



Regional ITS Architecture and Deployment Plan
Lawrence-Douglas County Region

Regional ITS Deployment Plan

Prepared by:



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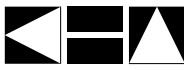


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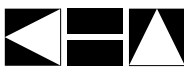
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LIST OF ACRONYMS

AD	Archived Data
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
CMAQ	Congestion Mitigation and Air Quality
DMS	Dynamic Message Sign
EM	Emergency Management
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HRI	Highway-Rail Intersection
ITS	Intelligent Transportation System
KC	Kansas City
KDOT	Kansas Department of Transportation
KTA	Kansas Turnpike Authority
KU	University of Kansas
MC	Maintenance and Construction
MDSS	Maintenance Decision Support System
MPO	Metropolitan Planning Office
NHS	National Highway System
RWIS	Road Weather Information System
STP	Surface Transportation Program
TOC	Traffic Operations Center
TOMC	Transportation Operations and Management Center

1. INTRODUCTION

1.1 Project Description

The Lawrence-Douglas County Region has developed a Regional Intelligent Transportation System (ITS) Architecture under the direction of the City of Lawrence. 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 Regional ITS Architecture focuses on the functionality that ITS provides in the Region as well as how those functions can operate for agencies in and around the Lawrence-Douglas County Region. The Regional ITS Architecture also satisfies an important requirement from the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) regarding transportation funding. An FHWA Final Rule and an FTA Final Policy issued in 2001 require that regions develop an ITS architecture and show how ITS projects conform to that regional ITS architecture in order to receive federal funding.

The ITS Deployment Plan, while not required by FHWA and FTA, is a useful tool for regions to identify specific projects for deployment in order to implement the architecture. The ITS Deployment Plan builds on the ITS Architecture by outlining specific ITS project recommendations and strategies for the Region and identifying deployment timeframes so that the recommended projects and strategies can be implemented over time.

A total of 35 ITS projects were identified for the Lawrence-Douglas County Region. The implementation of the projects identified will depend largely on the funding available for deployment as well as the priority of each project when compared against other regional transportation needs, such as roadway widening projects or procurement of additional transit buses. The ITS Deployment Plan does not attempt to rank the identified ITS project against other types of transportation projects. The intent of the plan is to identify all ITS projects that stakeholders would like to implement in the Region so that these projects can then be considered in the regional planning process when determining regional funding and priorities for transportation projects.

Each project that was identified in this plan includes a brief project description, an opinion of probable cost, funding status, identifies the agency responsible for implementation of the project, and indicates a time-frame for deployment. Separate sections in this plan also address project communications and project funding. Projects are categorized in the following functional areas:

- Travel and Traffic Management;
- Emergency Management
- Maintenance and Construction Management;
- Public Transportation Management; and
- Archived Data Management.

The ITS Deployment Plan also shows the correlation between each project and the Lawrence-Douglas County Regional ITS Architecture by identifying the market packages from the ITS Architecture that correspond with each project.

The Lawrence-Douglas County Regional ITS Architecture and ITS Deployment Plan were both developed with significant input from local, state, and federal officials. A series of four workshops were held to solicit input from stakeholders and ensure that the plans reflected the unique needs of the Region. Copies of the draft reports were made available to all stakeholders

for review and comment. The Regional ITS Architecture and Deployment Plan developed reflect an accurate snapshot of existing ITS deployments and future ITS plans in the Region. Needs and priorities of the Region will change over time and, in order to remain effective, this plan should be periodically reviewed and updated.

1.2 Document Layout

The Lawrence-Douglas County Regional ITS Deployment Plan is organized into four key sections:

Section 1 – Introduction

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

Section 2 – Application of Regional ITS Architecture Market Packages

A summary of the market packages selected and prioritized for the Region is provided in this section. Each market package is defined, accompanied by a listing of projects that support implementation of the market package services.

Section 3 – Project Recommendations

This section contains project recommendations to address stakeholder needs and goals for ITS implementation in the Region. Each project includes a description of the project, the responsible agency, an opinion of probable cost, whether or not funding has been identified, and a listing of market packages associated with the project.

Section 4 – Maintaining the Regional ITS Deployment Plan

A brief description of the maintenance procedure for the Regional ITS Deployment Plan is provided in this section.

1.3 The Lawrence-Douglas County Region

1.3.1 Region Overview

The Lawrence-Douglas County Region encompasses the total geographic area of Douglas County in the northwest part of Kansas. There are four incorporated cities listed in order of population from greatest to least: Lawrence, Eudora, Baldwin City, and Lecompton. The City of Lawrence has more than 80,000 residents and is home to the University of Kansas (KU), the largest university in the state with a student population of approximately 27,000.

The Region is served by several State and US highways. The primary roadway facilities include I-70, US 24, US 40, US 56, US 59, and K-10.

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

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

1.3.2 Stakeholders

ITS often transcends traditional transportation infrastructure; therefore, the involvement of non-traditional stakeholders is important in the architecture development and visioning process. Input from these stakeholders, both public and private, is a crucial part of defining the interfaces, integration needs, and overall vision for ITS in a region.

The following stakeholder agencies have participated in the Lawrence-Douglas County Region project workshops or provided input to the study team:

- City of Eudora;
- City of Lawrence Public Works Department;
- City of Lawrence Information Systems;
- City of Lawrence Fire Department/EMS;
- City of Lawrence Police Department;
- Douglas County Information Technology;
- Douglas County 911;
- Douglas County Emergency Management Agency;
- Douglas County Public Works;
- Douglas County Sheriff's Office;
- Federal Highway Administration;
- Federal Transit Administration;
- Kansas Department of Transportation;
- Kansas Turnpike Authority;
- KU on Wheels;
- KU Parking and Transit;
- KU Public Safety Office;
- Lawrence Freenet;
- Lawrence Transit System;
- Lawrence-Douglas County MPO;
- Lawrence-Douglas County Planning;
- Lecompton Fire/Rescue/EMS;
- University of Kansas – Department of Civil, Environmental, and Architectural Engineering; and
- USD 497 – Laidlaw Transportation.

A more detailed list of stakeholders, including the individuals representing each agency, is provided in the Lawrence-Douglas County Regional ITS Architecture report.

2. REGIONAL ITS ARCHITECTURE MARKET PACKAGE IMPLEMENTATION

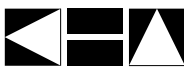
Of the 91 market packages available in Version 6.0 of the National ITS Architecture, 44 were selected and customized for deployment in the Lawrence-Douglas County Region. The market packages outline the functions that stakeholders envision ITS to perform in coming years. The Deployment Plan builds on those market packages through the development of project concepts to implement in the Region.

2.1 Market Package Prioritization

Stakeholders were asked to prioritize the market packages into high, medium, and low priorities based on regional needs, feasibility, likelihood of deployment, and overall contribution of the market package to the goals and vision for ITS functionality in the Region. A summary of these prioritized market packages is shown in **Table 1**. More detail on the ITS market packages is provided in the Lawrence-Douglas County Regional ITS Architecture report.

Table 1 – 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	ATMS07	Regional Traffic Management	ATMS02	Traffic Probe Surveillance
ATMS03	Surface Street Control	ATMS10	Electronic Toll Collection		
ATMS06	Traffic Information Dissemination	ATMS13	Standard Railroad Grade Crossing		
ATMS08	Traffic Incident Management System	ATMS16	Parking Facility Management		
ATMS21	Roadway Closure Management	ATMS19	Speed Monitoring		
Emergency Management					
EM01	Emergency Call-Taking and Dispatch	EM04	Roadway Service Patrols	EM03	Mayday and Alarms Support
EM02	Emergency Routing	EM08	Disaster Response and Recovery	EM06	Wide-Area Alert
EM10	Disaster Traveler Information			EM09	Evacuation and Reentry Management
Maintenance and Construction Management					
MC03	Road Weather Data Collection	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC05	Roadway Automated Treatment
MC04	Weather Information Processing and Distribution	MC09	Work Zone Safety Monitoring	MC12	Infrastructure Monitoring
MC06	Winter Maintenance	MC11	Environmental Probe Surveillance		
MC07	Roadway Maintenance and Construction				
MC08	Work Zone Management				
MC10	Maintenance and Construction Activity Coordination				



**Table 1 – Lawrence-Douglas County Market Package Prioritization by Functional Area
(continued)**

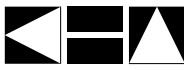
High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Public Transportation Management		
APTS01 Transit Vehicle Tracking	APTS04 Transit Fare Collection Management	APTS09 Transit Signal Priority
APTS02 Transit Fixed-Route Operations	APTS06 Transit Fleet Management	APTS10 Transit Passenger Counting
APTS03 Demand Response Transit Operations	APTS07 Multi-modal Coordination	
APTS05 Transit Security		
APTS08 Transit Traveler Information		
Traveler Information		
ATIS01 Broadcast Traveler Information		
ATIS02 Interactive Traveler Information		
Archived Data Management		
	AD1 ITS Data Mart	
	AD2 ITS Data Warehouse	

The market package prioritization was a primary factor in developing recommendations for ITS deployment and integration in the Lawrence-Douglas County Region. These priorities identified the key ITS services desired by stakeholders in the Lawrence-Douglas County Region, as well as the interfaces that need to be established to provide integrated functionality and establish communication between elements. The high, medium, and low prioritization does not necessarily correspond to any specific time frame (such as five-, ten-, or twenty-year deployment horizon). For example, a market package can be a high priority, but due to funding needs or prerequisite project requirements, deployment might not be feasible for several years. Maturity and availability of technology were also considered in prioritizing the market packages along with determining if the market package was more suitable for private deployment and operations or public sector deployment.

2.2 Market Packages and Supporting Projects

In order to implement the ITS market package services in the Lawrence-Douglas County Region, each market package was reviewed to determine which projects should be deployed. Stakeholders provided a great deal of feedback on these projects at an ITS Deployment Plan Workshop that was held in the Region. Although the timeframe of the ITS Deployment Plan extended beyond ten years, stakeholders generally focused on identifying shorter term projects that were more likely to be funded.

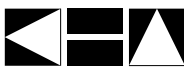
Not every market package has an associated ITS project. Several market packages were identified as being important to the Region; however, at this time there were no projects identified to document in the ITS Deployment Plan. In the future, additional projects will likely be added to the ITS Deployment Plan to implement these ITS market packages. In the following subsection, the market packages that were selected for the Region and their associated projects are identified. Those market packages that did not include any associated projects are also included.



The ITS market packages in the following subsections are organized by service areas as they appear in the National ITS Architecture. Each ITS market package includes:

- A brief definition of the market package (which were modified from the National ITS Architecture definitions);
- Stakeholder priority for the market package; and
- Recommended projects that will address some or all of the services that are contained in the ITS market package.

It should be noted that for several of the market packages there are existing ITS deployments in place that support that market package. For example, the KTA has a traveler advisory radio in place along I-70 that supports the ATMS06 Traveler Information Dissemination market package. The market packages presented in the following subsections only include projects that are recommended for future deployment and do not include existing deployments of ITS.



2.2.1 Traffic Management Service Area

The following market packages and related projects implement the traffic management service area functions. These traffic management service areas represent some of the most commonly deployed projects, such as traffic signal system upgrades, closed-circuit television (CCTV) cameras, dynamic message signs (DMS), and traffic operations centers (TOCs). Many of the market packages in this service area are expected to be deployed prior to market packages in other service areas.

Table 2 – Traffic Management Market Packages and Projects

Network Surveillance (ATMS01)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Traffic Operations Center ▪ City of Lawrence CCTV Camera Deployment ▪ City of Lawrence Fiber Backbone ▪ Douglas County Flood Detection and Road Closure System ▪ KDOT CCTV Camera Deployment 	
Traffic Probe Surveillance (ATMS02)	Low Priority
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.	
Recommended Projects	
No projects have been identified at this time. Stakeholders did want to consider using the KTA toll tags as probe vehicles in the future to measure volumes and speeds but did not want to identify any projects for implementation at this time.	
Surface Street Control (ATMS03)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Traffic Operations Center ▪ City of Lawrence Signal System Upgrade ▪ City of Lawrence Special Event Traffic Control ▪ City of Lawrence Fiber Backbone 	

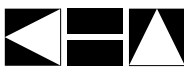


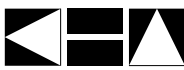
Table 2 – Traffic Management Market Packages and Projects (continued)

Traffic Information Dissemination (ATMS06)	High Priority
<p>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.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Lawrence Traffic Operations Center ▪ City of Lawrence Incident Information Dissemination to Local Agencies ▪ City of Lawrence Center to Center Data Connection to State Agencies ▪ City of Lawrence Special Event Traffic Control ▪ Douglas County 911 CAD Connection to City of Lawrence TOC ▪ Douglas County 911 CAD Connection to KDOT Statewide TOMC ▪ KDOT DMS Deployment 	
Regional Traffic Management (ATMS07)	Medium Priority
<p>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.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Lawrence Traffic Operations Center ▪ City of Lawrence Center to Center Data Connection to State Agencies ▪ City of Lawrence Fiber Backbone 	
Traffic Incident Management System (ATMS08)	High Priority
<p>Manages both unexpected incidents and planned events so that the impact to the transportation network 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.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Lawrence Traffic Operations Center ▪ City of Lawrence CCTV Camera Deployment ▪ City of Lawrence Incident Information Dissemination to Local Agencies ▪ City of Lawrence Center to Center Data Connection to State Agencies ▪ City of Lawrence Fiber Backbone ▪ Douglas County 911 CAD Connection to City of Lawrence TOC ▪ Douglas County 911 CAD Connection to KDOT Statewide TOMC ▪ KDOT CCTV Camera Deployment 	



Table 2 – Traffic Management Market Packages and Projects (continued)

Electronic Toll Collection (ATMS10)	Medium Priority
Provides toll operators with the ability to collect tolls electronically and detect and process violations.	
<p>Recommended Projects</p> <p>No projects have been identified at this time. KTA has recently upgraded their toll readers and are considering implementing a new type of toll tag. If KTA does decide to upgrade the toll tags they would be phased in as replacements for existing toll tags as batteries die and users request a replacement tag.</p>	
Standard Railroad Grade Crossing (ATMS13)	Medium Priority
Manages highway traffic at highway-rail intersections (HRIs) where rail operational speeds are less than 80 mph.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ Douglas County 911 Dispatch Intersection Blockage Notification 	
Parking Facility Management (ATMS16)	Medium Priority
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.	
<p>Recommended Projects</p> <p>No projects have been identified at this time. The City of Lawrence has considered ITS applications for the existing parking garages. Based on the current extra capacity and low parking rates, it was determined that ITS applications were not cost feasible at this time. KU has several ITS applications at existing parking facilities but no additional projects were being considered.</p>	
Speed Monitoring (ATMS19)	Medium Priority
Monitors the speeds of vehicles traveling through a roadway system.	
<p>Recommended Projects</p> <p>No projects have been identified at this time</p>	
Roadway Closure Management (ATMS21)	High Priority
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.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ Douglas County Flood Detection and Road Closure System 	



2.2.2 Emergency Management Service Area

The following market packages and related projects implement ITS functions that support emergency management activities. These market packages are important for incident response, coordination of the emergency management and transportation systems, and traveler information during disasters.

Table 3 – Emergency Management Market Packages and Projects

Emergency Call-Taking and Dispatch (EM01)	High Priority
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.	
Recommended Projects	
No projects have been identified at this time	

Emergency Routing (EM02)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies ▪ Douglas County 911 CAD Connection to City of Lawrence TOC ▪ Douglas County 911 CAD Connection to KDOT Statewide TOMC ▪ Douglas County 911 Dispatch Intersection Blockage Notification 	

Mayday and Alarms Support (EM03)	Low Priority
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.	
Recommended Projects	
No projects have been identified at this time	

Roadway Service Patrols (EM04)	Medium Priority
Supports the roadway service patrol vehicles that aid motorists, offering rapid response to minor incidents (flat tire, crashes, out of gas) to minimize disruption to the traffic stream. This market package monitors service patrol vehicle locations and supports vehicle dispatch.	
Recommended Projects	
No projects have been identified at this time	



Table 3 – Emergency Management Market Packages and Projects (continued)

Wide-Area Alert (EM06)	Low Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies 	

Disaster Response and Recovery (EM08)	Medium Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies 	

Evacuation and Reentry Management (EM09)	Low Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies 	

Disaster Traveler Information (EM10)	High Priority
Uses 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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies 	



2.2.3 Maintenance and Construction Management Service Area

The following market packages and related projects implement maintenance and construction management ITS functions. The priorities identified for the Region include maintenance vehicle tracking (especially for snow plows) and flood and ice detection systems.

Table 4 – Maintenance and Construction Management Market Packages and Projects

Maintenance and Construction Vehicle and Equipment Tracking (MC01)	Medium Priority
Tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Automated Vehicle Location Deployment ▪ Douglas County Automated Vehicle Location Deployment ▪ KDOT Automated Vehicle Location Deployment 	
Road Weather Data Collection (MC03)	High Priority
Collects current road weather conditions using data collected from environmental sensors deployed on and about the roadway.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Flood Detection and Road Closure Warning System ▪ City of Lawrence Fiber Backbone ▪ Douglas County Flood Detection and Road Closure System ▪ Douglas County Road Weather Information System Deployment ▪ KDOT Road Weather Information System Deployment 	
Weather Information Processing and Distribution (MC04)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Flood Detection and Road Closure Warning System ▪ Douglas County Flood Detection and Road Closure System ▪ Douglas County Road Weather Information System Deployment ▪ KDOT Road Weather Information System Deployment 	

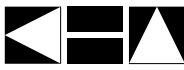


Table 4 – Maintenance and Construction Management Market Packages and Projects (continued)

Roadway Automated Treatment (MC05)	Low Priority
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.	
Recommended Projects	
No projects have been identified at this time	

Winter Maintenance (MC06)	High Priority
Supports winter road maintenance. Monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ Douglas County Road Weather Information System Deployment ▪ KDOT Road Weather Information System Deployment 	

Roadway Maintenance and Construction (MC07)	High Priority
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.	
Recommended Projects	
No projects have been identified at this time	

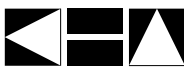
Work Zone Management (MC08)	High Priority
Directs activity in work zones, controlling traffic through portable dynamic message signs and informing other groups of activity for better coordination management. Also provides speed and delay information to motorists prior to the work zone.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KTA Traveler Information Website Enhancements 	

Work Zone Safety Monitoring (MC09)	Medium Priority
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.	
Recommended Projects	
No projects have been identified at this time	



Table 4 – Maintenance and Construction Management Market Packages and Projects (continued)

Maintenance and Construction Activity Coordination (MC10)	High Priority
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).	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Lawrence Incident Information Dissemination to Local Agencies ▪ City of Lawrence Center to Center Data Connection to State Agencies ▪ Douglas County 911 CAD Connection to KDOT Statewide TOMC ▪ Douglas County 911 CAD Connection to City of Lawrence TOC 	
Environmental Probe Surveillance (MC11)	Medium Priority
Collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions.	
Recommended Projects	
No projects have been identified at this time	
Infrastructure Monitoring (MC12)	Low Priority
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.	
Recommended Projects	
No projects have been identified at this time	



2.2.4 Public Transportation Management Service Area

The following market packages and related projects implement public transportation management ITS functions. Public transportation projects for the Region were identified for a number of market packages. Many of the projects that were identified were applicable for both KU on Wheels and Lawrence Transit. It is possible that the systems could be merged together at some point in the future and both KU on Wheels and Lawrence Transit wanted to have similar ITS elements implemented on their vehicles to facilitate the merging of the systems should this occur.

Table 5 – Public Transportation Management Market Packages and Projects

Transit Vehicle Tracking (APTS01)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Automated Vehicle Location ▪ Lawrence Transit Automated Vehicle Location 	
Transit Fixed-Route Operations (APTS02)	High Priority
Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for fixed-route and flexible-route transit services.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Automated Vehicle Location ▪ Lawrence Transit Automated Vehicle Location 	
Demand Response Transit Operations (APTS03)	High Priority
Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for demand responsive transit services.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Automated Vehicle Location ▪ Lawrence Transit Automated Vehicle Location 	
Transit Fare Collection Management (APTS04)	Medium Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Electronic Fare Collection ▪ Lawrence Transit Electronic Fare Collection 	



**Table 5 – Public Transportation Management Market Packages and Projects
(continued)**

Transit Security (APTS05)	High Priority
Provides for the physical security of transit passengers and transit vehicle operators. Includes on-board security cameras and panic buttons.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Transit Vehicle Security Cameras ▪ Lawrence Transit Vehicle Security Camera 	

Transit Fleet Management (APTS06)	Medium Priority
Supports automatic transit maintenance scheduling and monitoring for both routine and corrective maintenance.	
Recommended Projects	
No projects have been identified at this time	

Multi-modal Coordination (APTS07)	Medium Priority
Establishes two way communications between multiple transit and traffic agencies to improve service coordination.	
Recommended Projects	
No projects have been identified at this time	

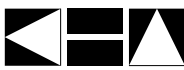
Transit Traveler Information (APTS08)	High Priority
Provides transit users at transit stops and on board transit vehicles with ready access to transit information. Services include stop annunciation, imminent arrival signs and real-time transit schedule displays. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Internet Trip Planning ▪ KU on Wheels Next Bus Arrival Signs ▪ Lawrence Transit Internet Trip Planning ▪ Lawrence Transit Next Bus Arrival Signs 	

Transit Signal Priority (APTS09)	Low Priority
Determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations to improve on-time performance of the transit system.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ KU on Wheels Traffic Signal Priority ▪ Lawrence Transit Traffic Signal Priority 	



**Table 5 – Public Transportation Management Market Packages and Projects
(continued)**

Transit Passenger Counting (APTS10)	Low Priority
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.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ KU on Wheels Automated Passenger Counters ▪ Lawrence Transit Automated Passenger Counters 	



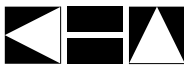
2.2.5 Traveler Information Service Area

The following market packages relate to traveler information ITS functions. Traveler information service area projects address market packages that broadcast traveler information over a wide area such as the 511 traveler information phone number. Traveler information provided at a specific location on the roadway, such as DMS, is addressed in the ATMS06 – Traffic Information Dissemination market package in Section 2.2.1. A number of projects were identified for ATMS06; however, no specific regional projects were identified for the traveler information market packages. Many of these types of projects, such as the 511 traveler information phone number, will be more statewide in nature and not regional projects.

Table 6 – Traveler Information Market Packages and Projects

Broadcast Traveler Information (ATIS01)	High Priority
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.).	
Recommended Projects	
No projects have been identified at this time	

Interactive Traveler Information (ATIS02)	High Priority
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.	
Recommended Projects	
No projects have been identified at this time	



2.2.6 Archived Data Management Service Area

The following market packages and related projects implement archived data management ITS functions. Data collected through ITS deployments can be housed in several different formats. The market packages selected by stakeholders will allow data from a specific agency to be housed by that agency, or data from throughout the Region can be sent to a site to be housed together. Data housed by an agency as part of an ITS data mart would likely be part of another project deployment and are not included as separate projects in this section. For example, DMS implementation might include software to archive all of the messages placed on the DMS over a period of time.

Table 7 – Archived Data Management Market Packages and Projects

ITS Data Mart (AD1)	Medium Priority
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.	
Recommended Projects	
No projects have been identified at this time	
ITS Data Warehouse (AD2)	Medium Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ Lawrence-Douglas County Archive Data Warehouse 	

3. PROJECT RECOMMENDATIONS

The purpose of the ITS Deployment Plan is to identify projects that provide the functionality and interoperability identified in the Regional ITS Architecture. Input from all stakeholders is required in order for the stakeholders to have ownership of the ITS Deployment Plan and also to ensure that the plan has realistically identified projects and timeframes for the Region. To achieve input from stakeholders, a workshop was held in the Lawrence-Douglas County Region on November 8, 2007 to discuss potential ITS projects. Each project recommended for the Regional ITS Deployment Plan was discussed, and consensus was reached by the stakeholders on the project description and the timeframe for implementation.

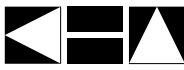
In Section 3.1 projects are presented and categorized into the following five functional areas:

- Travel and Traffic Management;
- Emergency Management;
- Maintenance and Construction Management;
- Public Transportation Management; and
- Archived Data Management.

Each project identified includes the following information:

- **Description** – A brief description of each project includes the goals of the project, priority corridors where applicable, and information on funding in some cases. Some projects were defined in greater detail when stakeholders were more definite about the deployment and components of the project.
- **Opinion of Probable Cost and Funding Status** – The opinion of probable cost is typically provided as a unit cost per device as most projects will require substantially more conceptual planning and design before more exact quantities can be determined. The status of any funding for the project is also included.
- **Responsible Agency** – The agency that would take the lead for the implementation, operations, and maintenance of the project has been identified.
- **Deployment Timeframe** – Timeframes for deployment are recommended based on project priority, dependence on other projects, availability of technology, and overall project feasibility. The timeframes were categorized as short-term (0 to 5 years), mid-term (5 to 10 years), and long-term (beyond 10 years). Actual deployment timeframes for the projects will depend on availability of funding and priority of the project when compared to other regional needs.
- **Applicable Market Packages** – The ITS market packages identified in the Lawrence-Douglas County Regional ITS Architecture represent the types of services that stakeholders wanted to implement in the Region. Each project recommended will assist in implementing one or more of these services. The ITS market package(s) that each project will assist in implementing have been identified.

It should be noted that the opinion of probable cost should only be used for high level planning purposes. Costs can vary a great deal for many ITS elements, depending on the level of deployment, maturity of the technology, type of communications, etc. For example, the City of Lawrence CCTV Camera Deployment project may just include cameras at a limited number of intersections with high accident rates or it may include enough cameras to provide full monitoring capabilities along all high priority corridors in the City. Depending on the quality of video desired and the availability of high bandwidth communications at locations selected for cameras, communications cost could vary a great deal. Use of existing poles for cameras may also be possible at some locations but a structural analysis will need to be undertaken to determine if this is possible. Given the large number of factors in



determining a project cost, in most cases a unit cost for deployment of one element is provided in the opinion of probable cost. Even the cost per element can vary depending on the features selected and the availability of the technology at the time it is procured.

3.1 Regional Projects

Regional projects are identified in **Table 8** through **Table 12**. The tables are divided as follows:

- **Table 8** – Travel and Traffic Management Project Recommendations;
- **Table 9** – Emergency Management Project Recommendations;
- **Table 10** – Maintenance and Construction Management Project Recommendations;
- **Table 11** – Public Transportation Project Recommendations; and
- **Table 12** – Archived Data Management Project Recommendations.



Table 8 – Travel and Traffic Management Project Recommendations

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects</i>					
City of Lawrence Traffic Operations Center	<p>Implement a Traffic Operations Center (TOC) for the City of Lawrence. Initially the TOC will serve as the central point for monitoring and controlling the City of Lawrence traffic signal system. Future functions of the TOC may also include closed circuit television (CCTV) camera monitoring, incident and closure notification to other agencies, and special event management.</p> <p>Potential locations of the TOC include City Hall or the Douglas County Judicial and Law Enforcement Center where it would be collocated with the Emergency Operations Center and 911 Dispatch. A temporary location at the City of Lawrence Traffic Engineering Division at 445 Mississippi was also discussed. Each potential location requires the modification of existing space rather than construction of a new facility for the TOC.</p> <p>The initial role of the TOC will be for traffic signal monitoring. Eventually the TOC could include larger displays and be used for monitoring CCTV cameras, weather and flood detection equipment, and posting information about road conditions. This type of TOC would require the remodel of an existing facility including implementation of integrated workstations and a video wall.</p> <p>Similar facilities have been implemented in other parts of Kansas. Stakeholders noted that the TOC in Lenexa, Kansas is a good model for a small TOC with only signal monitoring capabilities. The TOC in Olathe, Kansas was identified as a model for a larger TOC with the capabilities Lawrence would eventually like to implement.</p>	<p>Limited Modification of Existing Facility to Include 1-2 Computers and Networking Equipment: \$50,000-\$100,000</p> <p>Remodel of an Existing Facility to Include Integrated Workstations and Video Wall: \$400,000 - \$600,000</p> <p>Funding Identified: No</p>	City of Lawrence	Short-term	<p>ATMS01</p> <p>ATMS03</p> <p>ATMS06</p> <p>ATMS07</p> <p>ATMS08</p>



Table 8 – Travel and Traffic Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects (continued)</i>					
City of Lawrence Signal System Upgrade	<p>Upgrade the City of Lawrence traffic signal system to a centrally controlled system with interconnected signals. Upgrades will include:</p> <ul style="list-style-type: none"> -Central control system software; -Signal controllers; and -Signal interconnect. <p>Deployment will be prioritized based on key traffic corridors in the area and phased over multiple years. The signal system currently includes approximately 85 traffic signals.</p> <p>Cost for the central control system software will depend on the features that are selected by the City and total cost could vary by several hundred thousand dollars. Cost for controller upgrades and communications equipment in the traffic signal cabinet are estimated at approximately \$7,000 per intersection. Interconnect cost will vary depending on the communications systems selected. Where available the City will use existing fiber optic cable for traffic signal interconnect. Installation of new fiber or wireless radios will be considered for signals where fiber does not currently exist. Where radios are used for traffic signal interconnect, the typical structure will be to connect multiple intersections (subscriber units) to a single radio tower (access unit).</p>	<p>Central Control Signal System Software: \$150,000 - \$500,000</p> <p>Traffic Signal Controller, Ethernet Switch, and Ancillary Equipment: \$7,000 per intersection</p> <p>Fiber Optic Traffic Signal Interconnect: \$112,000 per mile</p> <p>Wireless Radio Traffic Signal Interconnect: Access Unit: \$10,000 per tower Subscriber Unit: \$5,000 per radio</p> <p>Funding Identified: Partial</p>	City of Lawrence	Mid-term	ATMS03



Table 8 – Travel and Traffic Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects (continued)</i>					
City of Lawrence CCTV Camera Deployment	<p>Deploy CCTV cameras in the City of Lawrence for traffic monitoring. Key corridors could include 6th Street, 23rd Street/Clinton Parkway, Wakarusa, 31st Street, North 2nd Street, and Iowa Street.</p> <p>CCTV cameras could be mounted on existing poles in locations where poles are present and structurally able to handle the additional weight of the camera. Communications cost will vary depending on availability of fiber optic cable in the area as well as distance and line of sight to the TOC. A majority of CCTV cameras will be located at or near a signalized intersection and communications can be combined with the traffic signal controller communication system. An estimate for planning purposes of \$10,000 per location is recommended for communications.</p>	<p>CCTV Camera Installation on Existing Pole: \$12,000 per camera</p> <p>CCTV Camera Installation on New Pole: \$22,000 per camera</p> <p>Communications: \$10,000 per camera</p> <p>Funding Identified: No</p>	City of Lawrence	Short-term	ATMS01 ATMS08
City of Lawrence Incident Information Dissemination to Local Agencies	<p>Implement a web based data connection from the City of Lawrence TOC to the emergency operations center (EOC), public safety dispatch, transit, and school districts. The TOC data connection could include sharing of data regarding incidents, road closures, and video including pan/tilt/zoom control of CCTV cameras. Project includes hardware, training, and setting up information dissemination protocol.</p>	<p>\$10,000 - \$50,000</p> <p>Funding Identified: No</p>	<p>Joint Effort: City of Lawrence Lawrence Transit KU on Wheels Douglas County 911 Dispatch Douglas County EOC School Districts</p>	Mid-term	<p>ATMS06 ATMS08 EM02 EM06 EM08 EM09 EM10 MC10</p>



Table 8 – Travel and Traffic Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects (continued)</i>					
City of Lawrence Center to Center Data Connection to State Agencies	Implement a data connection from the City of Lawrence TOC to KC Scout, the Statewide Transportation Operations and Management Center (TOMC), and Kansas Turnpike Authority (KTA). The TOC data connection may include sharing of data regarding incidents, road closures, traffic volumes, traffic speeds, and video including pan/tilt/zoom control of CCTV cameras. Project includes hardware, training, and setting up information dissemination protocol.	\$10,000 - \$50,000 Funding Identified: No	Joint Effort: City of Lawrence KDOT KTA	Mid-term	ATMS06 ATMS07 ATMS08 MC10
City of Lawrence Special Event Traffic Control	Develop alternate signal timing plans for traffic management during special events. Includes deployment of portable dynamic message signs (DMS) and permanent static routing signs that can be folded down when not in use. The cost is based on development of timing plans for 25 signals and assumes that all count data is provided. Portable DMS and pop-up signs are not included in the cost.	\$40,000 - \$50,000 Funding Identified: No	City of Lawrence	Mid-term	ATMS03 ATMS06
City of Lawrence Fiber Backbone	Continue to implement fiber optic conduit and cable throughout the City of Lawrence. The fiber backbone will be implemented as part of other planned construction projects as well as in individual fiber projects as needed to complete the City's fiber optic backbone. The fiber optic backbone will be able to support many of the ITS projects that have been identified for the City of Lawrence such as deployment of CCTV cameras, traffic signal system upgrades, and the sharing of traffic information and video images with other agencies. This project supports the implementation of almost all market packages identified for the City of Lawrence in the Regional ITS Architecture. Some of the market packages that rely the most on high-bandwidth communications have been identified in the Applicable Market Packages column.	Cost determined per project based on if project is done as part of existing construction or separate project. Funding Identified: No	City of Lawrence	On-going	ATMS01 ATMS03 ATMS07 ATMS08 MC03



Table 8 – Travel and Traffic Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects (continued)</i>					
<p>KDOT CCTV Camera Deployment</p>	<p>Deploy KDOT CCTV cameras on K-10, US 24, US 59 and US 40 for traffic monitoring. K-10 and US 59 are the highest priority for cameras in the short-term. US 24 and US 40 do not currently need CCTV cameras but traffic is expected to grow and these should be considered for CCTV in the future as necessitated by growth.</p> <p>Communications could be through fiber optic cable, wireless radio, or a combination of technologies. For wireless communication an assumption was made for planning purposes that the cost will include equipment for up to 3 links over a 10 mile distance.</p>	<p>CCTV Camera Installation on Existing Pole: \$12,000 per camera</p> <p>CCTV Camera Installation on New Pole: \$22,000 per camera</p> <p>Communications: Fiber: \$112,000 per mile Wireless: \$60,000 per 10 miles</p> <p>Funding Identified: No</p>	<p>KDOT</p>	<p>Short-term</p>	<p>ATMS01 ATMS08</p>
<p>KDOT DMS Deployment</p>	<p>Deploy KDOT DMS on I-70, K-10, and US 59 for traveler information. The I-70 DMS deployments will be led by KDOT in coordination with KTA and the K-10 and US 59 DMS will be led by KDOT. Because the K-10 and US 59 DMS will not be located on an Interstate it is assumed that a smaller DMS will be used and will be mounted next to the roadway rather than over the roadway.</p> <p>Communications could be through fiber optic cable, wireless radio, cellular modem, or a phone drop. For wireless communication an assumption was made for planning purposes that the cost will include equipment for up to 3 links over a 10 mile distance. If cellular modems or phone drops are used the primary cost will be for monthly service rather than installation.</p>	<p>Interstate DMS Sign and Structure: \$225,000 per location</p> <p>Highway DMS Sign and Structure: \$75,000 per location</p> <p>Communications: Fiber: \$112,000 per mile Wireless: \$60,000 per 10 miles</p> <p>Funding Identified: No</p>	<p>KDOT</p>	<p>Short-term</p>	<p>ATMS06</p>



Table 8 – Travel and Traffic Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Travel and Traffic Management Projects (continued)</i>					
KTA Traveler Information Website Enhancements	Enhance the KTA website to include real-time traveler information updates on I-70 during the reconstruction of the Kansas River bridges. KTA has also purchased a number of portable DMS and improved the coverage of the traveler advisory radio broadcast to assist in providing up to date traveler information during the Kansas River bridge project.	To be determined	KTA	Short-term	MC08

¹ Agency listed is responsible for implementation, operations, and maintenance unless otherwise noted.

² Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).



Table 9 – Emergency Management Project Recommendations

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Emergency Management Projects					
Douglas County 911 CAD Connection to KDOT Statewide TOMC	Implement a connection from the Douglas County 911 Computer Aided Dispatch (CAD) system to the KDOT Statewide Transportation Operations and Management Center (TOMC) to allow automated sharing of incident and road closure information between traffic and public safety. Douglas County and KDOT KanRoad use different geographic information system databases which will require coordination between the databases in order to share information.	\$20,000 Funding Identified: No	Joint Effort: Douglas County KDOT	Short-term	AMTS06 ATMS08 EM02 MC10
Douglas County 911 CAD Connection to City of Lawrence TOC	Implement a connection from Douglas County 911 CAD system to the City of Lawrence Traffic Operations Center (TOC) to allow automated sharing of incident and road closure information between traffic and public safety. The level of difficulty of this project will be dependent on what type of system the future City of Lawrence TOC uses for logging incident and road closures.	\$20,000 Funding Identified: No	Joint Effort: City of Lawrence Douglas County	Mid-term	ATMS06 ATMS08 EM02 MC10
Douglas County 911 Dispatch Intersection Blockage Notification	Provide automated warning to Douglas County 911 Dispatch of rail road crossing blockages by trains at signalized intersections to facilitate emergency vehicle dispatch.	\$10,000 Funding Identified: No	Joint Effort: City of Lawrence Douglas County	Mid-term	ATMS13 EM02

¹ Agency listed is responsible for implementation, operations, and maintenance unless otherwise noted.

² Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).



Table 10 – Maintenance and Construction Management Project Recommendations

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Maintenance and Construction Management Projects					
City of Lawrence Automated Vehicle Location Deployment	Deploy automated vehicle location (AVL) on City of Lawrence maintenance vehicles. AVL will allow the City to identify the location of all maintenance vehicles and keep a record of where vehicles have traveled. Both the City of Lawrence and Douglas County noted this is especially important for snowplow vehicles. AVL will allow the City to record which roads have been plowed and also provide a record of the snowplow's location to help protect the City from liability claims when citizens report damage to their vehicle from a snowplow.	Cost per Vehicle: \$12,000 Funding Identified: No	City of Lawrence	Mid-term	MC01
City of Lawrence Flood Detection and Road Closure Warning System	Implement a flood detection system on 2nd Street at the railroad underpass. System includes flashing beacons to warn of water on roadway. Automatic road closure gates will not be included as part of this project and long-term closures will require barricades be manually placed on 2nd Street.	Cost per Site: \$25,000 Funding Identified: No	City of Lawrence	Short-term	MC03 MC04
Douglas County Automated Vehicle Location Deployment	Deploy AVL on Douglas County maintenance vehicles. AVL will allow the County to identify the location of all maintenance vehicles and keep a record of where vehicles have traveled. Both the City of Lawrence and Douglas County noted this is especially important for snowplow vehicles. AVL will allow the County to record which roads have been plowed and also provide a record of the snowplow's location to help protect the County from liability claims when citizens report damage to their vehicle from a snowplow.	Cost per Vehicle: \$12,000 Funding Identified: No	Douglas County	Mid-term	MC01
Douglas County Road Weather Information System Deployment	Implement road weather information system (RWIS) stations as needed in Douglas County. The primary purpose of the stations will be for ice detection; however, they could also be used to monitor precipitation, wind, and visibility conditions.	Cost per Site: \$50,000 - \$70,000 Funding Identified: No	Douglas County	Mid-term	MC03 MC04 MC06
Douglas County Flood Detection and Road Closure System	Implement a flood detection and closure system on Route 458 east of US 59. System will include a closed-circuit television (CCTV) camera for monitoring and road closure gates. Additional flood detection and closure systems may be deployed at other locations as needed.	Cost per Site: \$35,000 per site Funding Identified: No	Douglas County	Mid-term	ATMS01 ATMS21 MC03 MC04



Table 10 – Maintenance and Construction Management Project Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
<i>Maintenance and Construction Management Projects (continued)</i>					
KDOT Road Weather Information System Deployment	Implement a RWIS station on US 59 in Douglas County. Primary purpose of the stations would be for ice detection; however it could also be used to monitor precipitation, wind, and visibility conditions.	Cost per Site: \$50,000 - \$70,000 Funding Identified: No	KDOT	Short-term	MC03 MC04 MC06
KDOT Automated Vehicle Location Deployment	Deploy AVL on KDOT maintenance vehicles. Deployment will be based on an AVL evaluation that is underway. A final decision on whether or not to proceed with AVL is expected in the Spring of 2008.	Cost per Vehicle: \$12,000 per vehicle Funding Identified: No	KDOT	Short-term	MC01

¹ Agency listed is responsible for implementation, operations, and maintenance unless otherwise noted.

² Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).



Table 11 – Public Transportation Management Project Recommendations

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Public Transportation Management Projects					
KU on Wheels Automated Vehicle Location	Continue implementation of automated vehicle location (AVL) on all KU on Wheels buses. Project includes software to enable vehicle tracking. Software cost is included in the cost per vehicle. Implementation of mobile data terminals could also be included with this project but is not included in the current AVL implementation effort.	Cost per Vehicle: \$12,000 Funding Identified: No	KU on Wheels	On-going	APTS01 APTS02 APTS03
KU on Wheels Transit Vehicle Security Cameras	Continue implementation of on-board video security cameras on KU on Wheels buses. SafeBus vehicles and a limited number of KU on Wheels buses currently have video security cameras implemented. Security cameras will be included on all new buses at the time of purchase.	Cost per Vehicle: \$3,000 Funding Identified: Included as part of new bus procurement	KU on Wheels	On-going	APTS05
KU on Wheels Internet Trip Planning	Provide trip planning capabilities through the internet to allow transit passengers the ability to plan routes and receive real time updates on transit bus locations. The internet trip planning system should be compatible with the potential Lawrence Transit trip planning system to allow users to plan trips using both transit agencies. Cost is the estimated total cost for developing a combined trip planning system that would serve both KU on Wheels and Lawrence Transit.	Cost for Both KU on Wheels and Lawrence Transit: \$80,000 Funding Identified: No	KU on Wheels (Possibly in coordination with private information service provider and Lawrence Transit)	Short-term	APTS08
KU on Wheels Electronic Fare Collection	Implement electronic fare collection payment system on KU on Wheels buses. System should be compatible with the possible future Lawrence Transit electronic fare collection system. (Fares may only apply to KU on Wheels users that are not KU faculty, staff, or students.)	Hardware and Software Cost: \$75,000 Cost per Vehicle: \$12,000 Funding Identified: No	KU on Wheels	Mid-term	APTS04



Table 11 – Public Transportation Management Projects Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Public Transportation Management Projects (continued)					
KU on Wheels Automated Passenger Counters	Implement automated passenger counters on KU on Wheels buses.	Hardware and Software Cost: \$15,000 Cost per Vehicle: \$9,800 Funding Identified: No	KU on Wheels	Long-term	APTS10
KU on Wheels Next Bus Arrival Signs	Implement next bus arrival signs at transit stops on selected routes. Priority will be given to transit stops with the greatest number of users.	Cost per Sign: \$7,000 Funding Identified: No	KU on Wheels	Long-term	APTS08
KU on Wheels Traffic Signal Priority	Provide transit priority capability for KU on Wheels buses at City of Lawrence traffic signals. Priority will be given along specified routes in coordination with the City of Lawrence Public Works as well as any Lawrence Transit bus priority that may be implemented. Transit priority will likely not be implemented until the City of Lawrence traffic signal system has been upgraded and signals have been interconnected. Cost includes the cost per intersection to add priority capabilities as well as a cost per vehicle to purchase an emitter.	Cost per Intersection: \$6,000 Cost per Vehicle: \$1,500 Funding Identified: No	KU on Wheels (In coordination with City of Lawrence Public Works)	Long-term	APTS09
Lawrence Transit Automated Vehicle Location	Implement AVL on all Lawrence Transit buses including fixed route and paratransit buses. Project includes software to enable vehicle tracking and could also include mobile data terminals to provide information directly to drivers. Software cost is included in the cost per vehicle.	Cost per Vehicle: \$12,000 Funding Identified: No	Lawrence Transit	Short-term	APTS01 APTS02 APTS03



Table 11 – Public Transportation Management Projects Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Public Transportation Management Projects (continued)					
Lawrence Transit Vehicle Security Cameras	Implement on-board video security cameras on Lawrence Transit buses. Video security will not be purchased separately but included on new buses and paratransit vehicles at the time of purchase.	Hardware and Software Cost: \$10,000 Cost per Vehicle: \$3,000 Funding Identified: Included as part of new bus procurement	Lawrence Transit	Short -term	APTS05
Lawrence Transit Internet Trip Planning	Provide trip planning capabilities through the internet to allow transit passengers the ability to plan routes and receive real time updates on transit bus locations. The internet trip planning system should be compatible with the potential KU on Wheels trip planning system to allow users to plan trips using both transit agencies. Cost is the estimated total cost for developing a combined trip planning system that would serve both KU on Wheels and Lawrence Transit.	Cost for Both KU on Wheels and Lawrence Transit: \$80,000 Funding Identified: No	Lawrence Transit (Possibly in coordination with private information service provider and KU on Wheels)	Short-term	APTS08
Lawrence Transit Electronic Fare Collection	Implement electronic fare collection payment system on Lawrence Transit buses. The system should be compatible with the possible future KU on Wheels electronic fare collection system.	Hardware and Software Cost: \$75,000 Cost per Vehicle: \$12,000 Funding Identified: No	Lawrence Transit	Mid-term	APTS04



Table 11 – Public Transportation Management Projects Recommendations (continued)

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Public Transportation Management Projects (continued)					
Lawrence Transit Automated Passenger Counters	Implement automated passenger counters on Lawrence Transit fixed-route buses.	Hardware and Software Cost: \$15,000 Cost per Vehicle: \$9,800 Funding Identified: No	Lawrence Transit	Long-term	APTS10
Lawrence Transit Next Bus Arrival Signs	Implement next bus arrival signs at transit stops on selected routes. Priority will be given to transfer points and any future transfer stations that may be added in the Lawrence area.	Cost per Sign: \$7,000 Funding Identified: No	Lawrence Transit	Long-term	APTS08
Lawrence Transit Traffic Signal Priority	Provide transit priority capability for Lawrence Transit fixed route buses at City of Lawrence traffic signals. Priority will be given along specified routes in coordination with the City of Lawrence public works. Transit priority will likely not be implemented until the City of Lawrence traffic signal system has been upgraded and signals have been interconnected. Priority routes include 6th Street, 23rd Street, 31st Street, and Iowa Street. Cost includes the cost per intersection to add priority capabilities as well as a cost per vehicle to purchase an emitter.	Cost per Intersection: \$6,000 Cost per Vehicle: \$1,500 Funding Identified: No	Lawrence Transit (In coordination with City of Lawrence Public Works)	Long-term	APTS09

¹ Agency listed is responsible for implementation, operations, and maintenance unless otherwise noted.

² Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).



Table 12 – Archived Data Management Project Recommendations

Program Area/Project	Description	Opinion of Probable Cost and Funding Status	Responsible Agency ¹	Deployment Timeframe ²	Applicable Market Packages
Archived Data Management Projects					
Lawrence-Douglas County Archive Data Warehouse	Establish a data warehouse to archive data from cities, the county, and transit agencies in the Douglas County Region for use in regional planning. Cost for the system will be dependent on the amount and type of data stored as well as accessibility and features available for users. A deployment timeframe of long-term was selected by stakeholders to allow for the implementation of ITS elements and time to start data collection before it is ultimately put into an archive.	Data Archive Cost: \$50,000 - \$100,000 Funding Identified: No	Joint Effort: City of Lawrence, Lawrence-Douglas County Metropolitan Planning Office	Long-term	AD2

¹ Agency listed is responsible for implementation, operations, and maintenance unless otherwise noted.

² Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2 Statewide Projects

Several ITS projects that are being considered for deployment or are being implemented on a statewide basis were discussed as part of the Lawrence-Douglas County ITS Deployment Plan. These projects could assist the Lawrence-Douglas County Region in addressing some of their transportation needs; however stakeholders within the Region would not be responsible for the implementation of the projects. Because these projects were being implemented on a statewide level and not at a regional level stakeholders decided to not include them in the projects listed in ITS Deployment Plan project tables in Section 3.1. Several of the statewide ITS projects that may be deployed are discussed below.

- **KDOT Maintenance Decision Support System** – KDOT is currently doing a research test of a winter maintenance decision support system (MDSS) in Topeka, Olathe, La Crosse, and Dodge City. The system gathers information from weather forecasts, road weather information system stations, a database of pavement types, and data from snow plows with GPS units and uses this data to make recommendations for winter maintenance actions such as the type and amount of chemicals to put down, location, and time frames. At this time maintenance personnel are not being directed by the MDSS but they are reviewing the MDSS recommendations to see if they agree with the recommendations. The system has shown potential for improving winter maintenance activities but KDOT does not think it is ready for a statewide deployment and does not have a time frame for deployment of the system beyond the four cities where it is being tested.
- **KANROAD Data Flow Enhancements** – At the present time the KDOT KANROAD Reporting System pushes data to the 511 Traveler Information Website and the 511 Telephone Information System. KDOT is enhancing the KANROAD Reporting System so that it will be able to push this information flow to other agencies and allow them to integrate real time travel information into their own systems.
- **KDOT 511 Enhancements** – KDOT is improving the accessibility and functionality of the Statewide 511 System and associated website to enhance the value for those accessing the system from mobile devices.

3.3 Communications

Communications are often the most important part of any ITS deployment. One of the primary purposes of an ITS architecture is to identify the data that needs to flow between agencies. Much of this data, such as video from CCTV cameras and real time traffic information, can require high bandwidth communication. Reliability of communications is also a concern. ITS functions are often most needed during major incidents, severe weather, or other emergencies. These are the same times that communication systems are often most stressed due to high call volumes and potential damage from severe weather events. Therefore, no ITS deployment is complete without addressing the communications needed.

Unfortunately, a robust and reliable communication system requires a substantial monetary investment. Fiber systems may require miles of underground conduit, environmentally controlled hub buildings, and right-of-way acquisition. Wireless systems often require multiple repeater stations and may be subject to interference from other systems. New technologies, such as Voice over Internet Protocol and Ethernet systems for ITS deployments, are emerging as strong contenders and offer bandwidth and flexibility at a reasonable price.

Maintenance of any communication system must also be carefully considered. Redundancy in the system adds reliability but also adds cost. If redundancy is not built into the communication



system then an agency must be prepared with enough resources to quickly diagnose and repair problems. Even with redundancy, failures can happen and require that skilled maintenance personal be available with the necessary parts to make a repair.

Resource sharing between agencies is often a very cost effective way to deploy communications. Resource sharing may be as simple as two departments within a municipality sharing the cost of a fiber installation, or it may be much more complicated, such as all of the partners at a regional transportation management center determining their share of the deployment cost of the communication system. Resource sharing can also apply to maintenance where multiple agencies establish a maintenance contract with a contractor or share maintenance personnel.

The City of Lawrence Information Systems Department has deployed fiber optic cable between the Lawrence City Hall and the Douglas County Emergency Communications-911 Department located in the Douglas County Judicial and Law Enforcement Center. Of the 48 strands of fiber only 12 are currently used. Any ITS deployments in the Lawrence-Douglas County Region should consider the availability of this fiber and any other high bandwidth communications that may be available for use in the project. Cost should consider not only construction cost to deploy the communications but also on-going maintenance and monthly lease fees or user costs.

It is recommended that for each project identified in the ITS Deployment Plan an analysis of the communications needs and the availability of existing communications infrastructure be performed during the design phase.

3.4 Funding

Implementation of the ITS plans and projects presented in the Regional ITS Architecture and Deployment Plan represent a major challenge for the Lawrence-Douglas County stakeholders. The challenges in implementing ITS are largely financial, but institutional and educational challenges also exist. Some of the major challenges in implementing ITS in the Region include:

- Identifying funds for ITS project deployment;
- Creating a stable funding source for ongoing operations and maintenance of ITS deployments;
- Training of staff in the planning, design, construction, operations, and maintenance of ITS deployments;
- Increasing awareness among local officials and decision makers about ITS and its capabilities;
- Increasing the visibility of ITS in the regional transportation planning processes; and
- Educating public agencies and the general public about the full-range of ITS applications, including those relevant to local transportation and emergency service agencies.

City and county governments may have some available funds for ITS and traffic management projects, however in most cases local government budgets are usually taken up by operations and maintenance activities with very little remaining for significant capital projects. In general, funding of ITS projects will need to compete with all other local transportation needs. In many cases the cost benefit of ITS projects can compete very favorably with other projects. Projects such as traffic signal coordination projects can have very positive benefits on the capacity of a corridor (i.e. reduce travel times and fuel consumption) and do not require the enormous funding investments that are required by right-of-way acquisition and construction when widening a roadway. Flood detection systems require only a fraction of the investment that the construction of a new bridge may require in areas that are prone to occasional floods.

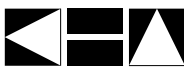


Funding for constructing ITS projects may use many of the Federal funding categories, including:

- National Highway System (NHS) – Includes current Interstate system, other rural principal arterials, urban freeways and connecting urban principal arterials, facilities on the Department of Defense designated Strategic Highway Network, and roads connecting the NHS to intermodal facilities.
- Surface Transportation Program (STP) – Includes projects on any Federal-aid highway, bridge projects on any public road, transit capital projects, and intracity and intercity bus terminals and facilities.
- Congestion Mitigation and Air Quality Improvement Program (CMAQ) – Any transportation projects that assist in meeting and maintaining national ambient air quality standards.
- Research ITS funds may be used for specific types of projects if approved by FHWA.

Ongoing funding for operations and maintenance requires that a stable source of funding be established that allows for both day-to-day operation and replacement of equipment as it wears out or becomes obsolete. Federal sources that are currently used for operations and maintenance funding include NHS, STP, and CMAQ program funds. STP funds can be used for operations and maintenance activities with no time limit and an 80 percent federal share, with a 20 percent state/local match. NHS and CMAQ funds can also be used with an 80/20 split between federal and state/local funds. CMAQ funds can be used year to year as long as the project proves to continue providing air quality benefits. The Lawrence-Douglas County Region does not currently receive CMAQ funds due to their air quality attainment status but should their status change in the future CMAQ funds may become available to the Region.

Public-private partnerships should also be considered. Public-private partnerships have been used successfully by many agencies to help offset some costs of ITS deployments, although it has been rare that the partnership has been able to fully fund an ITS deployment without any investment from a public agency. Sharing of traffic data between public and private agencies such as traffic reporting agencies have been very successful. Data sharing includes both incident information, congestion levels, and video images from CCTV cameras that may be deployed either by a public or private agency. Google Transit and other providers can assist in getting traveler information to the public, although many of these systems still require substantial staff time and effort in order to make the system operational. As with any agreement, a public-private partnership agreement should clearly define the terms and conditions for sharing of information and public agencies need to be sure that any funds they invest are not restricting them to a proprietary system that may be limited in terms of expansion in the future. Also, public agencies must be careful that when entering into a public-private partnership they are confident that the private entities can provide their services for the entire length of the contract so that a public agency does not make an investment into the system that is suddenly no longer supported by the private provider.



4. MAINTAINING THE REGIONAL ITS DEPLOYMENT PLAN

The Regional ITS Architecture and Deployment Plan documents how ITS can be implemented and operated within the Region to address local needs. As the Region changes over time transportation needs may also change, and, as technology progresses new ITS opportunities will arise. Shifts in Regional focus as well as changes in the National ITS Architecture will necessitate that the Lawrence-Douglas County Regional ITS Architecture be updated to remain a useful resource for the Region in the future. These same changes will create new project opportunities and may possibly eliminate the need for some existing projects in the ITS Deployment Plan.

Stakeholders discussed the procedure for updating the Regional ITS Architecture and Deployment Plan at the February 2008 Comment Resolution Workshop. The procedure, documented in the Lawrence-Douglas County Regional ITS Architecture, outlines how to document ITS architecture changes for inclusion in the next plan update. While complete plan updates are scheduled to occur approximately every four years in the year preceding the Long Range Transportation Plan update, stakeholders agreed that it would be beneficial to review the projects identified in the ITS Deployment Plan at least once per year and ideally twice per year. The City of Lawrence and the Lawrence-Douglas County MPO will lead the project reviews. The purpose of the reviews will be to update the project status, remove projects that were completed, include additional project detail when available, and add new projects. Any corresponding ITS architecture changes would be documented and retained by the MPO for inclusion during the next complete update as outlined in the Regional ITS Architecture.