



Regional ITS Architecture and Deployment Plan Lawrence-Douglas County Region

Draft Regional ITS Architecture

Prepared by:



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LIST OF ACRONYMS

AD	Archived Data
AMBER	America's Missing Broadcast Emergency Response
APTS	Advanced Public Transportation Systems
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CAD	Computer Aided Dispatch
CCTV	Closed-circuit Television
DMS	Dynamic Message Sign
EM	Emergency Management
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAZMAT	Hazardous Materials
IM	Incident Management
ITS	Intelligent Transportation System
L RTP	Long Range Transportation Plan
MC	Maintenance and Construction
MDT	Mobile Data Terminal
MPO	Metropolitan Planning Organization
NOAA	National Oceanic and Atmospheric Administration
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organizations
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Plan
TMC	Transportation Management Center
TOC	Traffic Operations Center
TOMC	Traffic Operations and Management Center
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detection Systems

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 have 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.

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

- Improving traffic signal coordination;
- Ability to bring 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**.

Intelligent Transportation Systems

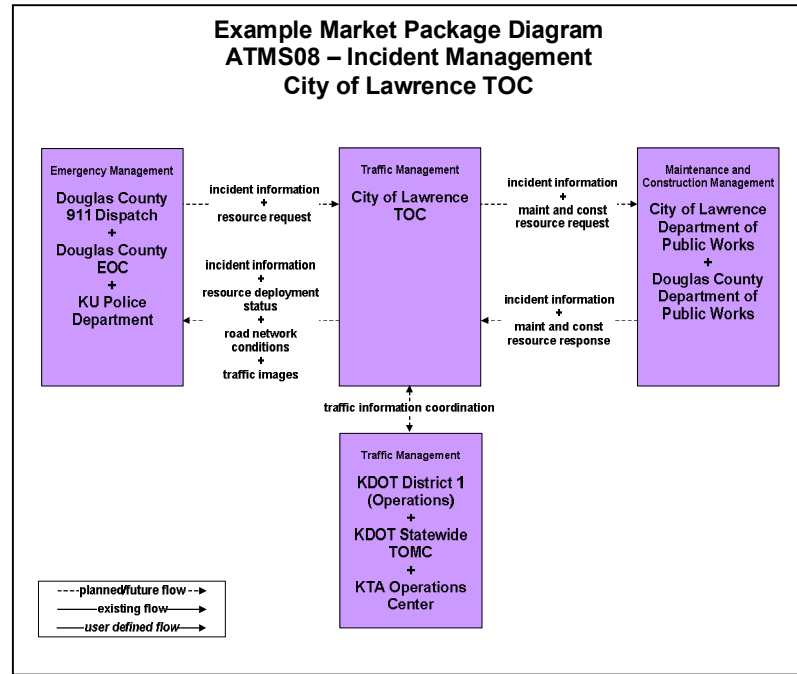
Intelligent Transportation Systems are the application of electronic technologies and communications to improve the operations of roadways and transit systems.

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

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, 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 45 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, 20 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 5**.

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 7**.

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 8**. Roles and responsibilities are categorized across a range of transportation services such as arterial management, highway 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** will document how the ITS architecture will be updated and will outline a process for evaluating whether or not a project fits within the architecture.

A companion document to the Regional ITS Architecture will be developed to identify projects that can be implemented incrementally to develop intelligent transportation systems in the Lawrence-Douglas County Region. The Lawrence-Douglas County ITS Deployment Plan will group the projects into short-term (5-year), mid-term (10-year), and long-term (20-year) deployment timeframes and provide a brief description and estimate of probable cost for planning purposes.

**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
MC08 Work Zone Management
MC10 Maintenance and Construction Activity Coordination

Public Transportation Management

APTS1 Transit Vehicle Tracking
APTS2 Transit Fixed-Route Operations
APTS3 Demand Response Transit Operations
APTS5 Transit Security
APTS8 Transit Traveler Information

Traveler Information

ATIS1 Broadcast Traveler Information
ATIS2 Interactive Traveler Information
ATIS6 Transportation Operations Data Sharing

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 is being 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 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 will be held to gather input from stakeholders and two presentations will be given to the MPO/Governing Bodies to ensure that policy makers have been updated on the project.

The Regional ITS Architecture and Deployment Plan that will be developed should reflect an accurate snapshot of existing ITS deployments and future ITS plans in the Region. However, needs and priorities of the Region will change over time, and, in order to remain 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 National ITS Architecture requirements, 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 will be developed for the Lawrence-Douglas County Regional ITS Architecture and will be included in this section. The plan will outline the procedure for updating the ITS architecture over time. *(Note: This section will be completed after the final Comment Resolution Workshop and updated in the Revised Draft ITS Architecture.)*

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.

(Note: Appendix C and D will be completed in the Revised Draft ITS Architecture)

1.3 Lawrence-Douglas County

1.3.1 Geographic Boundaries

Lawrence-Douglas County encompasses the total geographic area of Douglas County in the northwest part of Kansas. The Region is the second fastest growing county in the state and has experienced a 12% 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 public 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.

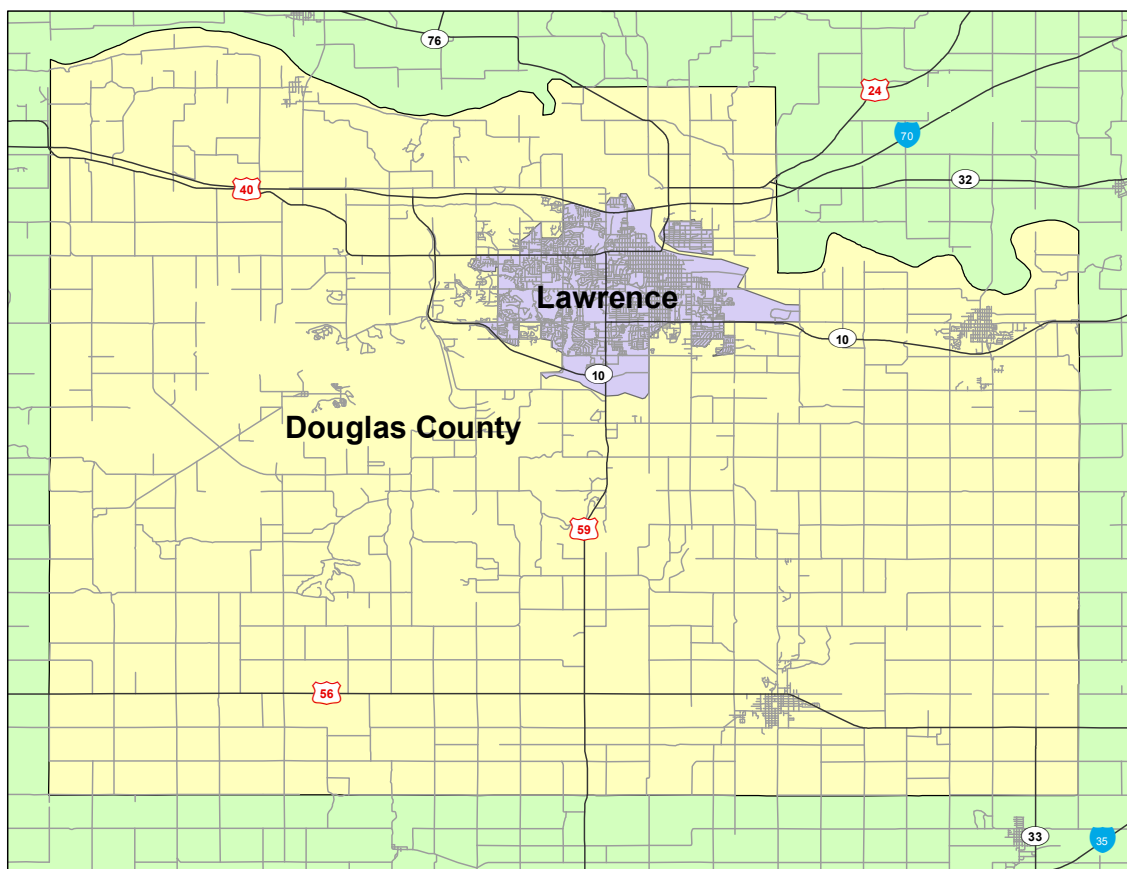


Figure 1 – Lawrence-Douglas County Regional Boundaries

1.3.2 Transportation Infrastructure

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

I-70 extends from east to the 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 56 is an east-west road located in the 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 indefinitely due to land acquisition issues.

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 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 goes 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 have 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 7 th 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 Information Systems	PO Box 708 Lawrence, KS 66044	John Williams
City of Lawrence Information Systems	6 E 6 th 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 11 th Street Lawrence, KS 66044	William Cory
City of Lawrence Police Department	111 E 11 th Street Lawrence, KS 66044	Ron Olin
Douglas County Information Technology	111 E 11 th Street Lawrence, KS 66044	Jim Lawson
Douglas County 911	111 E 11 th Street Lawrence, KS 66044	Jim Denny
Douglas County Emergency Management Agency	111 E 11 th Street Lawrence, KS 66044	Jillian Blair
Douglas County Emergency Management Agency	111 E 11 th 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 11 th Street Lawrence, KS 66044	Ken McGovern
Douglas County Sheriff's Office	111 E 11 th Street Lawrence, KS 66044	Steve Rector
Federal Highway Administration	6111 SW 29 th Street Suite 100 Topeka, KS 66614	Robert Alva
Federal Highway Administration	6111 SW 29 th Street Suite 100 Topeka, KS 66614	Byron Low
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	700 SW Harrison Street Topeka, KS 66603	Karen Gilbertson



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

Stakeholder Agency	Address	Contact
KDOT	700 SW Harrison Street Topeka, KS 66603	Joel Skelley
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 Keapy
Lawrence Freenet	4105 W 6 th Street Lawrence, KS 66049	Michael Courtney
Lawrence Freenet	4105 W 6 th 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
USD 497 – Laidlaw Transportation	1548 E 23 rd 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 Lawrence-Douglas County 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.

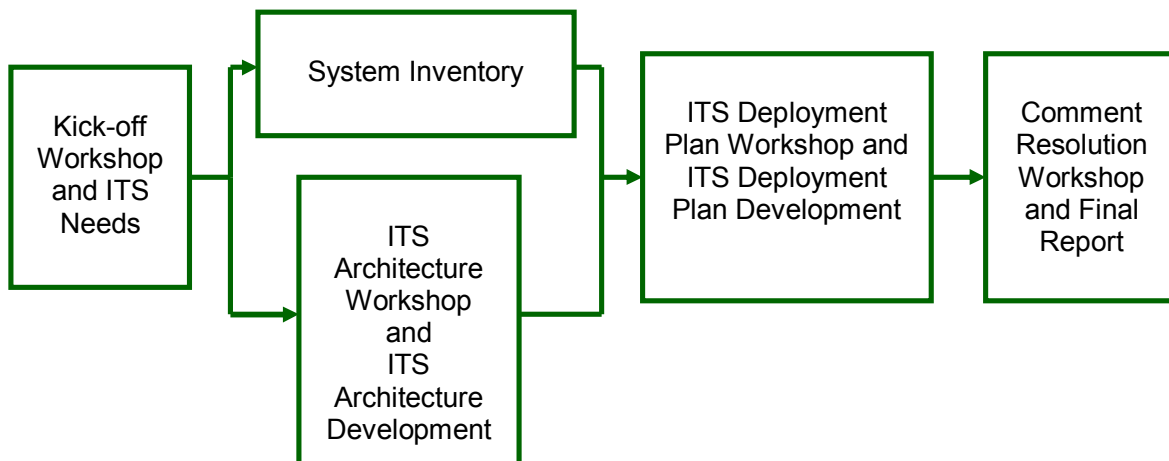


Figure 2 – ITS Architecture and Deployment Plan Development Process

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 MPO/Governing Bodies group at the beginning and the end of the project.

Hard 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 Presentation and 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.

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 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 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 – Final Presentation and Workshop: A Comment Resolution Workshop will be held with stakeholders to review the Draft Regional ITS Architecture and the Draft Regional ITS Deployment Plan. Next steps for the Region will also be discussed. A presentation will be given to the MPO/Governing Bodies that provided an overview of the final project recommendations.

Task 6 – Final Report: Comments from the Final Presentation and Workshop will be incorporated, and a Revised Draft Regional ITS Architecture and Regional ITS Deployment Plan will developed. Following a comment period, the final Regional ITS Architecture and Deployment Plan will be developed.

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:

Traffic Management – includes future traffic management and/or operations centers, vehicle detection systems, fixed and portable DMS, and CCTV cameras.

Traveler Information – includes broadcast traveler information and other related technologies such as the Internet.

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.

Commercial Vehicle Operations – includes hazardous material (HAZMAT) management.

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 2** 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 2 – 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 locations (AVL) 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 information service providers.

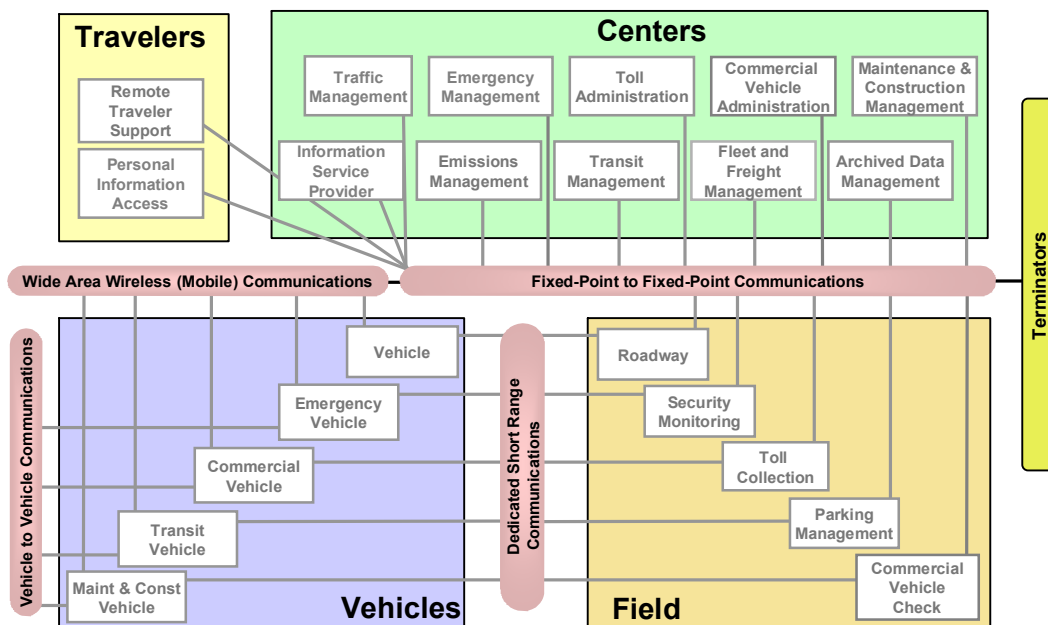


Figure 3– National ITS Architecture Physical Subsystem Interconnect Diagram

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 3** 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 municipalities which represents the cities and towns not specifically called out in the architecture.

Table 4 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 3 – 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 EMS, Fire, Sheriff and Highway Departments.
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 responsible for the construction, maintenance, and operation of roadways in the State of Kansas.
KHP	Kansas Highway Patrol. State law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.
KTA	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	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	National Oceanic and Atmospheric Administration, 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 and coordinates services with Lawrence Transit.



Table 4 – 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	City of Lawrence gates that automatically 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 TOC for traffic condition monitoring and management of incidents.	Planned
	City of Lawrence City Engineer's Office	Responsible for administration of maintenance and construction projects within the City.	Existing
	City of Lawrence Department of Public Works	The Public Works Department is 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 Vehicles	Vehicles used in maintenance operations including snow removal.	Existing
	City of Lawrence DMS	Dynamic message signs operated by the City of Lawrence to provide information to drivers such as lane closures due to a crash or from the weather.	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	The law enforcement agency within the City of Lawrence.	Existing
	City of Lawrence Police Vehicles	The patrol vehicles used by the City of Lawrence Police Department.	Existing
	City of Lawrence Public Works Data Archive	The traffic data archive system for the City of Lawrence.	Planned
	City of Lawrence RWIS Sensors	Road weather information system operated and maintained 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 owned and operated by the City of Lawrence.	Planned
	City of Lawrence TOC	Lawrence traffic operations center responsible for the City signal system operations.	Planned



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
City of Lawrence (continued)	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 will include real-time construction, work zone, special event, incident, and traffic information.	Existing
	Lawrence-Douglas County MPO Data Warehouse	Metropolitan Planning Organization for Lawrence-Douglas County. The agency is responsible for transportation planning in the Region including development of the TIP for the Region.	Planned
Douglas County	Douglas County Automated Road Flood and Ice Closure Gates	Douglas County gates that automatically close when flood or ice conditions make a roadway hazardous.	Planned
	Douglas County Department of Public Works Engineering and Operations Divisions	The public works department is responsible for the maintenance of roadways in Douglas County.	Existing
	Douglas County Department of Public Works Engineering and Operations Divisions Vehicles	Vehicles used in maintenance operations including snow removal in Douglas County.	Existing
	Douglas County DMS	Dynamic message signs operated by Douglas County to provide information to drivers such as lane closures due to a crash or from the weather.	Planned
	Douglas County Engineer's Office	Responsible for administration of maintenance and construction projects within the County.	Existing
	Douglas County EOC	Emergency operations center 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	Douglas County equipment that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned
	Douglas County Maintenance Management System	System to track the status of maintenance projects within the County.	Planned



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Douglas County (continued)	Douglas County Public Works Engineering and Operations Divisions Data Archive	The traffic data archive system for Douglas County.	Planned
	Douglas County RWIS Sensors	Road weather information system operated and maintained by the Douglas County. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Planned
	Douglas County Sheriff's Vehicles	Vehicles owned and operated by the Douglas County Sheriff's department.	Existing
	Douglas County Website	Website for Douglas County. This website is currently static. The City envisions that at some point the site will provide real-time information.	Existing
	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 Leocompton and can also dispatch KU Police.	Existing
Financial Institution	Financial Service Provider	Handles exchange of money for transit and toll electronic payment collection.	Existing
	Service Agency	Agency responsible for payment of transit fares for medial transportation as part of government subsidized medical care. This includes Medicare, and Veteran's Administration programs.	Existing
Johnson County Transit	Johnson County Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operate 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	Responsible for the collection and dissemination of criminal justice information to public and private agencies.	Existing
	KBI Amber Alert System	Responsible for issuing statewide Amber Alerts in Kansas.	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 dynamic message signs. The center is a joint effort between KDOT and MoDOT.	Existing

Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KDOT (continued)	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)	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 used for anti-icing and de-icing that is owned by the Kansas Department of Transportation.	Existing
	KDOT Bureau of Construction and Maintenance	The Bureau is responsible for plans and proposals, specifications, special provisions and maintenance management in Kansas.	Existing
	KDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	KDOT Construction and Maintenance Vehicles	Kansas Department of Transportation vehicles used in maintenance and construction operations. This includes snow removal operations.	Existing
	KDOT District 1 (Construction and Maintenance)	Responsible for the construction and maintenance activities for counties in KDOT District 1.	Existing
	KDOT District 1 (Operations)	Responsible for traffic operations along 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	Dynamic message signs for 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 for traffic information dissemination.	Planned
	KDOT Infrastructure Monitoring Data Collection Equipment	Equipment that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KDOT (continued)	KDOT KanRoad Reporting System	Information is inputted into the 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 that provides real time information to users about road conditions, construction detours and travel weather information for specific routes.	Existing
	KDOT Planning Archive	The traffic data archive system for KDOT.	Planned
	KDOT RWIS Database	Central database for data gathered by KDOT RWIS sensors system.	Existing
	KDOT RWIS Sensors	Road weather information system operated and maintained by KDOT. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Existing
	KDOT Statewide TOMC	Traffic operations and management center responsible for maintaining and implementing roadway projects, traffic management, and serves as a backup TMC for Kansas.	Planned
	KDOT Telecommunications Infrastructure GIS Database	Database for the sharing of GIS data within the state of Kansas.	Existing
	KDOT Traffic Management System Field Equipment	Traffic management equipment 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 to hold transportation related information, including traffic volumes, along KDOT roadways.	Existing
	KDOT Traveler Information Kiosks	Kiosks for dissemination of traveler information. Typically located in rest areas.	Existing
	KDOT Work Zone Safety Monitoring Equipment	Workzone monitoring and alerting equipment to improve the safety of workers.	Planned
KHP	KHP Communications Center	Responsible for the operation of the Highway Patrol's radio communication system.	Existing
	KHP Troop G	Special Kansas Highway Patrol troop responsible for 24 hour patrol along Kansas Turnpike Authority roadways.	Existing
	KHP Troop G Vehicles	Vehicles used by the Kansas Highway Patrol Troop G. Includes patrol cars and service patrol vehicles.	Existing



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KTA	KTA Construction and Maintenance Vehicles	Kansas Turnpike Authority vehicles used in maintenance and construction operations. This includes snow removal operations.	Existing
	KTA Database	Central database for KTA traffic information.	Planned
	KTA DMS	Dynamic message signs for traffic information dissemination.	Existing
	KTA Infrastructure Monitoring Data Collection Equipment	Equipment that measures the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure.	Planned
	KTA Maintenance Dispatch	Responsible for receiving calls and dispatching maintenance personnel to respond to maintenance issues along the Kansas Turnpike.	Existing
	KTA Operations Center	Kansas Turnpike Authority operations center is responsible for the daily operations along the turnpike.	Existing
	KTA RWIS Sensors	Road weather information system operated and maintained by the Kansas Turnpike Authority. Sensors are installed in the field to gather information about the roadway such as temperature and moisture levels.	Existing
	KTA Security/Traffic Cameras	Cameras used for traffic surveillance, incident management, and toll enforcement.	Existing
	KTA Service Area Kiosks	Kiosks for dissemination of traveler information.	Planned
	KTA Toll Plazas	Toll collection location for use of the Kansas Turnpike.	Existing
	KTA Traffic Management System Field Equipment	Traffic data collection equipment operated by the Kansas Turnpike Authority.	Planned
	KTA Traveler Advisory Radio	Radio broadcast of current weather and traffic information along the Kansas Turnpike.	Existing
	KTA Traveler Card	Allows the automatic transfer of funds through electronic payment card.	Existing
	KTA Traveler Information Website	Website for the dissemination of traveler information. Currently static, but at some point in the future will provide real time information to users about road conditions, construction detours and travel weather information for specific routes.	Existing
KU	KU Design and Construction Management	Responsible for the planning, design, and management of consultant services and construction on the KU campus, including roads.	Existing



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
KU (continued)	KU Dispatch	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	Any special event on campus must be approved by the events committee. The events committee then notifies appropriate agencies of any resulting road closures.	Existing
	KU Maintenance Department	Responsible for construction and maintenance on the KU campus, including roads.	Existing
	KU Parking System	Keeps track of parking availability in commuter lots on the KU campus.	Existing
	KU Police Department	The law enforcement agency on the KU campus.	Existing
	KU Police Vehicles	The patrol vehicles used by KU police.	Existing
KU on Wheels	KU on Wheels CCTV Surveillance	CCTV 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	Medium for collection of transit fares electronically.	Planned
	KU on Wheels Fixed Route Vehicles	Fixed route vehicles that are operated by KU on Wheels.	Existing
	KU on Wheels Kiosks	Kiosks 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 that are operated by KU on Wheels.	Existing
	KU on Wheels Website	Website 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, with door-to-door service to their home between 10:30 AM and 2:30 AM.	Existing
Lawrence Transit	Lawrence Transit DMS	Dynamic message signs at transfer points to post real time transit travel information including schedules, fares, and route destinations for Lawrence Transit.	Planned



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Lawrence Transit (continued)	Lawrence Transit System Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Lawrence Transit E-Routes Email System	E-Routes is a 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 CCTV Surveillance	CCTV surveillance on Lawrence Transit fixed route and paratransit vehicles (future) as well as at the maintenance facility (existing). Surveillance feeds are envisioned to be local record only.	Existing
	Lawrence Transit System Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operate by Lawrence Transit.	Existing
	Lawrence Transit System Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Lawrence Transit System Fixed Route Vehicles	Fixed route vehicles operated by Lawrence Transit.	Existing
	Lawrence Transit System Kiosks	Kiosks 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 TLIift Paratransit Vehicles	Paratransit vehicles that are operated by Lawrence Transit.	Existing
	Lawrence Transit System Website	Website with information about fares and schedules. Currently static information only.	Existing
Media	Local Print and Broadcast Media	Local media that provides traffic or incident information to the public.	Existing
Municipal	Municipal Department of Public Works	The public works department is responsible for the maintenance of roadways in the municipality.	Existing
	Municipal Emergency Vehicles	Local law enforcement, fire, and EMS vehicles.	Existing
	Municipal Website	Websites are currently static. Municipalities envision that at some point the sites will provide real-time information.	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts and information about meteorology.	Existing
Other Agencies	Reverse Calling System	An automated system that delivers outbound notifications on a large scale basis.	Existing



Table 4 – Lawrence-Douglas County Inventory of Regional Subsystems/Terminators (continued)

Stakeholder	Element Name	Element Description	Status
Other Agencies (continued)	School Bus System	Local School bus fleets, these are frequently contracted services.	Existing
	Unified School District	Consists of elementary, secondary, and high schools.	Existing
Private Information Service Provider	Private Concierge Providers	Private entities that provide customized services to travelers. This service is usually subscription based, for example On-Star.	Existing
	Private Sector Traveler Information Services	Website sponsored by a private entity. Often this information is provided through a subscription service.	Existing
Rail Operators	Rail Operator Wayside Equipment	Equipment 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	Those who request information from the archive system.	Planned
	Commercial Vehicles	Privately owned commercial vehicles that travel throughout the region.	Existing
	Maintenance and Construction Field Personnel	The individuals working at a maintenance or construction site.	Existing
	Pedestrians	People who travel on foot within the region.	Existing
	Private Traveler Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
	Private Vehicles	Vehicles operated in the region by a private sector individual.	Existing
	Traveler	Users of the transportation system, either transit or other service such as 511 traveler information.	Existing
Topeka Bus System	Topeka Bus System Dispatch	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operate by the Topeka Bus System. Future plans to connect the current bus system to Lawrence through agency agreements.	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.

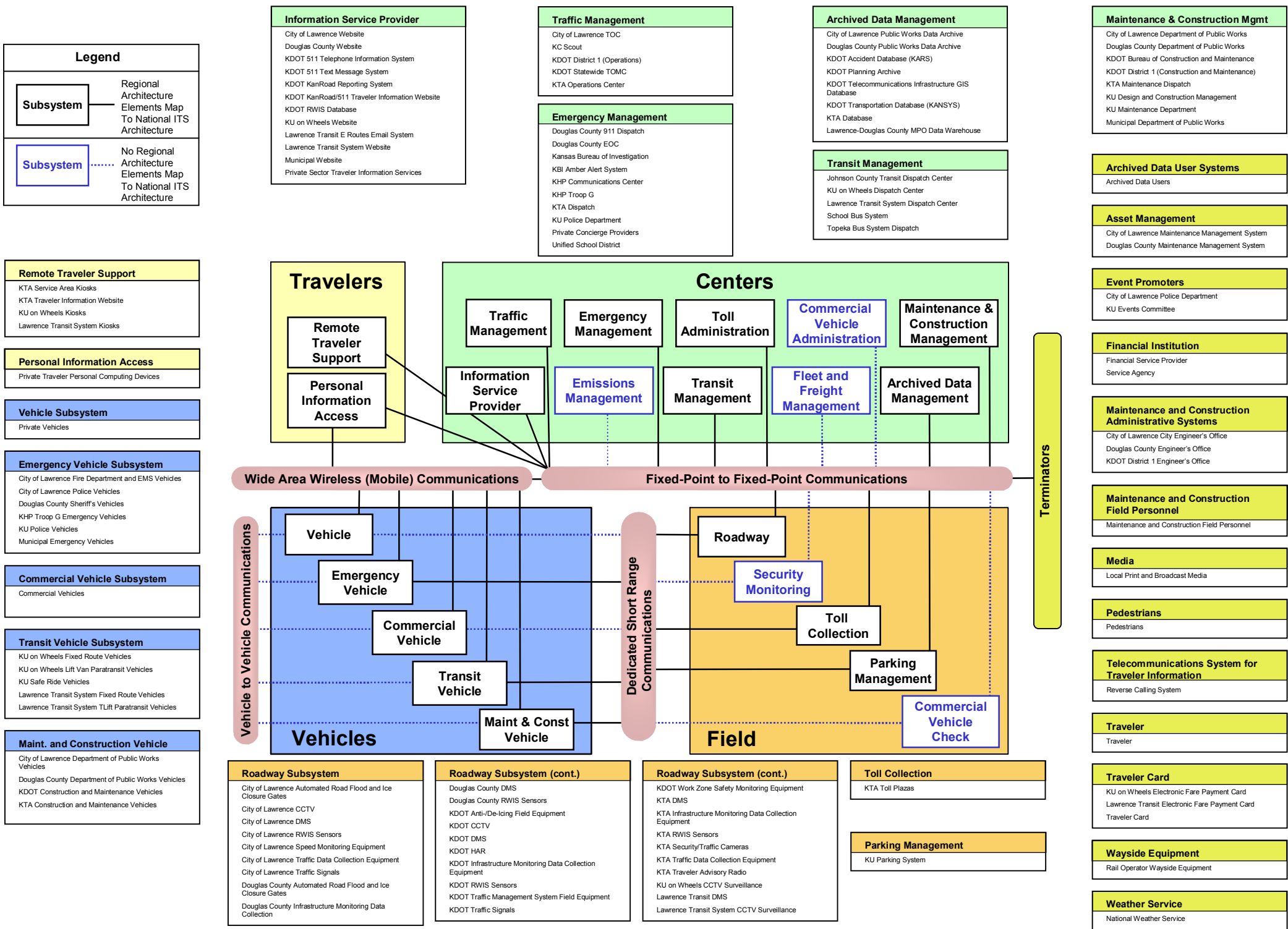


Figure 4 – Lawrence-Douglas County Regional System Interconnect Diagram

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-five market packages were selected for implementation in the Region as shown in **Table 5**. 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 5 – 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 EM09 Evacuation and Reentry Management	EM03 Mayday and Alarms Support EM06 Wide-Area Alert EM08 Disaster Response and Recovery
Maintenance and Construction Management		
MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC08 Work Zone Management MC10 Maintenance and Construction Activity Coordination	MC06 Winter Maintenance MC07 Roadway Maintenance and Construction MC09 Work Zone Safety Monitoring MC11 Environmental Probe Surveillance	MC01 Maintenance and Construction Vehicle and Equipment Tracking 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 ATIS06 Transportation Operations Data Sharing		
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.

Error! Reference source not found. 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 2**, drove the market package customization. Those needs are matched to their respective market package(s) in **Table 6**. Not all market packages included in the architecture are matched to needs in **Table 6** because some market packages already exist or there is not an immediate need in the Region that is encompassed by the market package.

Table 6 – 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 ATIS06
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 mobile data terminals (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.	ATPS01 APTS08
Need signal priority for Lawrence Transit vehicles.	APTS09



ITS Need	Market Package
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 5**. 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.

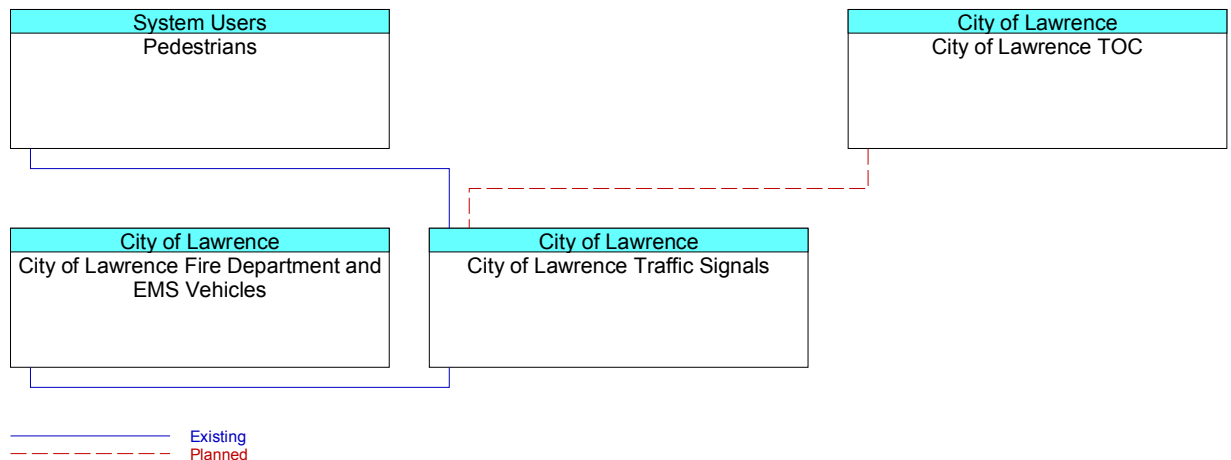


Figure 5 – Example Interconnect Diagram: City of Lawrence Traffic Signals

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 6**.

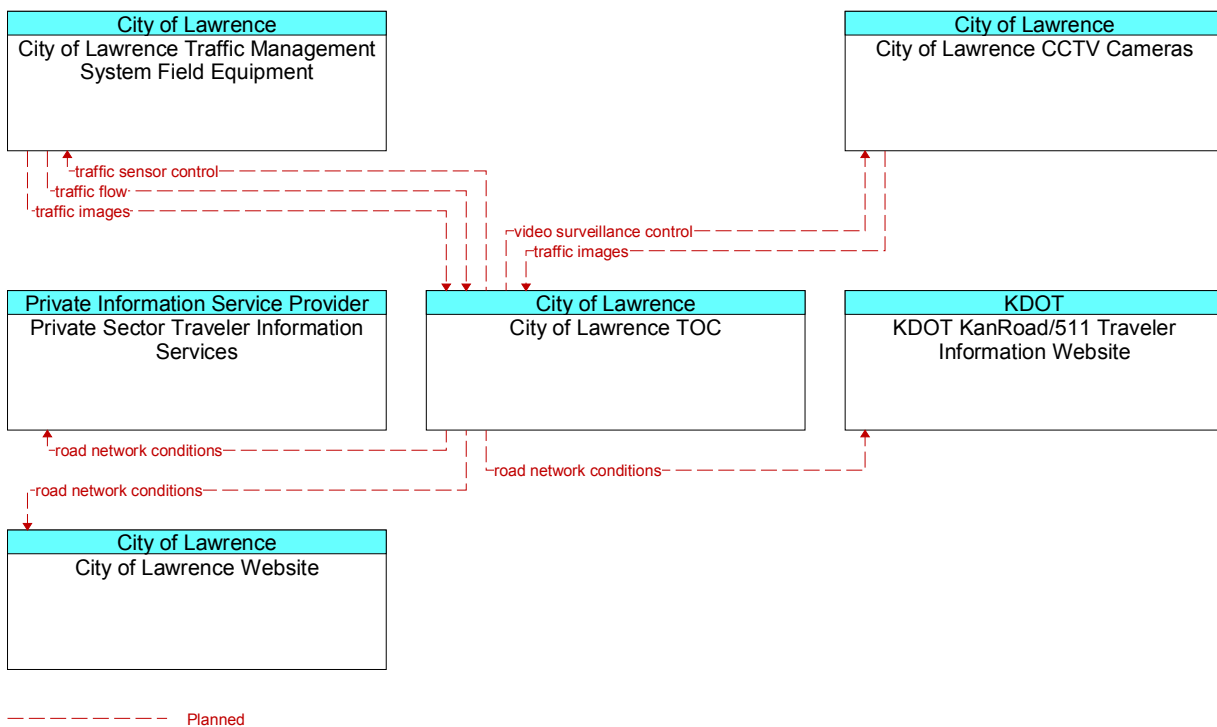


Figure 6 – Example Flow Diagram: ATMS01 – Network Surveillance

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. *(Note: Appendix C will be included in the Revised Draft ITS Architecture. Version 4.0 of Turbo Architecture to support Version 6 of the National ITS Architecture was not available when this draft was prepared but is scheduled for release in late fall 2007).*

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 7** (to be included when the draft is revised so the most recent version of Turbo Architecture can be used) 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 7 – Lawrence-Douglas County Applicable ITS Standards

SDO	Document ID	Title
(Note: Table 7 will be included when the Revised Draft ITS Architecture is revised so the most recent version of Turbo Architecture can be used.)		

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:

Arterial 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.

Highway 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.

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.

Emergency Management – The development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.

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



Table 8 – Lawrence-Douglas County Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Arterial 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.
		Provide speed monitoring on city owned roadways
	Municipal	Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Provide road closures on municipality 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.
Highway Management	KDOT	Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
		Operate dynamic message signs and highway advisory radio 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 dynamic message signs 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.

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 network surveillance equipment including CCTV cameras and vehicle detection for detection and verification of incidents on city streets.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Operate dynamic message signs for the distribution of incident information to travelers on the roadway.
		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 dynamic message signs and highway advisory radio for the distribution of incident information to travelers on the roadway.
		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 dynamic message signs and highway advisory radio for the distribution of incident information to travelers on the roadway.
		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.

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.
	KU Dispatch	Dispatch University police and City's fire vehicles, as well as coordinate with all other public safety agencies within the Region.
		Coordinate incident response with other public safety agencies and traffic management.
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.
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.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Lawrence Transit	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.
	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
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.		

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	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, highway advisory radio, and sharing of information with other groups.
		Disseminate work 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, highway advisory radio, and sharing of information with other groups.
		Disseminate work 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.
	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.



Transportation Service	Stakeholder	Roles/Responsibilities
Archived Data Management	City of Lawrence	Collect and archive information from regional traffic management providers, regional transit agencies, and maintenance agencies.
	Douglas County	Collect and archive information from regional traffic management providers, regional transit agencies, and maintenance agencies.
	KDOT	Collect and archive information from regional traffic management providers, regional transit agencies, and maintenance agencies.
	KTA	Collect and archive transportation and emergency data and information for KTA.
	Lawrence-Douglas County MPO	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 management, incident management, provide traveler information, and 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 9 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 9 – 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 CAD 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 will be 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.



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. Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture and Regional ITS Deployment Plan. 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 for implementation of the projects.

(Note: This section will be completed after the final Comment Resolution Workshop and updated in the Revised Draft ITS 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, accidents, 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 or 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.



APPENDIX B – CUSTOMIZED MARKET PACKAGES



APPENDIX B

LIST OF FIGURES

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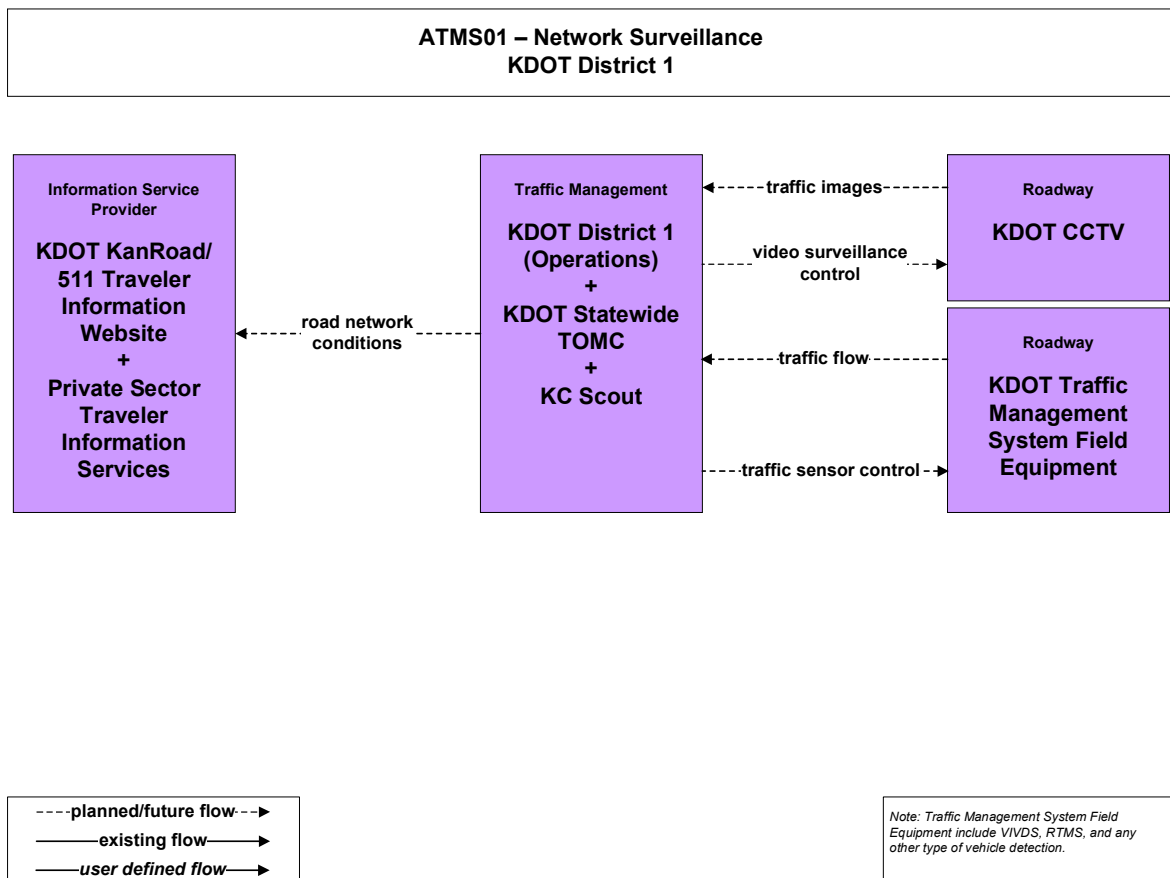


APPENDIX B

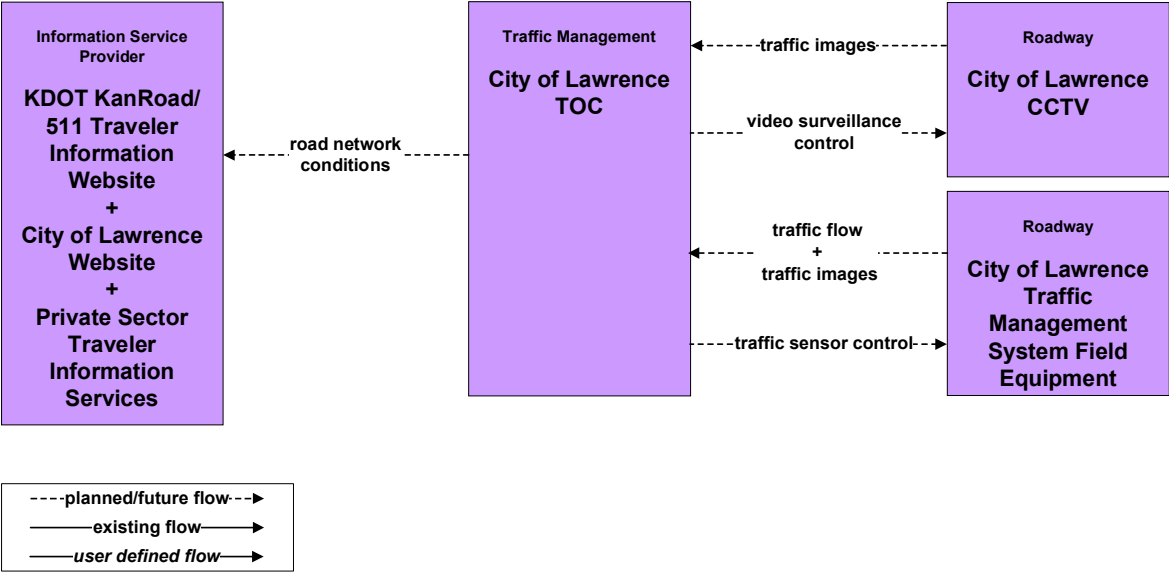
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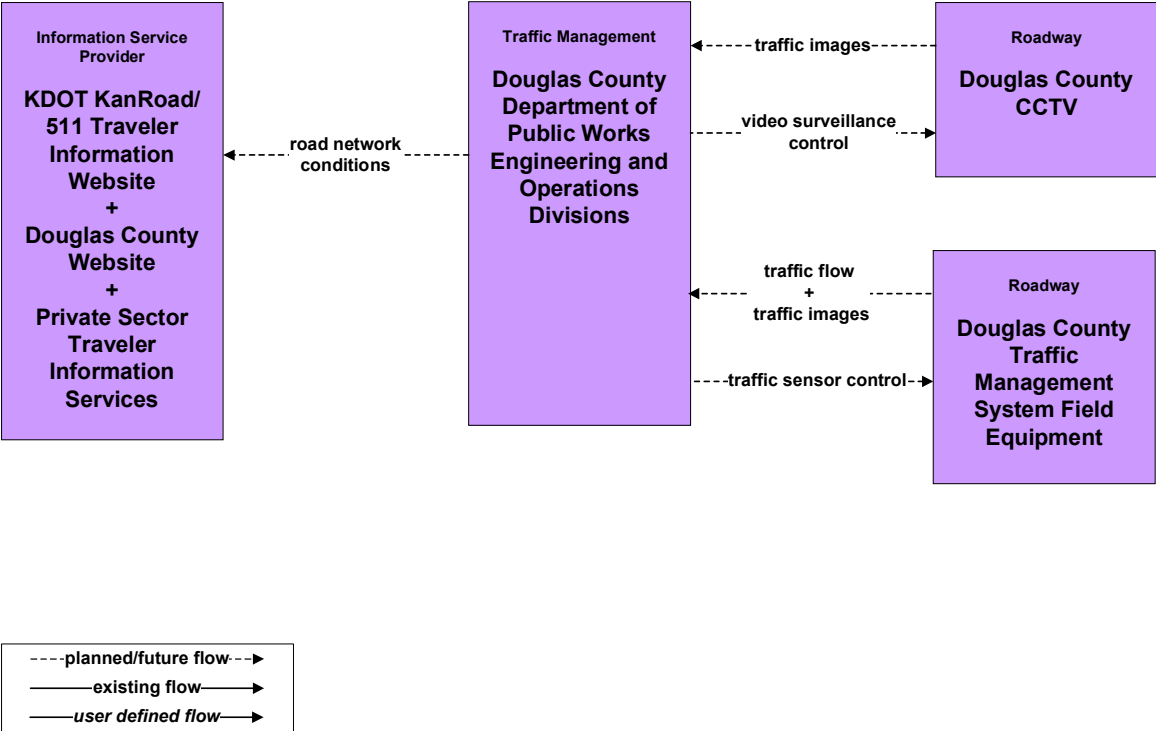
Advanced Traffic Management System

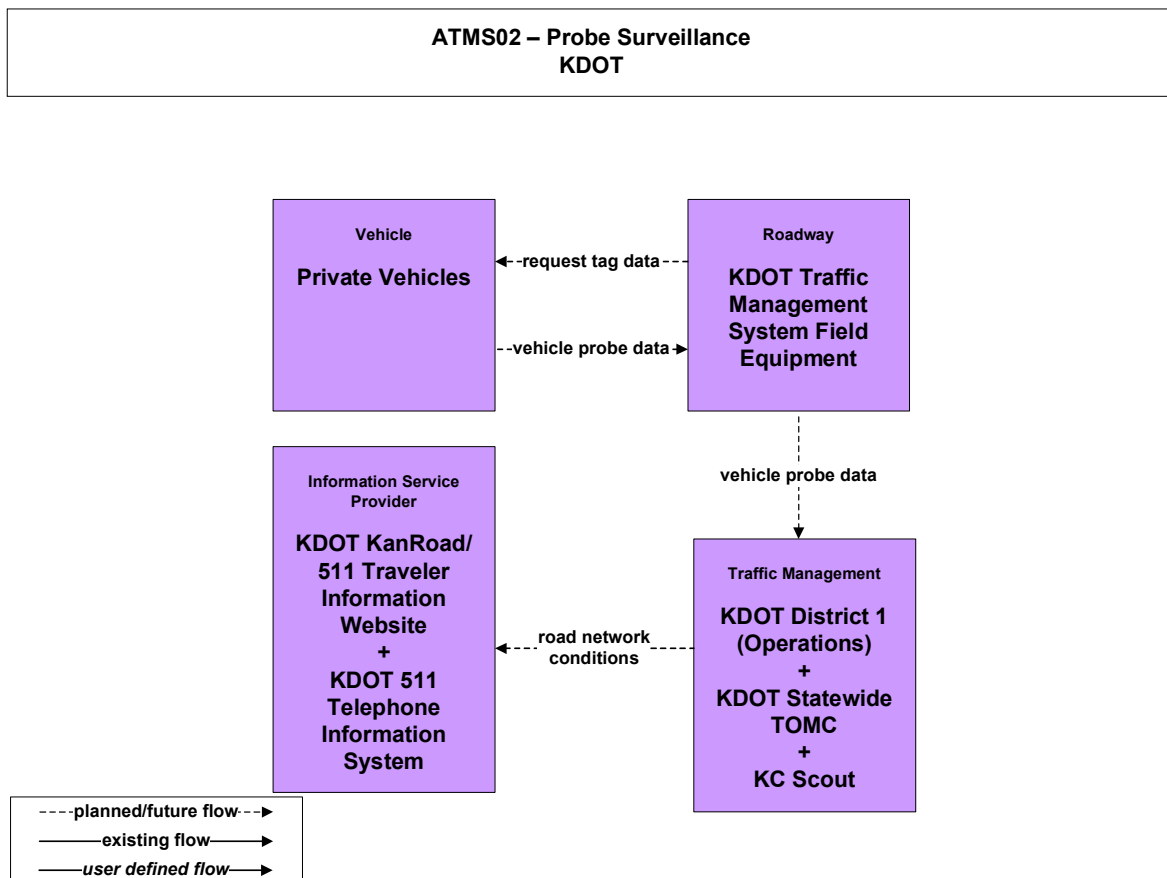
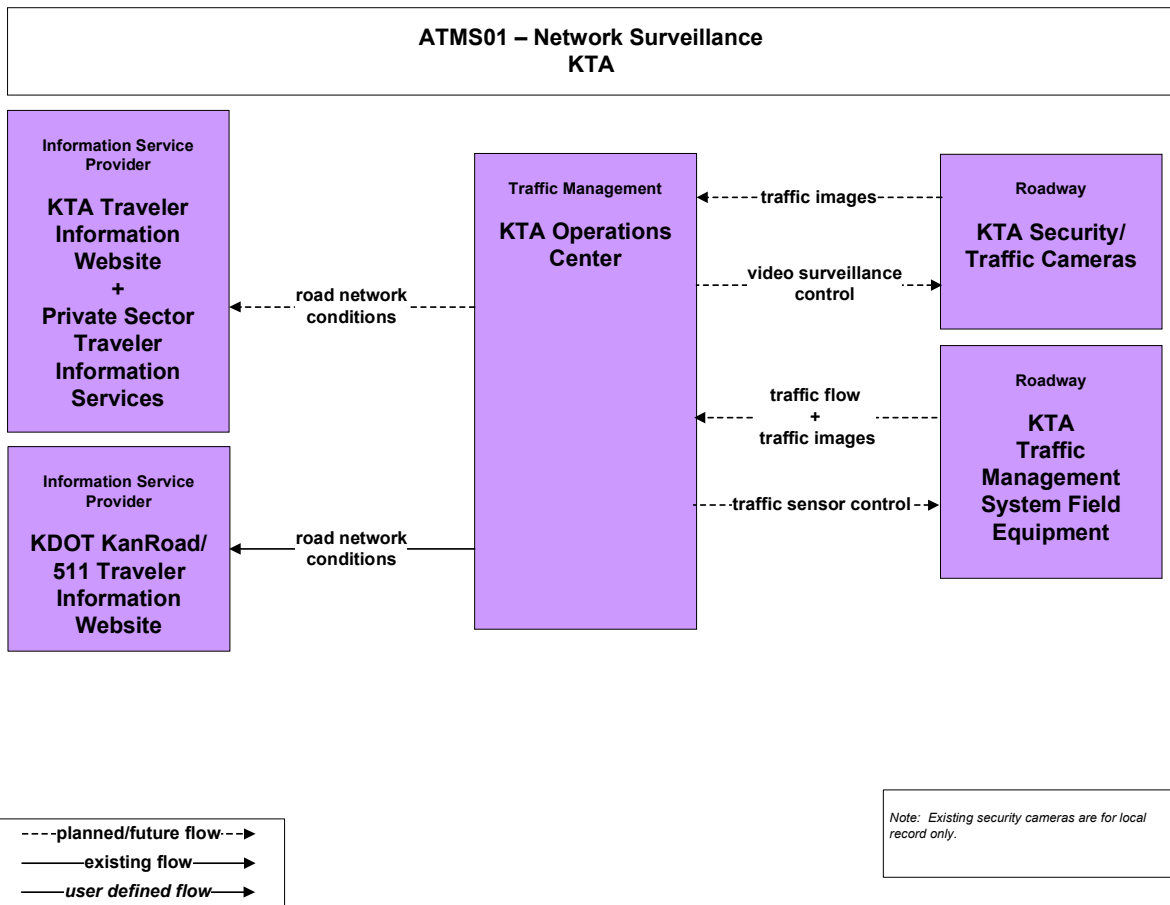


**ATMS01 – Network Surveillance
City of Lawrence**

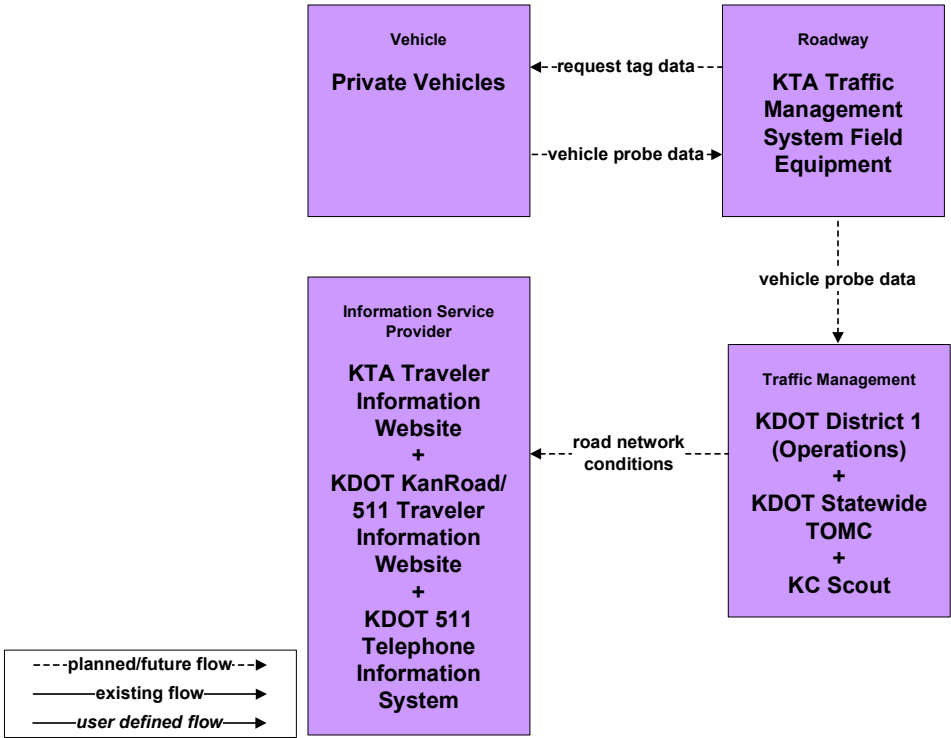


**ATMS01 – Network Surveillance
Douglas County**

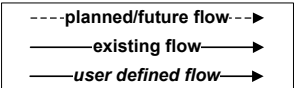
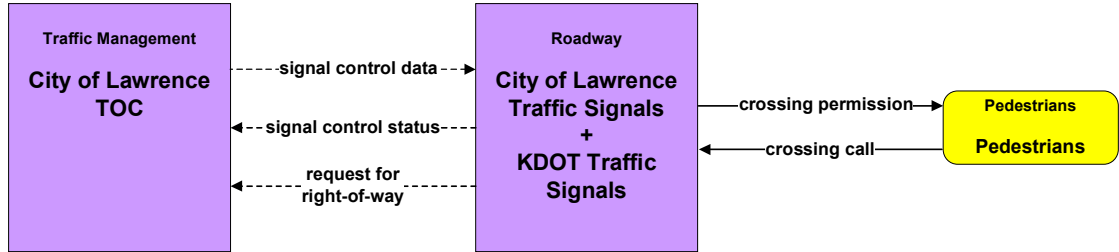




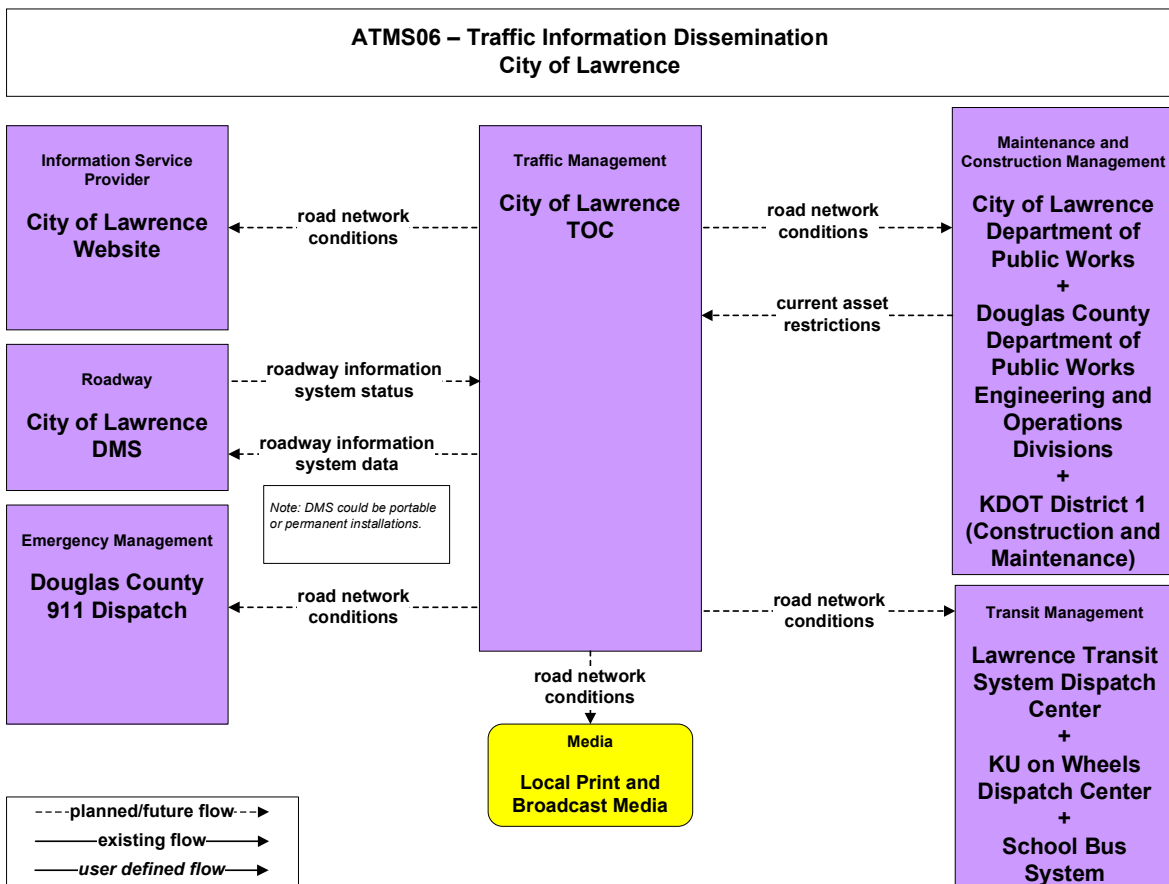
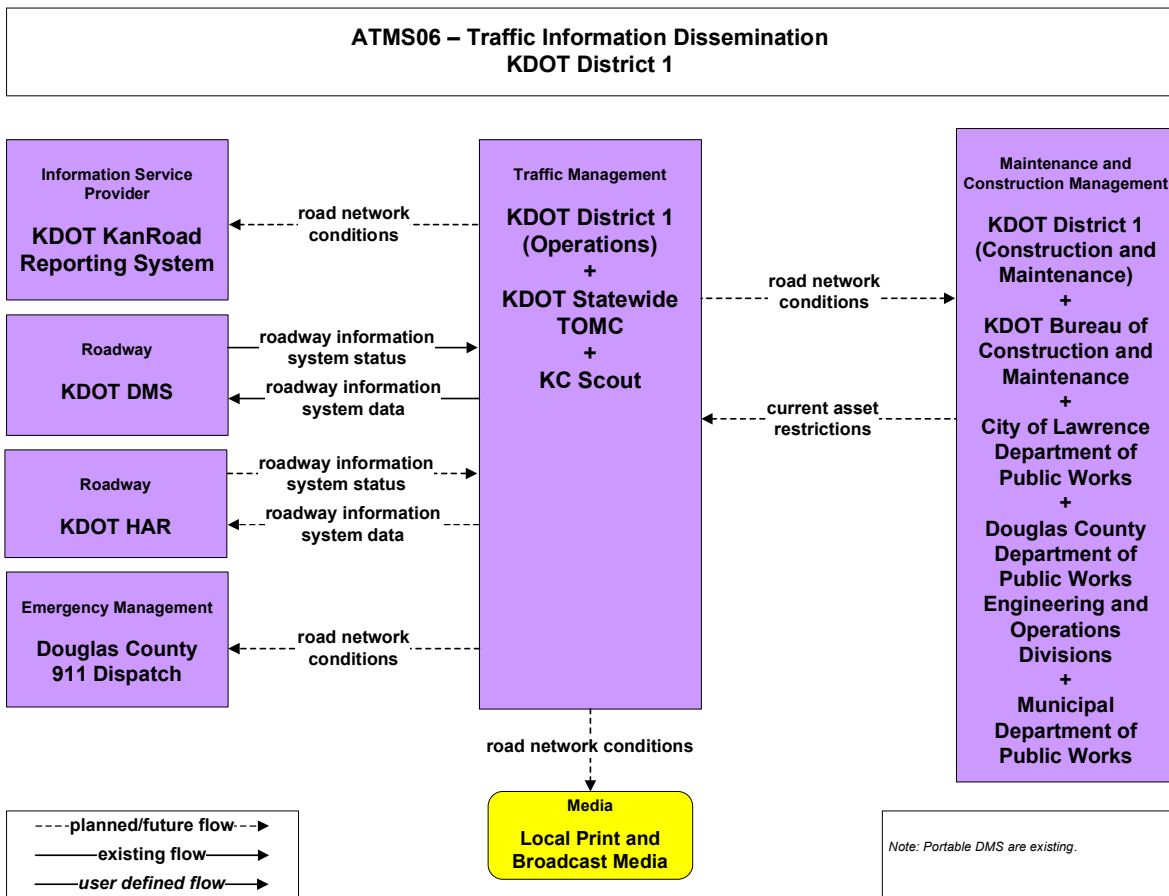
**ATMS02 – Probe Surveillance
KTA**



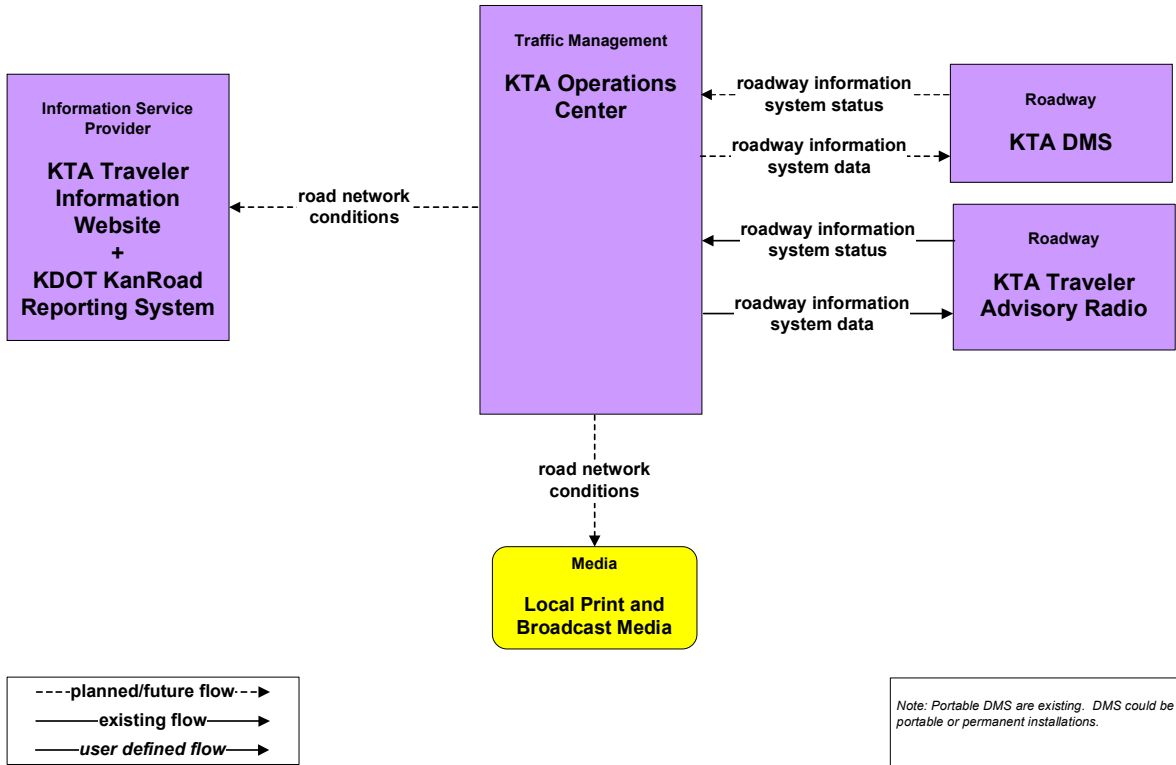
**ATMS03 – Surface Street Control
City of Lawrence Signal System**



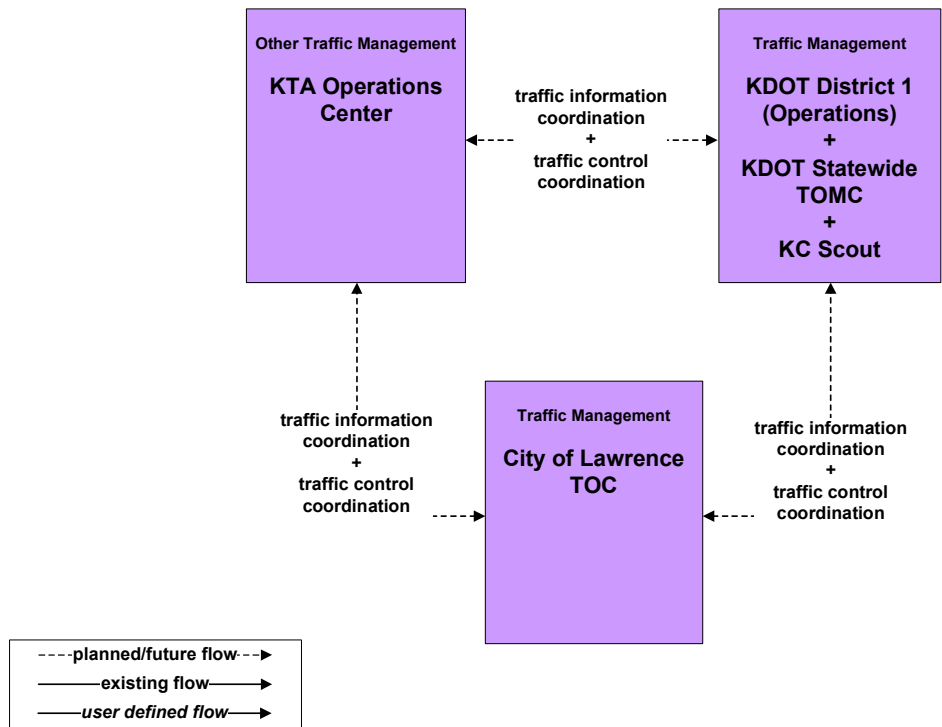
Note: The City of Lawrence maintains and operates traffic signals for Douglas County.



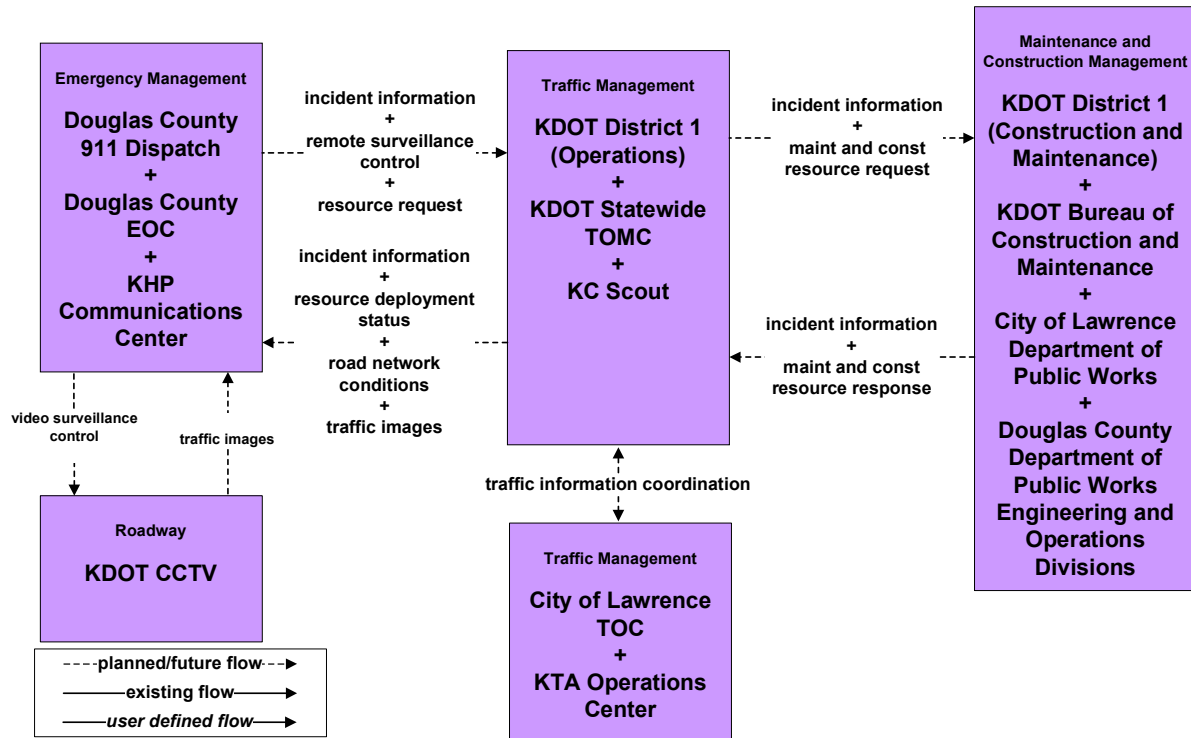
**ATMS06 – Traffic Information Dissemination
KTA**



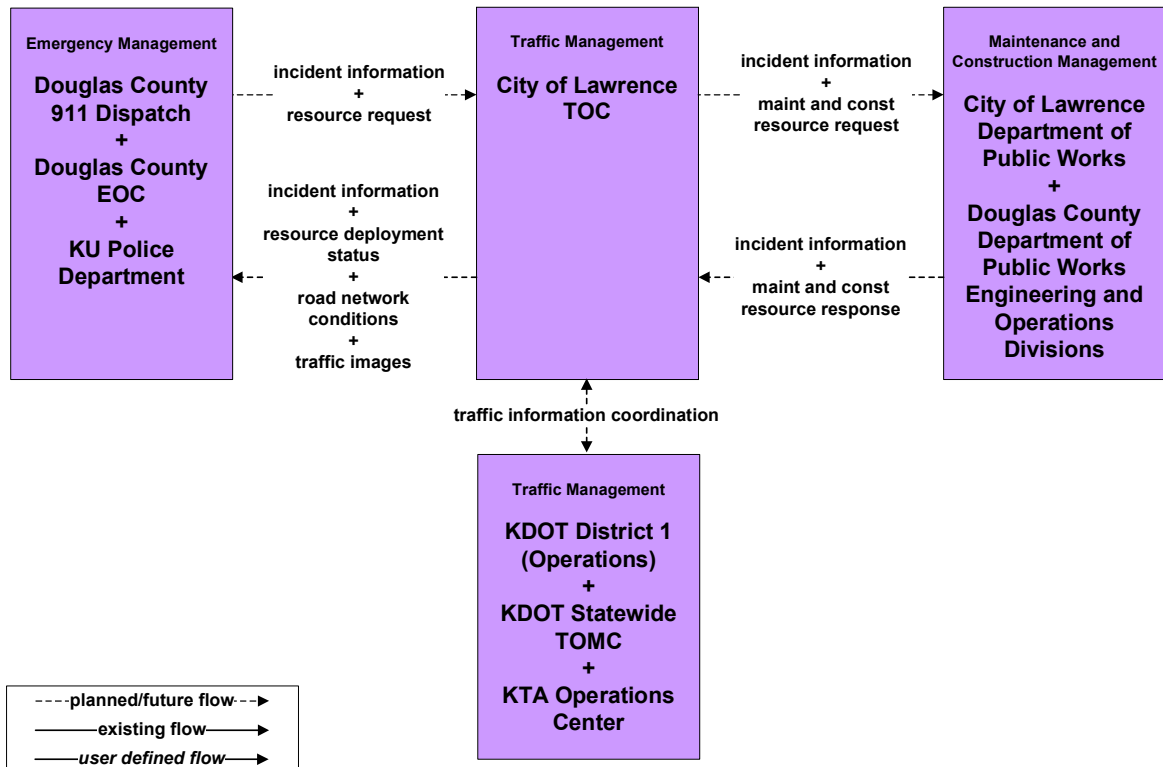
**ATMS07 – Regional Traffic Control
Lawrence-Douglas County Region**

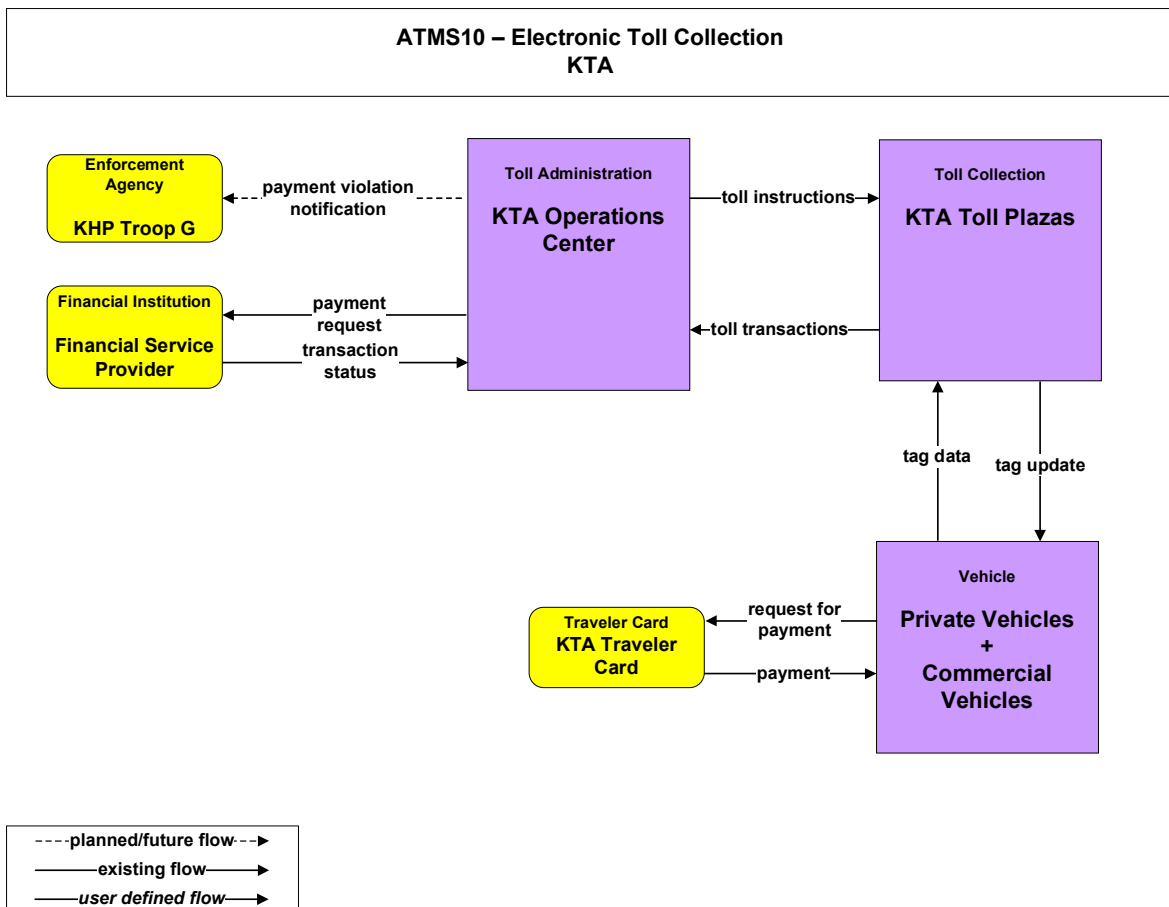
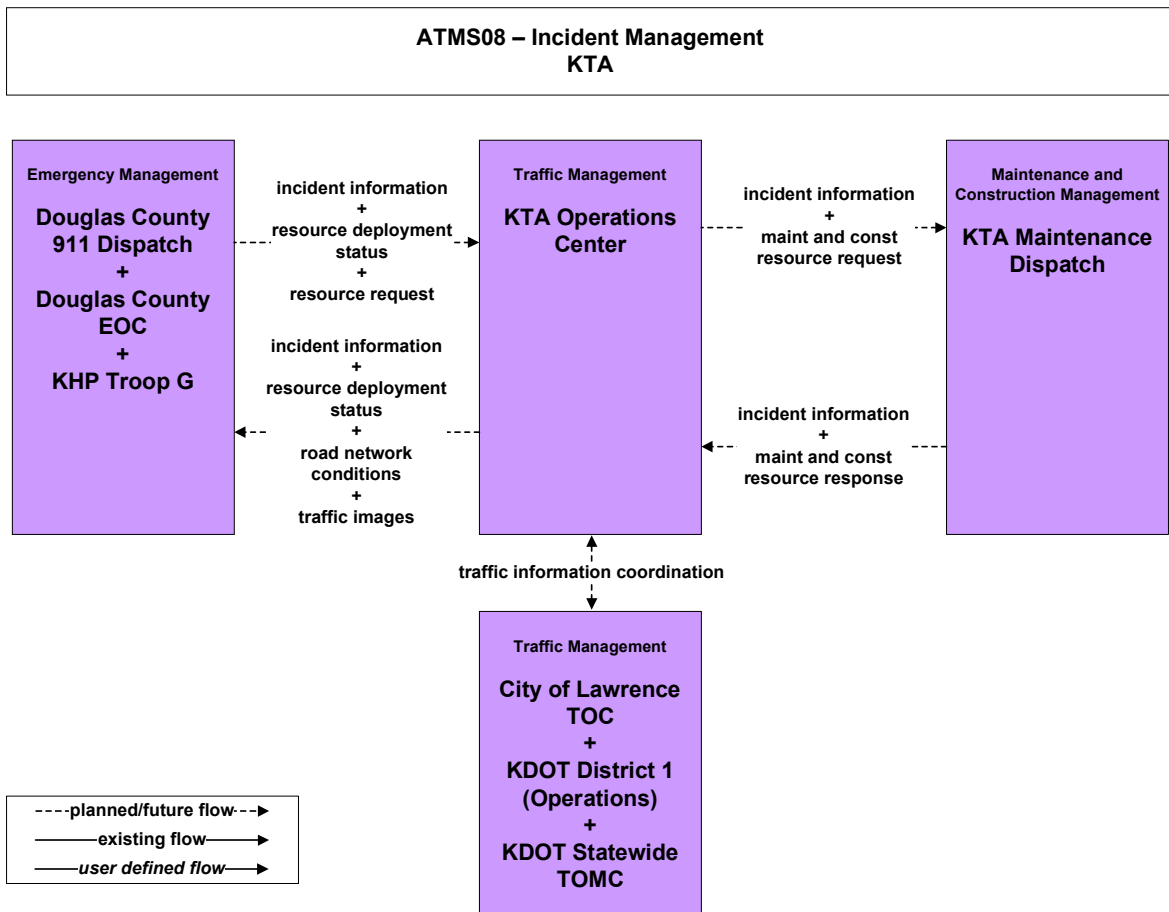


**ATMS08 – Incident Management
KDOT District 1**

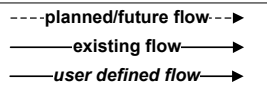
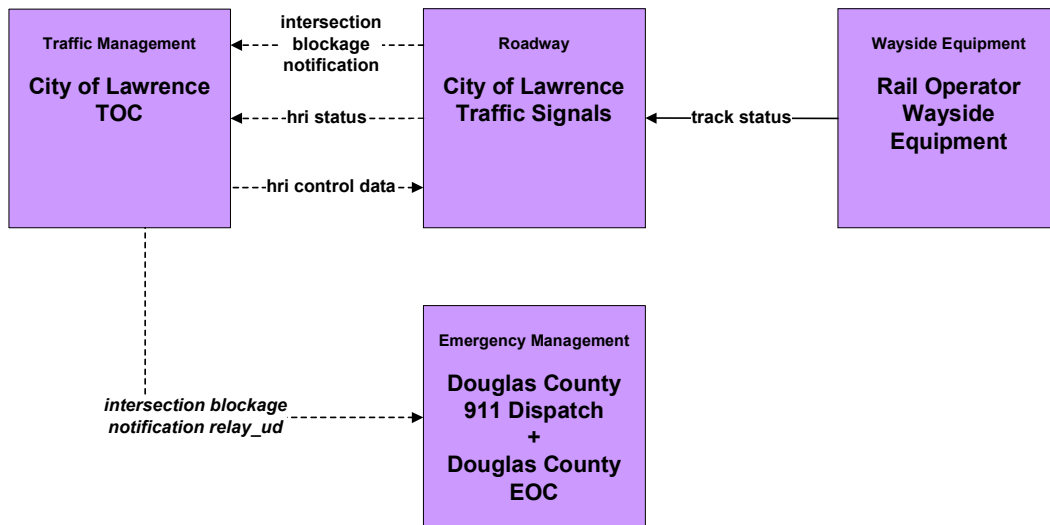


**ATMS08 – Incident Management
City of Lawrence TOC**

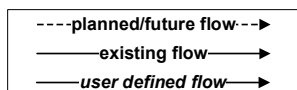
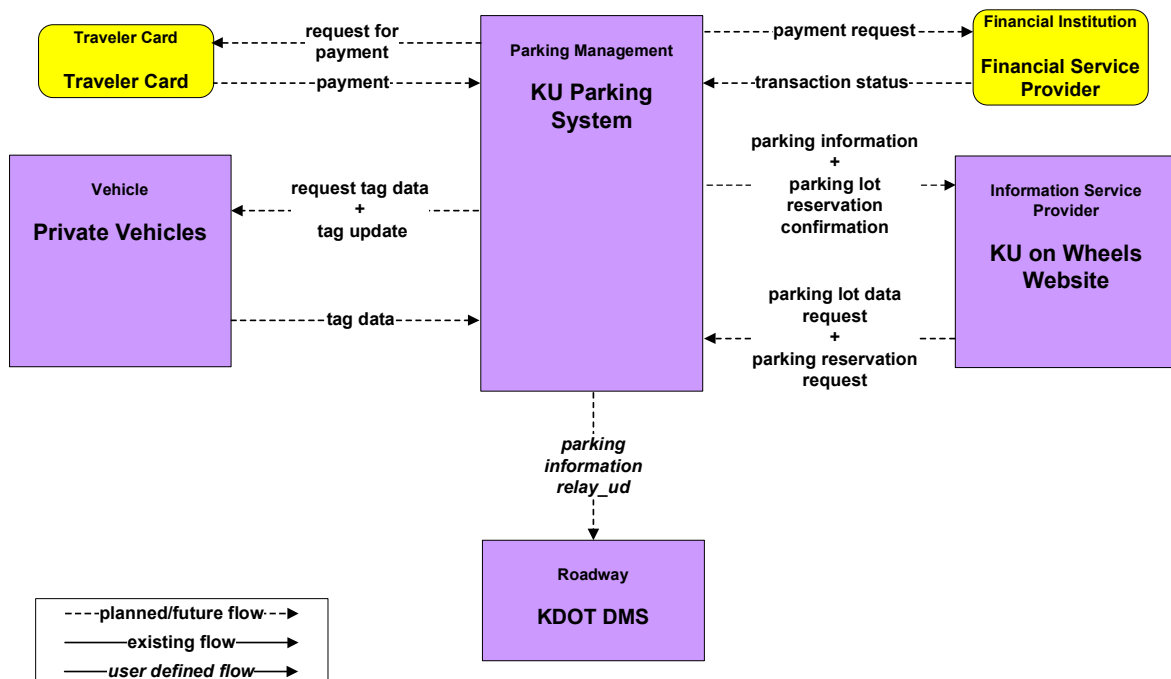




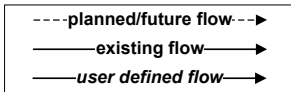
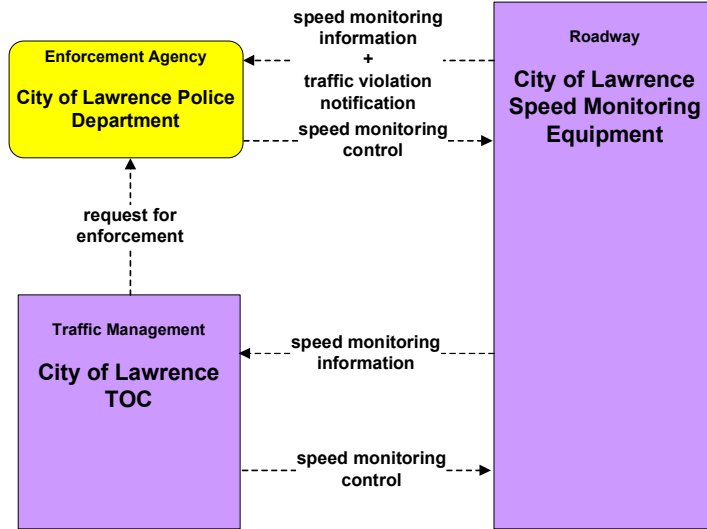
ATMS13 – Standard Railroad Grade Crossing City of Lawrence



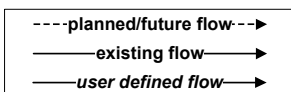
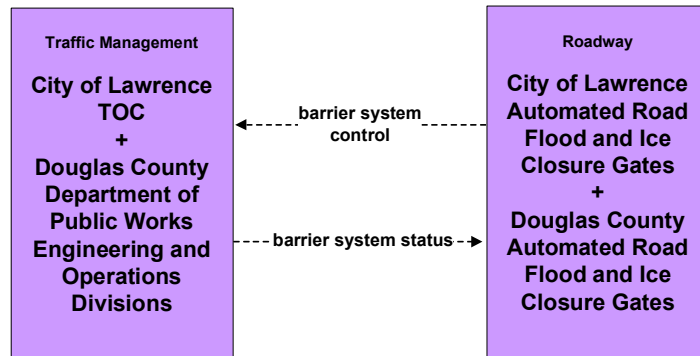
ATMS16 – Parking Facility Management KU Commuter Parking



ATMS19 – Speed Monitoring City of Lawrence

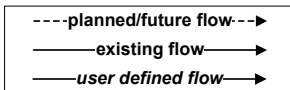
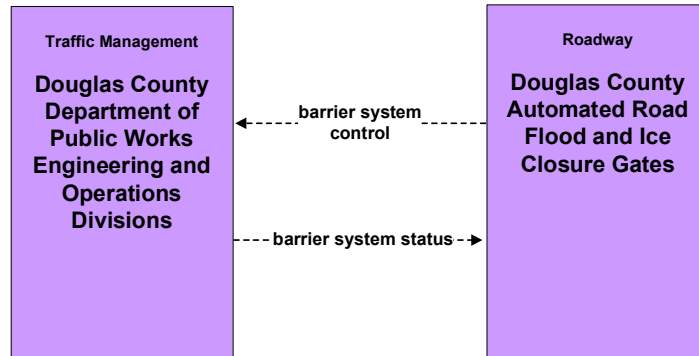


ATMS21 – Roadway Closure Management City of Lawrence Flood and Ice Closure System



*Note:
See MC03 for associated road weather
information market package.*

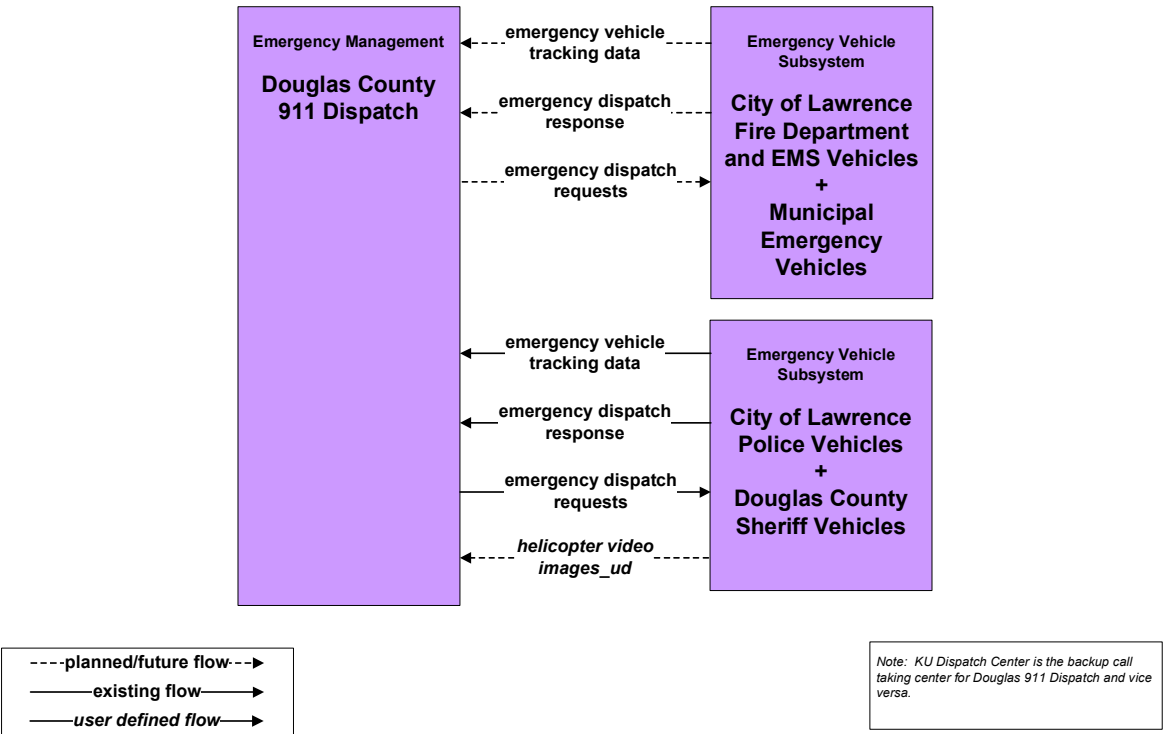
**ATMS21 – Roadway Closure Management
Douglas County Flood and Ice Closure System**



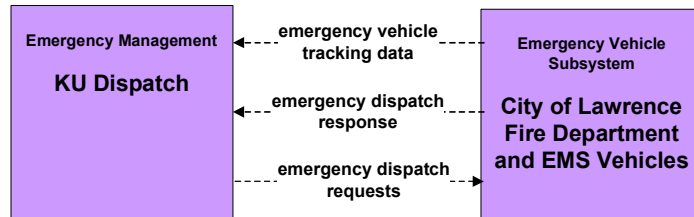
*Note:
See MC03 for associated road weather
information market package.*

Emergency Management

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



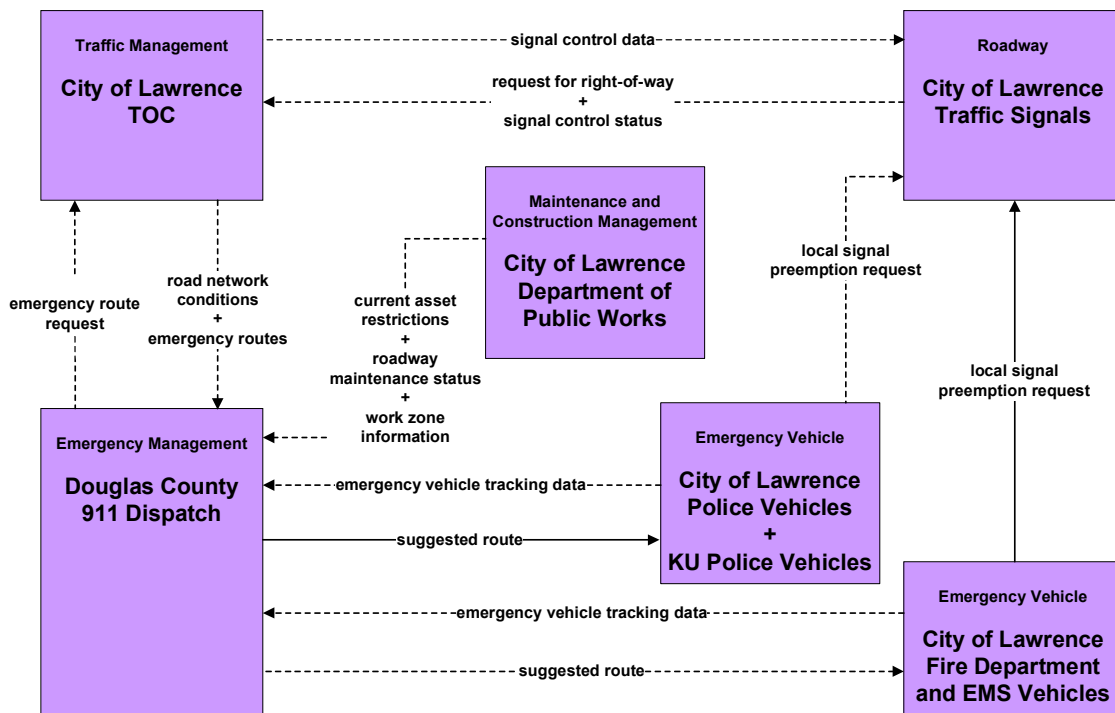
EM01 – Emergency Call-Taking and Dispatch KU Dispatch



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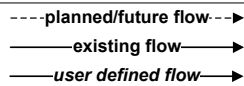
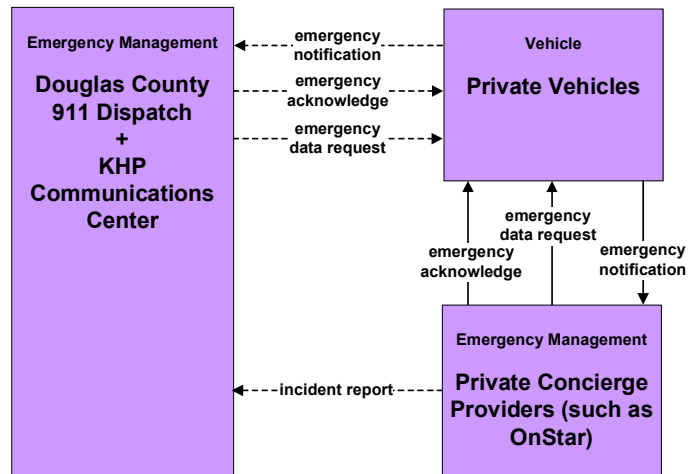
Note: KU Dispatch Center is the backup call taking center for Douglas 911 Dispatch and vice versa.

EM02 – Emergency Routing City of Lawrence and KU

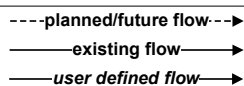
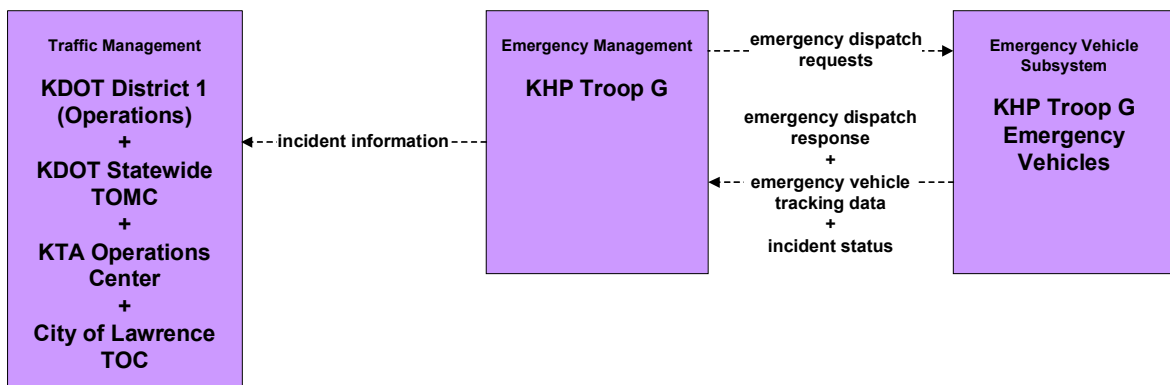


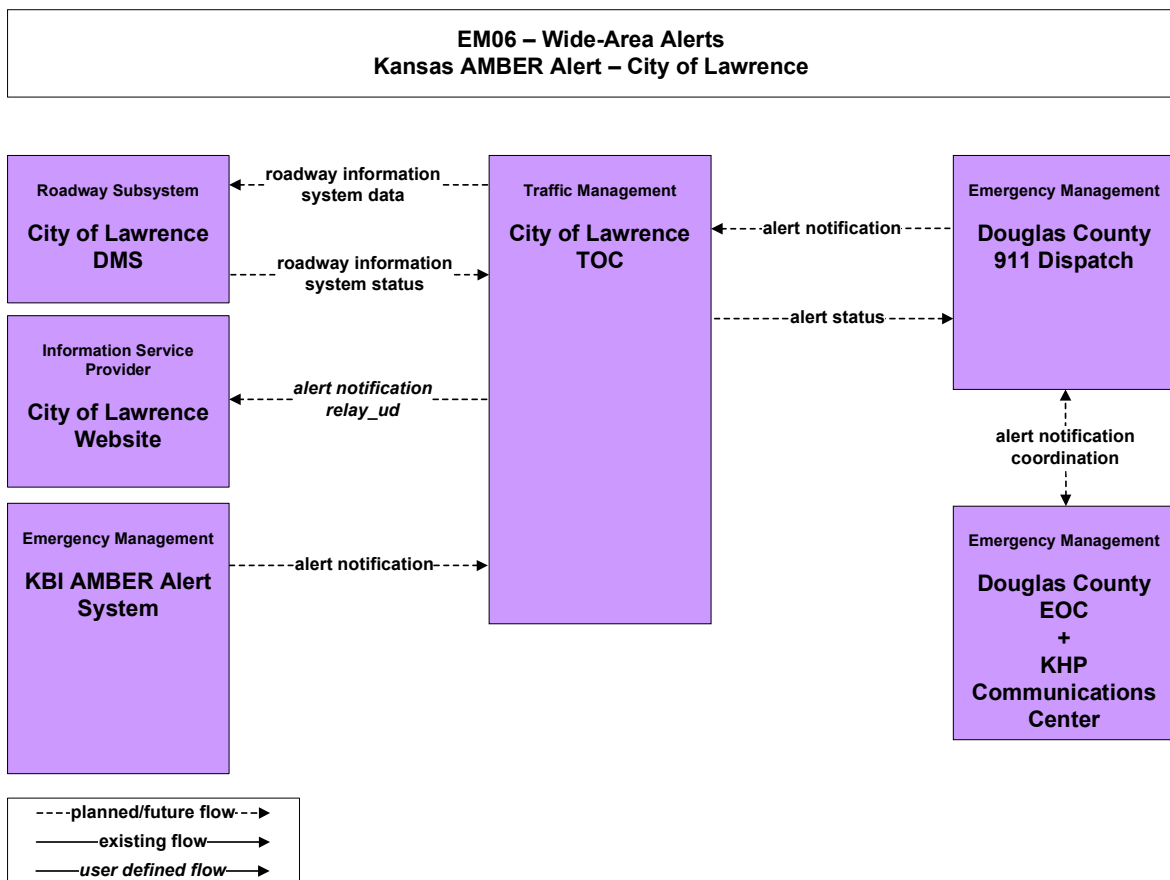
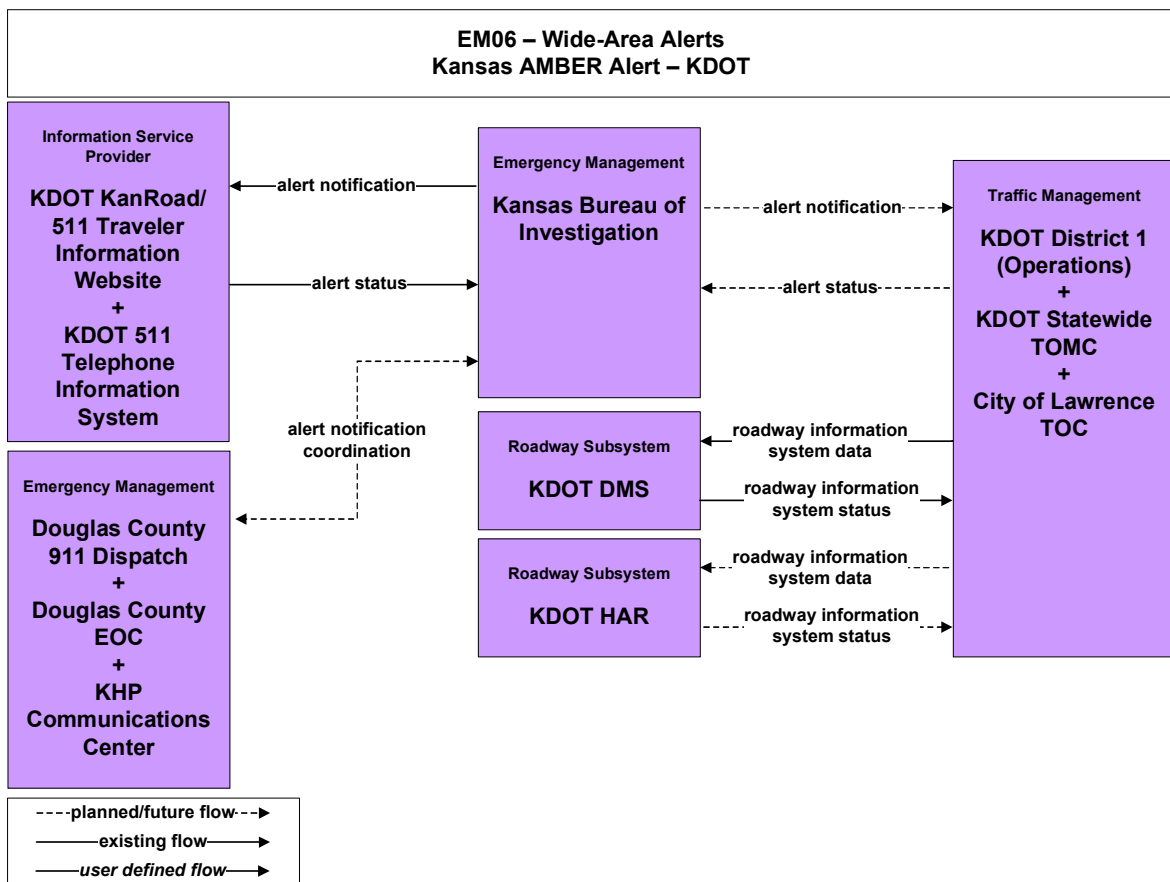
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**EM03 – Mayday and Alarm Support
Douglas County and KHP Public Safety**

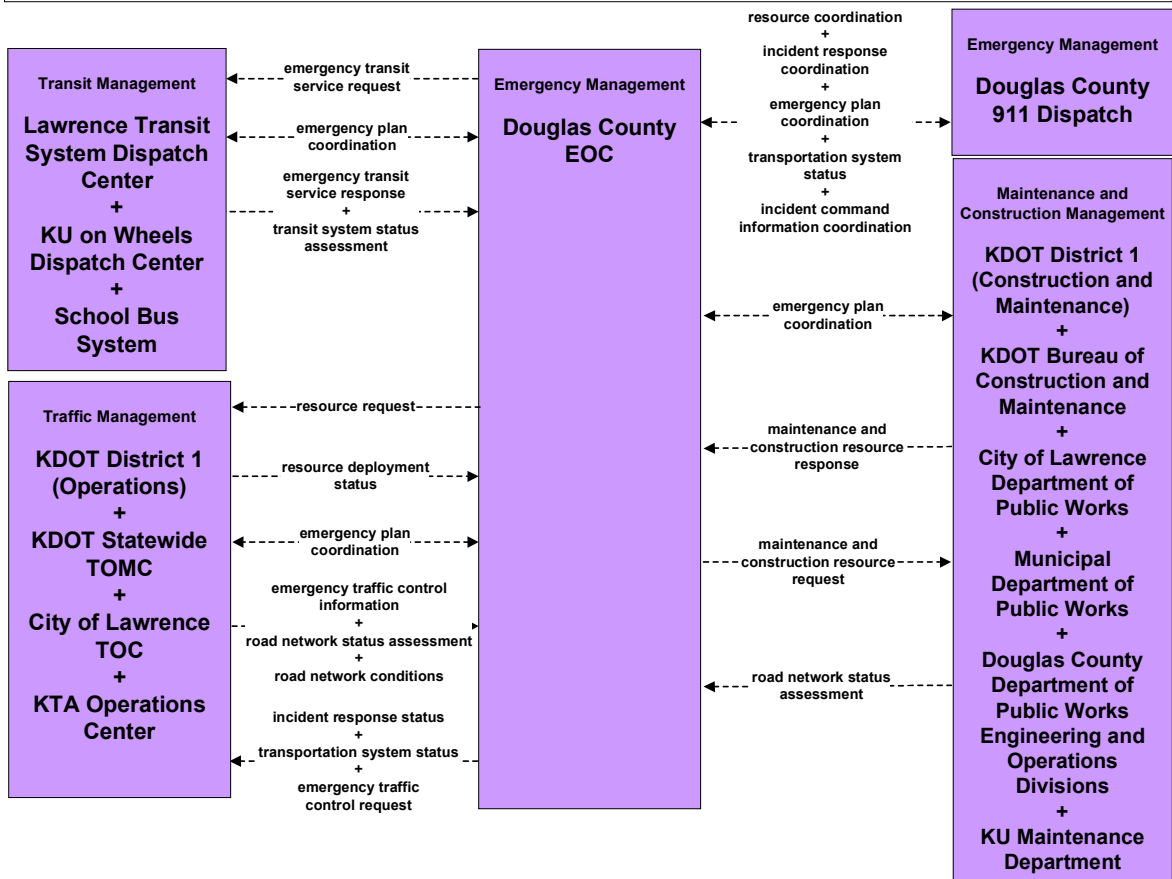


**EM04 – Roadway Service Patrols
KHP Motorist Assistance**

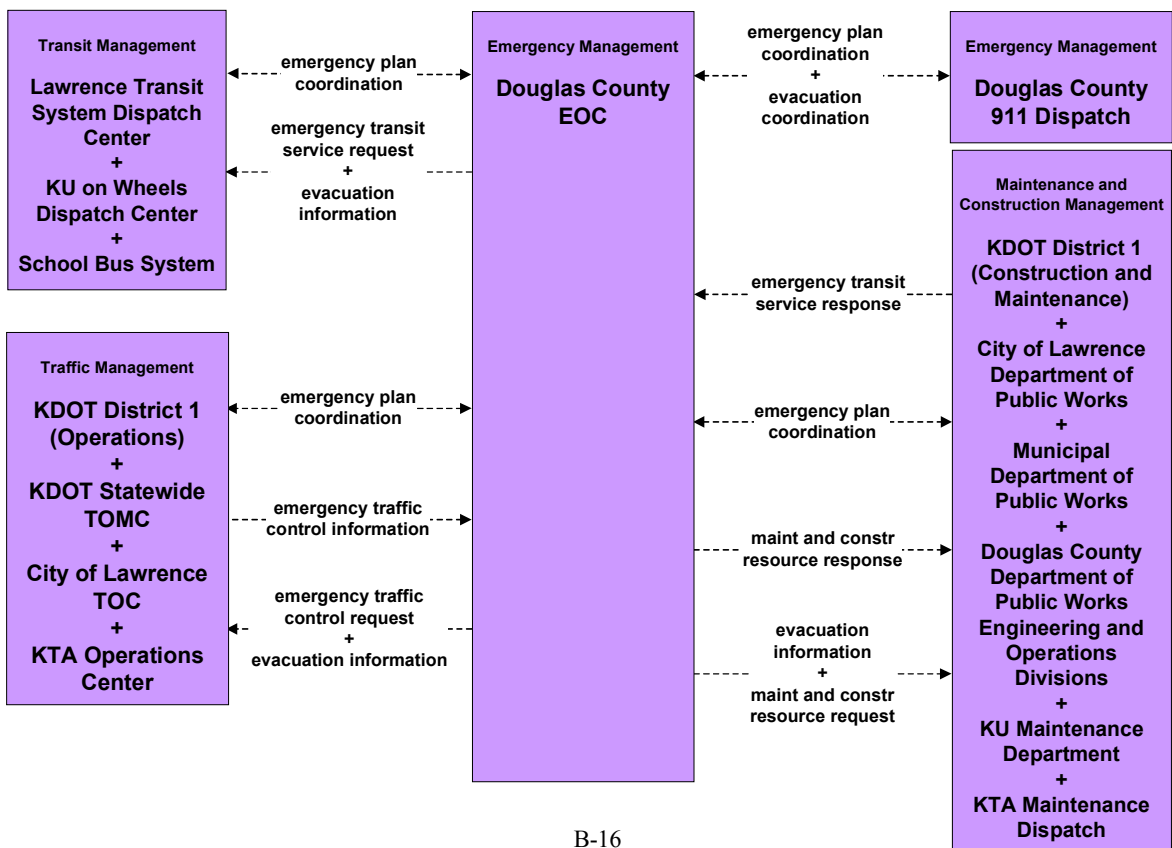




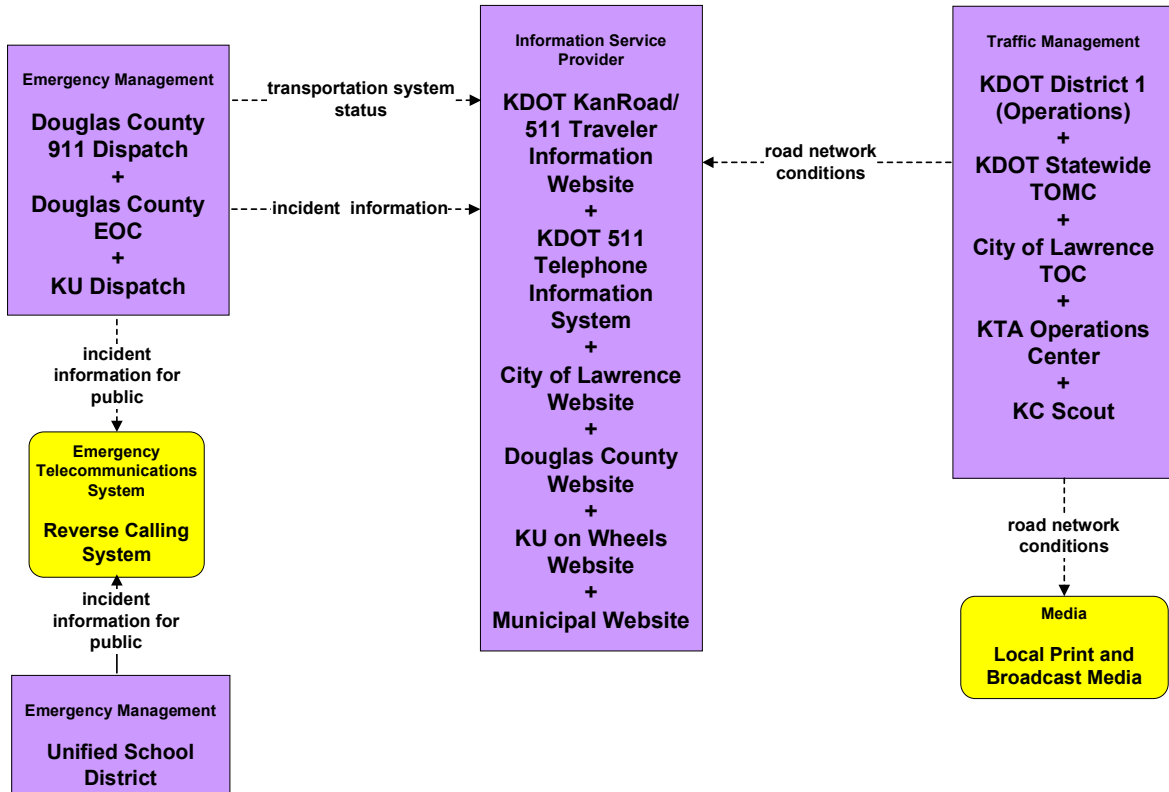
**EM08 – Disaster Response and Recovery
Lawrence-Douglas County**



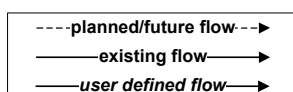
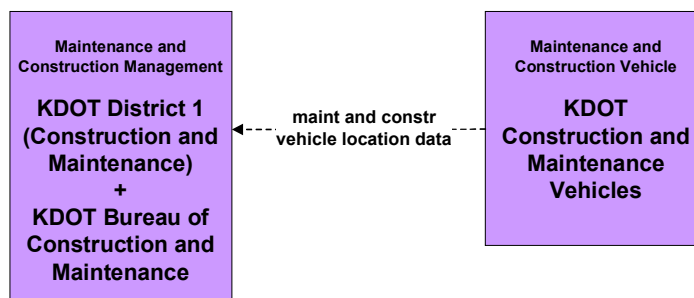
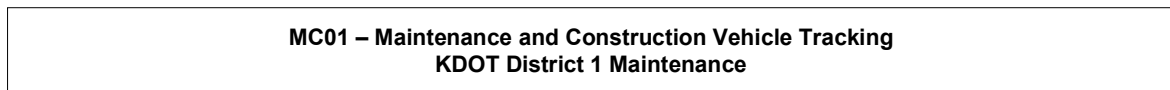
**EM09 – Evacuation and Reentry Management
Douglas County EOC**



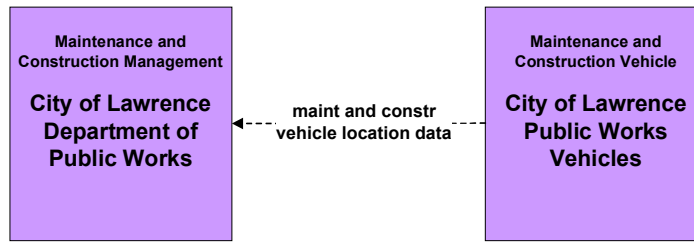
EM10 – Disaster Traveler Information



Maintenance and Construction Management

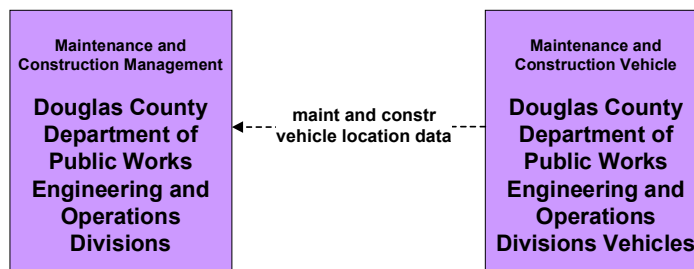


**MC01 – Maintenance and Construction Vehicle Tracking
City of Lawrence**



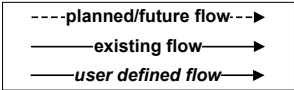
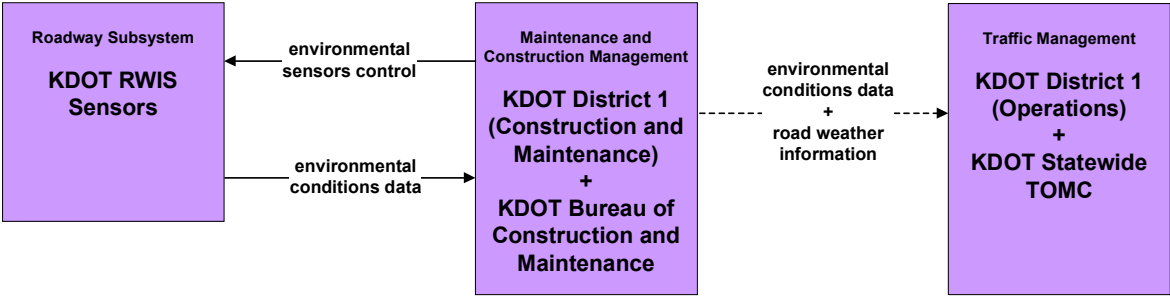
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**MC01 – Maintenance and Construction Vehicle Tracking
Douglas County**

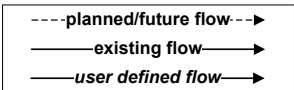
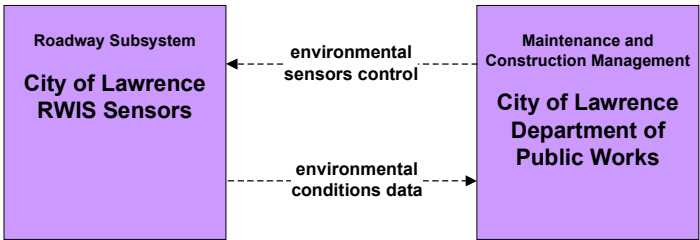


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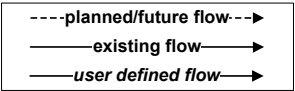
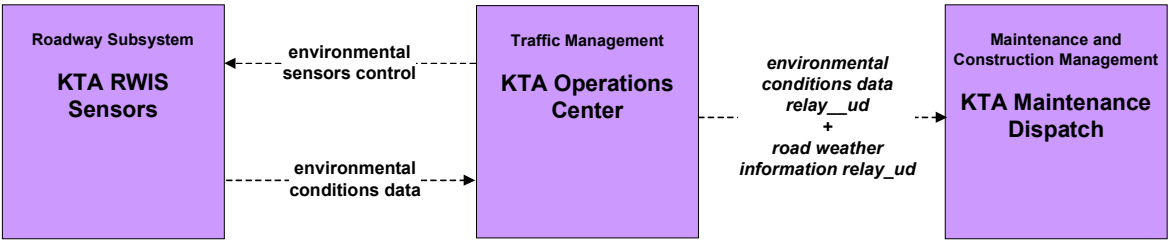
**MC03 – Road Weather Data Collection
KDOT RWIS**



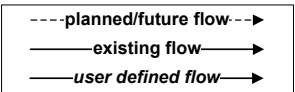
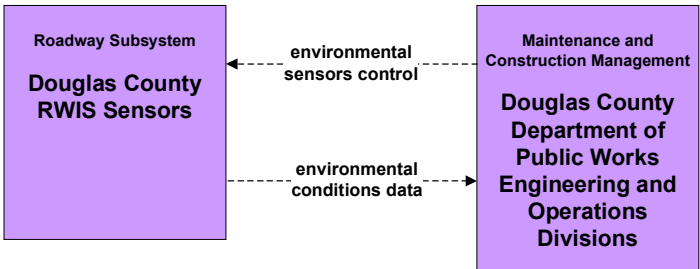
**MC03 – Road Weather Data Collection
City of Lawrence RWIS**

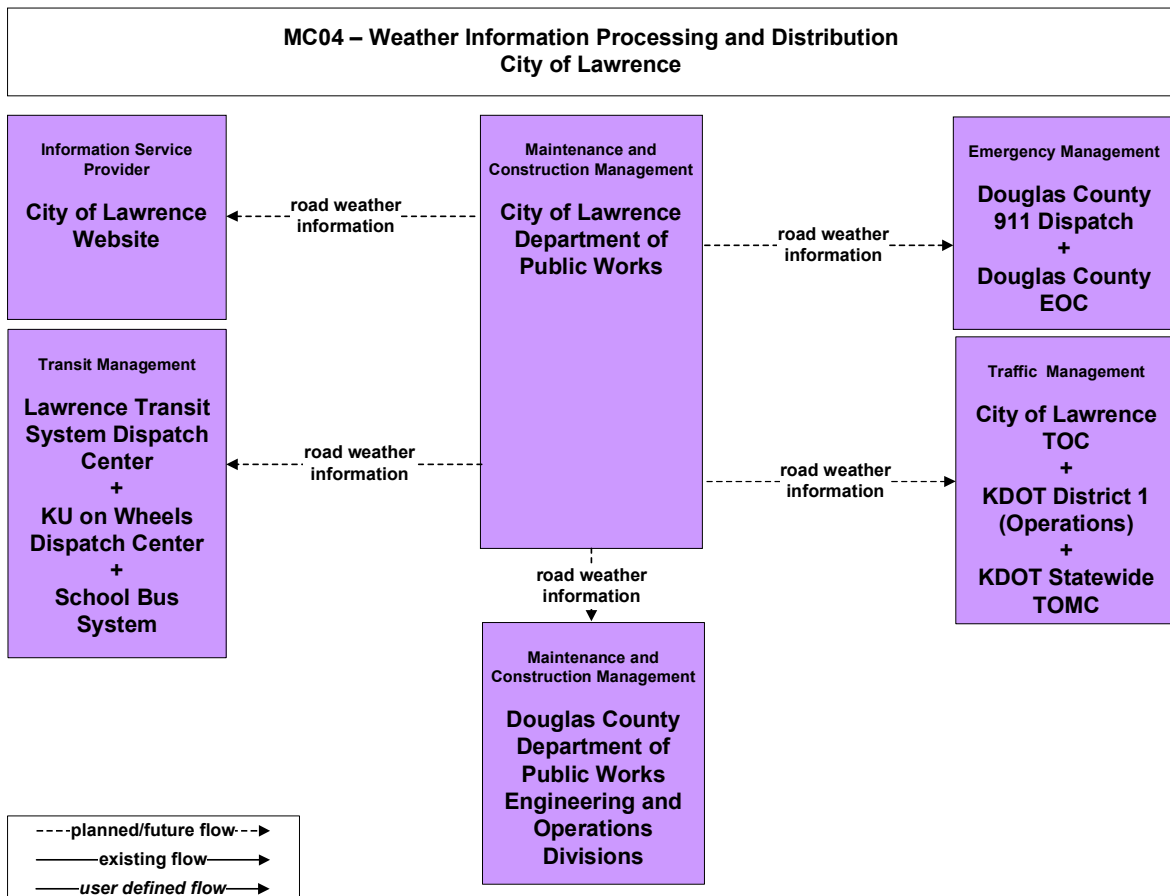
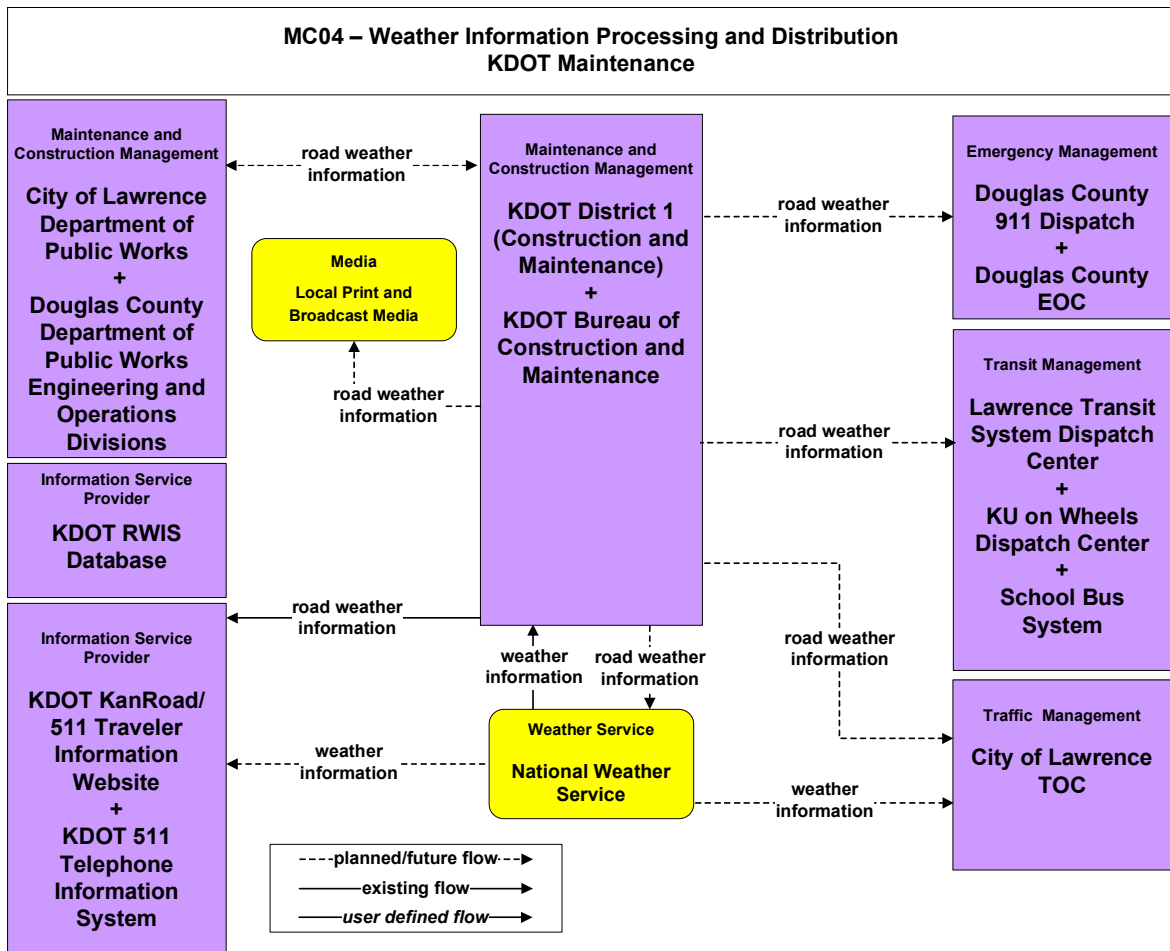


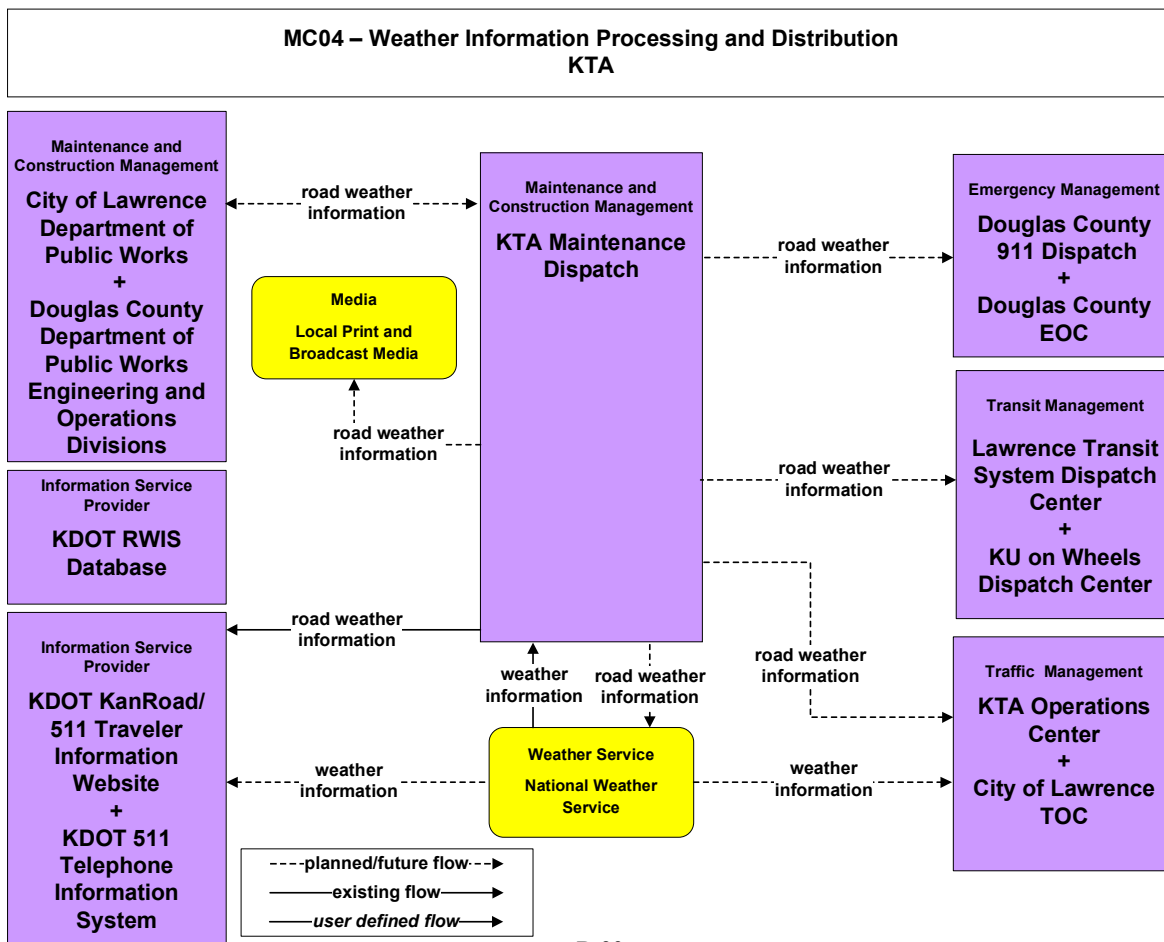
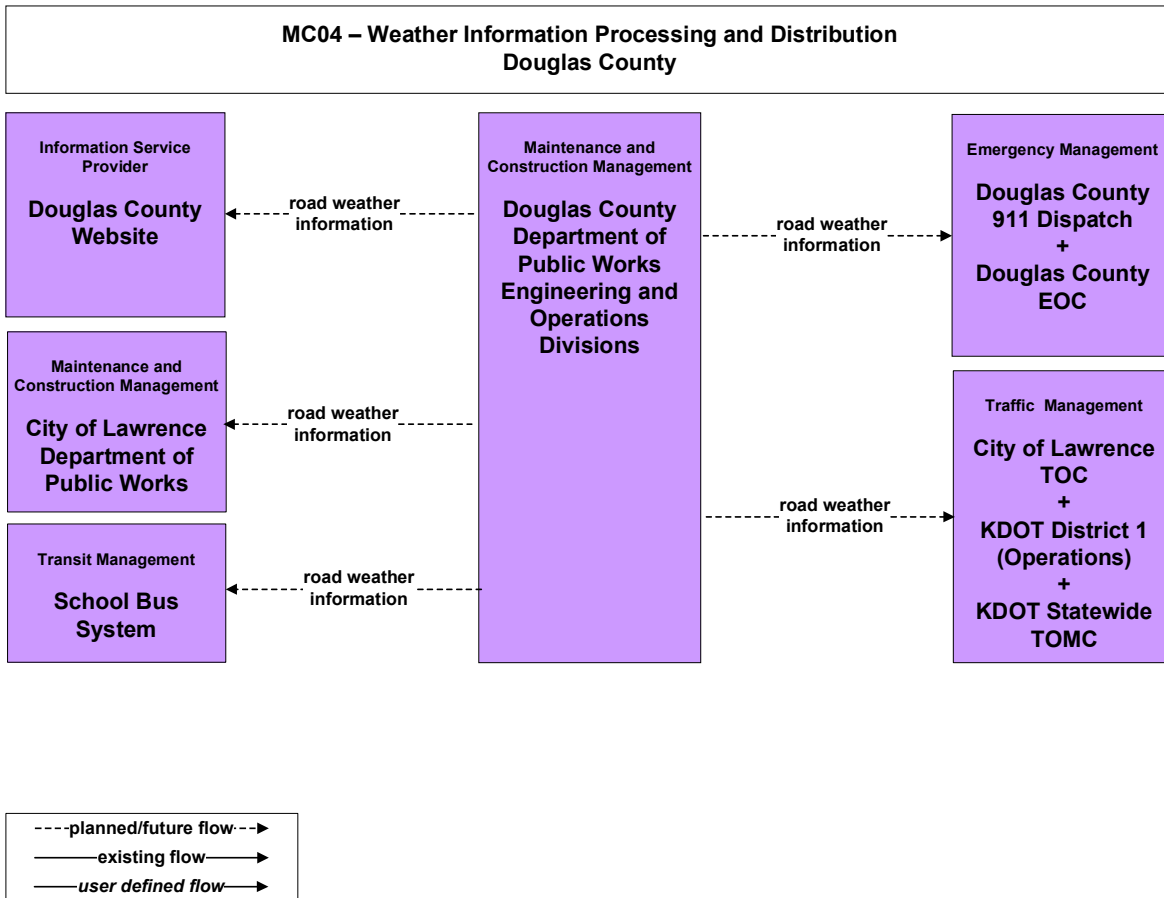
MC03 – Road Weather Data Collection
KTA RWIS Sensors



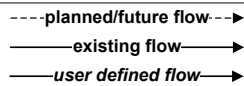
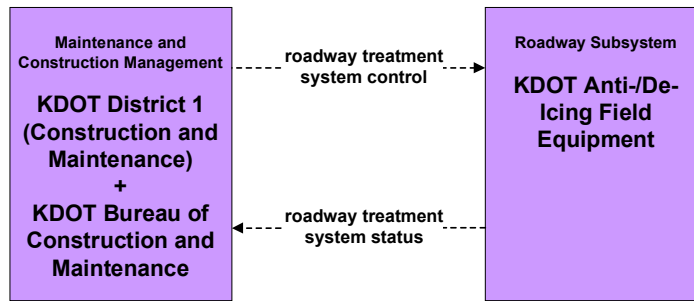
MC03 – Road Weather Data Collection
Douglas County Flood and Ice Detection



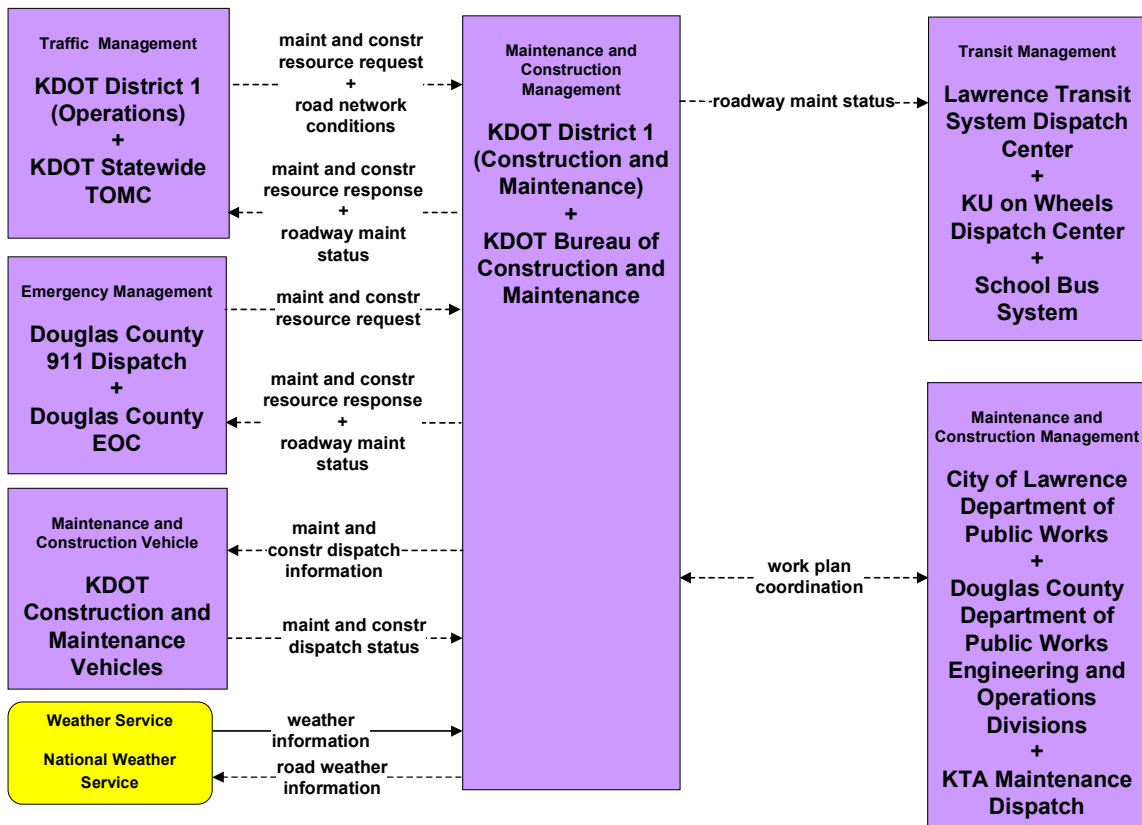


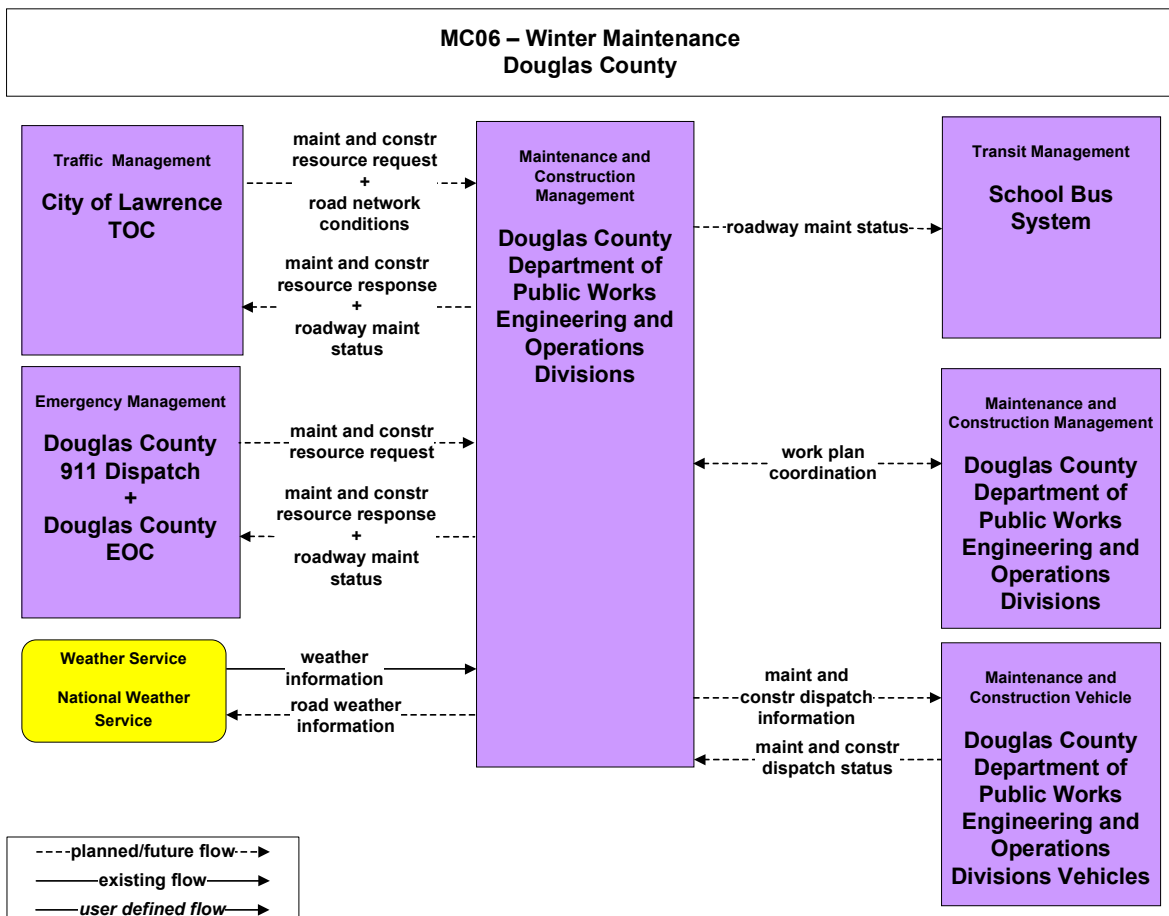
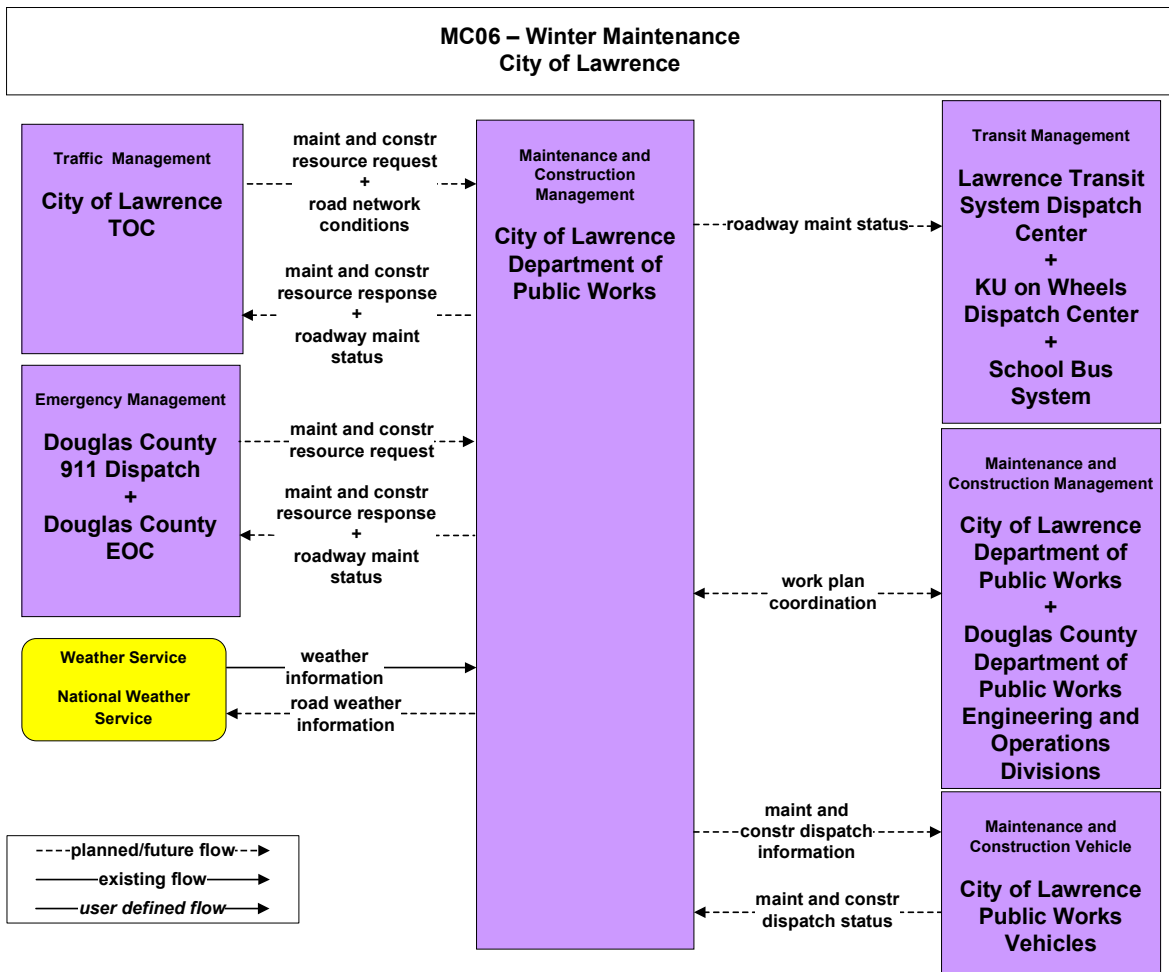


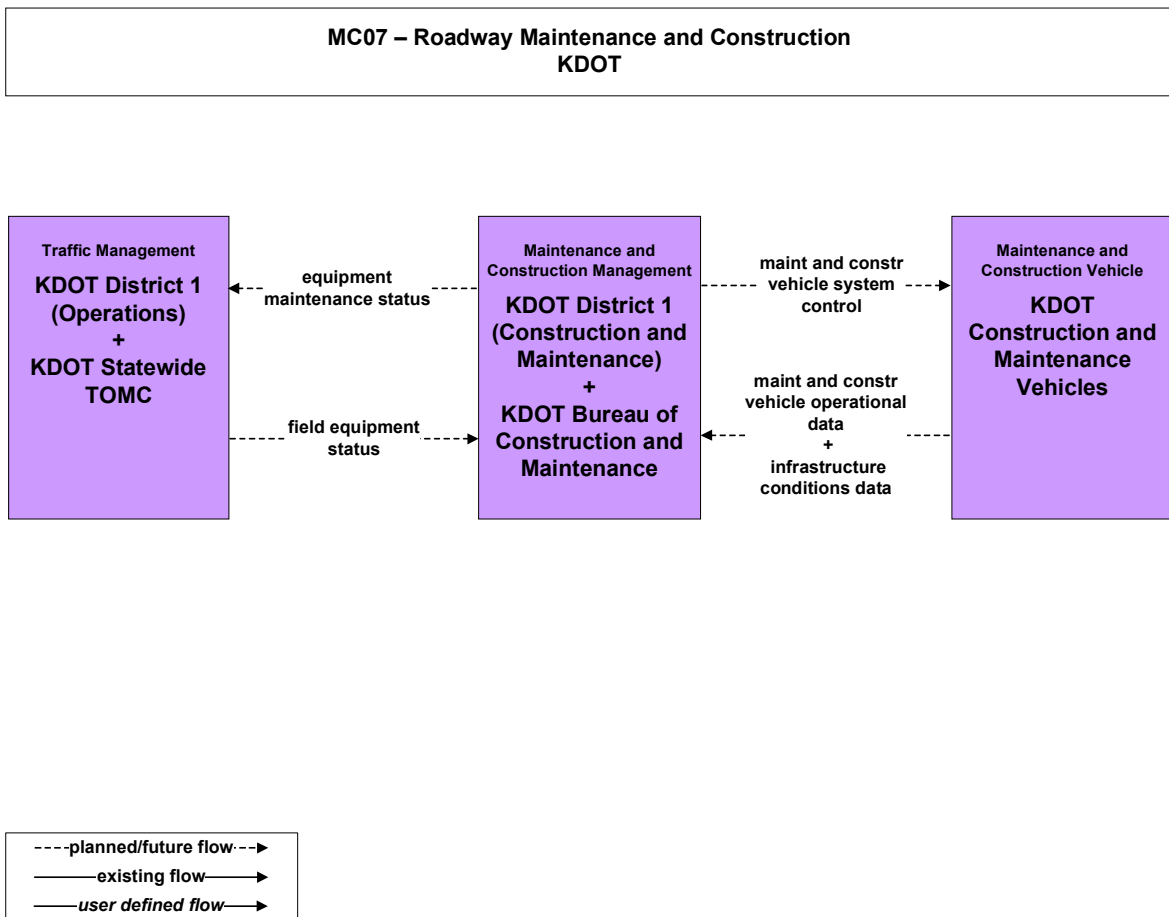
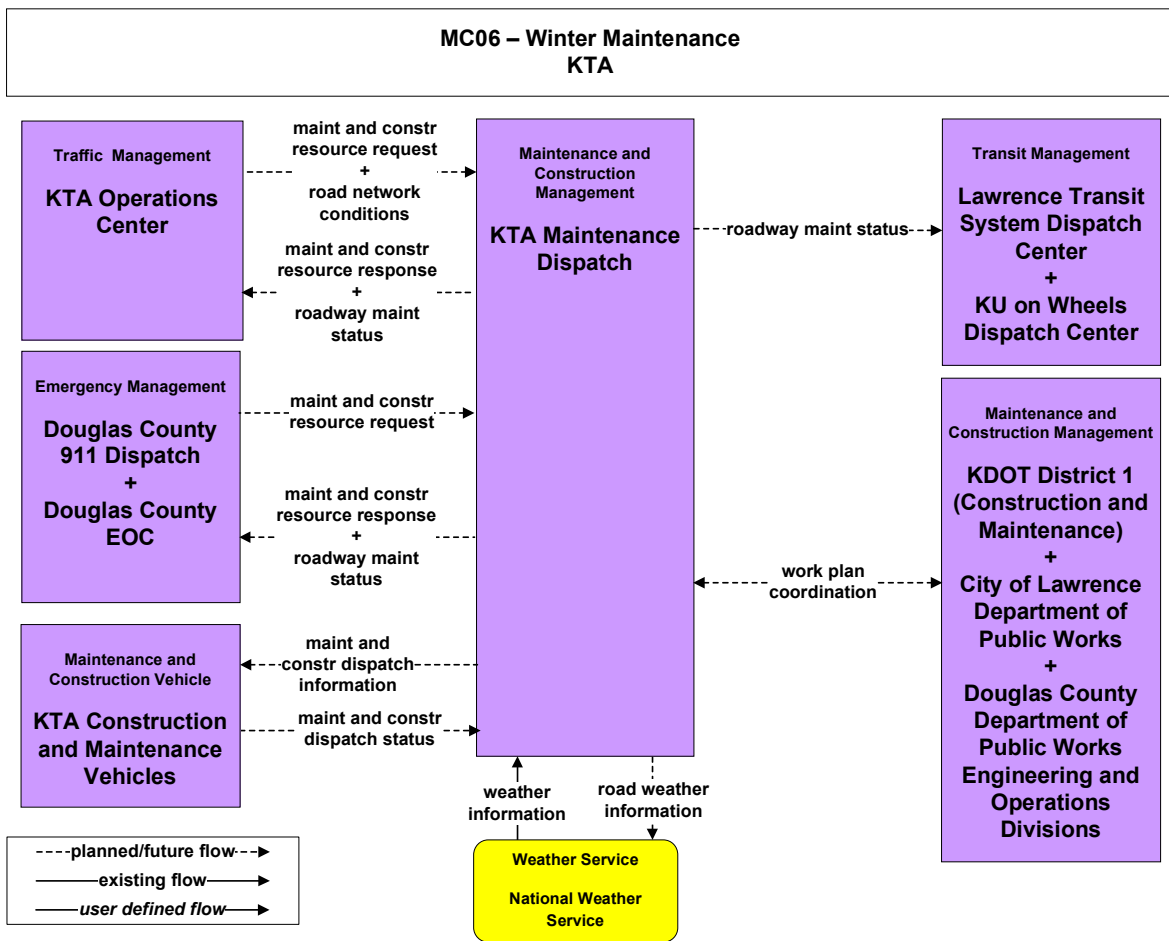
**MC05 – Roadway Automated Treatment
KDOT**



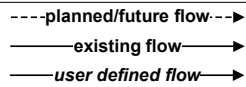
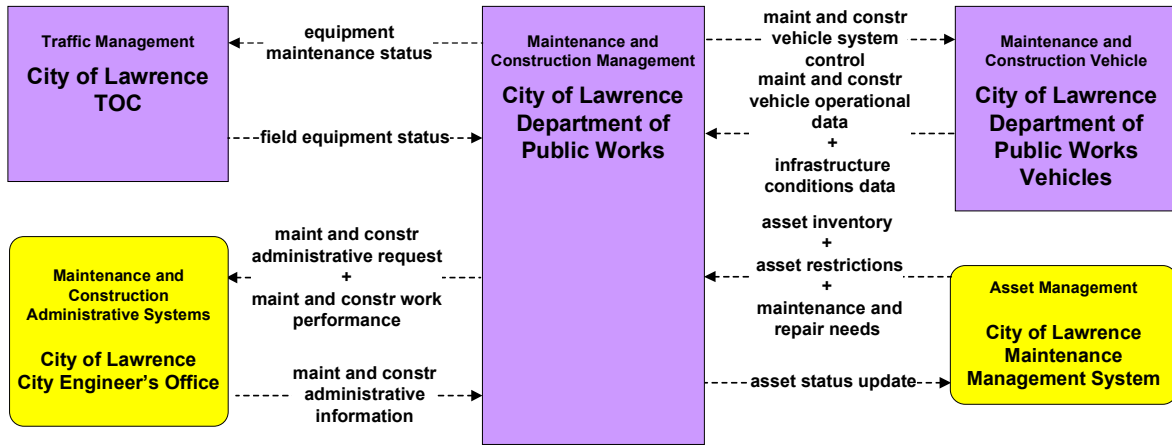
**MC06 – Winter Maintenance
KDOT**



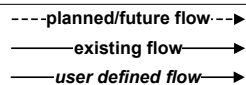
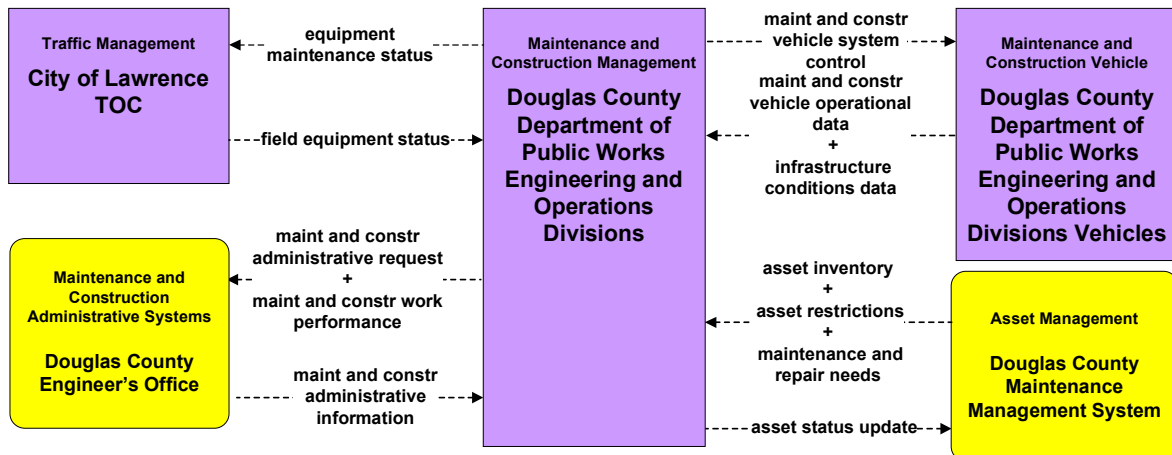


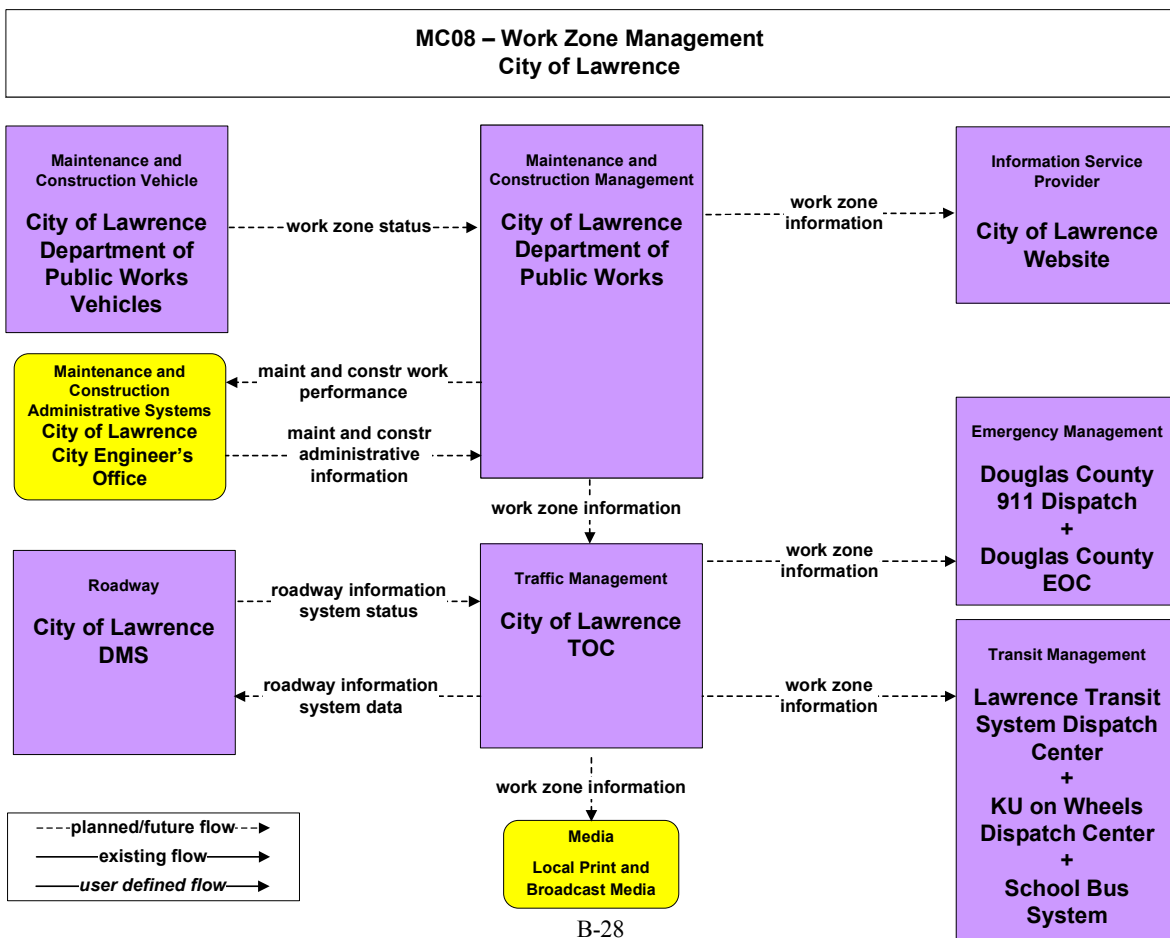
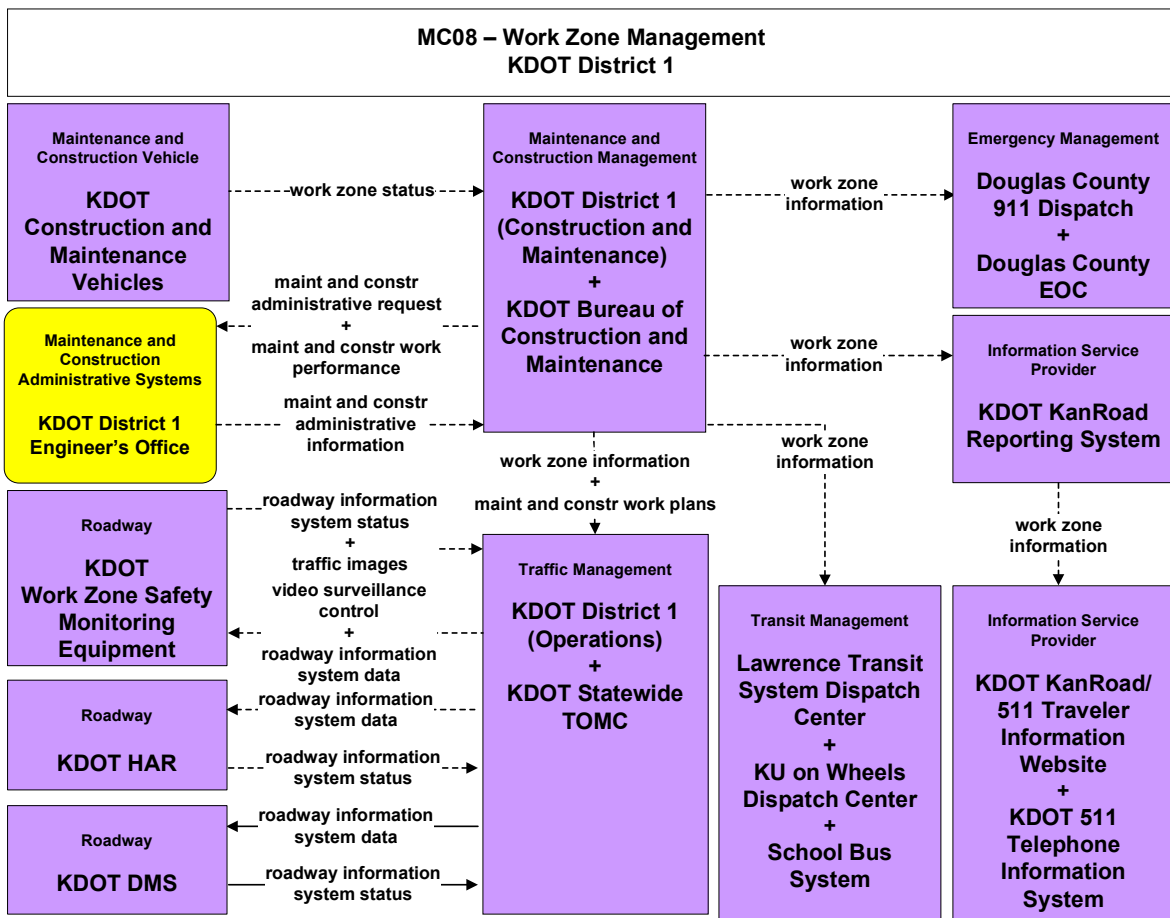


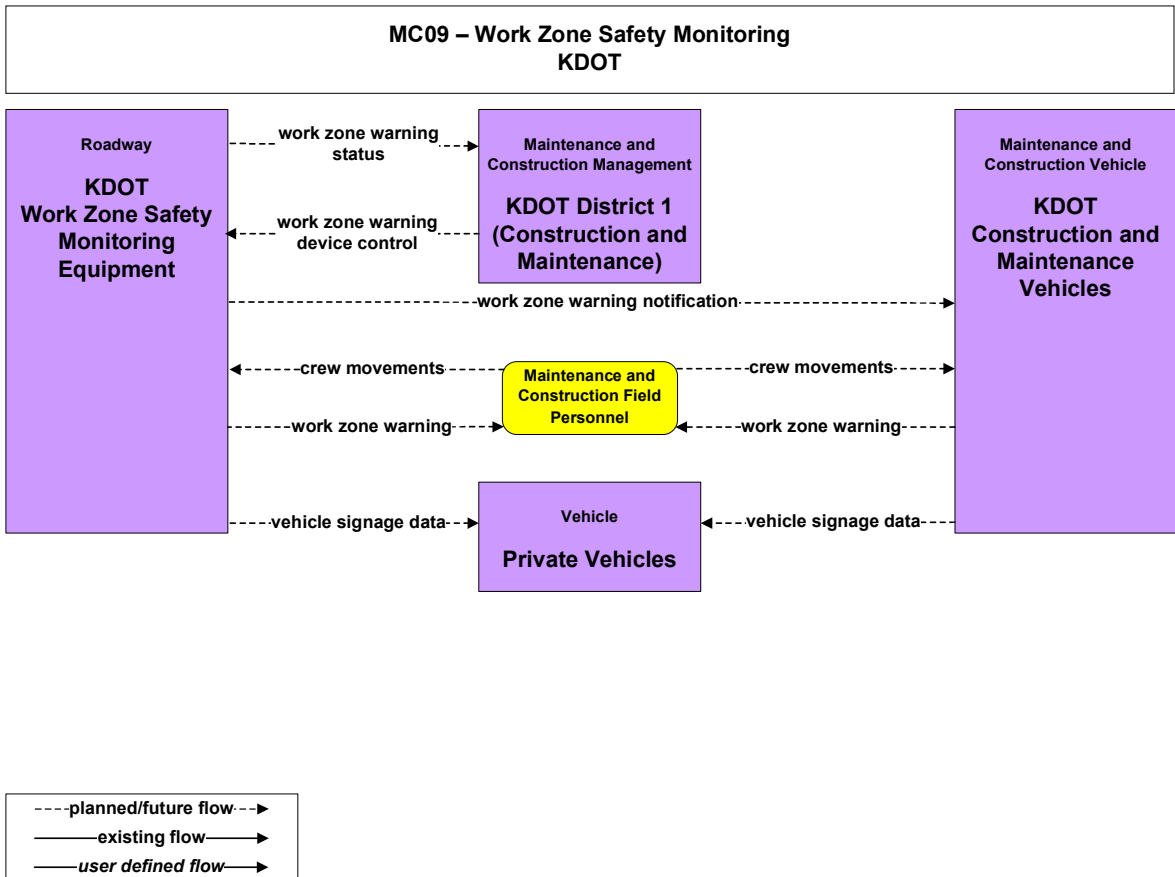
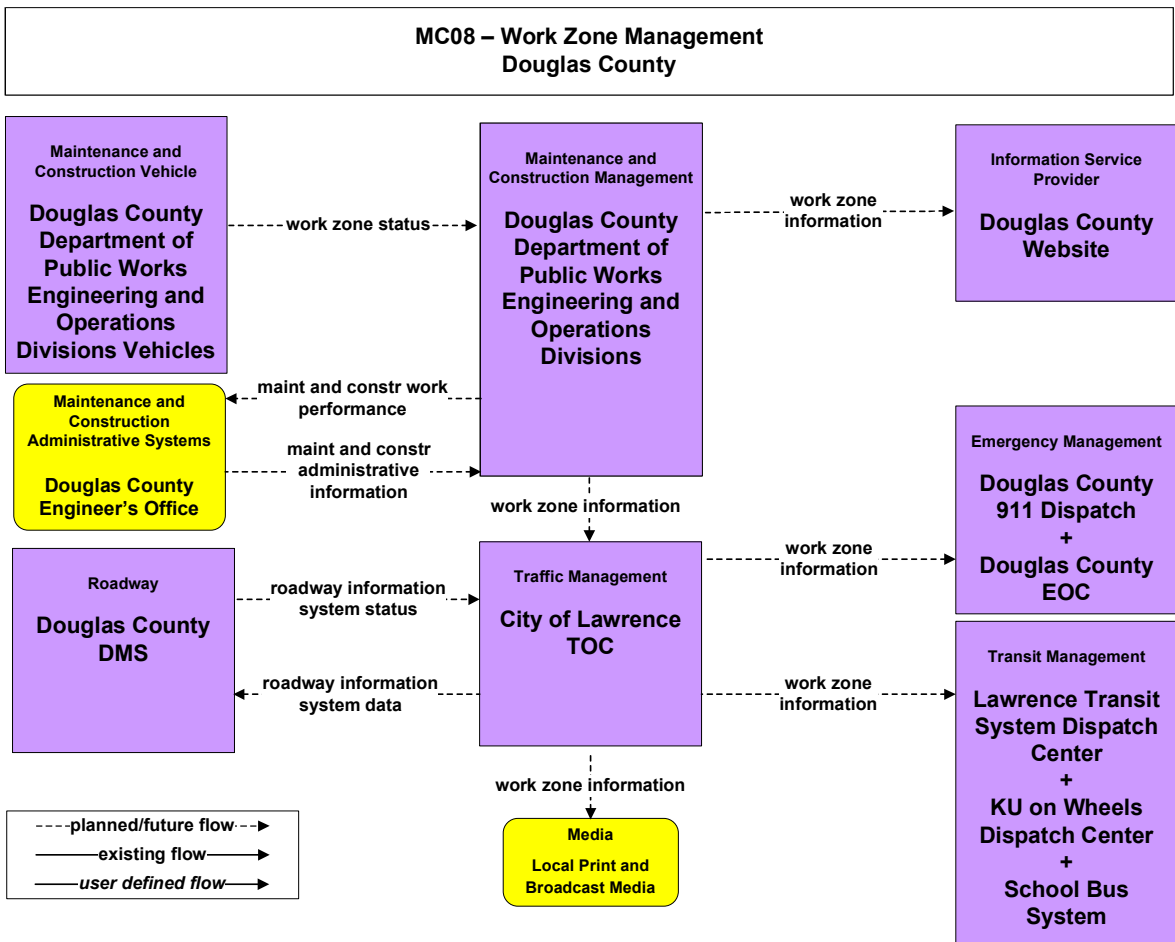
**MC07 – Roadway Maintenance and Construction
City of Lawrence**

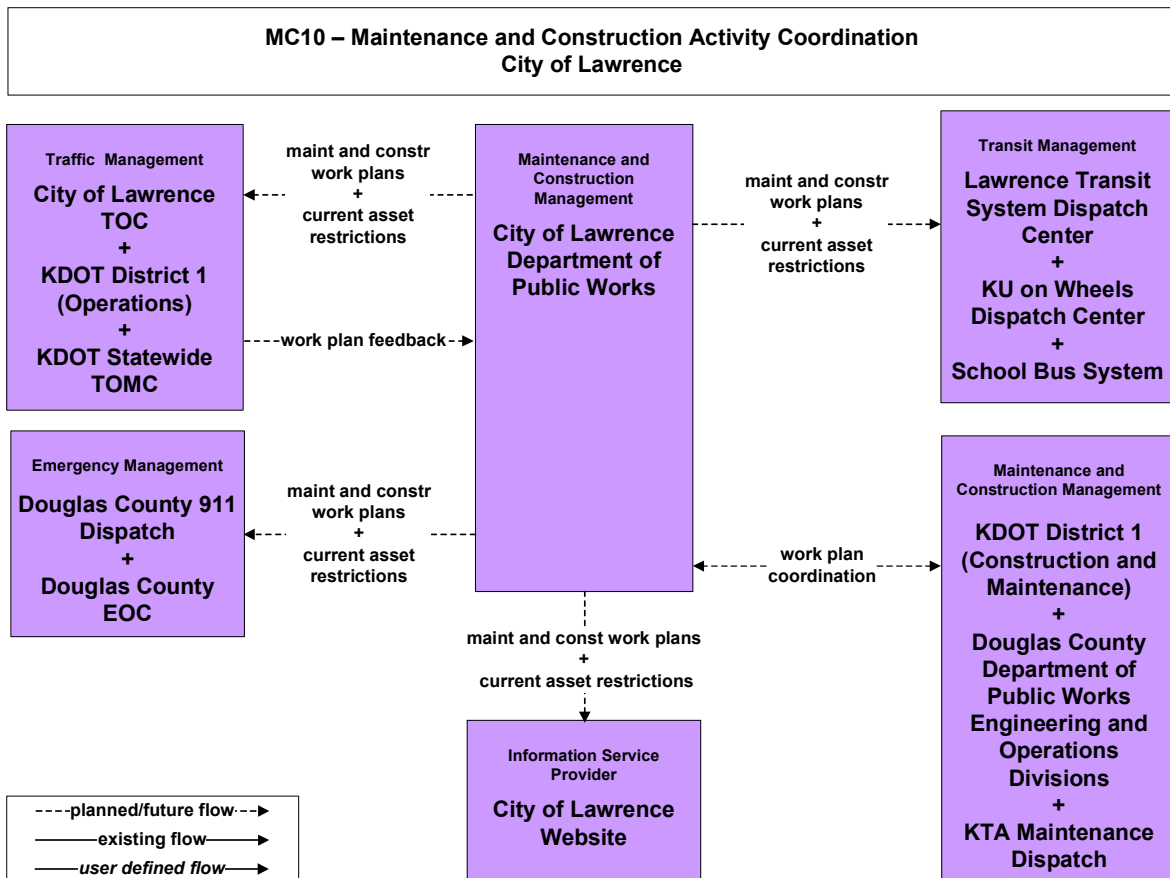
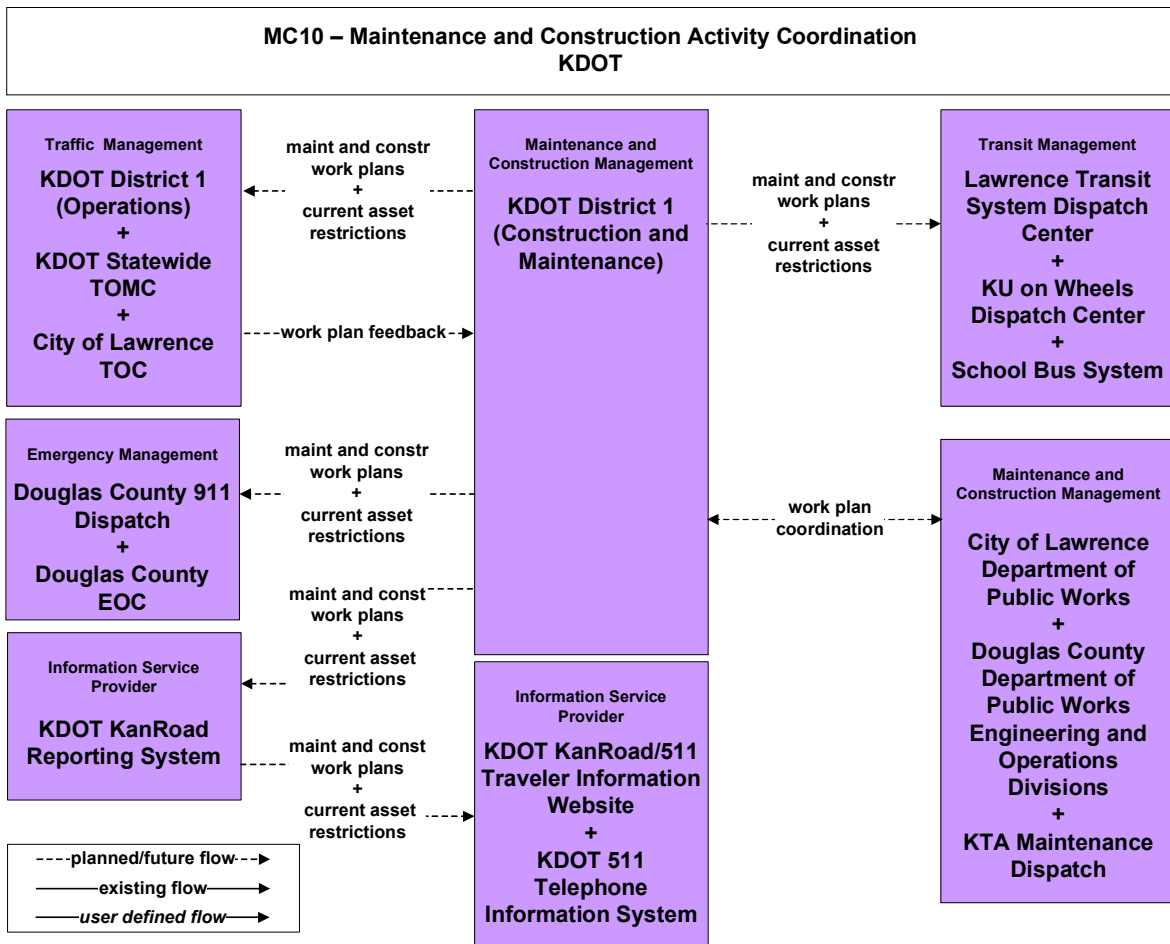


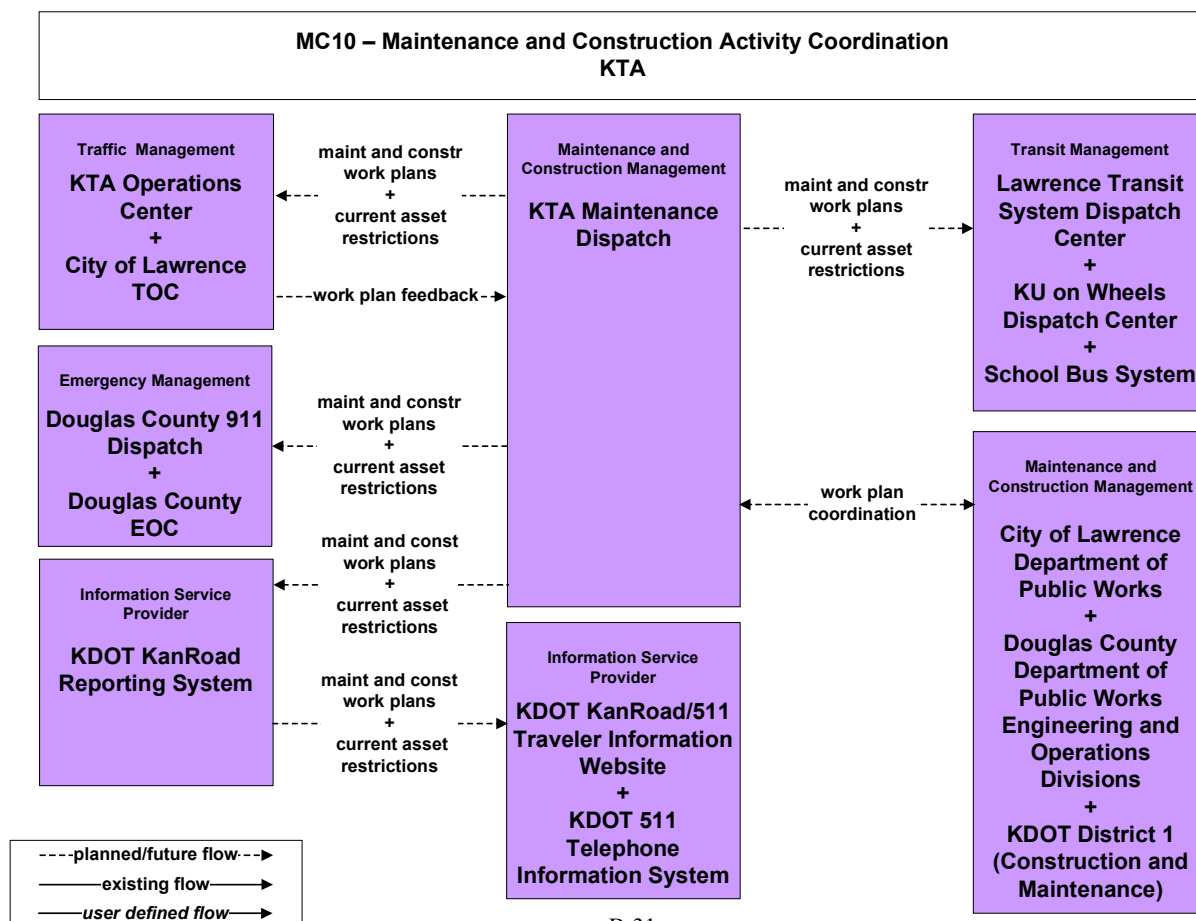
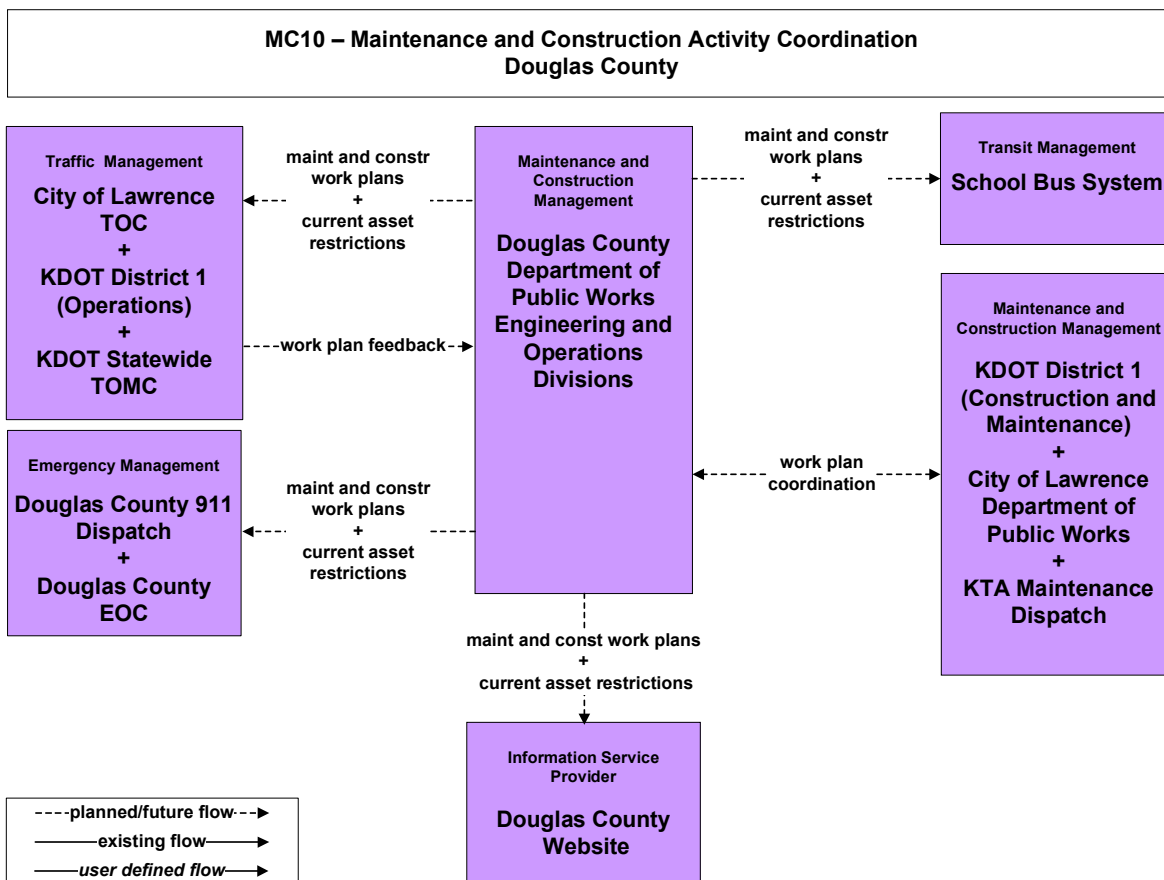
**MC07 – Roadway Maintenance and Construction
Douglas County**



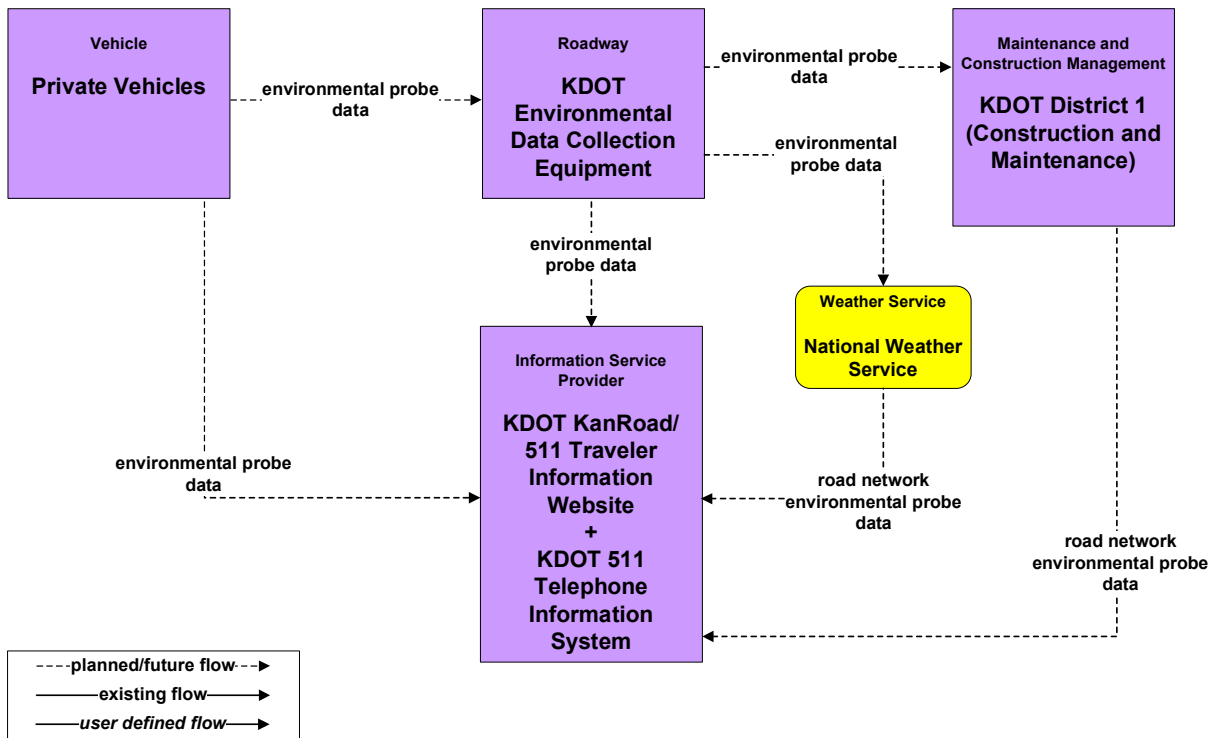




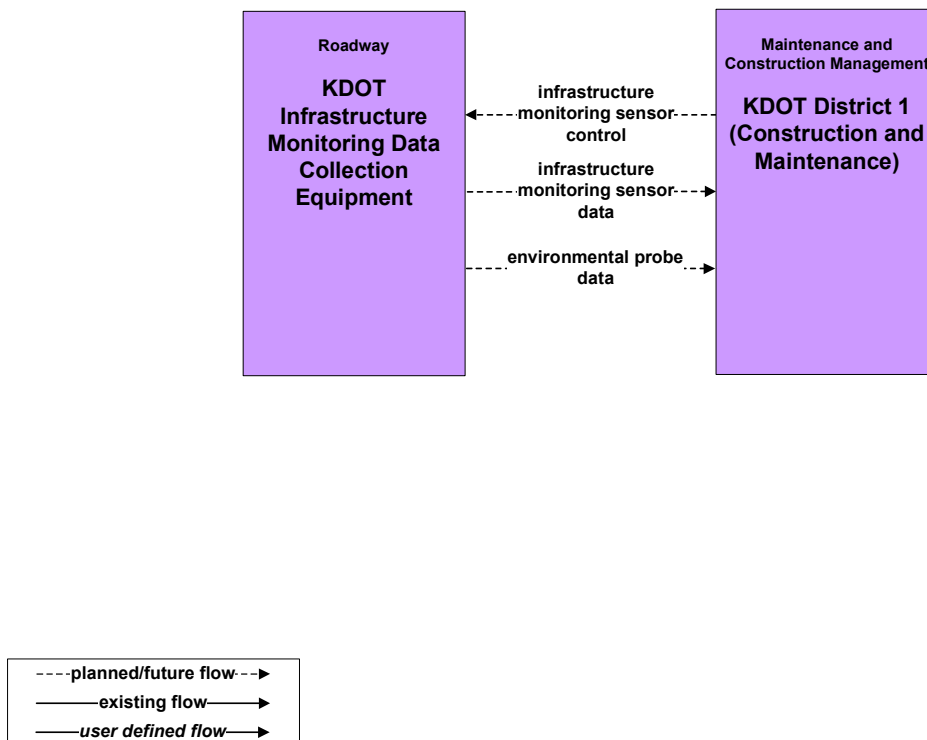




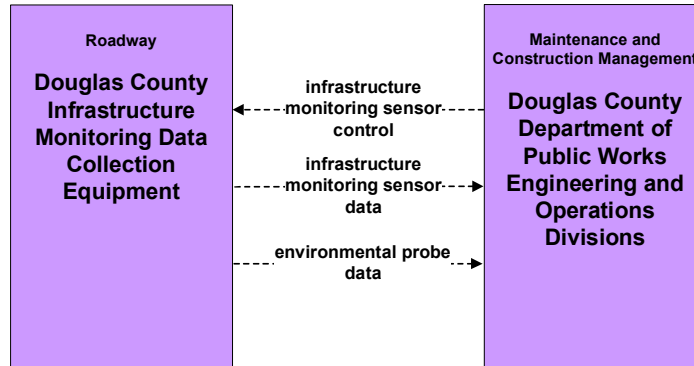
**MC11 – Environmental Probe Surveillance
KDOT**



**MC12 – Infrastructure Monitoring
KDOT**

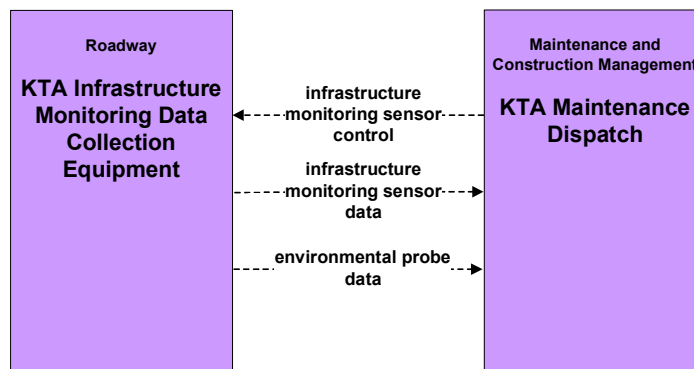


**MC12 – Infrastructure Monitoring
Douglas County**



---planned/future flow-->
 —existing flow—>
 —user defined flow—>

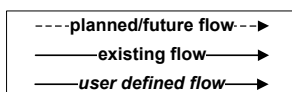
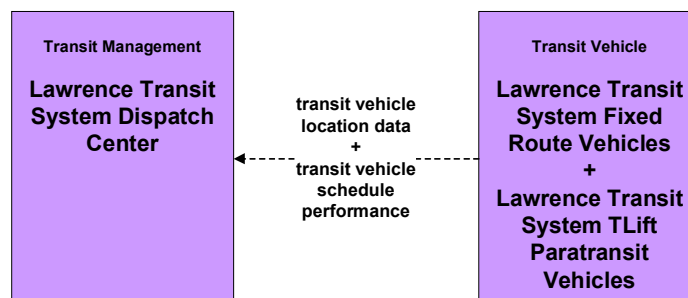
**MC12 – Infrastructure Monitoring
KTA**



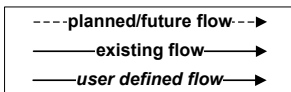
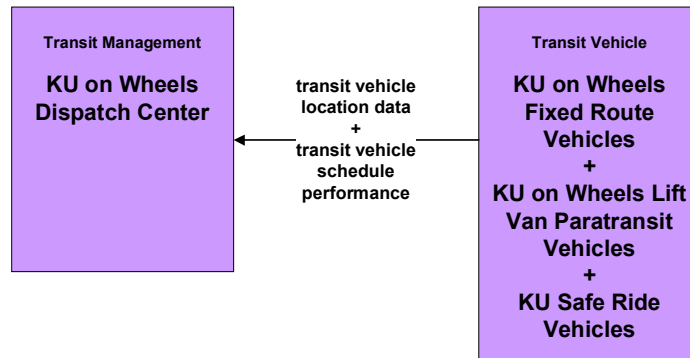
---planned/future flow-->
 —existing flow—>
 —user defined flow—>

Advanced Public Transportation Systems

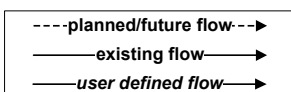
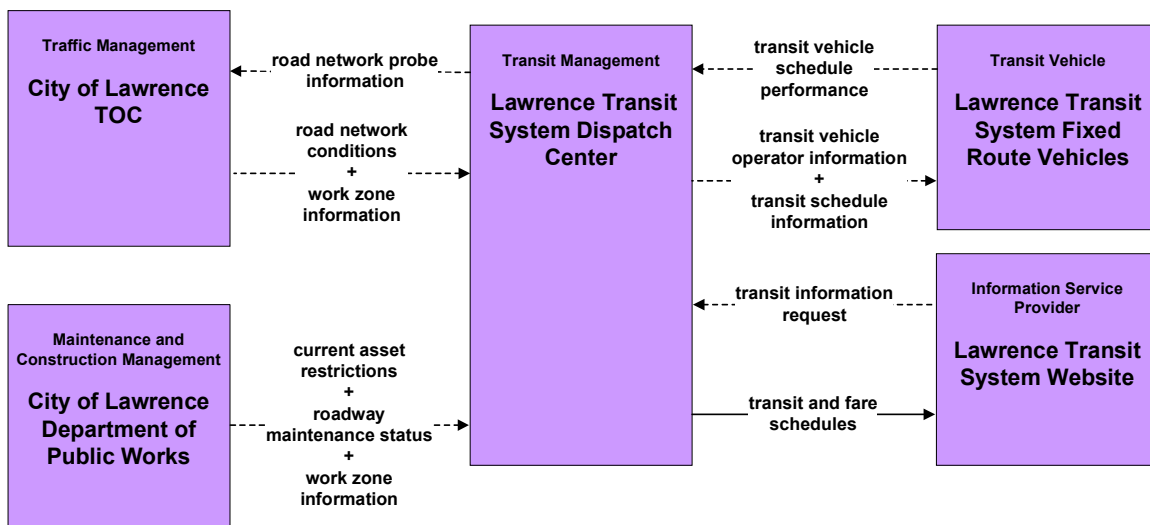
APTS01 – Transit Vehicle Tracking Lawrence Transit System



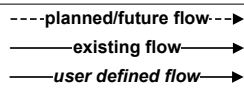
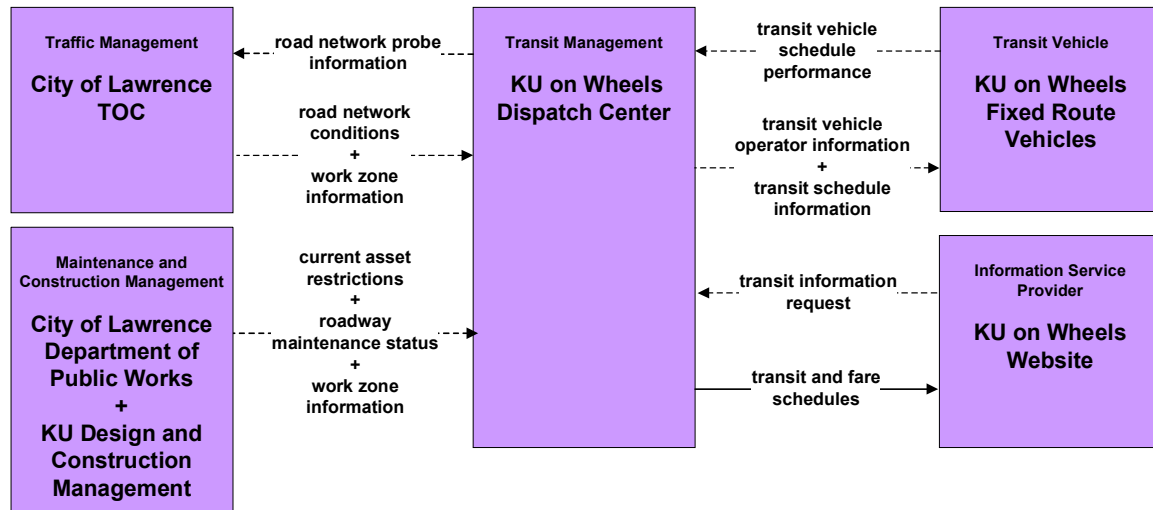
**APTS01 – Transit Vehicle Tracking
KU on Wheels**



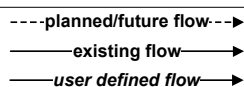
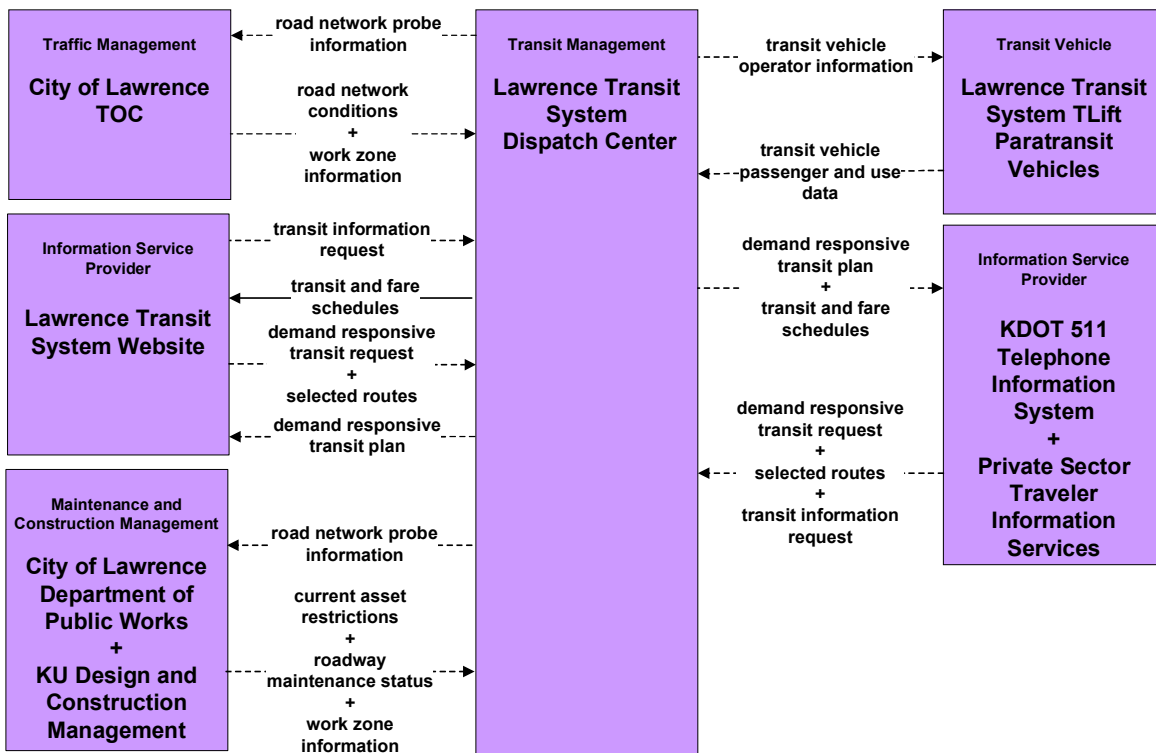
**APTS02 – Transit Fixed Route Operations
Lawrence Transit System**

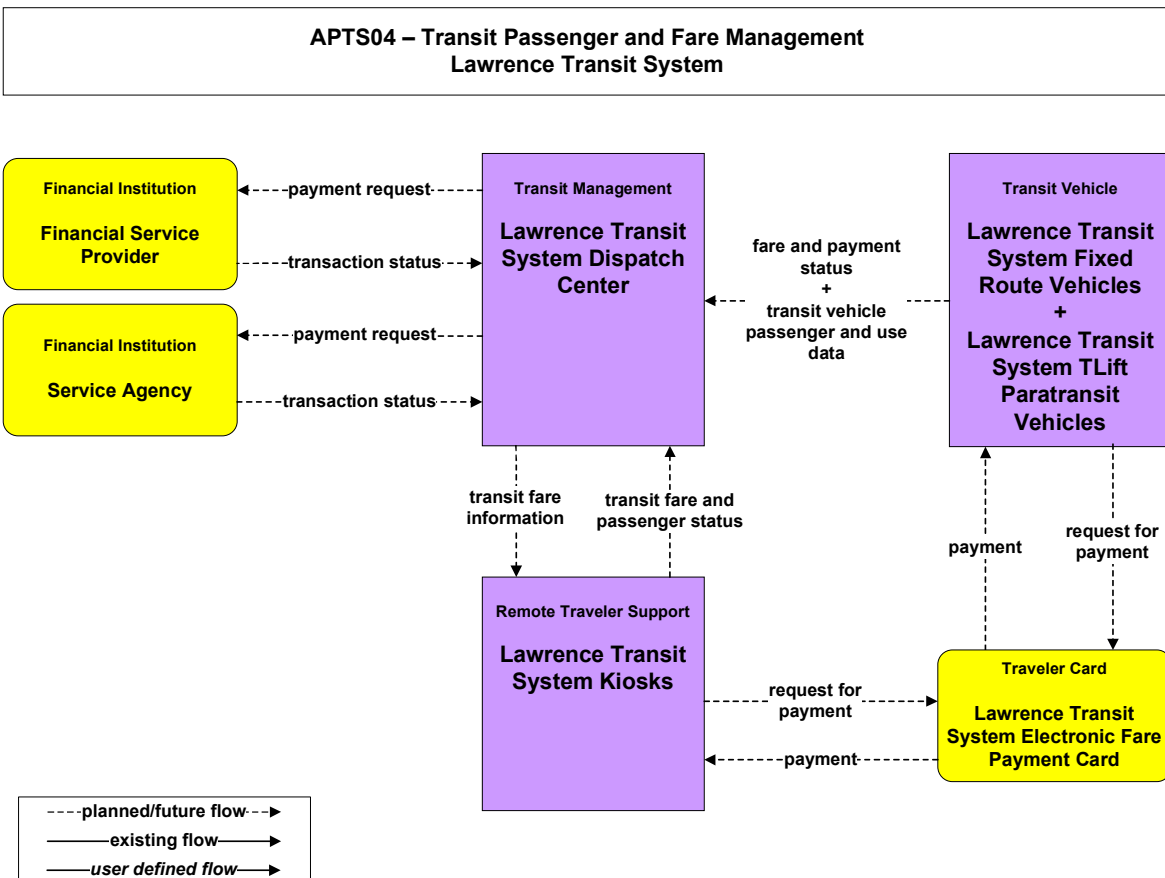
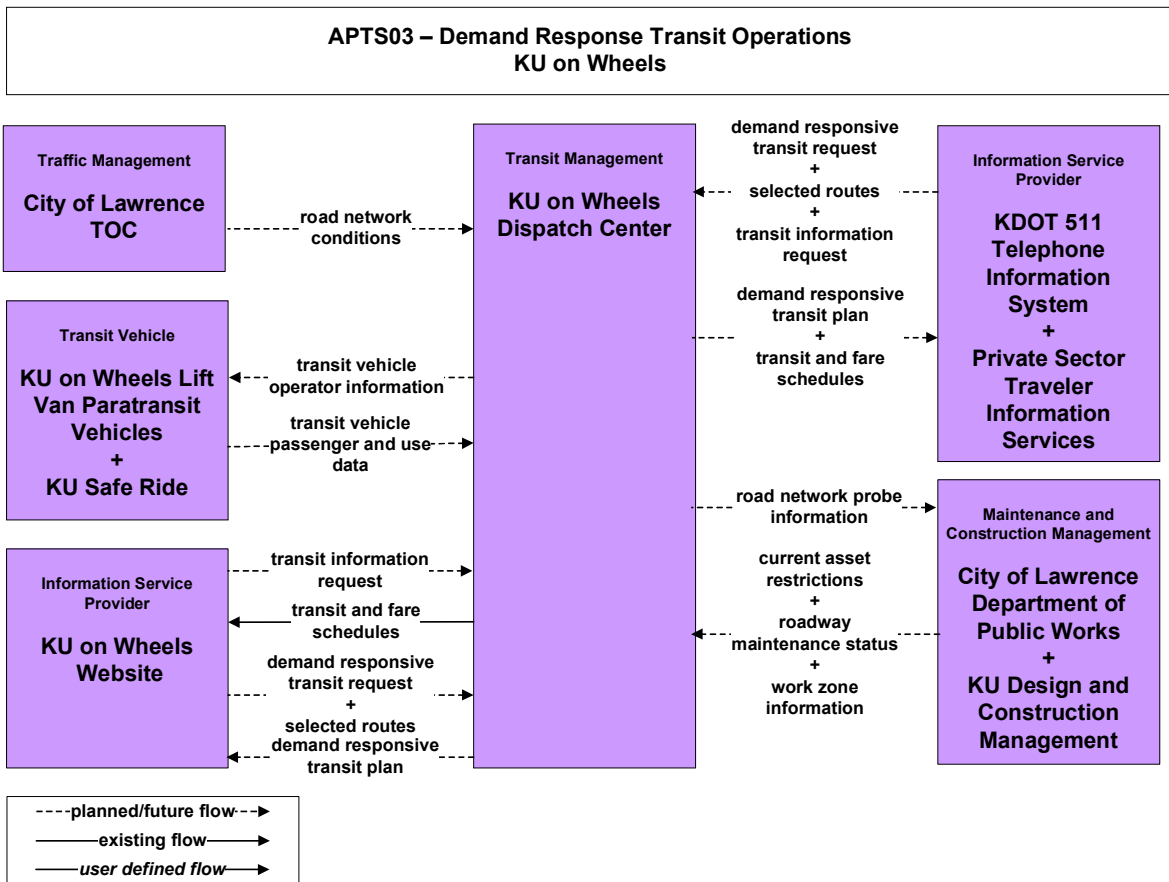


APTS02 – Transit Fixed Route Operations KU on Wheels

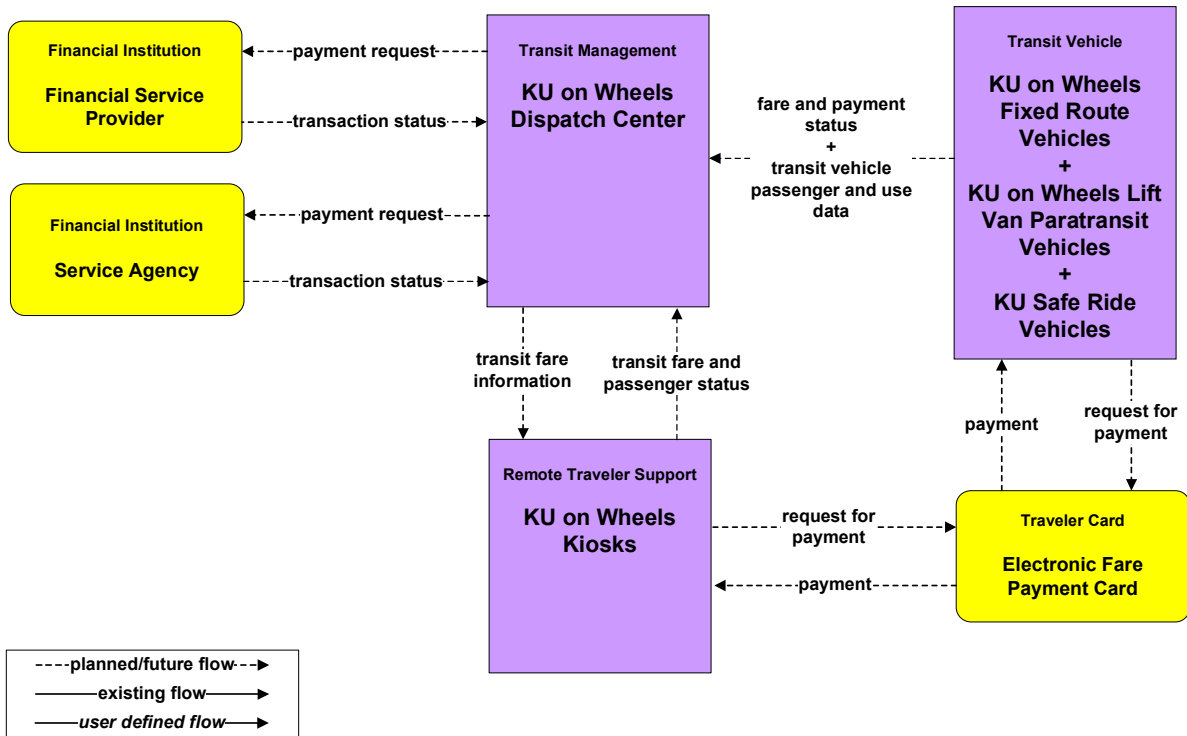


APTS03 – Demand Response Transit Operations Lawrence Transit System

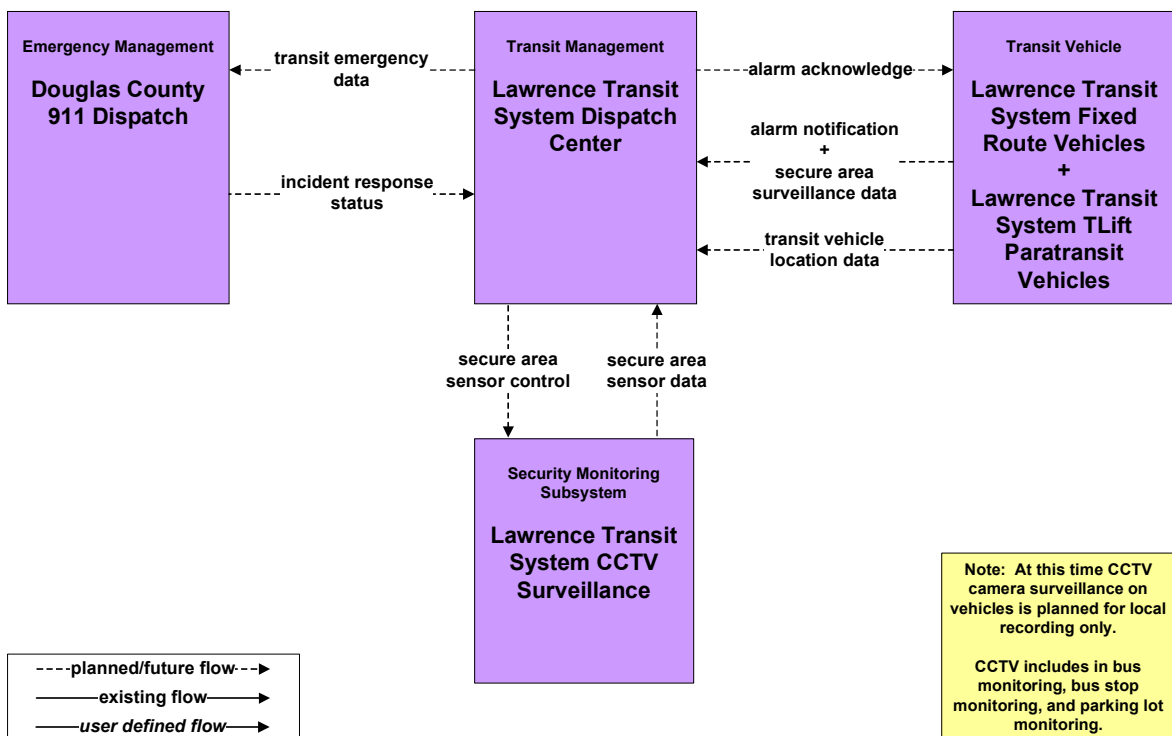




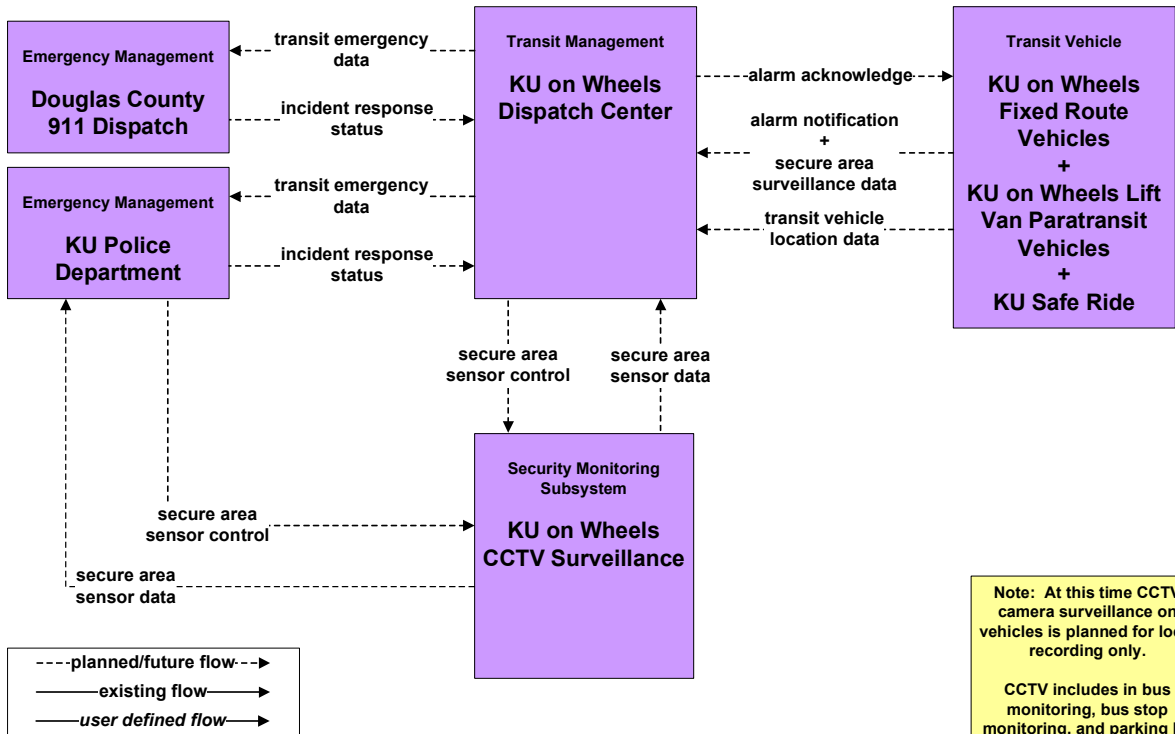
APTS04 – Transit Passenger and Fare Management KU on Wheels



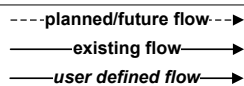
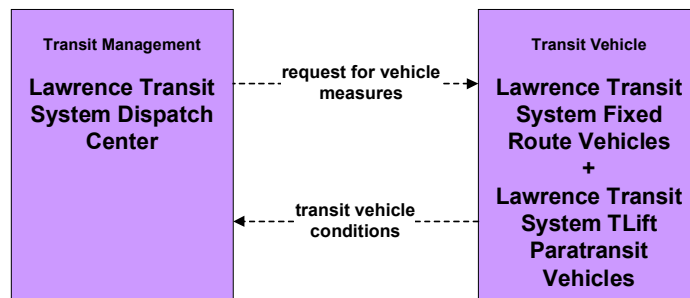
APTS05 – Transit Security Lawrence Transit System



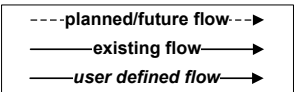
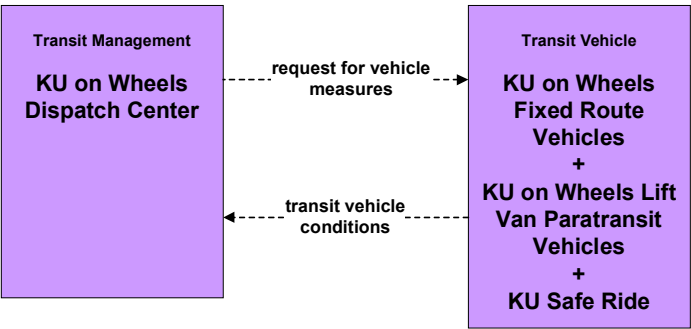
APTS05 – Transit Security KU on Wheels



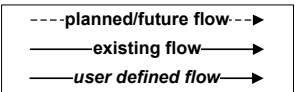
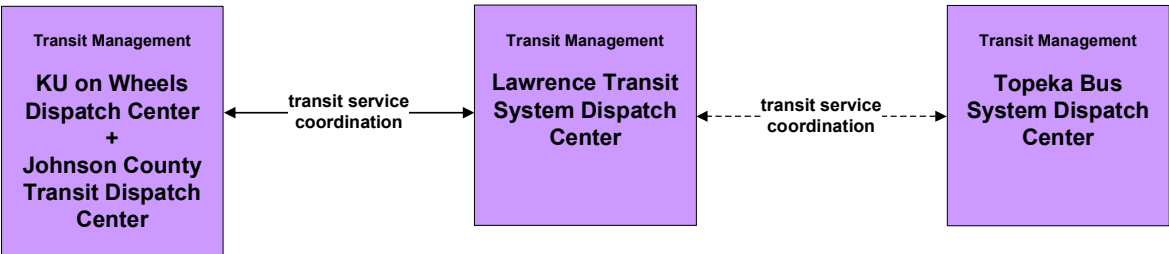
APTS06 – Transit Fleet Management Lawrence Transit System



**APTS06 – Transit Fleet Management
KU on Wheels**

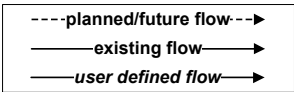
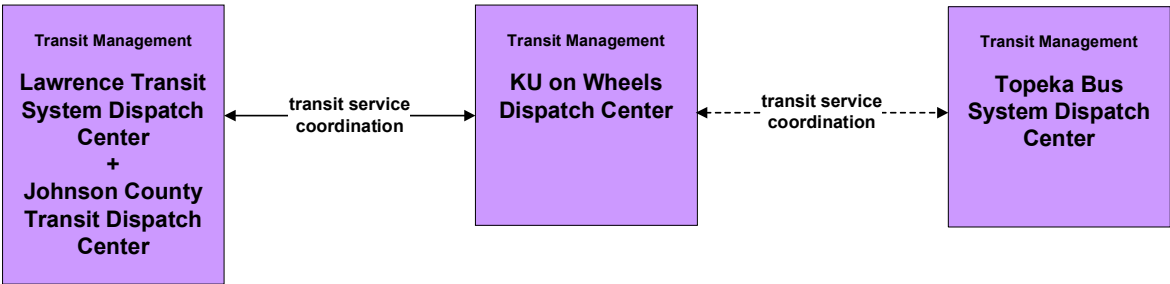


**APTS07 – Multi-modal Coordination
Lawrence Transit**



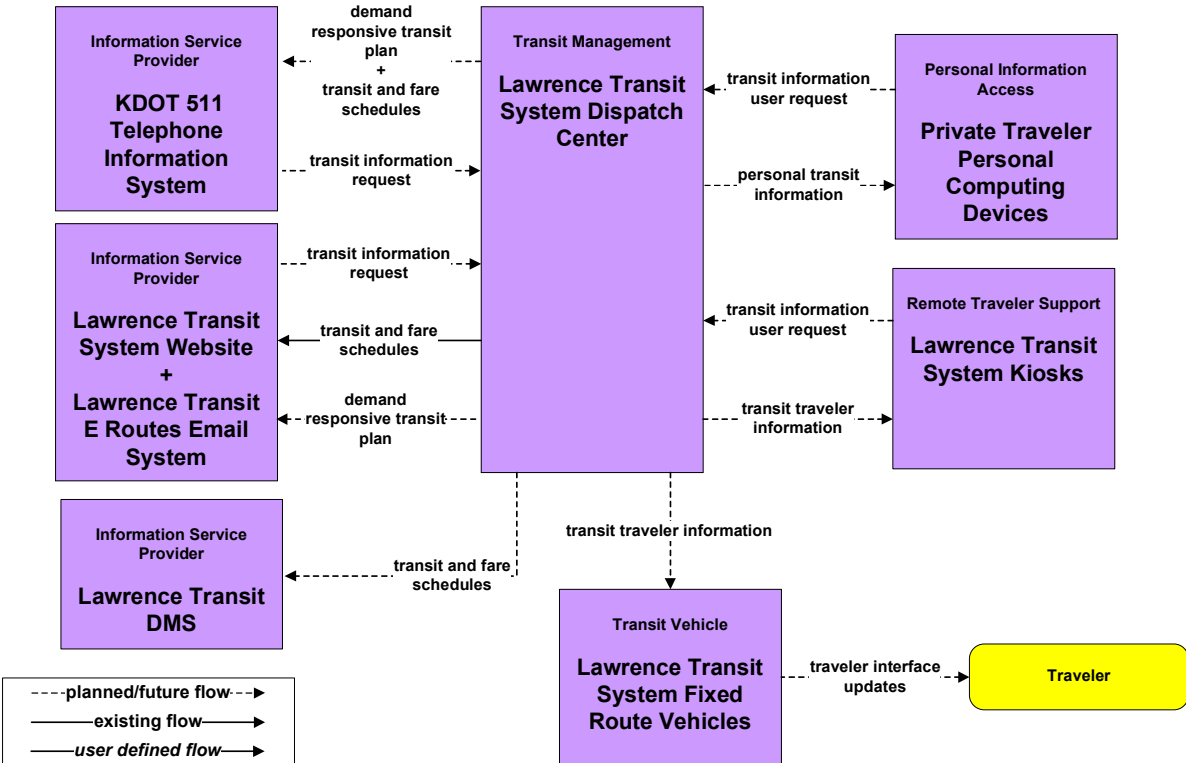
Note: Applies to fixed route services only.

**APTS07 – Multi-modal Coordination
KU on Wheels**

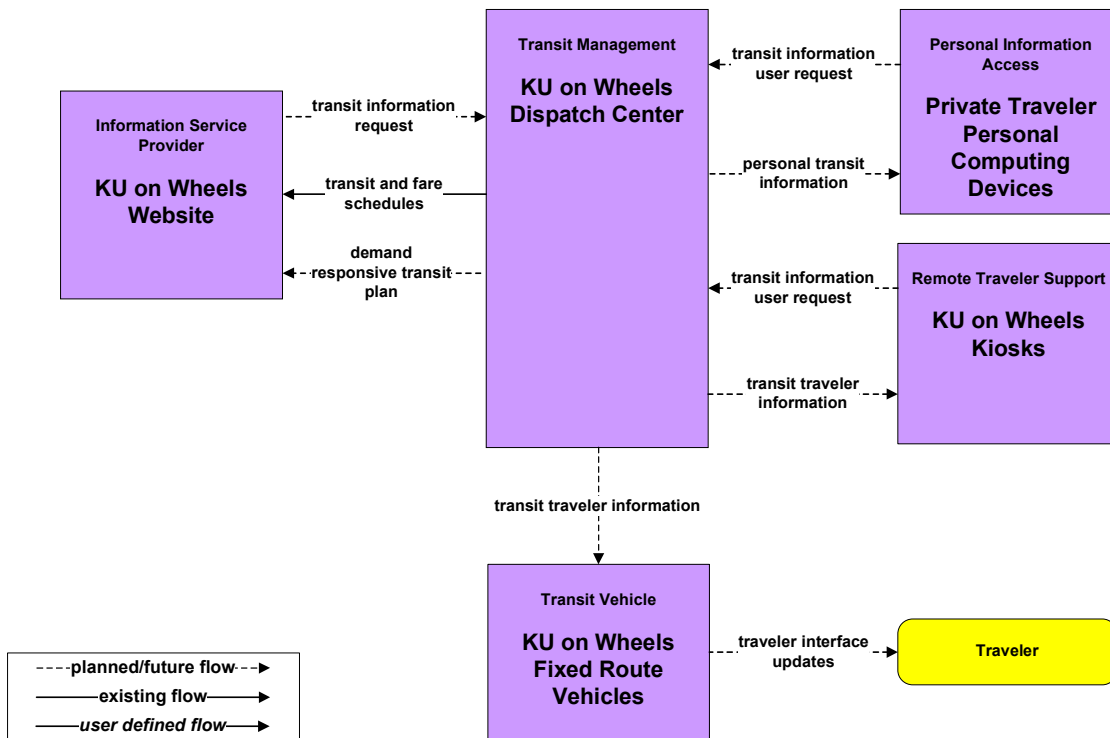


Note: Applies to fixed route services only.

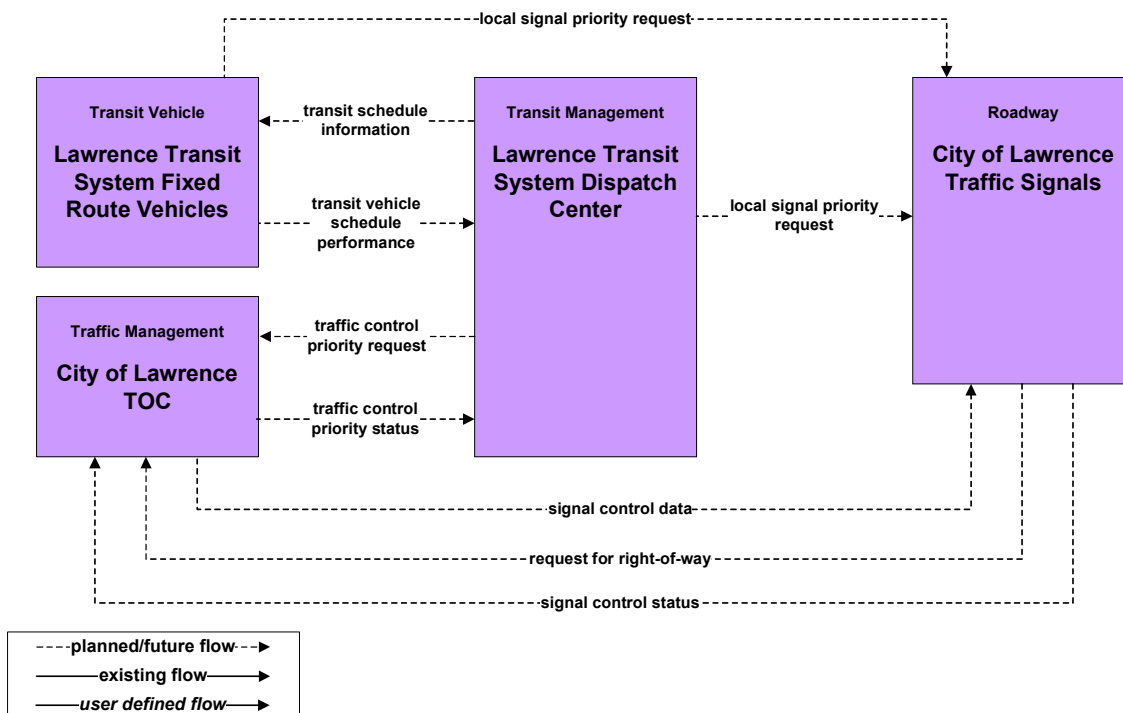
**APTS08 – Transit Traveler Information
Lawrence Transit System**



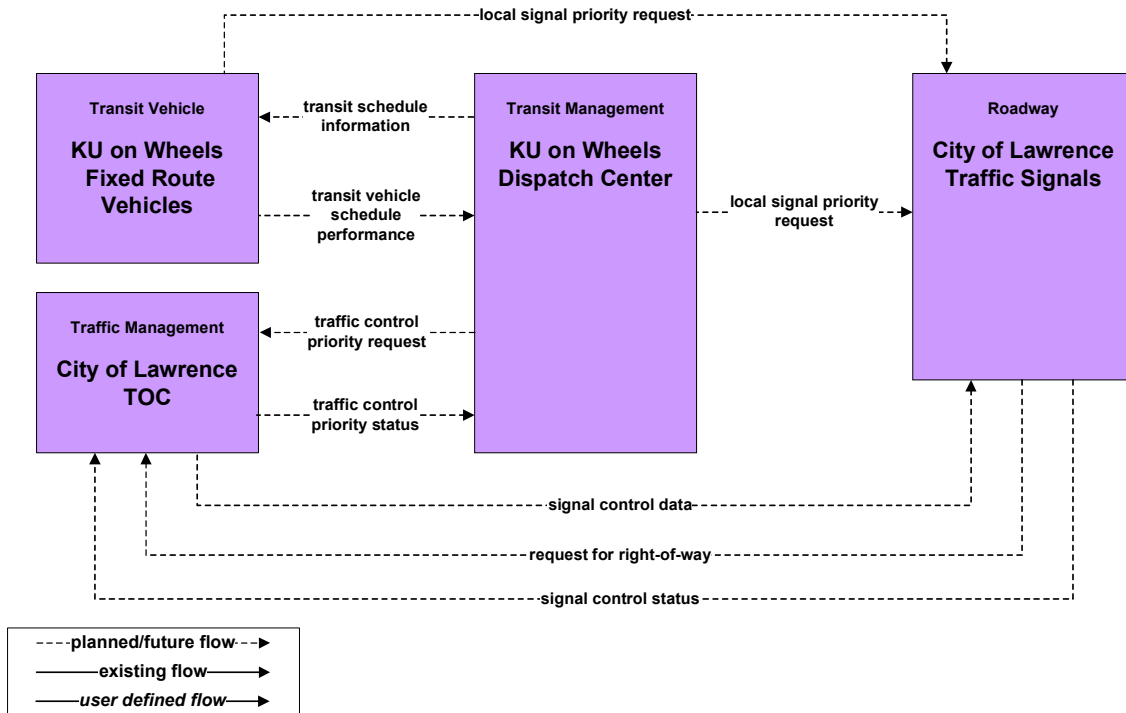
APTS08 – Transit Traveler Information KU on Wheels



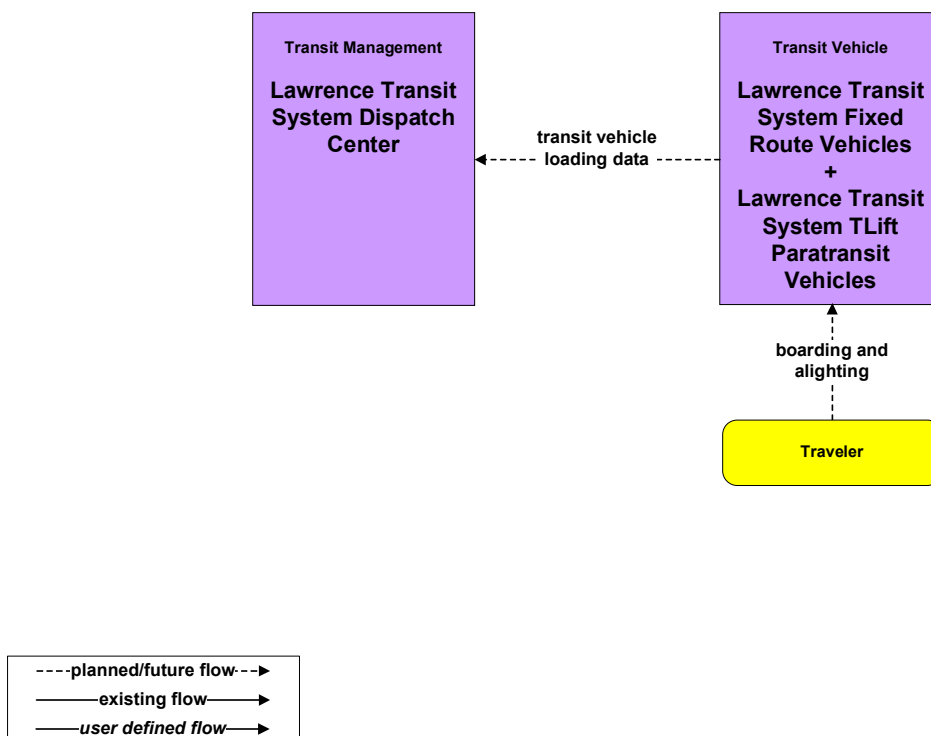
APTS09 – Transit Signal Priority Lawrence Transit System



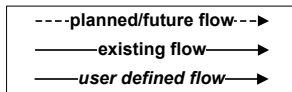
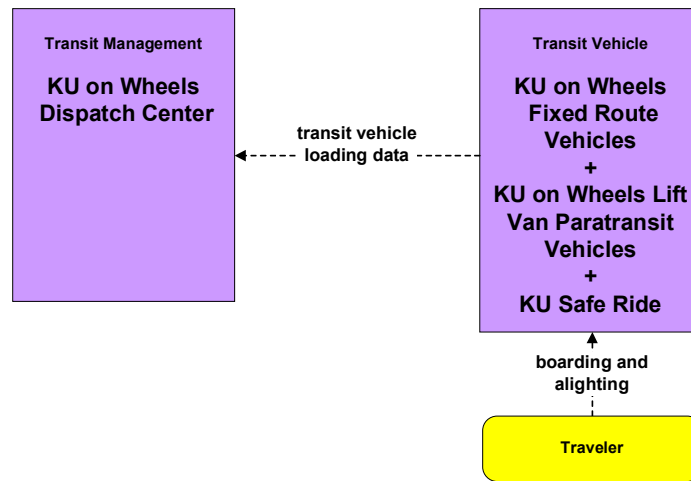
APTS09 – Transit Signal Priority KU on Wheels



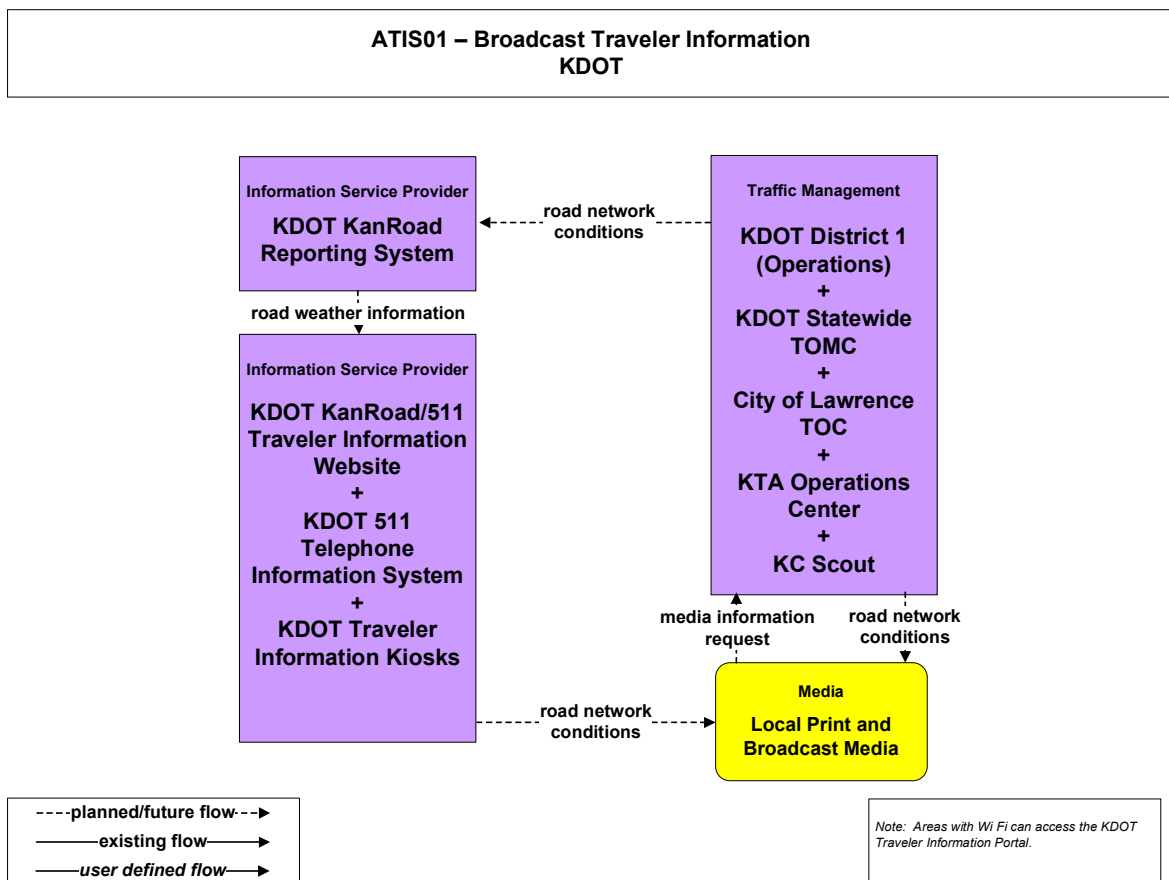
APTS10 – Transit Passenger Counting Lawrence Transit System



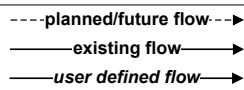
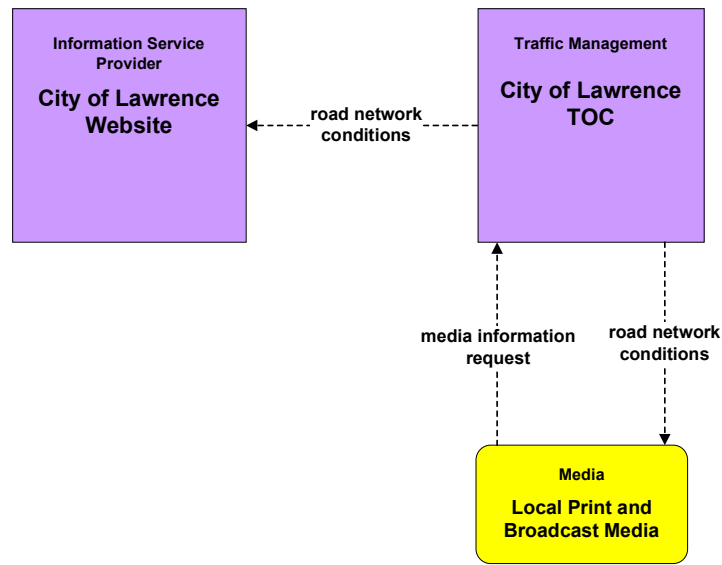
**APTS10 – Transit Passenger Counting
KU on Wheels**



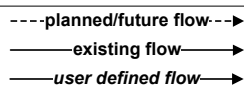
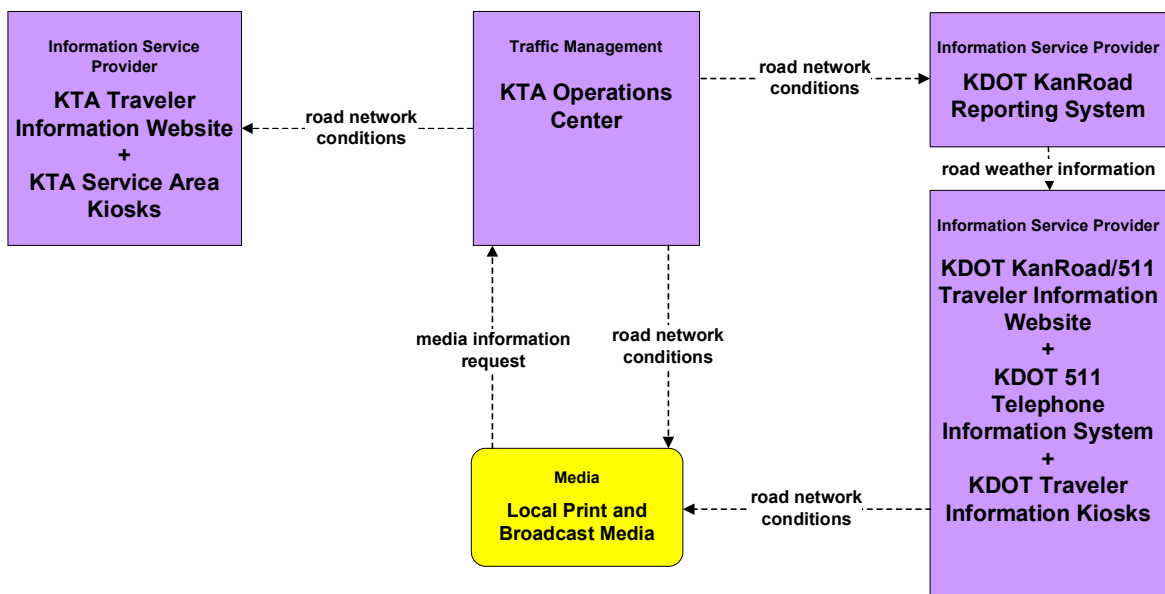
Advanced Traveler Information System

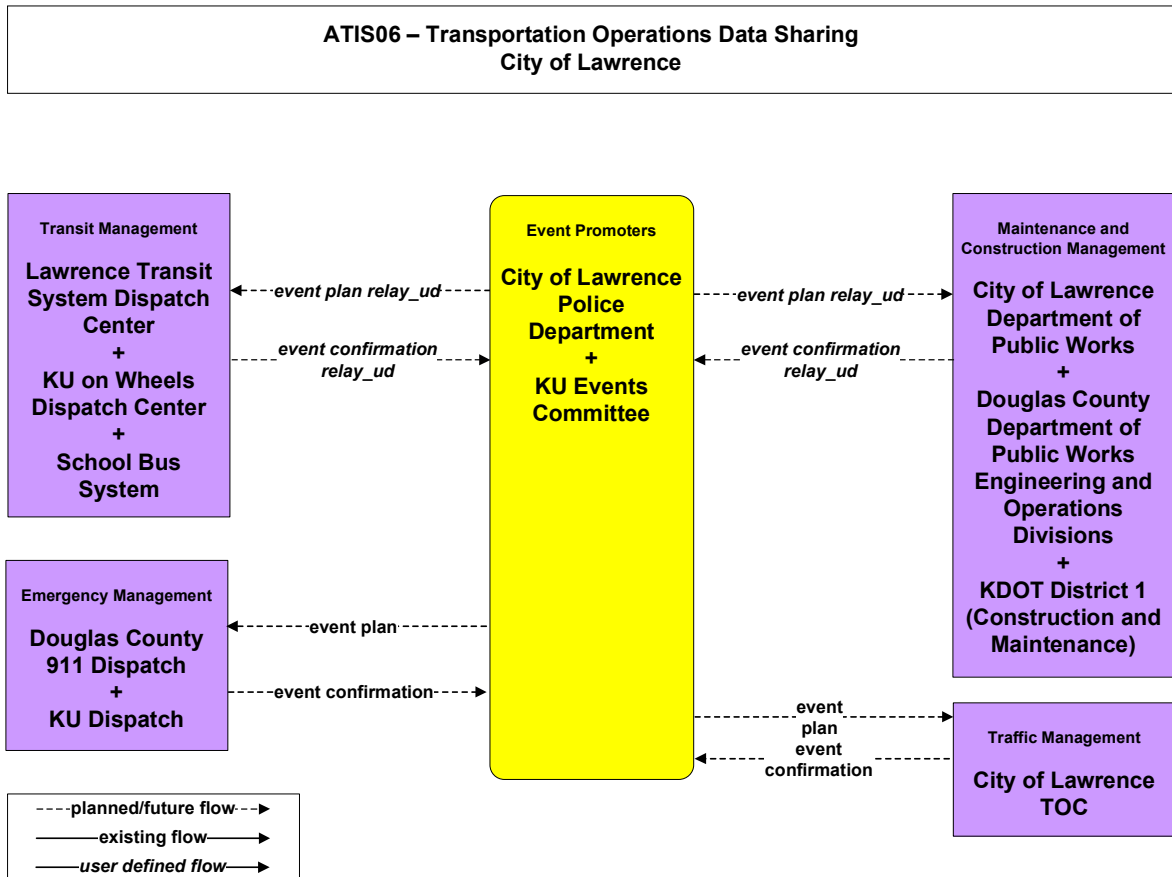
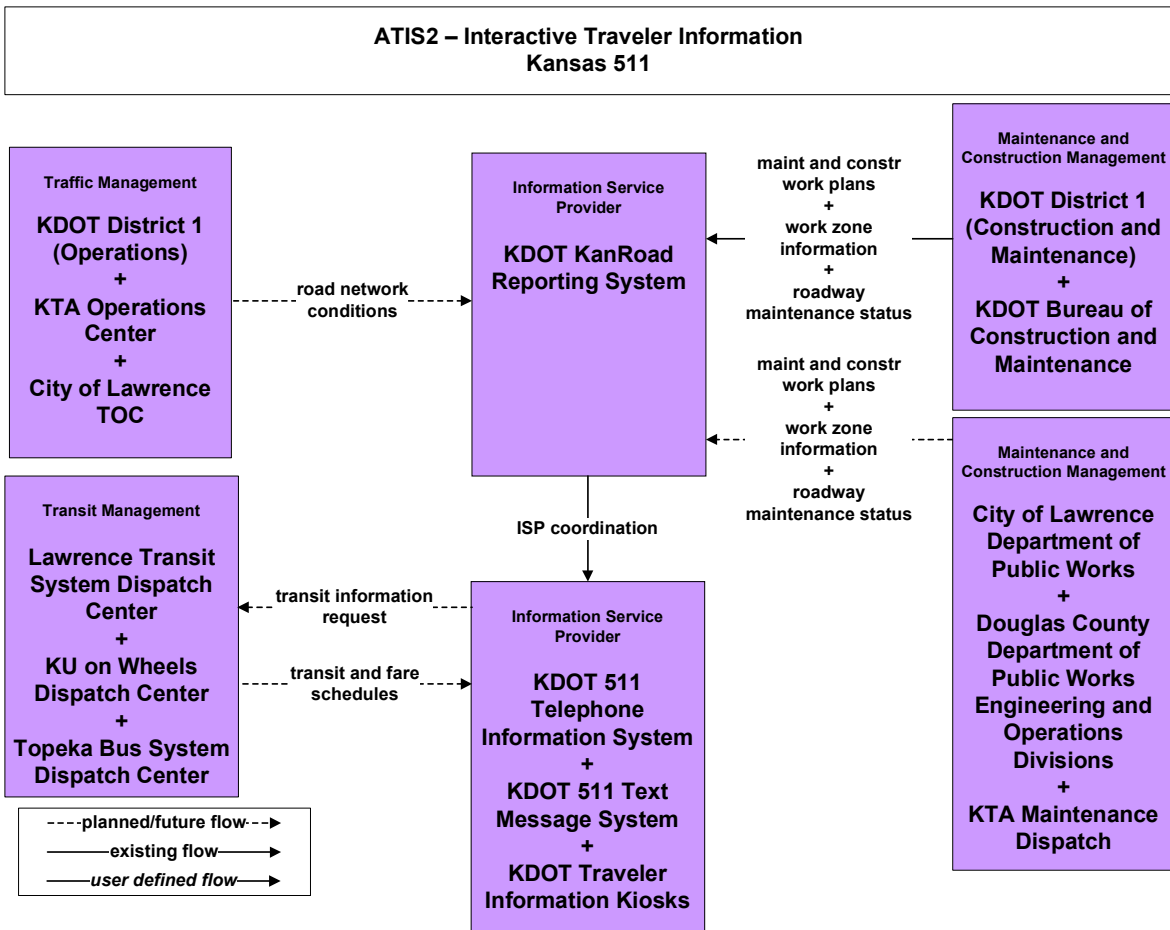


**ATIS01 – Broadcast Traveler Information
City of Lawrence**

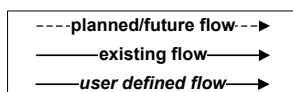
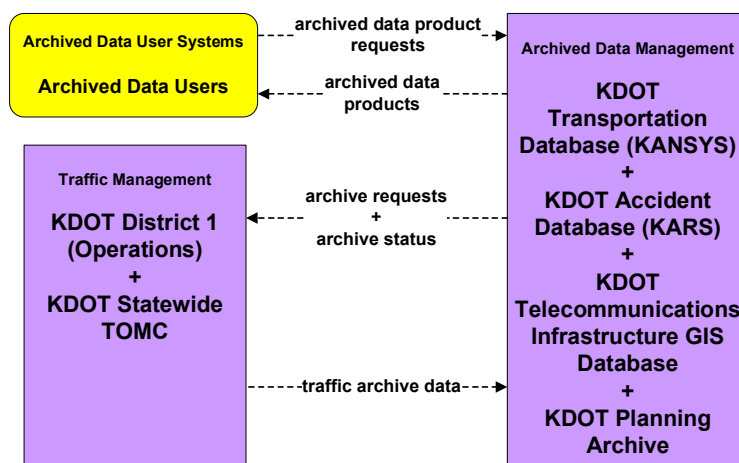
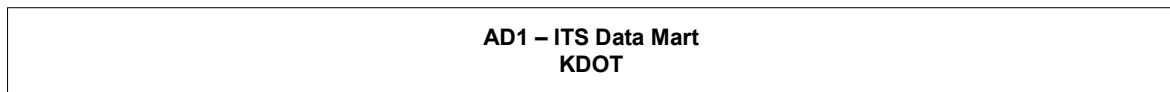


**ATIS01 – Broadcast Traveler Information
KTA**

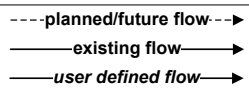
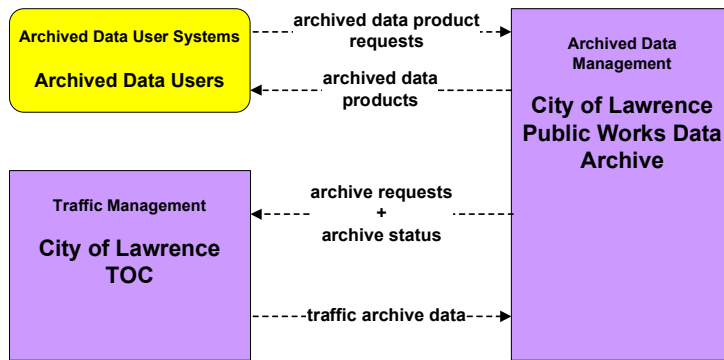




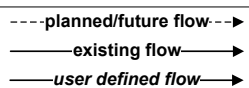
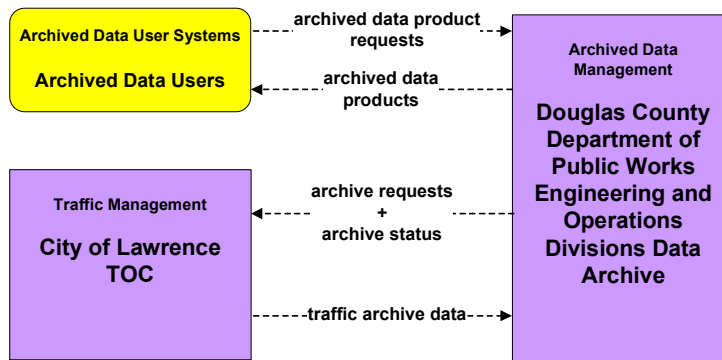
Archived Data



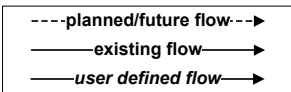
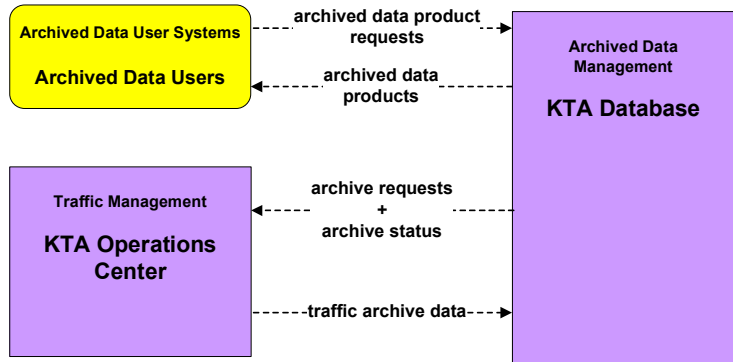
**AD1 – ITS Data Mart
City of Lawrence**



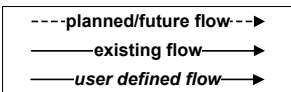
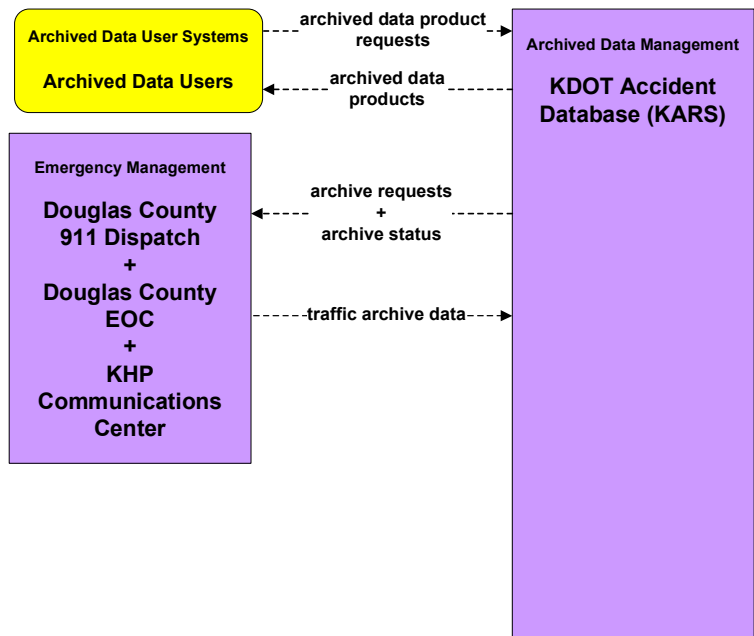
**AD1 – ITS Data Mart
Douglas County**



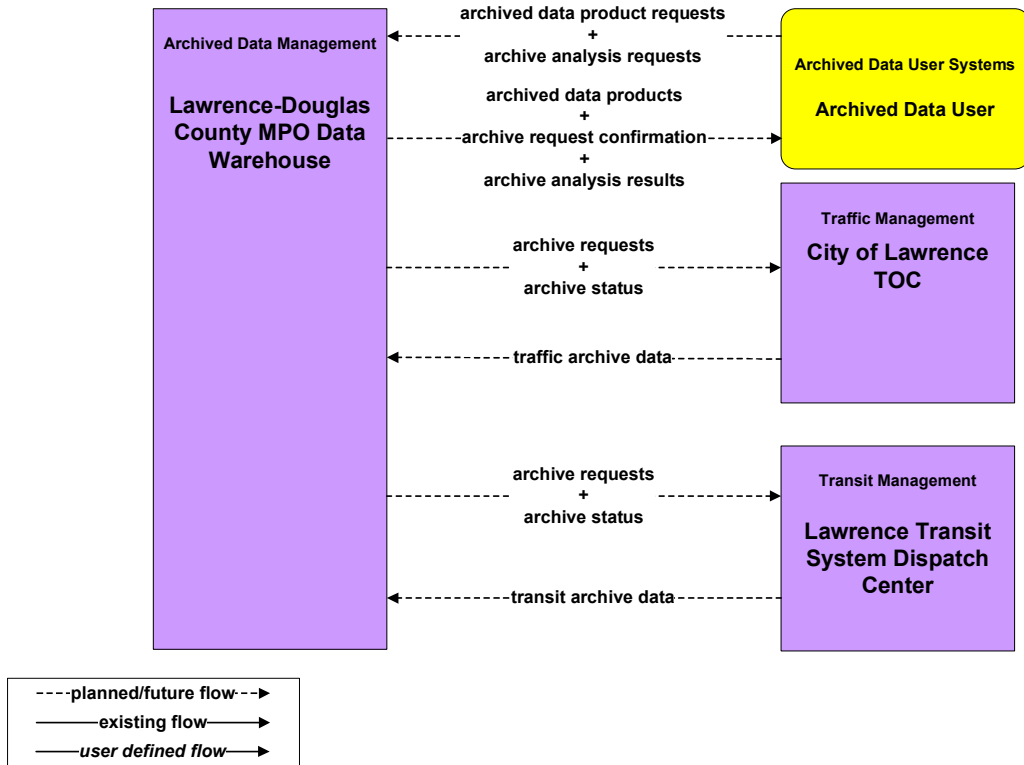
**AD1 – ITS Data Mart
KTA**



**AD1 – ITS Data Mart
KDOT Accident Database (KARS)**



**AD2 – ITS Data Warehouse
Lawrence-Douglas County MPO**





APPENDIX C – ELEMENT FUNCTIONS



(Will Be Completed in Revised Draft)



Kimley-Horn
and Associates, Inc.



APPENDIX D – ITS ARCHITECTURE MAINTENANCE DOCUMENTATION FORM



(Will Be Completed in Revised Draft)