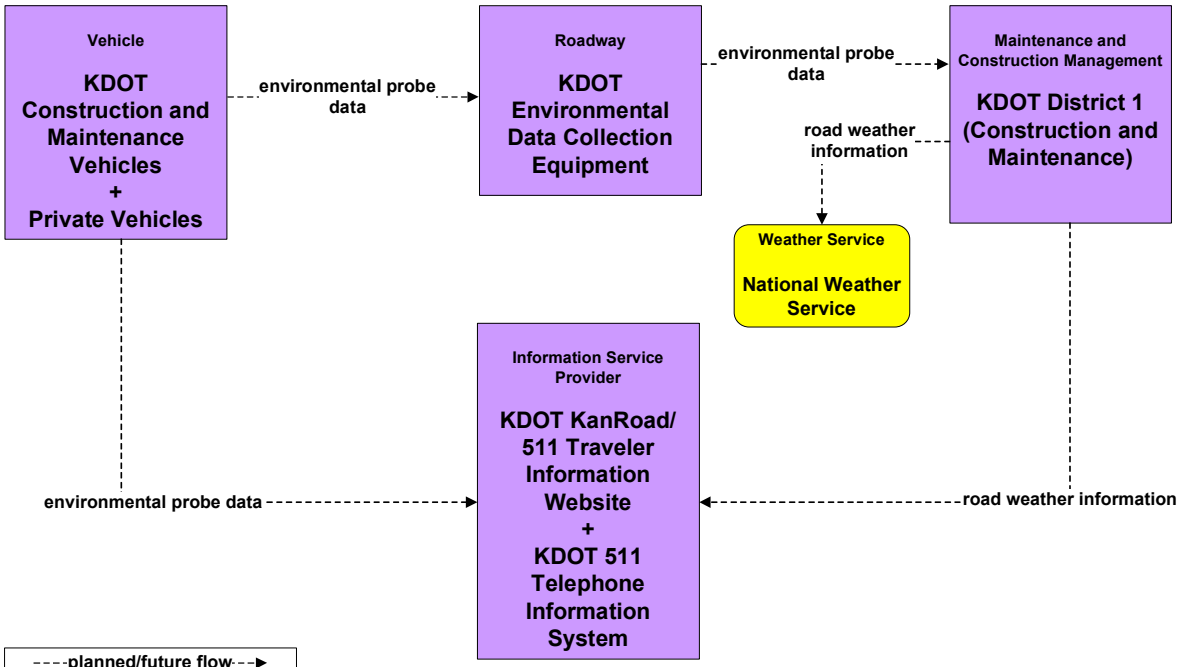

MC10 – Maintenance and Construction Activity Coordination
KDOT
Traffic Management
KDOT District 1 (Operations) + KDOT Statewide TOMC + City of Lawrence TOC
maint and constr work plans + current asset restrictions
work plan feedback
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance)
maint and constr work plans + current asset restrictions
Transit Management
Lawrence Transit System Dispatch Center + KU on Wheels Dispatch Center + School Bus System
Emergency Management
Douglas County 911 Dispatch + Douglas County EOC
maint and constr work plans + current asset restrictions
work plan coordination
Maintenance and Construction Management
City of Lawrence Department of Public Works + Douglas County Department of Public Works Engineering and Operations Divisions + KTA Maintenance Dispatch
maint and const work plans + current asset restrictions
Information Service Provider
KDOT KanRoad Reporting System
ISP coordination
Information Service Provider
KDOT KanRoad/511 Traveler Information Website + KDOT 511 Telephone Information System
planned/future flow
existing flow
user defined flow


MC10 – Maintenance and Construction Activity Coordination
City of Lawrence
Traffic Management
City of Lawrence TOC + KDOT District 1 (Operations) + KDOT Statewide TOMC
maint and constr work plans + current asset restrictions
work plan feedback
Maintenance and Construction Management
City of Lawrence Department of Public Works
maint and constr work plans + current asset restrictions
Transit Management
Lawrence Transit System Dispatch Center + KU on Wheels Dispatch Center + School Bus System
Emergency Management
Douglas County 911 Dispatch + Douglas County EOC
maint and constr work plans + current asset restrictions
work plan coordination
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance) + Douglas County Department of Public Works Engineering and Operations Divisions + KTA Maintenance Dispatch
maint and const work plans + current asset restrictions
Information Service Provider
City of Lawrence Website
planned/future flow
existing flow
user defined flow

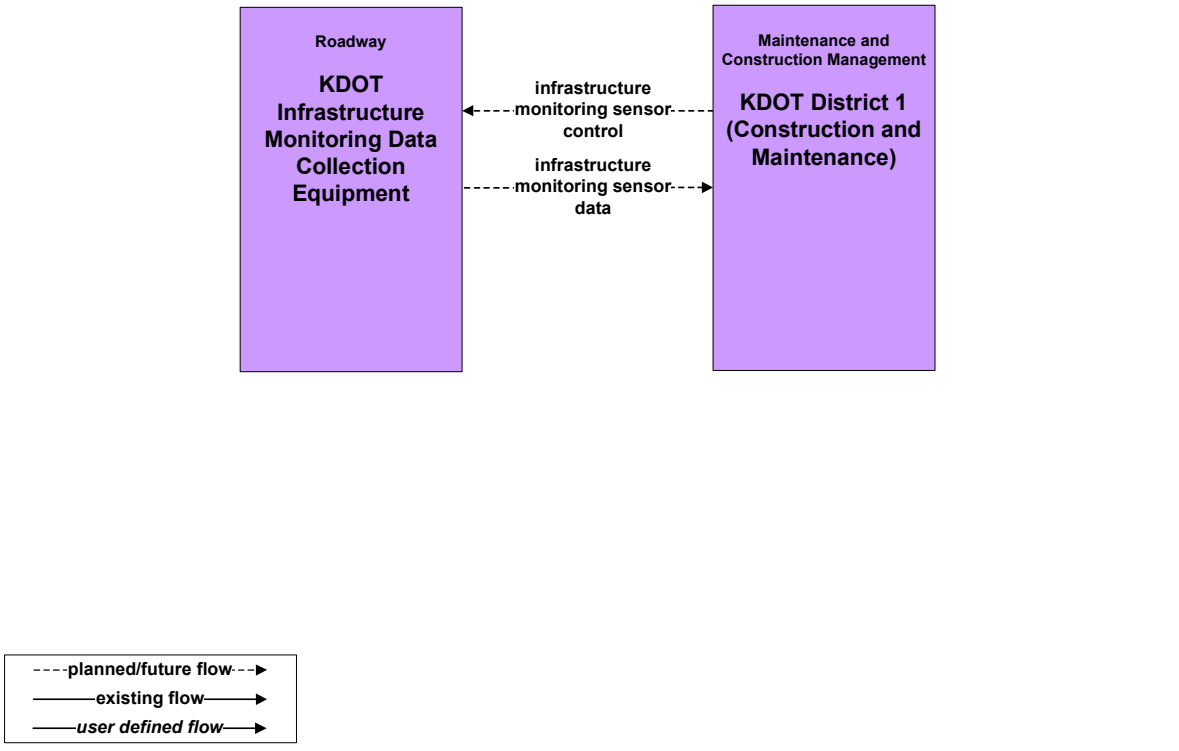

MC10 – Maintenance and Construction Activity Coordination
Douglas County
Traffic Management
City of Lawrence TOC
+
KDOT District 1 (Operations)
+
KDOT Statewide TOMC
maint and constr work plans
+
current asset restrictions
work plan feedback
Maintenance and Construction Management
Douglas County Department of Public Works Engineering and Operations Divisions
maint and constr work plans
+
current asset restrictions
Transit Management
School Bus System
Maintenance and Construction Management
KDOT District 1 (Construction and Maintenance)
+
City of Lawrence Department of Public Works
+
KTA Maintenance Dispatch
work plan coordination
Emergency Management
Douglas County 911 Dispatch
+
Douglas County EOC
maint and constr work plans
+
current asset restrictions
maint and const work plans
+
current asset restrictions
Information Service Provider
Douglas County Website
planned/future flow
existing flow
user defined flow


MC10 – Maintenance and Construction Activity Coordination
KTA
Traffic Management
KTA Operations Center
+
City of Lawrence TOC
maint and constr work plans
+
current asset restrictions
work plan feedback
Maintenance and Construction Management
KTA Maintenance Dispatch
maint and constr work plans
+
current asset restrictions
Transit Management
Lawrence Transit System Dispatch Center
+
KU on Wheels Dispatch Center
+
School Bus System
Emergency Management
Douglas County 911 Dispatch
+
Douglas County EOC
maint and constr work plans
+
current asset restrictions
work plan coordination
Maintenance and Construction Management
City of Lawrence Department of Public Works
+
Douglas County Department of Public Works Engineering and Operations Divisions
+
KDOT District 1 (Construction and Maintenance)
Information Service Provider
KDOT KanRoad Reporting System
maint and const work plans
+
current asset restrictions
ISP coordination
Information Service Provider
KDOT KanRoad/511 Traveler Information Website
+
KDOT 511 Telephone Information System
planned/future flow
existing flow
user defined flow

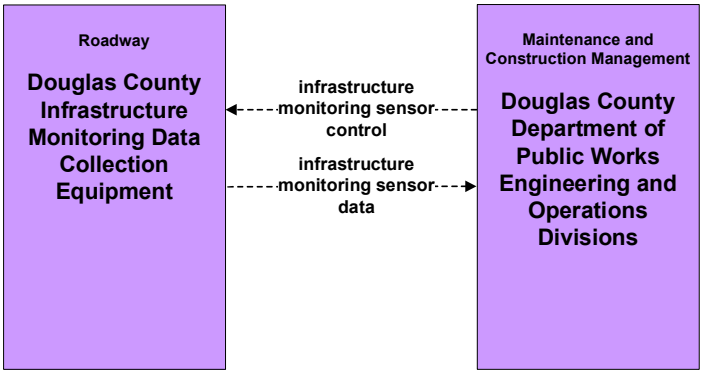
MC11 – Environmental Probe Surveillance
KDOT

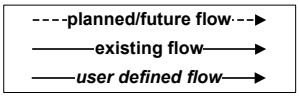


MC12 – Infrastructure Monitoring
KDOT

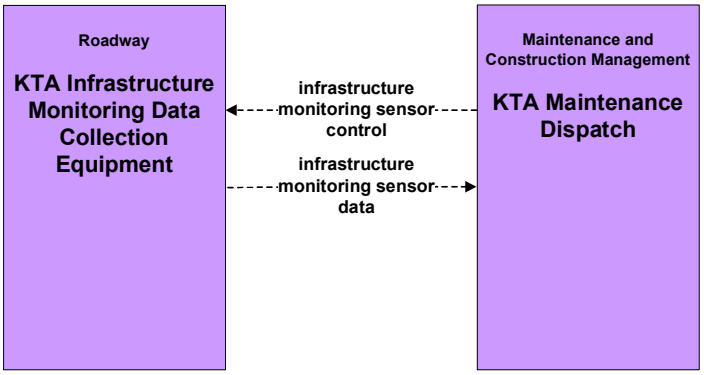


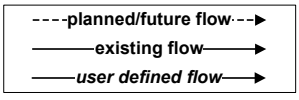
MC12 – Infrastructure Monitoring
Douglas County



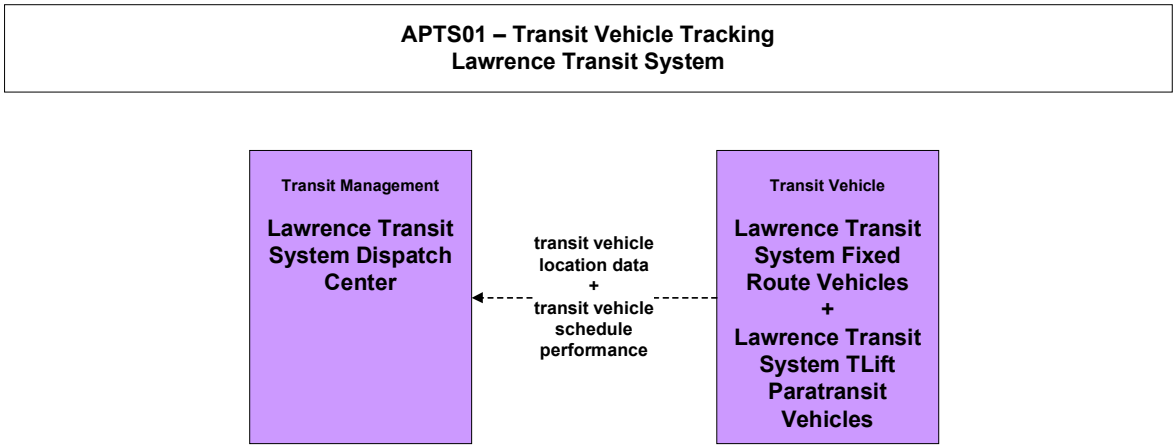


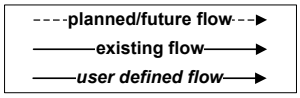
MC12 – Infrastructure Monitoring
KTA



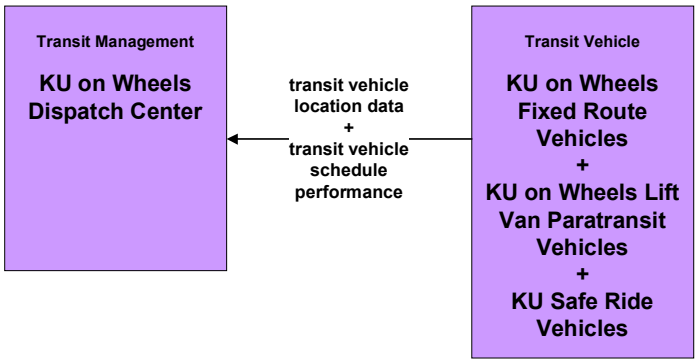


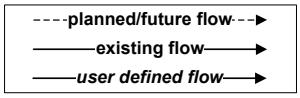
Advanced Public Transportation Systems



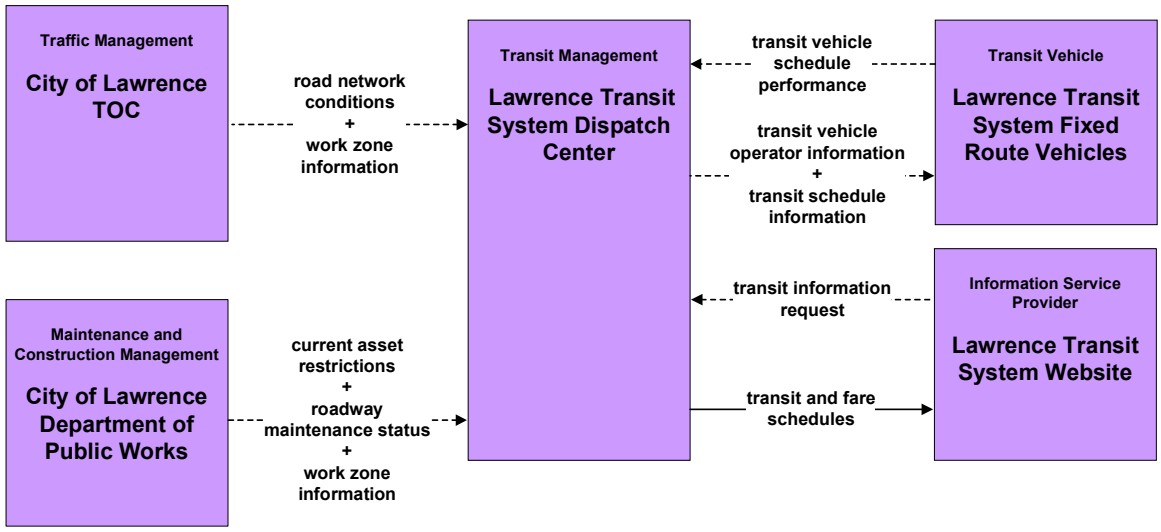


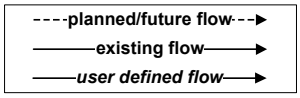
APTS01 – Transit Vehicle Tracking
KU on Wheels



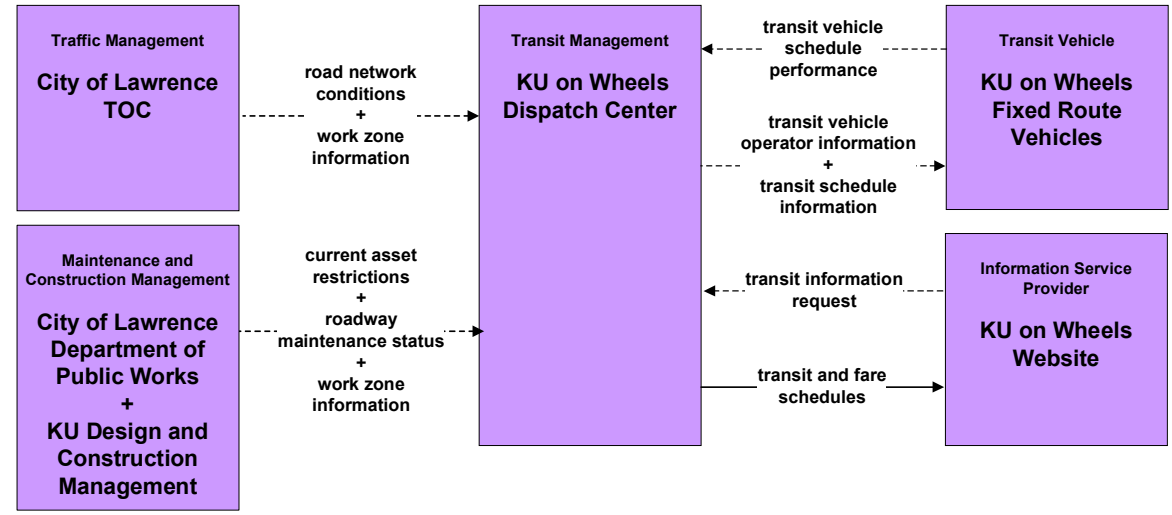


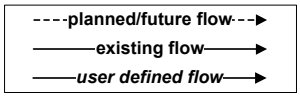
APTS02 – Transit Fixed Route Operations
Lawrence Transit System



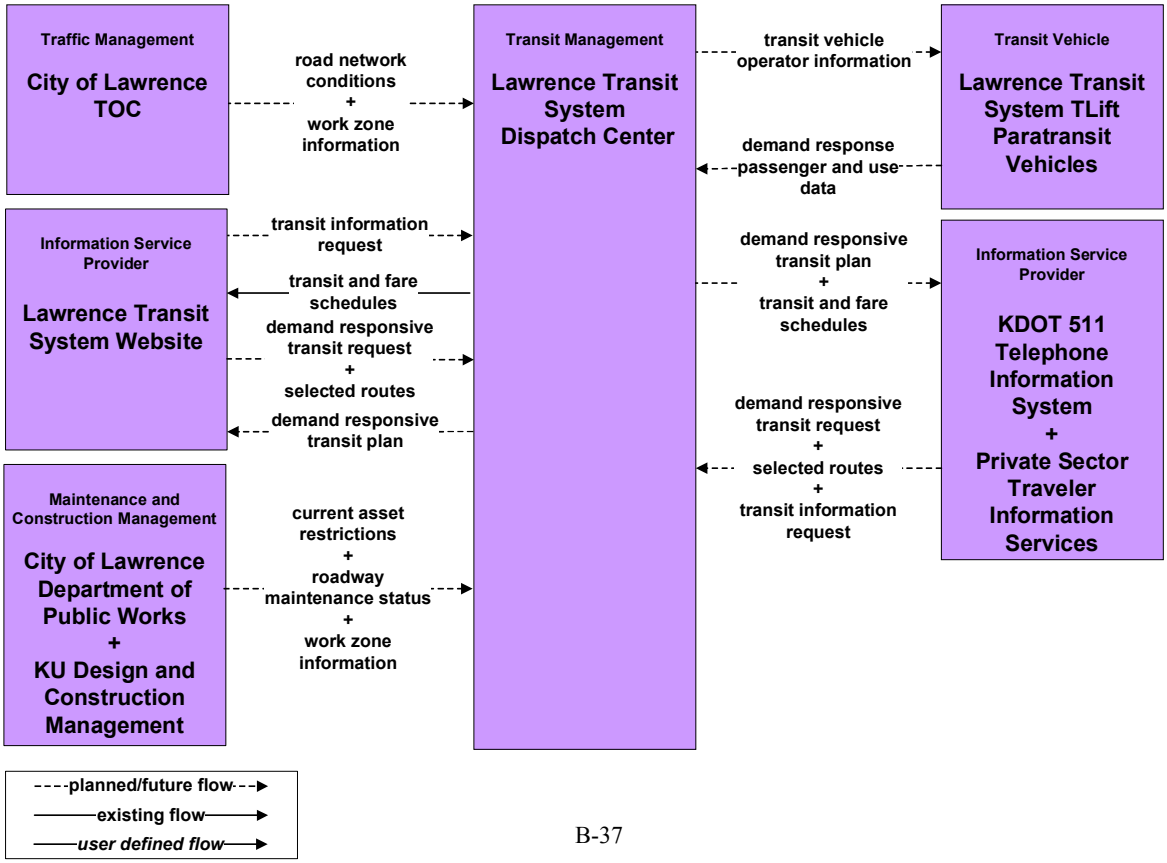


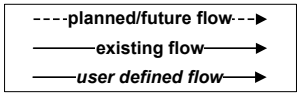
APTS02 – Transit Fixed Route Operations
KU on Wheels



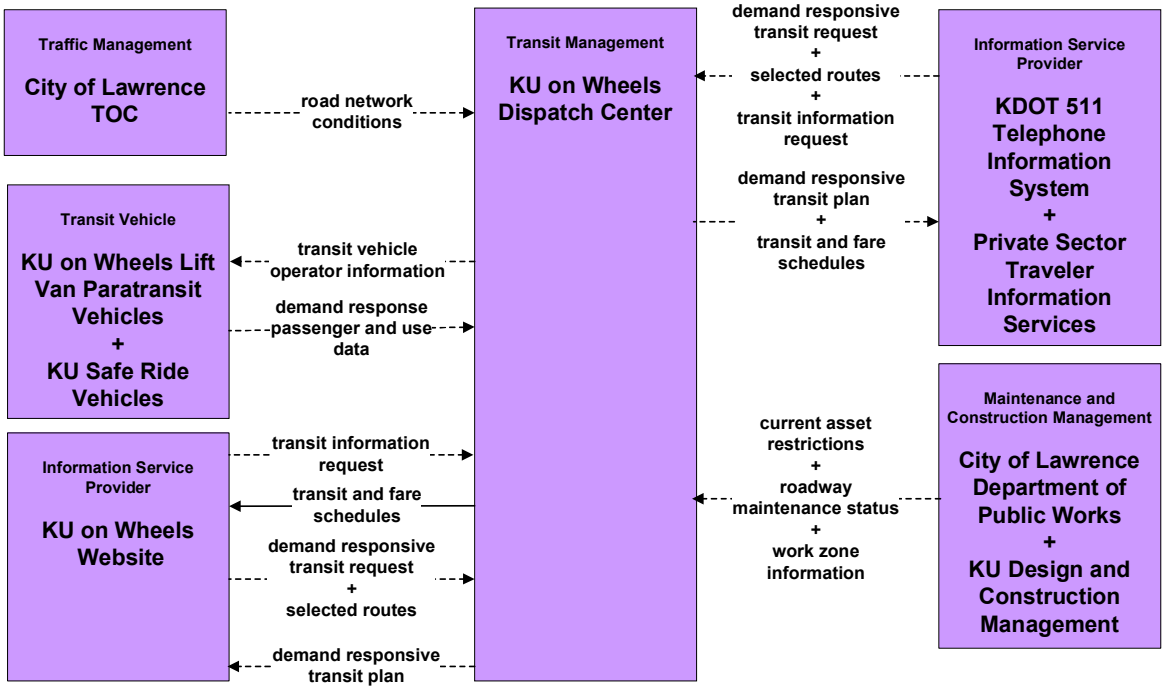


APTS03 – Demand Response Transit Operations
Lawrence Transit System

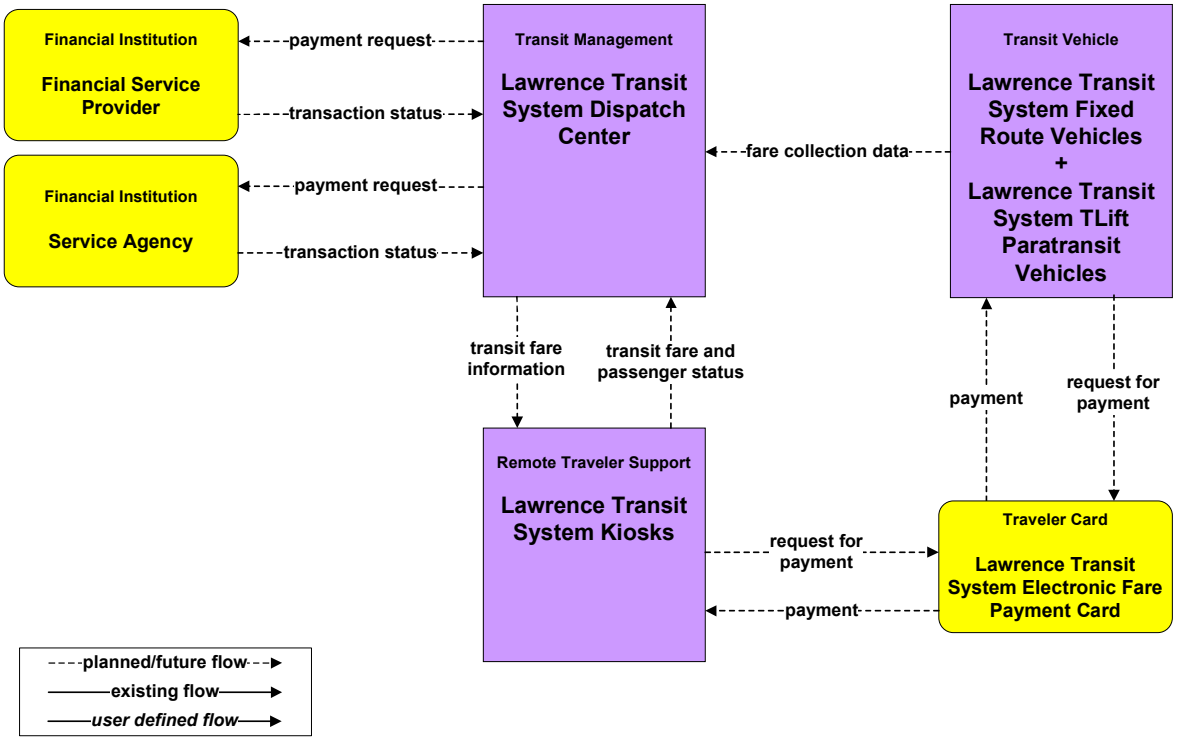




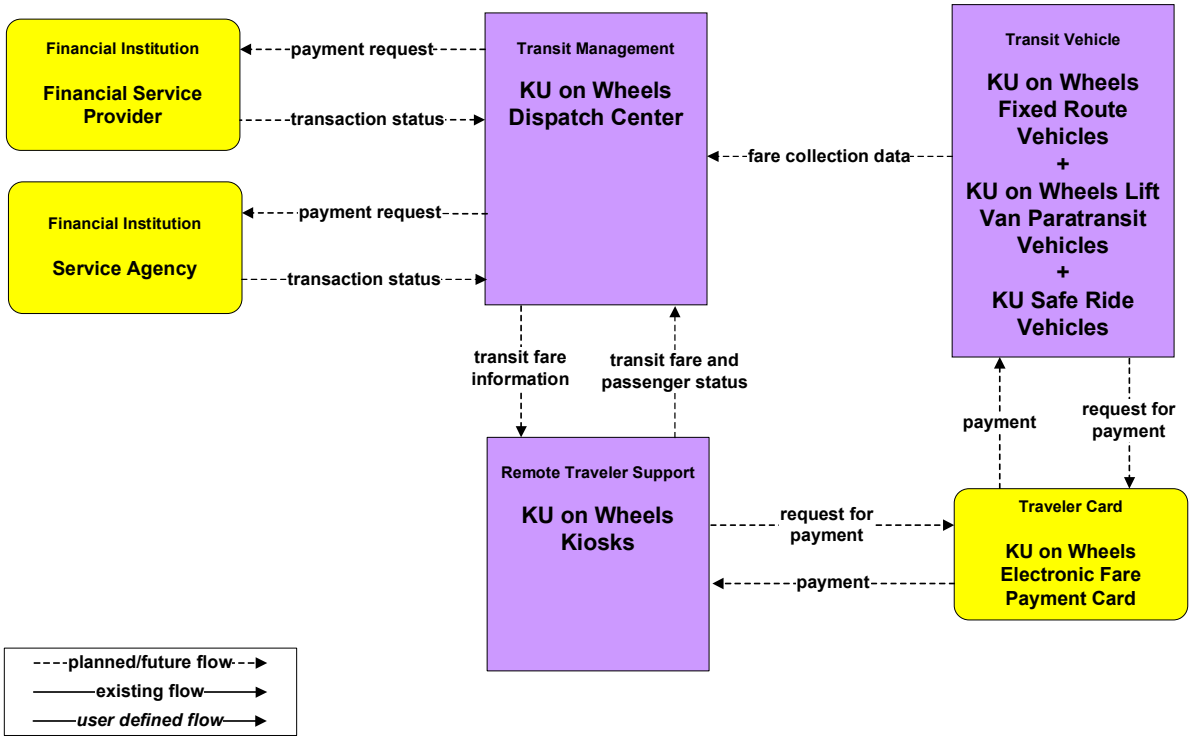
APTS03 – Demand Response Transit Operations
KU on Wheels



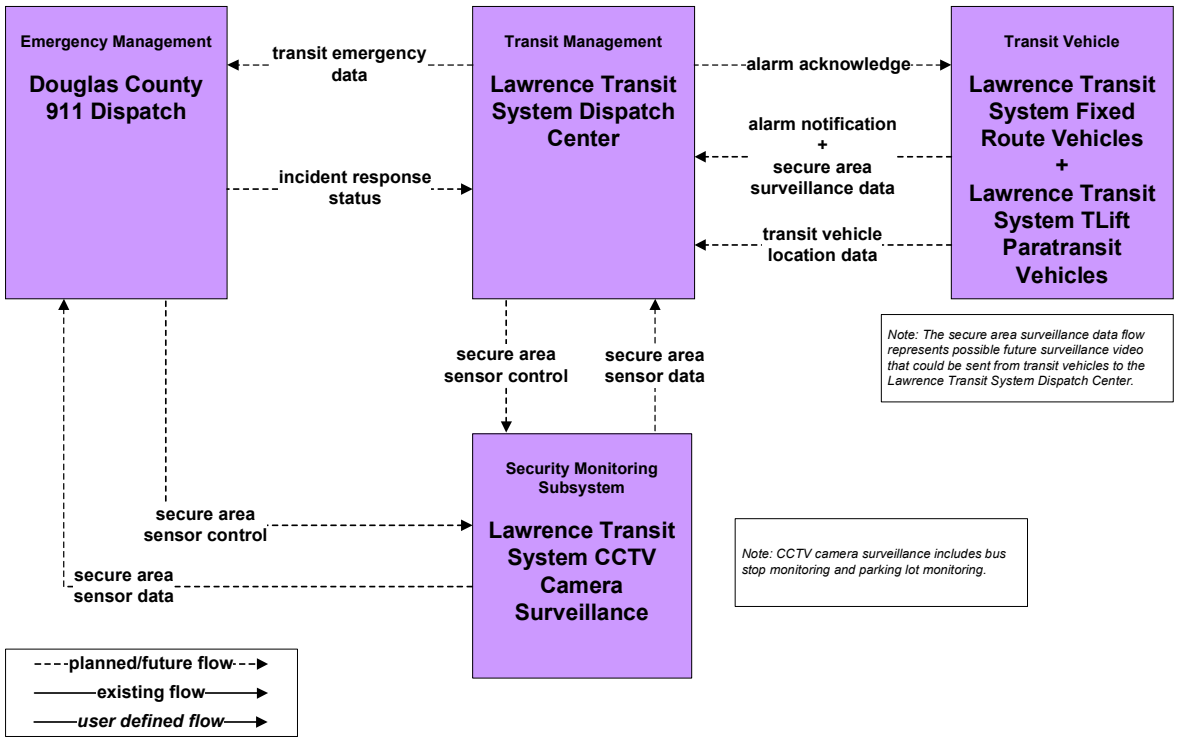
APTS04 – Transit Fare Collection Management
Lawrence Transit System



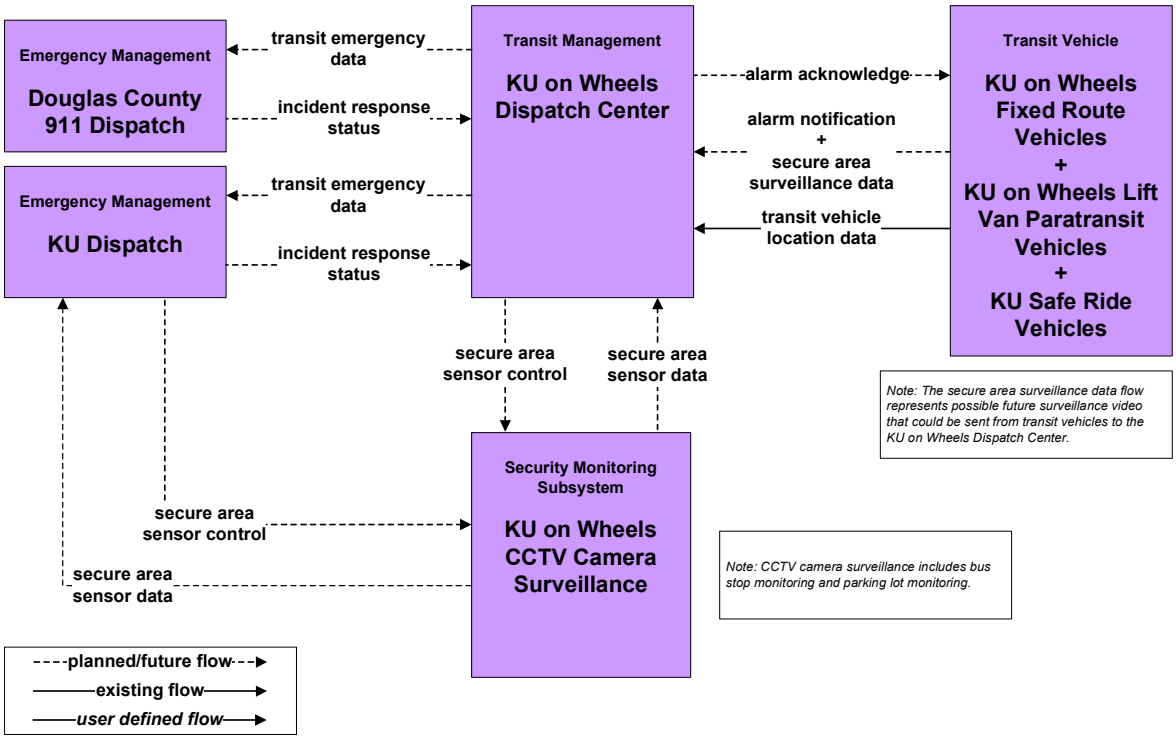
APTS04 – Transit Passenger and Fare Management
KU on Wheels



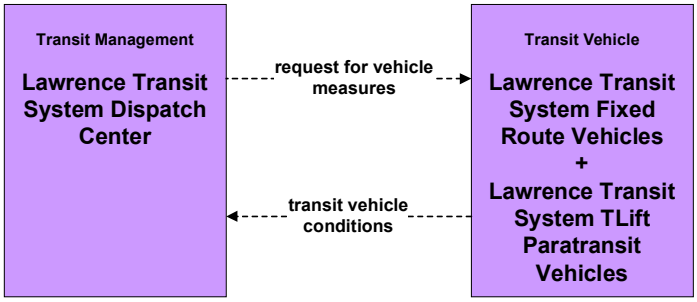
APTS05 – Transit Security
Lawrence Transit System



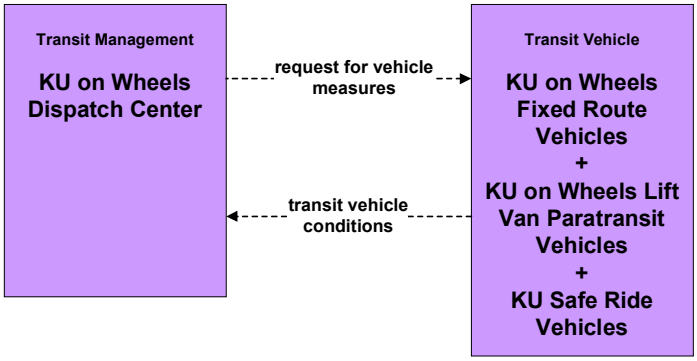
APTS05 – Transit Security
KU on Wheels

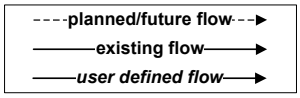


APTS06 – Transit Fleet Management
Lawrence Transit System

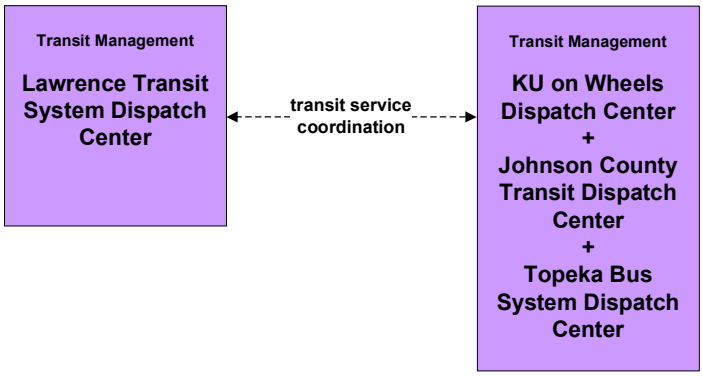


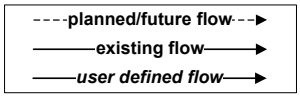
APTS06 – Transit Fleet Management
KU on Wheels



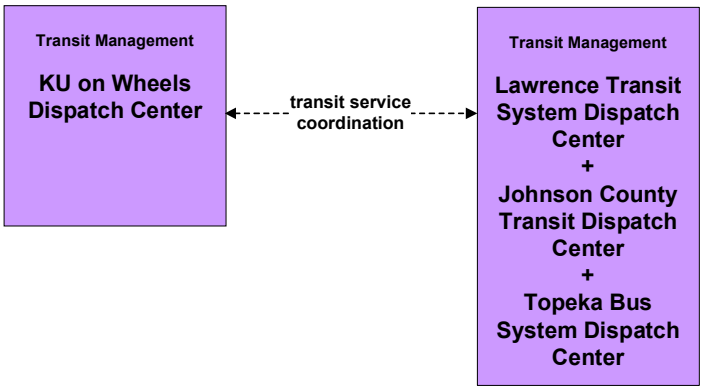


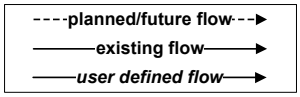
APTS07 – Multi-modal Coordination
Lawrence Transit System



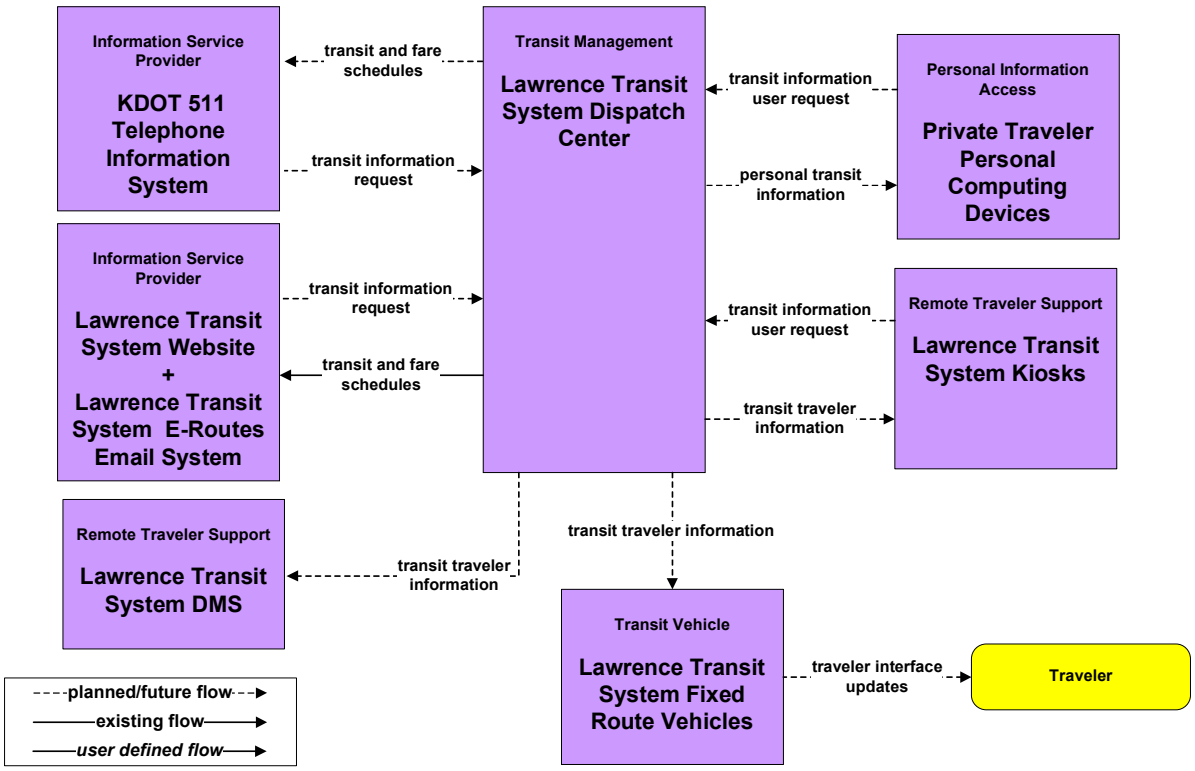


APTS07 – Multi-modal Coordination
KU on Wheels

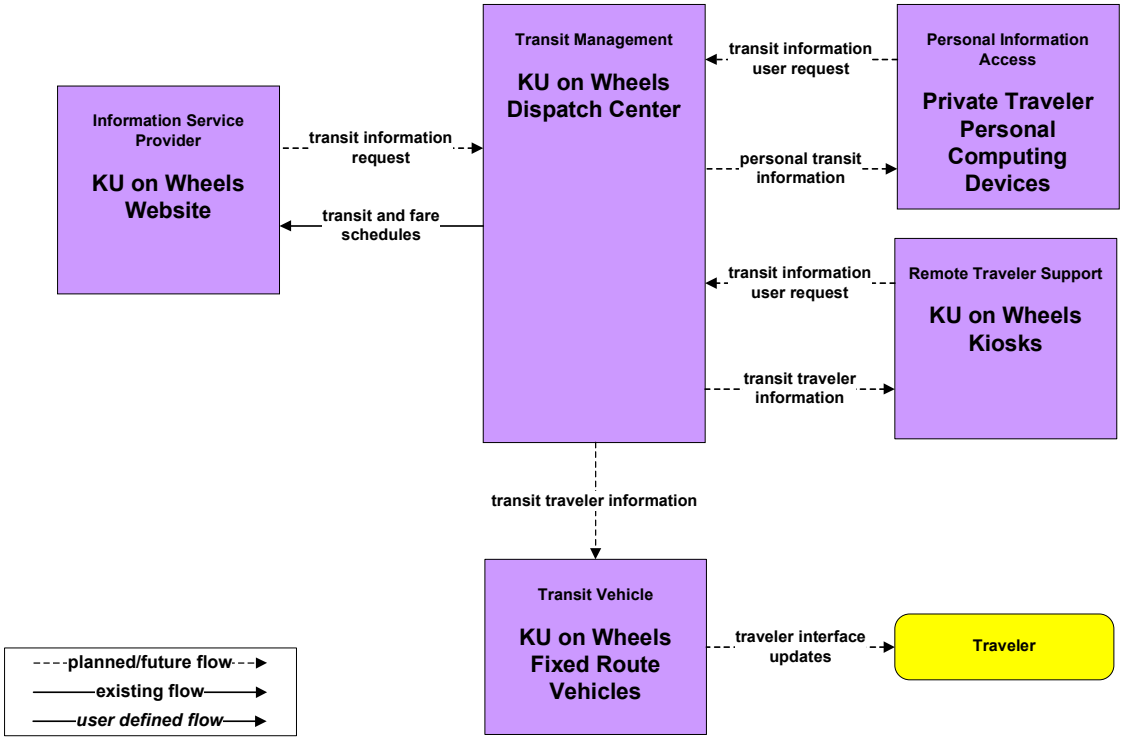




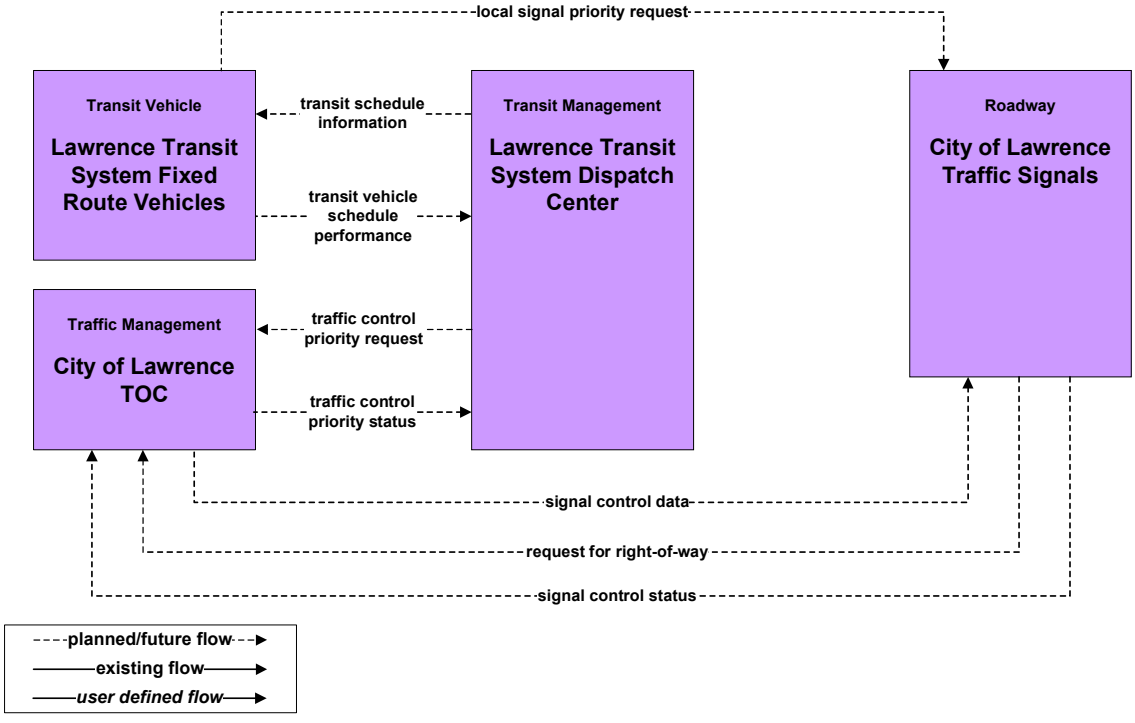
APTS08 – Transit Traveler Information
Lawrence Transit System



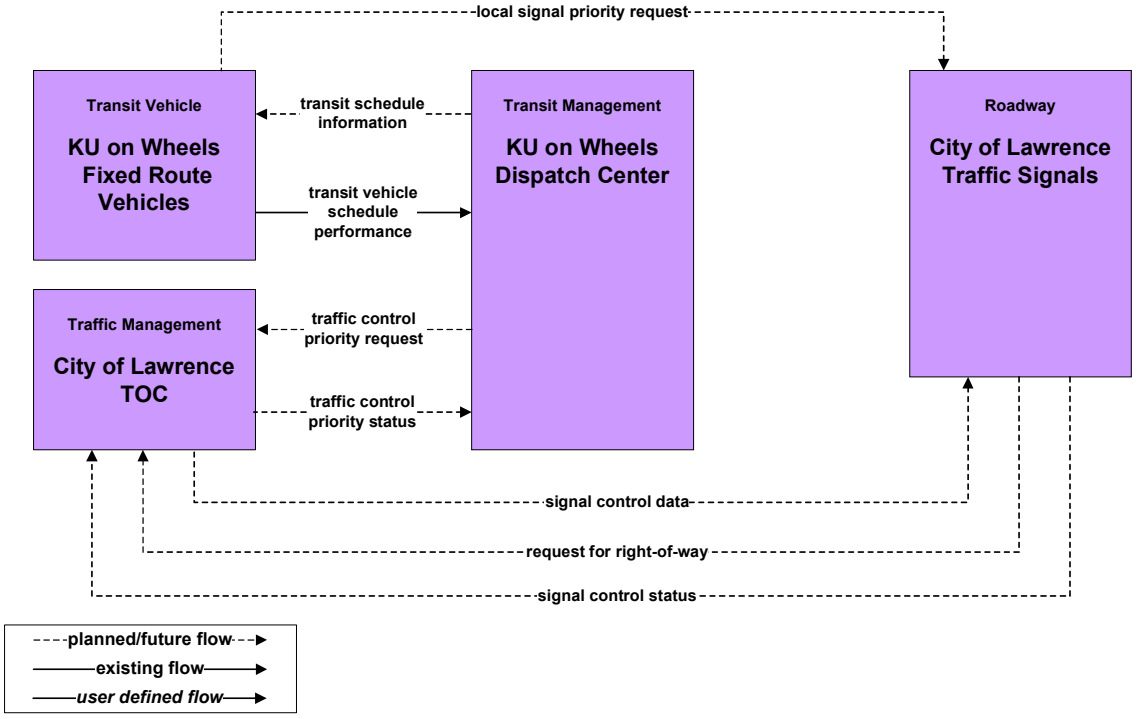
APTS08 – Transit Traveler Information
KU on Wheels



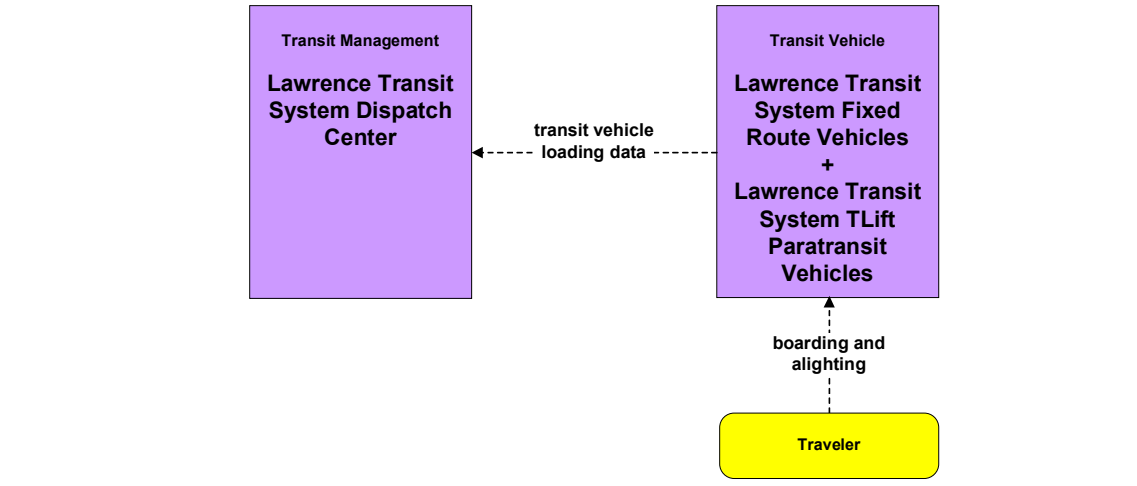
APTS09 – Transit Signal Priority
Lawrence Transit System



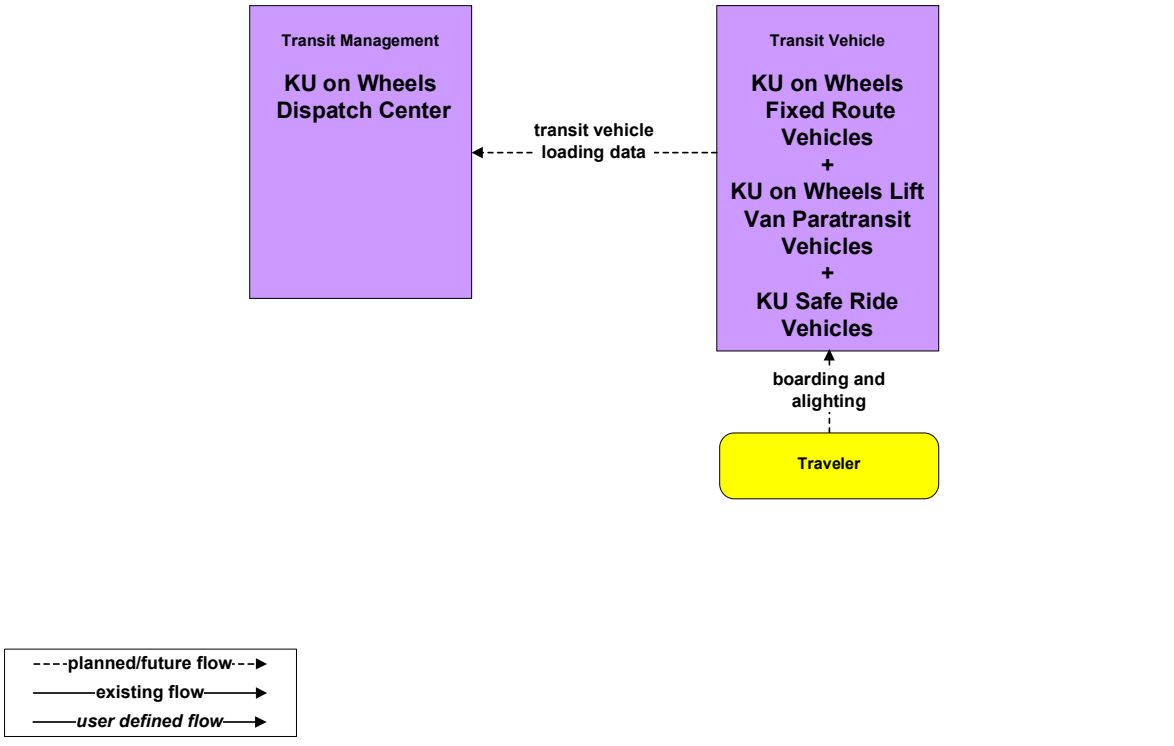
APTS09 – Transit Signal Priority
KU on Wheels



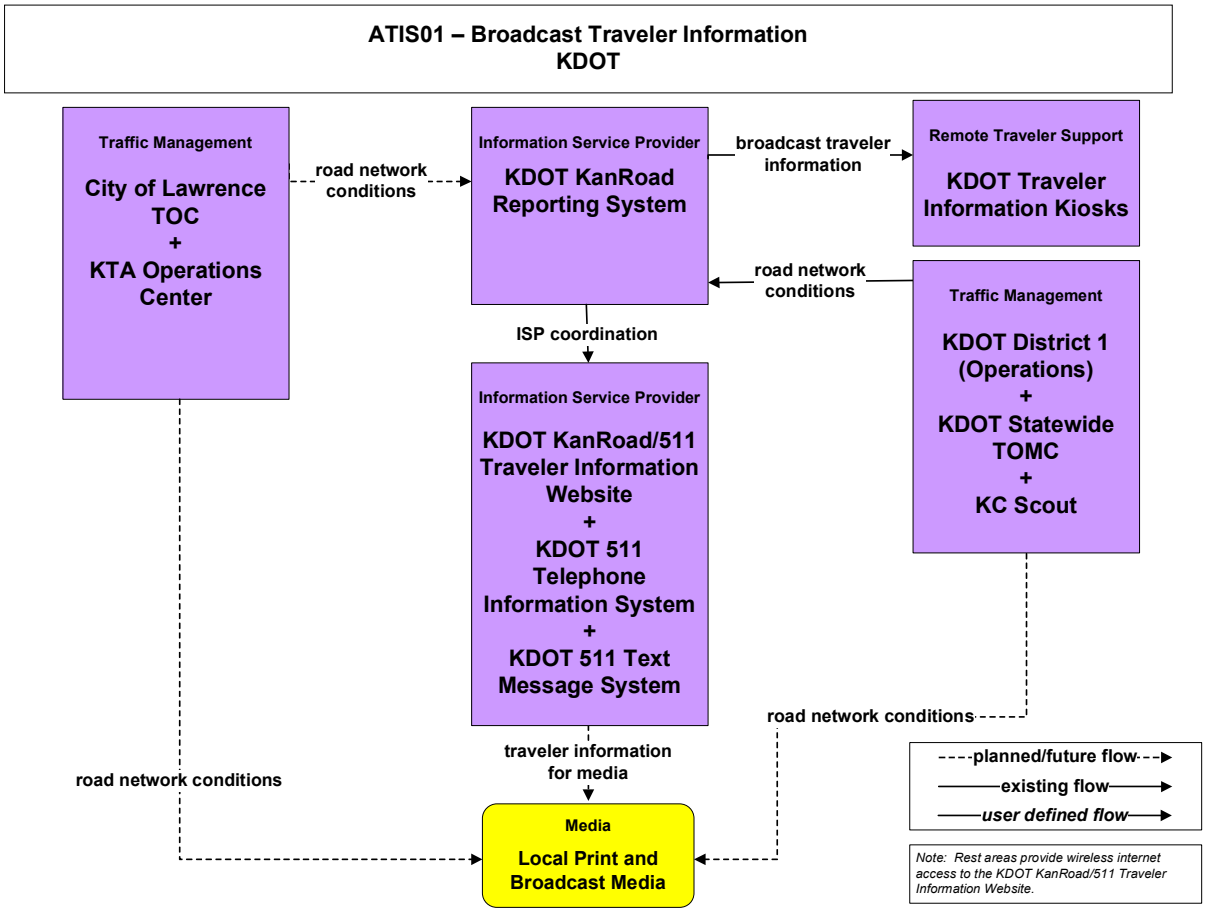
APTS10 – Transit Passenger Counting
Lawrence Transit System



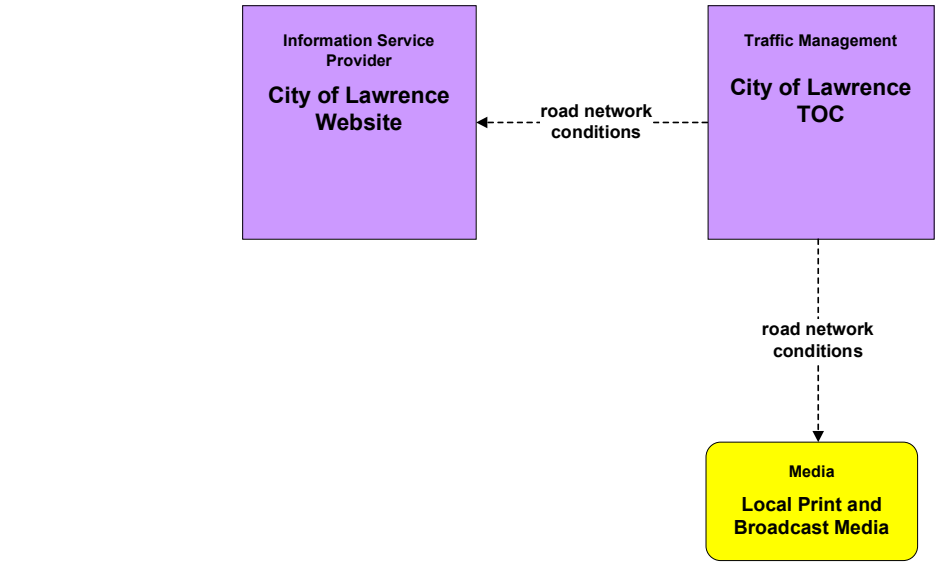
APTS10 – Transit Passenger Counting
KU on Wheels



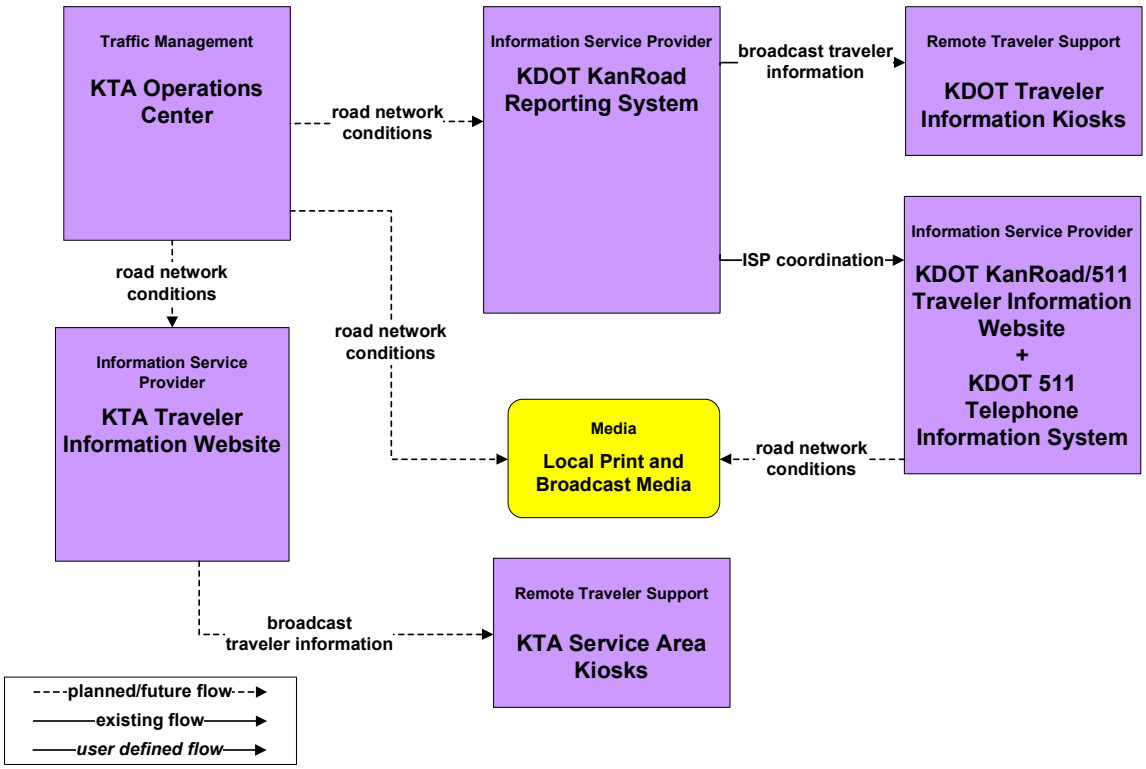
Advanced Traveler Information System



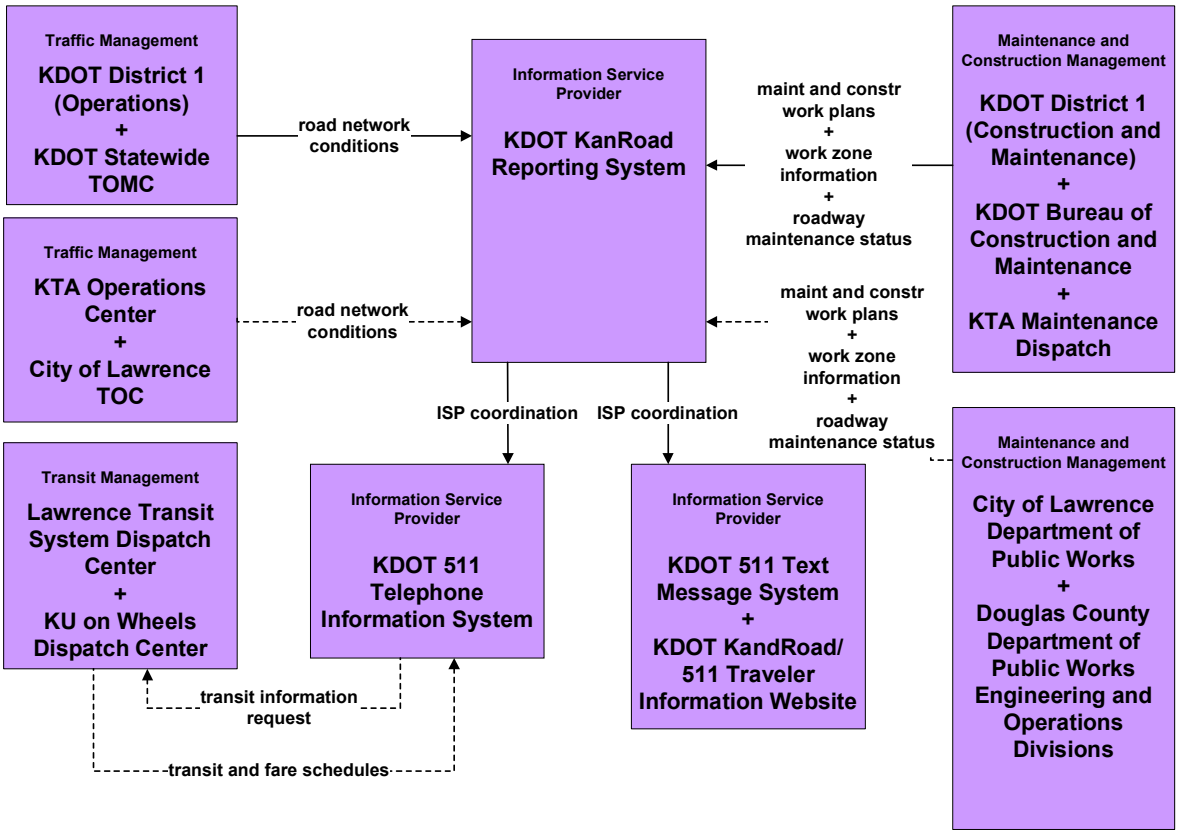
ATIS01 – Broadcast Traveler Information
City of Lawrence



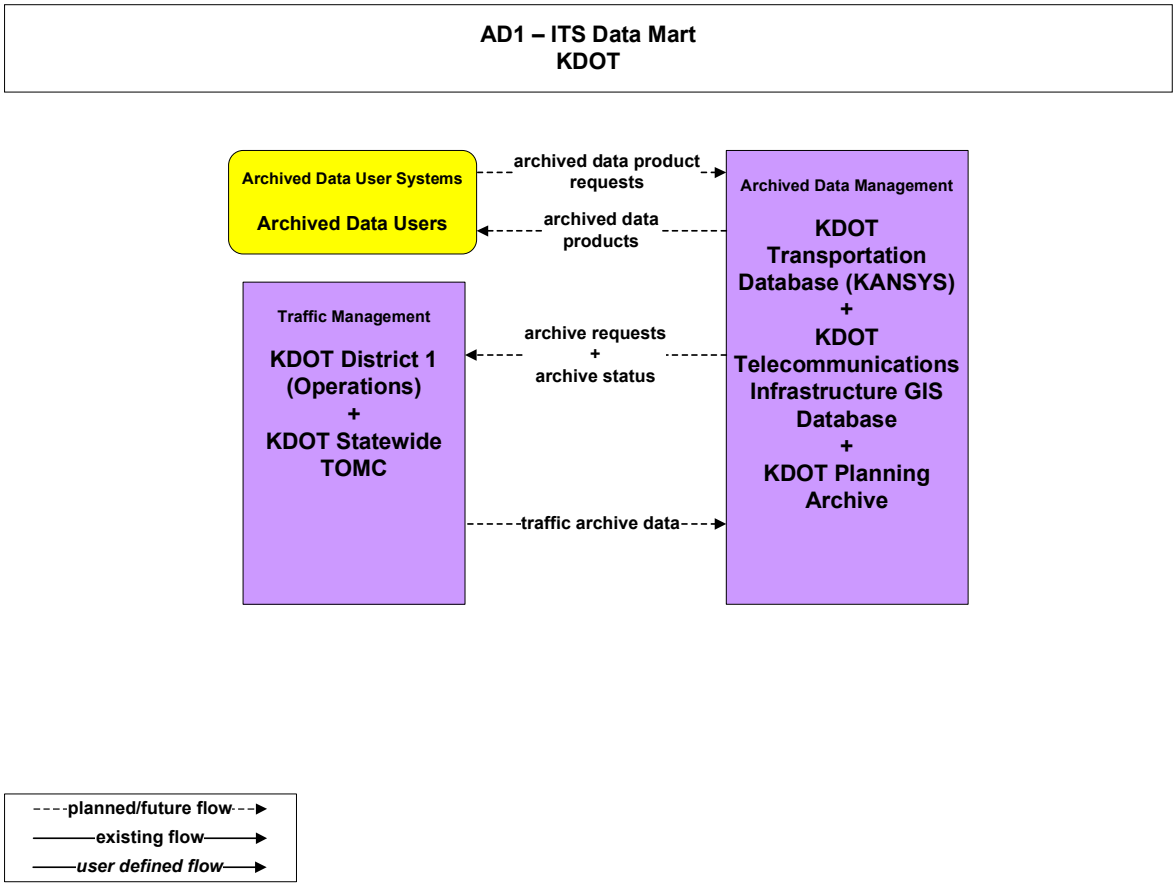
ATIS01 – Broadcast Traveler Information
KTA



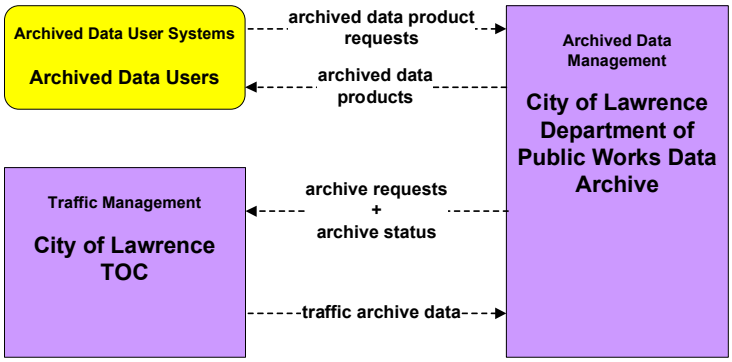
ATIS02 – Interactive Traveler Information
Kansas 511

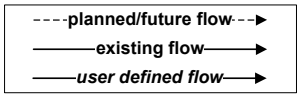


Archived Data

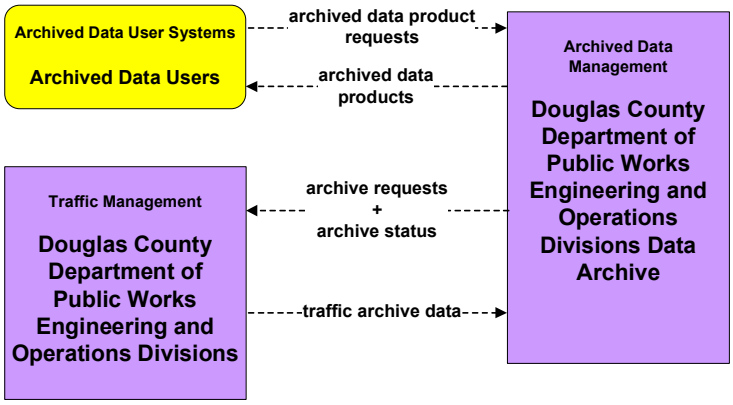


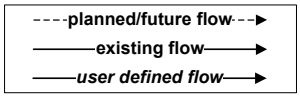
AD1 – ITS Data Mart
City of Lawrence



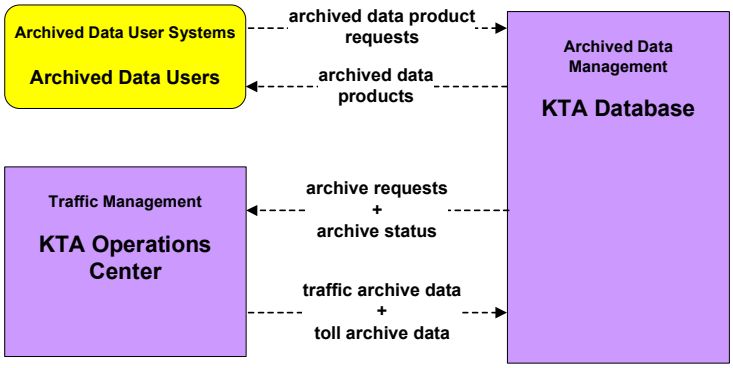


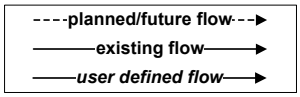
AD1 – ITS Data Mart
Douglas County



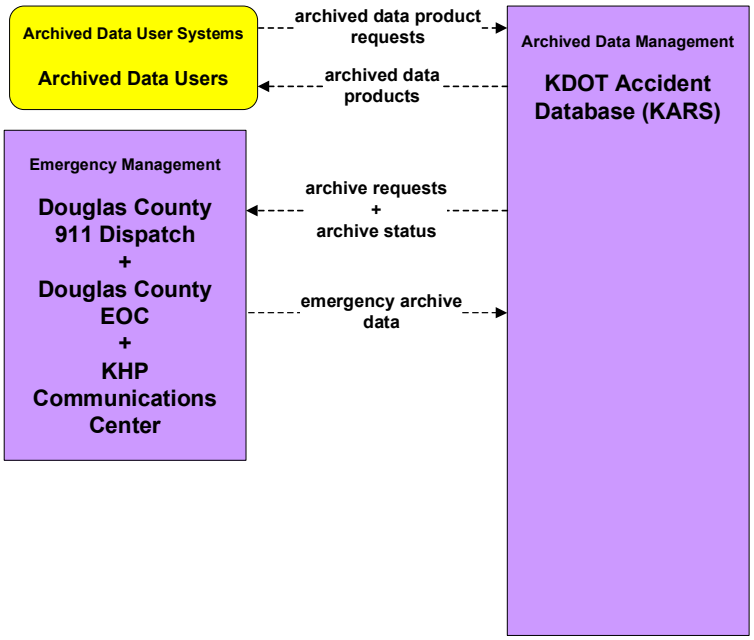


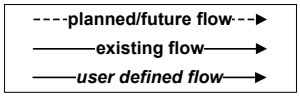
AD1 – ITS Data Mart
KTA



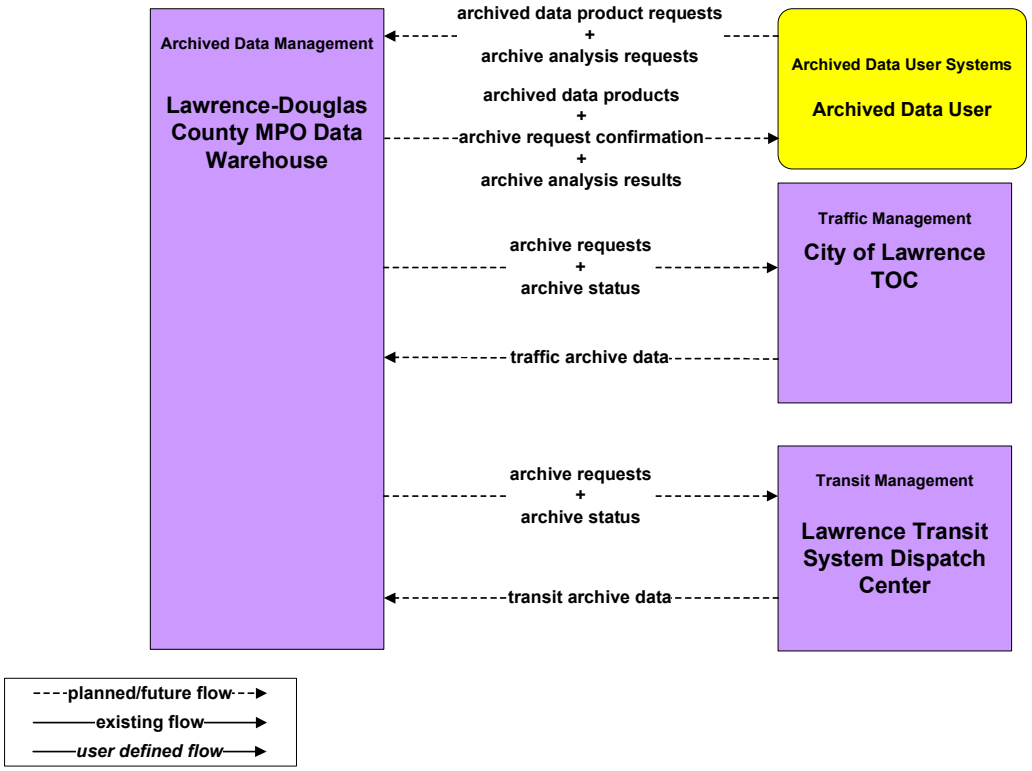


AD1 – ITS Data Mart
KDOT Accident Database (KARS)





AD2 – ITS Data Warehouse
Lawrence-Douglas County MPO



APPENDIX C – ELEMENT FUNCTIONS

Element Name	Equipment Package (Function)
City of Lawrence Automated Road Flood and Ice Closure Gates	Field Barrier System Control
	Roadway Equipment Coordination
City of Lawrence CCTV Cameras	Roadway Basic Surveillance
City of Lawrence Department of Public Works	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
City of Lawrence Department of Public Works Data Archive	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
City of Lawrence Department of Public Works Vehicles	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
City of Lawrence DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Lawrence Fire Department and EMS Vehicles	On-board EV En Route Support
City of Lawrence Police Vehicles	On-board EV En Route Support
City of Lawrence RWIS Sensors	Roadway Environmental Monitoring
City of Lawrence Speed Monitoring Equipment	Roadway Equipment Coordination
	Roadway Speed Monitoring
City of Lawrence TOC	Barrier System Management
	Collect Traffic Surveillance
	HRI Traffic Management
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Speed Monitoring
	MCM Work Activity Coordination

Element Name	Equipment Package (Function)
City of Lawrence TOC (continued)	MCM Work Zone Management
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Multimodal Coordination
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Speed Monitoring
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
City of Lawrence Traffic Management System Field Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
City of Lawrence Traffic Signals	Roadway Equipment Coordination
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
City of Lawrence Website	Basic Information Broadcast
	ISP Emergency Traveler Information
Commercial Vehicles	Vehicle Toll/Parking Interface
Douglas County 911 Dispatch	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Emergency Call-Taking
	Emergency Data Collection
	Emergency Dispatch
	Emergency Environmental Monitoring
	Emergency Evacuation Support
	Emergency Response Management
	Emergency Routing
	Incident Command
	Mayday Support

Element Name	Equipment Package (Function)
Douglas County Automated Road Flood and Ice Closure Gates	Field Barrier System Control
	Roadway Equipment Coordination
Douglas County CCTV Cameras	Roadway Basic Surveillance
Douglas County Department of Public Works Engineering and Operations Divisions	Barrier System Management
	Collect Traffic Surveillance
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Infrastructure Monitoring
	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
Douglas County Department of Public Works Engineering and Operations Divisions Data Archive	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
Douglas County Department of Public Works Engineering and Operations Divisions Vehicles	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
Douglas County EOC	Emergency Data Collection
	Emergency Environmental Monitoring
	Emergency Evacuation Support
	Emergency Response Management
	Incident Command

Element Name	Equipment Package (Function)
Douglas County Infrastructure Monitoring Data Collection Equipment	Roadway Infrastructure Monitoring
Douglas County RWIS Sensors	Roadway Environmental Monitoring
Douglas County Sheriff Vehicles	On-board EV En Route Support
Douglas County Traffic Management System Field Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
Douglas County Website	Basic Information Broadcast
	ISP Emergency Traveler Information
Johnson County Transit Dispatch Center	Transit Center Multi-Modal Coordination
KC Scout	Collect Traffic Surveillance
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Probe Information Collection
	TMC Regional Traffic Management
	TMC Traffic Information Dissemination
	Traffic Maintenance
KDOT 511 Telephone Information System	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Probe Information Collection
	ISP Traveler Data Collection
	Traveler Telephone Information
KDOT 511 Text Message System	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Traveler Data Collection
KDOT Accident Database (KARS)	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
KDOT Anti-Icing and De-Icing Field Equipment	Roadway Automated Treatment
	Roadway Equipment Coordination
KDOT Bureau of Construction and Maintenance	MCM Automated Treatment System Control
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management

Element Name	Equipment Package (Function)
KDOT Bureau of Construction and Maintenance (continued)	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Zone Management
KDOT CCTV Cameras	Roadway Basic Surveillance
KDOT Construction and Maintenance Vehicles	MCV Environmental Monitoring
	MCV Vehicle Location Tracking
	MCV Vehicle Safety Monitoring
	MCV Winter Maintenance
	MCV Work Zone Support
	Vehicle Environmental Probe Support
	Vehicle Location Determination
KDOT District 1 (Construction and Maintenance)	MCM Automated Treatment System Control
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Infrastructure Monitoring
	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
	MCM Work Zone Safety Management
KDOT District 1 (Operations)	Collect Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Probe Information Collection
	TMC Regional Traffic Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management

Element Name	Equipment Package (Function)
KDOT District 1 (Operations) (continued)	Traffic Data Collection
	Traffic Maintenance
KDOT DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
KDOT Environmental Data Collection Equipment	Roadway Probe Data Communications
KDOT HAR	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
KDOT Infrastructure Monitoring Data Collection Equipment	Roadway Infrastructure Monitoring
KDOT KanRoad Reporting System	Basic Information Broadcast
	ISP Probe Information Collection
	ISP Traveler Data Collection
KDOT KanRoad/511 Traveler Information Website	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Probe Information Collection
	ISP Traveler Data Collection
KDOT Planning Archive	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
KDOT RWIS Database	ISP Traveler Data Collection
KDOT RWIS Sensors	Roadway Environmental Monitoring
KDOT Statewide TOMC	Collect Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Probe Information Collection
	TMC Regional Traffic Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
KDOT Telecommunications Infrastructure GIS Database	ITS Data Repository

Element Name	Equipment Package (Function)
KDOT Traffic Management System Field Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Probe Data Communications
KDOT Traffic Signals	Roadway Equipment Coordination
	Roadway Signal Controls
KDOT Transportation Database (KANSYS)	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
KDOT Traveler Information Kiosks	Remote Basic Information Reception
	Remote Interactive Information Reception
KDOT Work Zone Safety Monitoring Equipment	Roadway Equipment Coordination
	Roadway Work Zone Safety
	Roadway Work Zone Traffic Control
KHP Communications Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Emergency Data Collection
	Emergency Response Management
	Incident Command
	Mayday Support
KHP Troop G	Emergency Response Management
	Incident Command
	Service Patrol Management
KHP Troop G Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
KTA Construction and Maintenance Vehicles	MCV Winter Maintenance
KTA Database	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
KTA DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
KTA Infrastructure Monitoring Data Collection Equipment	Roadway Infrastructure Monitoring
KTA Maintenance Dispatch	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management

Element Name	Equipment Package (Function)
KTA Maintenance Dispatch (continued)	MCM Infrastructure Monitoring
	MCM Roadway Maintenance and Construction
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
KTA Operations Center	Collect Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Probe Information Collection
	TMC Regional Traffic Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Toll Administration
	Toll Data Collection
	Traffic Data Collection
	Traffic Maintenance
KTA RWIS Sensors	Roadway Environmental Monitoring
KTA Security/Traffic Cameras	Roadway Basic Surveillance
KTA Service Area Kiosks	Remote Basic Information Reception
	Remote Interactive Information Reception
KTA Toll Plazas	Toll Plaza Toll Collection
KTA Traffic Management System Field Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Probe Data Communications
KTA Traveler Advisory Radio	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
KTA Traveler Information Website	Basic Information Broadcast
	ISP Emergency Traveler Information
	ISP Probe Information Collection
	ISP Traveler Data Collection
KU Dispatch	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Emergency Call-Taking

Element Name	Equipment Package (Function)
KU Dispatch (continued)	Emergency Data Collection
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
KU Maintenance Department	MCM Roadway Maintenance and Construction
KU on Wheels CCTV Camera Surveillance	Field Secure Area Surveillance
KU on Wheels Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management
	Transit Center Fixed-Route Operations
	Transit Center Information Services
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Passenger Counting
	Transit Center Security
	Transit Center Signal Priority
	Transit Center Vehicle Tracking
	Transit Evacuation Support
	Transit Garage Maintenance
KU on Wheels Fixed Route Vehicles	On-board Maintenance
	On-board Passenger Counting
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Information Services
	On-board Transit Security
	On-board Transit Signal Priority
	On-board Transit Trip Monitoring
KU on Wheels Kiosks	Remote Basic Information Reception
	Remote Interactive Information Reception
	Remote Transit Fare Management
	Remote Transit Information Services
KU on Wheels Lift Van Paratransit Vehicles	On-board Maintenance
	On-board Paratransit Operations
	On-board Schedule Management

Element Name	Equipment Package (Function)
KU on Wheels Lift Van Paratransit Vehicles (continued)	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
KU on Wheels Website	Basic Information Broadcast
	Infrastructure Provided Trip Planning
KU Parking Lot Management System	Parking Management
KU Parking Payment System	Parking Electronic Payment
KU Police Vehicles	On-board EV En Route Support
KU Safe Ride Vehicles	On-board Maintenance
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
KU Website	Basic Information Broadcast
	ISP Emergency Traveler Information
Lawrence Transit System CCTV Camera Surveillance	Field Secure Area Surveillance
Lawrence Transit System Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management
	Transit Center Fixed-Route Operations
	Transit Center Information Services
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Passenger Counting
	Transit Center Security
	Transit Center Signal Priority
	Transit Center Vehicle Tracking
	Transit Data Collection
	Transit Evacuation Support
	Transit Garage Maintenance
Lawrence Transit System DMS	Remote Basic Information Reception
	Remote Transit Information Services
Lawrence Transit System E-Routes Email System	Basic Information Broadcast

Element Name	Equipment Package (Function)
Lawrence Transit System Fixed Route Vehicles	On-board Maintenance
	On-board Passenger Counting
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Information Services
	On-board Transit Security
	On-board Transit Signal Priority
	On-board Transit Trip Monitoring
Lawrence Transit System Kiosks	Remote Basic Information Reception
	Remote Interactive Information Reception
	Remote Transit Fare Management
	Remote Transit Information Services
Lawrence Transit System TLift Paratransit Vehicles	On-board Maintenance
	On-board Paratransit Operations
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
Lawrence Transit System Website	Basic Information Broadcast
	Infrastructure Provided Trip Planning
Lawrence-Douglas County MPO Data Warehouse	Government Reporting Systems Support
	ITS Data Repository
	Traffic and Roadside Data Archival
Municipal Department of Public Works	MCM Incident Management
	MCM Roadway Maintenance and Construction
Municipal Emergency Vehicles	On-board EV En Route Support
Municipal Website	Basic Information Broadcast
	ISP Emergency Traveler Information
Private Concierge Providers	Mayday Support
Private Traveler Personal Computing Devices	Personal Interactive Information Reception
Private Vehicles	Vehicle Environmental Probe Support
	Vehicle Location Determination
	Vehicle Mayday I/F
	Vehicle Toll/Parking Interface

Element Name	Equipment Package (Function)
School Bus System	Transit Evacuation Support
Topeka Bus System Dispatch	Transit Center Multi-Modal Coordination

APPENDIX D – ITS ARCHITECTURE MAINTENANCE DOCUMENTATION FORM

Lawrence-Douglas County Regional ITS Architecture
Architecture Maintenance Documentation Form

Please complete the following questionnaire to document changes for the Lawrence-Douglas County Regional ITS Architecture. Modifications will be made during the next architecture update.

Agency	
Agency Contact Person	
Street Address	
City	
State, Zip Code	
Telephone	
Fax	
E-Mail	

Change Information

Please indicate the type of change:

- ☐ Administrative: Basic changes that do not affect the structure of the architecture
  Examples include: Changes to stakeholder or element name, element status, or data flow status
- ☐ Functional – Single Agency: Structural changes that impact only one agency
  Examples include: Addition of a new market package or modifications to an existing market package that affects only your agency
- ☐ Functional – Multiple Agency: Structural changes that have the potential to impact multiple agencies
  Examples include: Addition of a new market package or modifications to an existing market package that involves multiple agencies, incorporation of a new stakeholder into the architecture

Describe requested change	
What, if any, market packages are impacted by the proposed change? Note: If the proposed change involves creating or modifying a market package please attach a sketch of the new or modified market package.	

Does the proposed change affect any additional stakeholders?	
Has coordination occurred with any impacted stakeholders? Please describe the results.	

Please submit change forms to:

Lawrence-Douglas County Metropolitan Planning Office
P.O. Box 708
Lawrence, KS 66044-0708
Phone: (785) 832-3150

Date Request Filed: _____