



**2018 Kansas City Regional ITS Architecture
Deployment Strategy**



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In association with



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1. Introduction

1.1 Project Overview

The Kansas City Regional ITS Architecture Update project revised the Kansas City Regional ITS Architecture, which was last updated in 2012. The updated Architecture is now based on the USDOT's Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 8.1. Intelligent Transportation Systems (ITS) has evolved since the Kansas City Regional ITS Architecture was previously published. Advances in communications, mobile electronics, and vehicle technology are changing the capabilities of infrastructure equipment and mobile platforms making possible the emergency of connected and automated vehicles.

Kansas City has evolved as well, deploying the early instances of the Smart City initiative. The RideKC Streetcar, smart street lights, expanding city wi-fi communications availability and smart kiosks are some of the Smart City Initiative deployments. This initiative is going to be expanded in the coming years and transportation will become an increasingly important part of the implementation.

Kansas City Scout anchors the freeway system in Kansas City and numerous city agencies manage the arterial traffic signal network across the diverse metropolitan landscape. The Kansas City Area Transportation Authority (KCATA) along with its partner transit authorities in the region continues to consolidate and optimize transit operations making it easier for riders to understand the system and making the services more convenient.

Intermodal freight is a vital part of the Kansas City economic environment and partnership between transportation management organizations and intermodal operations is important to its growth in the area using the transportation facilities that exist. The growth of employment centers such as those along the southern section of I-435 with health care and corporate tenants puts strain on the transportation system's capacity.

The Architecture update took these new and evolving issues into account in the update of the Architecture. The project started with two workshops to gathering information from stakeholders regarding the most challenges in the region that needed to be addressed over the next 10 years. The first Stakeholder Workshop was held on September 11, 2017 to identify regional project priorities, needs and problem areas in preparation for the architecture update.

Attendees prioritized ITS focus areas in the following order of importance:

- Safety and Security
- KC Scout/Operation Green Light
- Connected Vehicles
- Smart Cities
- Transit
- Integrated Corridor Management
- Major Intermodal
- Other
- Ride Hailing

Attendees identified problem areas in the region as follows:

- Mobility
 - Mobility issues exist along many corridors and major interchanges.
 - Mobility issues regarding transit services exist along particular corridors such as I-35 and in Northland.
 - KC Scout expansion was highlighted on many corridors.
 - Job access for low income communities.
 - Large employment centers/corridors and Intermodal facilities are generating local mobility issues due to volume.
 - Event Management at Kansas City Speedway and Arrowhead Stadium areas.
 - Signal coordination along corridors and between jurisdictions.
- Safety
 - Safety issues exist along many corridors, interchanges, bottlenecks, and arterial intersections.
 - Limited data collection exists for bridge ice detection and road weather information for travelers.
 - Work zone safety for construction and maintenance activities.
 - Motorist assistance program expansion or response improvements needed.
 - Enhanced Queue Warning and Pedestrian Safety innovations are needed.
- Environmental
 - Downtown KC, major interchanges, and corridors have particulate concerns.
 - Flood detection needed along some creeks with adjacent roadways
 - Ride-sharing and transit support,
- Other comments

Existing infrastructure needs to accommodate and support Smart Cities and ITS activities.

The second Stakeholder Workshop was held on December 4, 2017 to explore ITS project concepts and priorities. The stakeholder feedback resulted in the project ideas and priorities.

The stakeholder inputs provided a basis for further analysis and assessment of the deployment strategy as well as refinement of the architecture update. The workshops were followed by individual stakeholder reviews of the draft architecture update content.

The Kansas City Regional ITS Architecture defines ITS projects identifying stakeholders involved, systems or inventory elements, services provided, interfaces included, and recommended standards based on the interfaces recommended.

1.2 Purpose of this Document

The purpose of this document is to present recommended projects to be pursued in the Kansas City Region over the next 10 years based on stakeholder feedback and the needs identified through stakeholder outreach. These projects are a combination of concept development and implementation. Included are projects that are future oriented in that they require study and planning to prepare for their implementation near the end or after the 10-year horizon of this document.

This document is intended to be used to plan ITS projects in the transportation planning process with stakeholder involvement. The projects identified are included in the Kansas City Regional ITS Architecture and are linked with existing systems providing integration and evolution perspectives.

1.3 Strategic Deployment Plan Process

As the Architecture was being developed, an overall deployment strategy was established. The Stakeholder inputs on needs and challenges facing transportation in the Kansas City Region were the primary guide for the project definition. In addition, the architecture reviews with the stakeholders provided further context for each of the projects identified. Figure 1 illustrates how the process was driven by existing ITS systems and services and by the definition of the regional ITS vision (in the form of needs). The “gap” between the current system and what is needed was established, involving the definition of stakeholder responsibilities and needed transportation functions. Both provided an underpinning for the ITS architecture and the definition of specific projects, as did the stated needs of individual stakeholders.

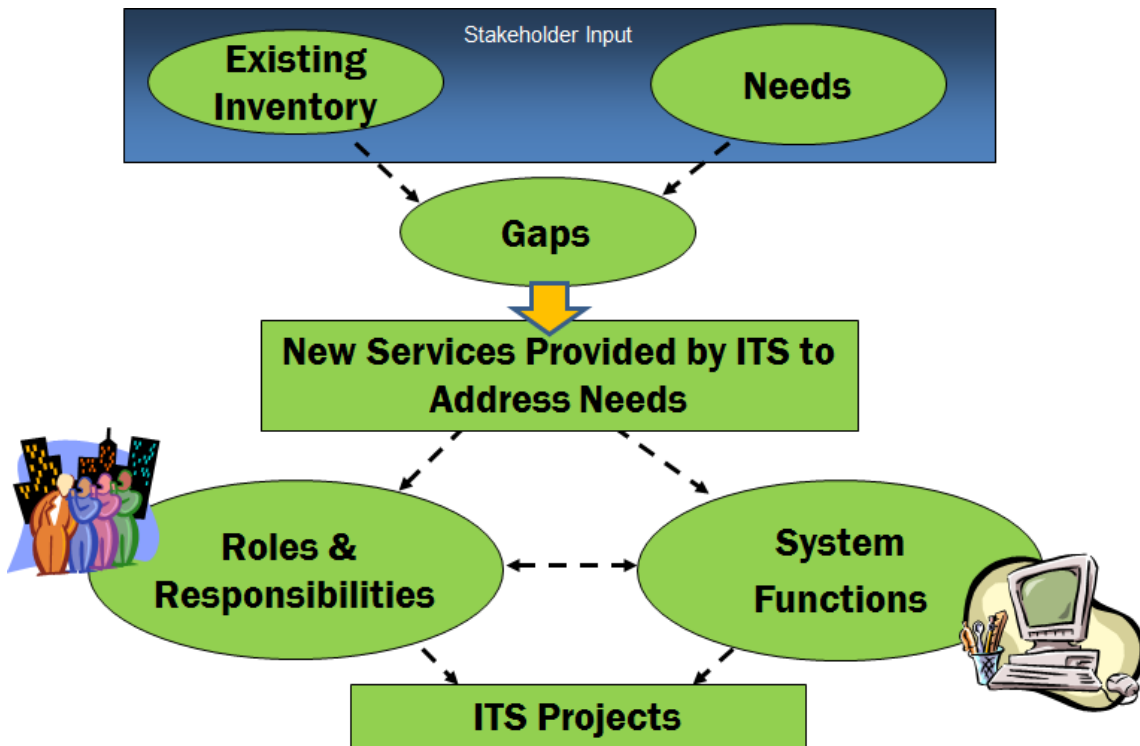


Figure 1 Development of the ITS Strategic Deployment Plan

All projects are related to the regional ITS architecture, either directly to specific ITS services, data and components, or by reference to other projects being supported (e.g., fiber optics expansion and deployment may enable other projects).

2. Project Area Description

2.1 Geographic Boundaries

The area covered by the Kansas City Area Regional ITS Architecture (see Figure 2) is consistent with the transportation planning boundary of the Mid-America Regional Council, the metropolitan planning organization for the bi-state Kansas City region. This boundary currently consists of the entirety of seven counties listed below encompassing a population of approximately 2.0 million people:

- Cass County, MO
- Clay County, MO
- Jackson County, MO
- Platte County, MO
- Johnson County, KS
- Leavenworth County, KS
- Miami County, KS
- Wyandotte County, KS

3. Deployment Strategy

The projects defined in this Deployment Strategy are ordered and numbered to reflect a sequencing relationship. The numbering groups were based on stakeholder feedback about importance or priority. These projects will build upon ITS activities that are existing in the region and form the Deployment Strategy.

Transportation is an evolving endeavor. Technology plays a central role in transportation operations and, as the technology improves, it affords more capabilities on the part of the owners, operators and maintainers of the transportation systems in the region. Each project defined in this Deployment Strategy is moving the region forward. Some of these projects will put in place the capabilities to manage the transportation system better today, while others are studies or planning efforts that are looking into the future so that the region will be prepared for what is coming over the horizon. Implementation of these projects will be dependent on funding availability and national and regional priorities that are in effect.

Funding for project implementation normally comes through transportation planning process. On occasion, grant funding from USDOT is made available for which regions can apply. The projects defined in this Deployment Strategy can be a source of projects to propose for grant funding. The project components are identified and the integration opportunities are included in the RAD-IT database. Other opportunities such as the SPaT Challenge have been addressed in the Deployment Strategy to support initial planning and implementation.

3.1 Project Sequencing

Each project has been designated as Near Term (1-3 year time frame), Mid Term (3-5 year time frame) and Long Term (5+ years). It does not imply specific priorities relative to all other projects, merely the relative importance of the project within the regional or corridor initiative. This does not preclude these projects from being submitted as part of a regional Long Range Transportation Plan (LRTP) as developed

by MARC, but it means the projects may be subject to further ranking criteria within the L RTP as they relate to other, non-ITS initiatives.

The above method of sequencing projects also brings structure to the planning process and gives focus to eventual project selection and deployment without establishing a “pre-defined” funding priority for specific projects.

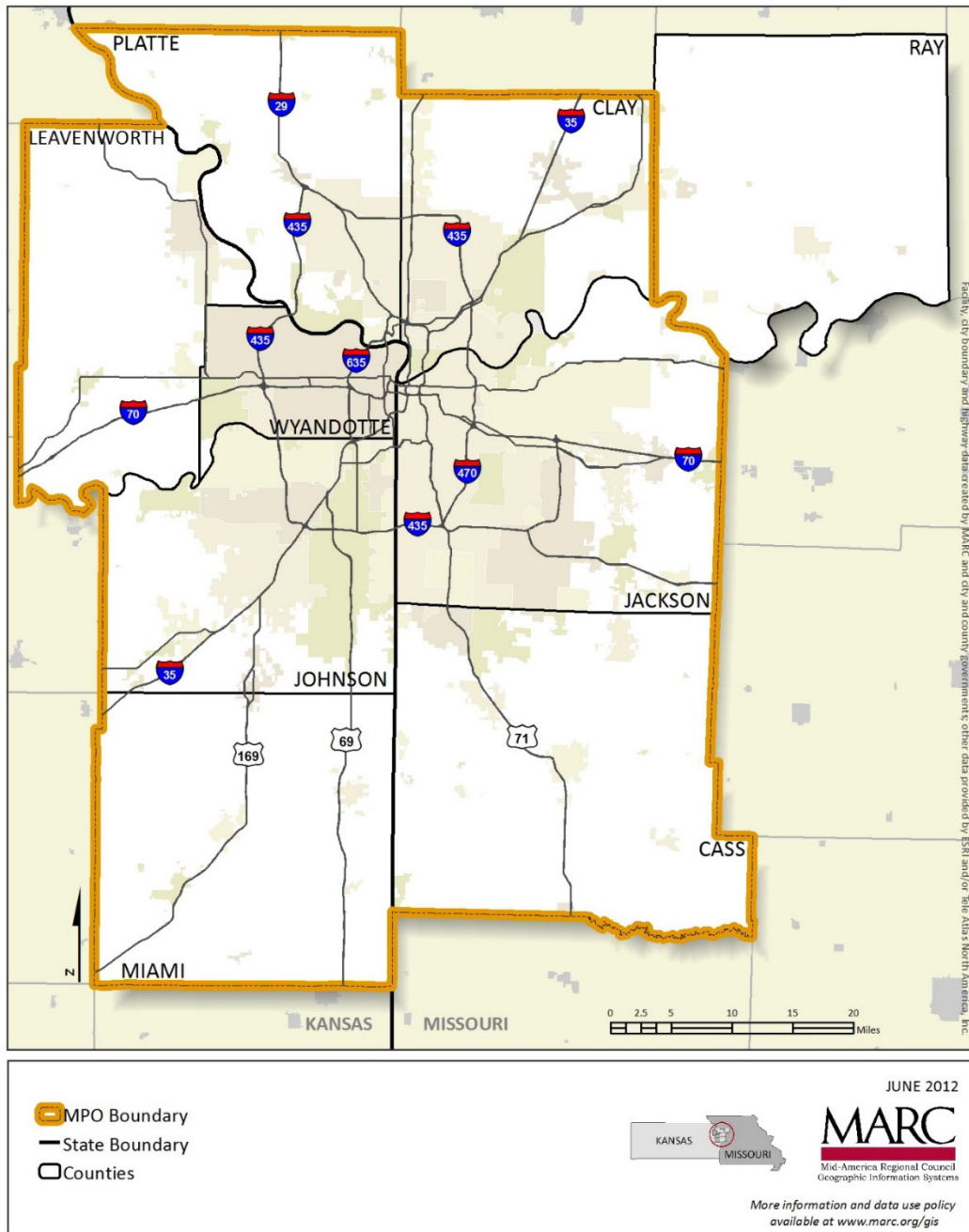


Figure 2 MARC MPO Boundary

The project sequencing designations have been assigned to the respective projects based on several factors. These factors are:

- **Need** – The primary factor is a logical ordering of projects based on dependencies as well as relative needs.
- **Funding** – Projects that are “shovel-ready” or that are urgently required in order to do other initiatives are ranked highest. It is not assumed that any of the projects are currently funded.
- **Dependencies** – The success of some projects is dependent upon the technologies in other projects.

It is important to understand that the prioritization of projects is intended as a guide and not an inflexible prescription. Some projects should be considered longer-term efforts because near-term deployment may represent an unacceptable risk or capital cost, or because there is no near-term funding available. In some cases, major events in a region may shift a region’s priorities and a project identified as medium- or long-term can be shifted to the near-term to address the new high-priority needs.

In other cases, an early opportunity to deploy a medium- or long-term project in the region, with relatively low risk, may present itself. Or perhaps, a technology or system advanced more quickly than was originally anticipated. These scenarios should not preclude implementation of a medium- or long-term project before a near-term project, if it makes sense in the context of the local setting and changing priorities of local needs. This plan should provide flexibility to the region in project deployment and not restrictions.

3.2 Projects

The following pages contain the sequenced ITS projects for the Kansas City region. They are shown in Table 2 and provide the following:

- Project Name with sequence number
- Project Description
- Status
- Timing
- Estimated Cost
- Geographic Scope
- Service Scope

The estimated cost is provided in ranges as follows:

- \$ - less than \$250,000
- \$\$ - \$250,000 to \$750,000
- \$\$\$ - more than \$750,000

The Kansas City Area Regional ITS Architecture is ultimately implemented one ITS project at a time. This chapter lists the projects that have been identified as part of the regional ITS architecture definition. Additional detail for each of these ITS projects may be defined in SET-IT. Summary information is included in the RAD-IT database.



2018 Kansas City Regional ITS Architecture Deployment Strategy

Appendix A provides more details about each project including service diagrams that illustrate the services expected to be offered by each project.

Table 1 List of ITS Projects

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
<p>1.1 Active Traffic Management/ Dynamic Lane Management Concept Development</p>	<p>Concept development in preparation for implementation of an Active Traffic Management solution on the southern section of Interstate 435 to manage traffic congestion in AM/PM peak periods. Active traffic management (ATM) is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. It increases throughput and safety through the use of integrated systems with new technology to optimize performance. ATM implementations focus on influencing travel behavior with respect to lane/facility choices and operations. ATM strategies can be deployed singularly to address a specific need such as the utilizing adaptive ramp metering to control traffic flow or can be combined to meet system-wide needs of congestion management, traveler information, and safety resulting in synergistic performance gains.</p> <p>Conduct feasibility study and concept development of ATM implementation on I-435. The scope of work will include:</p> <ul style="list-style-type: none"> • Feasibility Study • Concept of Operations Development • High-Level Requirements Definition • Recommendations Report 	Planned	Near Term	\$\$	Interstate 435 between Lenexa/ I-35 Interchange through the I-49 Interchange.	<ul style="list-style-type: none"> • TM12 – Dynamic Roadway Warning (KC Scout) • TM20 – Variable Speed Limits • TM22 – Dynamic Lane Management and Shoulder User (ITS)

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
1.2 Regional Communications Plan Development	<p>Transportation data is on the boundary of significant growth with the emergence of connected vehicles which will generate massive amounts of data about roadway conditions, pavement conditions, incidents, traffic flow, and many other data points. This data is of value to transportation agency operations by providing a higher resolution of information for decision making. To be ready for this opportunity, the region's communications system needs to be capable of handling the volume and latency requirements of the data being exchanged. A uniform communications capacity and throughput should be established to properly support these activities. The Regional Communications Plan will evaluate and define the regional communications bandwidth and performance requirements for the next 20 years and make recommendations on communications infrastructure improvements needed to address the requirements. The scope of the project is as follows:</p> <ul style="list-style-type: none"> • Evaluate the existing communication system in the region • Assess the data exchange requirements by analyzing the services defined for the region in the KC ITS Architecture • Conceptualize the communication system needed • Define the communication system requirements • Develop a high level design for the communication system • Develop a development/procurement plan for the communication system 	Planned	Near Term	\$\$	Kansas City Metropolitan Area	All Services
1.3 Work Zone Management and Safety	<p>Implement tools to improve the safety and efficiency of work zones. Tools such as cameras to monitor conditions in the work zone, speed warning signs to alert drivers, signs and other means to inform travelers about the work zone. The project may also give maintenance and construction crews improved control over traffic flow, including local signal control and advanced lane barrier systems.</p>	Planned	Near Term	\$ - \$\$	Interstates within the Kansas City region demarcated by the MARC boundary.	<ul style="list-style-type: none"> • MC06 - Work Zone Management
2.1 Intermittent Transit Vehicle Shoulder Running	<p>Intermittent Shoulder Running for Transit Vehicles can improve schedule adherence in congested conditions. To be done safely and with public knowledge of the rules, signage and lane controls are needed to guide its operation.</p>	Planned	Near Term	\$\$	I-35 South of Downtown Kansas City	<ul style="list-style-type: none"> • PT10 - Intermittent Bus Lanes (ITS)

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
2.2 Performance Monitoring System - Freeway	This project will implement performance monitoring on the freeway system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.	Planned	Mid Term	\$\$	Kansas City Scout system	<ul style="list-style-type: none"> DM02 - Performance Monitoring
2.3 Performance Monitoring System - Transit	This project will implement performance monitoring on the transit system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be schedule adherence or transit probe data information obtained from transit vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.	Planned	Mid Term	\$\$	Kansas City Metropolitan Area RideKC System	<ul style="list-style-type: none"> DM02 - Performance Monitoring

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
2.4 Performance Monitoring System - Arterial	This project will implement performance monitoring on the arterial system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.	Planned	Mid Term	\$\$	Kansas City Metropolitan area arterial systems including KCMO, Olathe, Overland Park	<ul style="list-style-type: none"> DM02 - Performance Monitoring
2.5 Active Traffic Management/ Dynamic Lane Management Design and Development	Develop and deploy Active Traffic Management solution on the southern section of Interstate 435 to manage traffic congestion in AM/PM peak periods. Active traffic management (ATM) is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. It increases throughput and safety through the use of integrated systems with new technology to optimize performance. ATM approaches focus on influencing travel behavior with respect to lane/facility choices and operations. ATM strategies can be deployed singularly to address a specific need such as the utilizing adaptive ramp metering to control traffic flow or can be combined to meet system-wide needs of congestion management, traveler information, and safety resulting in synergistic performance gains. Conduct design, develop, and deploy ATM implementation on I-435. The scope of work will include: <ul style="list-style-type: none"> High-level Design Detailed Design Development Testing- Deployment 	Planned	Mid Term	\$\$\$	Interstate 435 between Lenexa/ I-35 Interchange through the I-49 Interchange.	<ul style="list-style-type: none"> TM12 – Dynamic Roadway Warning (KC Scout) TM20 – Variable Speed Limits TM22 – Dynamic Lane Management and Shoulder User (ITS)

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
2.6 Event and Incident Management Improvements	Expand upon deployment of DMS, increased collection and sharing of traffic images, and improved information sharing among agencies. Implement systems to improve real-time communications among emergency responders and traffic management to coordinate event traffic management plans, respond to incidents, and provide travelers with congestion, parking and alternative mode information.	Planned	Mid Term	\$\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> • PM01 - Parking Space Management • PS07 - Incident Scene Safety Monitoring • PS08 - Roadway Service Patrols • PS10 - Wide-Area Alert • PS14 - Disaster Traveler Information • PT14 - Multi-modal Coordination • TI01 - Broadcast Traveler Information • TM01 - Infrastructure-Based Traffic Surveillance • TM05 - Traffic Metering • TM06 - Traffic Information Dissemination • TM07 - Regional Traffic Management • TM08 - Traffic Incident Management System
3.1 Snow Plow Operations Coordination	Snow Plow Operations involved every agency in the region during snow storms. To travelers, road jurisdictions do not exist and coordinated snow plow operations can improve road conditions available throughout the region.	Planned	Mid Term	\$\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> • MC04 - Winter Maintenance

<p>3.2 Connected and Automated Vehicle Support Plan Development</p>	<p>Develop a plan for supporting connected and automated vehicles in the Kansas City region. The plan should specifically identify initial deployment opportunities within the region as first steps. Numerous functional definitions of connected and autonomous vehicle opportunities have been defined in the 2018 Kansas City ITS Architecture that can be used to scope the candidates and develop the institutional framework within which the projects will be implemented. The deployment of vehicle to infrastructure equipment will be necessary to realize many of the connected vehicle applications. The plan should evolutionary in nature providing guidance on attainable implementations and establishing the supporting infrastructure required to sustain deployment. The scope of this project will include:</p> <ul style="list-style-type: none"> • Assessment of existing ITS available in region- Identification of regional transportation needs that can be addressed by connected and automated vehicles • Evaluation of connected vehicle applications to identify beneficial services • Definition of connected and autonomous vehicle roadmap for region Recommendations for next steps 	<p>Planned</p>	<p>Mid Term</p>	<p>\$\$</p>	<p>Kansas City Metropolitan Area</p>	<ul style="list-style-type: none"> • MC06 - Work Zone Management (with CV) • MC07 - Work Zone Safety Monitoring • MC09 - Infrastructure Monitoring • PM01 - Parking Space Management (With CV) • PM03 - Parking Electronic Payment (With CV) • PS03 - Emergency Vehicle Preemption • PT09 - Transit Signal Priority • PT10 - Intermittent Bus Lanes (with CV) • SU03 - Data Distribution (CV) • SU06 - Object Registration and Discovery • SU08 - Security and Credentials Management • TI07 - In-Vehicle Signage • TM02 - Vehicle-Based Traffic Surveillance • TM04 - Connected Vehicle Traffic Signal System • TM22 - Dynamic Lane Management and Shoulder Use (CV) • VS13 - Intersection Safety Warning and Collision Avoidance • VS16 - Automated Vehicle Operations
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Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
3.3 Mobility Hubs	<p>Mobility hubs are central places or districts that act as converging points for public transit and an integrated suite of mobility services, scaled for their respective environments and functions. Mobility hubs are also areas where there is an intensive concentration of working, living, shopping and/or playing in the form of mixed-use development. Mobility hubs serve three critical roles in the new Smart Moves 3.0 system: origin, destination and transfer point.</p>	Planned	Mid Term	\$\$\$	<p>Kansas City Metropolitan Area where numerous modes and services intersect in close proximity.</p>	<ul style="list-style-type: none"> • PT01 - Transit Vehicle Tracking • PT02 - Transit Fixed-Route Operations • PT03 - Dynamic Transit Operations • PT05 - Transit Security • PT08 - Transit Traveler Information • PT14 - Multi-modal Coordination • ST05 - Electric Charging Stations Management • TI02 - Personalized Traveler Information • TI06 - Dynamic Ridesharing and Shared Use Transportation

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
<p>3.4 Transit Signal Priority</p>	<p>Transit Signal Priority is easily accomplished with technology today but the impact on the signal system operation is the challenge. To operate efficiently, transit signal priority requires information about passenger count and transit route schedule performance be evaluated against agreed upon criteria to justify the priority request to the signal system operator. In situations where there is no justification for the priority request yet the request is still made, the relationship between transit and the traffic signal system is negatively affected. To lower the impact of signal priority on the traffic signal system, the establishment of priority request criteria must be established between transit and traffic operations. The criteria will include passenger count and schedule adherence which will be evaluated against the criteria on the transit vehicle prior to the signal priority request being made. This will require passenger counting systems, transit vehicle tracking for schedule adherence, processing of the priority request criteria, and communication of the request to traffic operations. At this time, all TSP is executed at the intersection, locally. This project will implement the transit vehicle and operations systems required to properly assess and communicate the signal priority request. It will be a collaboration between RideKC/KCATA and the various traffic signal operators in the metropolitan area. The scope of this project will include:</p> <ul style="list-style-type: none"> • Concept of Operations for TSP using passenger counting and schedule adherence data • Agreements with traffic signal system operators and RideKC regarding priority request criteria • Requirements definition • Design • System procurement and/or system development • Testing • Implementation • Sustainability 	Planned	Mid Term	\$\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> • PT01 - Transit Vehicle Tracking • PT02 - Transit Fixed-Route Operations • PT09 - Transit Signal Priority • PT14 - Multi-modal Coordination • TM03 - Traffic Signal Control

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
3.5 SPaT Challenge – Intersection Approach Countdown – KCMO	Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations.	Future	Mid Term	\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> • ST08 – Eco-Approach and Departure at Signalized Intersections
3.6 SPaT Challenge – Intersection Approach Countdown – Olathe	Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations.	Future	Mid Term	\$	Olathe	<ul style="list-style-type: none"> • ST08 – Eco-Approach and Departure at Signalized Intersections

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
3.7 SPaT Challenge – Intersection Approach Countdown – Overland Park	Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations.	Future	Mid Term	\$	Overland Park	<ul style="list-style-type: none"> ST08 – Eco-Approach and Departure at Signalized Intersections
4.1 Data Distribution System/ Data Portal	<p>Transportation data is available in numerous systems throughout the Kansas City region. There is potential in the data that can be leveraged by organizations beyond the public sector. These opportunities can lead to transformative product developments that move the region forward without the constraints of public budgets. This project will establish a data distribution or portal to make transportation data from systems in the region through a single source. The project scope will include the following:</p> <ul style="list-style-type: none"> Champion Identification Concept of Operations Requirements Definition Design- Development Testing- Implementation Operation and Maintenance 	Planned	Mid Term	\$\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> SU03 - Data Distribution

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
4.2 Intermodal Freight Facility Coordination	Kansas City is a major intermodal freight hub that brings in and ships out freight on water, rail and roadways. The arrival or departure of freight from these depots can have a negative impact on the surface transportation system. This project will establish communication of major freight movement schedules with transportation agencies to coordinate traffic and transit services to minimize the impact on the transportation system.	Planned	Mid Term	\$\$	Kansas City Metropolitan Area	<ul style="list-style-type: none"> • CVO01 - Carrier Operations and Fleet Management • SU03 - Data Distribution • TM05 - Traffic Metering • TM06 - Traffic Information Dissemination • TM07 - Regional Traffic Management • TM09 - Integrated Decision Support and Demand Management
4.3 Employment Center Coordination	There are major Employment Centers in the Kansas City Metropolitan Area in particular along the I-35 corridor in Kansas. These employment centers are large traffic generators when employees arrive at the work facility or the facility at the same time. This project will establish communication of employment center work schedules with transportation agencies to coordinate traffic and transit services to minimize the impact on the transportation system.	Planned	Mid Term	\$\$	Kansas City Metropolitan Area in particular along the I-35 corridor in Kansas	<ul style="list-style-type: none"> • PT03 - Dynamic Transit Operations • PT14 - Multi-modal Coordination • TI06 - Dynamic Ridesharing and Shared Use Transportation • TM06 - Traffic Information Dissemination • TM07 - Regional Traffic Management • TM09 - Integrated Decision Support and Demand Management

Name	Description	Status	Timing	Estimated Cost	Geographic Scope	Service Scope
4.4 Regional Parking Management	Finding Parking in Kansas City, especially in the downtown environment presents a problem for visitors during peak seasons for tourism and activities in the city. Parking venues are operated by a number of providers but there is no information for travelers to know where parking is available. The result is vehicles wandering the streets looking for available parking, creating traffic congestion in the process, and disturbing the flow of traffic. Technology exists to monitor parking availability through space monitoring or entry/exit counters. The objective of this project is to work with the parking operators to implement technology or supply data about parking space availability to a central database to inform travelers before departing, en-route or upon arrival in at their destination about parking availability.	Planned	Long Term	\$\$	Downtown Kansas City, Convention Center, Kaufmann Center, and the Plaza.	<ul style="list-style-type: none"> • PM01 - Parking Space Management • TI01 - Broadcast Traveler Information • TI02 - Personalized Traveler Information • TM06 - Traffic Information Dissemination

Appendix A – Project Details

Each of the projects identified in the Deployment Strategy are further detailed in this appendix. For each project - stakeholders, service scope, and service diagrams are documented. It is designed so that individual projects can be extracted and used in planning documents as necessary.

The service diagrams for each project have been included with each project definition. The service diagrams are from the Kansas City Regional ITS Architecture and they provide additional insight into the interactions among the systems within each project. The services identified for each project address different components of the functionality required to deliver the project scope. Each service should be examined in terms of the service scope it provides and how that service is linked or dependent upon other services identified as part of the project. Some project scope is narrow and may only have one service identified. Other projects are complex and have numerous services required to deliver the scope of the project.

Appendix B provides a list of the inventory elements from the Kansas City Regional ITS Architecture as a reference when reviewing the project services.

When the project is to be initiated, it is recommended that the project be imported from the Regional ITS Architecture in Regional Architecture Development for Intelligent Transportation (RAD-IT) software tool to the Systems Engineering Tool for Intelligent Transportation (SET-IT) software tool. Within SET-IT, the project can be further tailored at that point. SET-IT will allow the user to work with the services identified within a project scope, define the interface characteristics, and envision the project as a whole.

1.1 Active Traffic Management/Dynamic Lane Management Concept Development

Stakeholders: Kansas DOT, Missouri DOT

Description: Concept development in preparation for implementation of an Active Traffic Management solution on the southern section of Interstate 435 to manage traffic congestion in AM/PM peak periods. Active traffic management (ATM) is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. It increases throughput and safety through the use of integrated systems with new technology to optimize performance. ATM implementations focus on influencing travel behavior with respect to lane/facility choices and operations. ATM strategies can be deployed singularly to address a specific need such as the utilizing adaptive ramp metering to control traffic flow or can be combined to meet system-wide needs of congestion management, traveler information, and safety resulting in synergistic performance gains.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- TM12 – Dynamic Roadway Warning (KC Scout)
- TM20 – Variable Speed Limits
- TM22 – Dynamic Lane Management and Shoulder User (ITS)

Example strategies include:

Dynamic Lane Use Control: This strategy involves dynamically closing or opening of individual traffic lanes as warranted and providing advance warning of the closure(s) (typically through dynamic lane control signs), in order to safely merge traffic into adjoining lanes. As the network is continuously monitored, real-time incident and congestion data is used to control the lane use ahead of the lane closure(s) and dynamically manage the location to reduce rear-end and other secondary crashes.

Dynamic Merge Control: This strategy consists of dynamically managing the entry of vehicles into merge areas with a series of advisory messages (e.g., displayed on a dynamic message sign [DMS] or lane control sign) approaching the merge point that prepare motorists for an upcoming merge and encouraging or directing a consistent merging behavior. Applied conditionally during congested (or near congested) conditions, dynamic merge control can help create or maintain safe merging gaps and reduce shockwaves upstream of merge points. Conditions on the mainline lanes and ramps approaching merge areas are continuously monitored and the dynamic merge system will be activated dynamically based on real-time and anticipated congestion conditions.

Dynamic Shoulder Lanes: This strategy enables the use of the shoulder as a travel lane(s), known as Hard Shoulder Running (HSR) or temporary shoulder use, based on congestion levels during peak periods and in response to incidents or other conditions

as warranted during non-peak periods. In contrast to a static time-of-day schedule for using a shoulder lane, an ATM approach continuously monitors conditions and uses real-time and anticipated congestion levels to determine the need for using a shoulder lane as a regular or special purpose travel lane (e.g., transit only).

Dynamic Speed Limits: This strategy adjusts speed limits based on real-time traffic, roadway, and/or weather conditions. Dynamic speed limits can either be enforceable (regulatory) speed limits or recommended speed advisories, and they can be applied to an entire roadway segment or individual lanes. In an ATM approach, real-time and anticipated traffic conditions are used to adjust the speed limits dynamically to meet an agency's goals/objectives for safety, mobility, or environmental impacts.

Service Diagrams:

- **TM12 – Dynamic Roadway Warning (KC Scout)** - This service package includes systems that dynamically warn drivers approaching hazards on a roadway. Such hazards include roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway and any other transient event that can be sensed. These dynamic roadway warning systems can alert approaching drivers via warning signs, flashing lights, in-vehicle messages, etc. Such systems can increase the safety of a roadway by reducing the occurrence of incidents. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the TM17 – Speed Warning and Enforcement service package.

Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM22-Dynamic Lane Management and Shoulder Use).

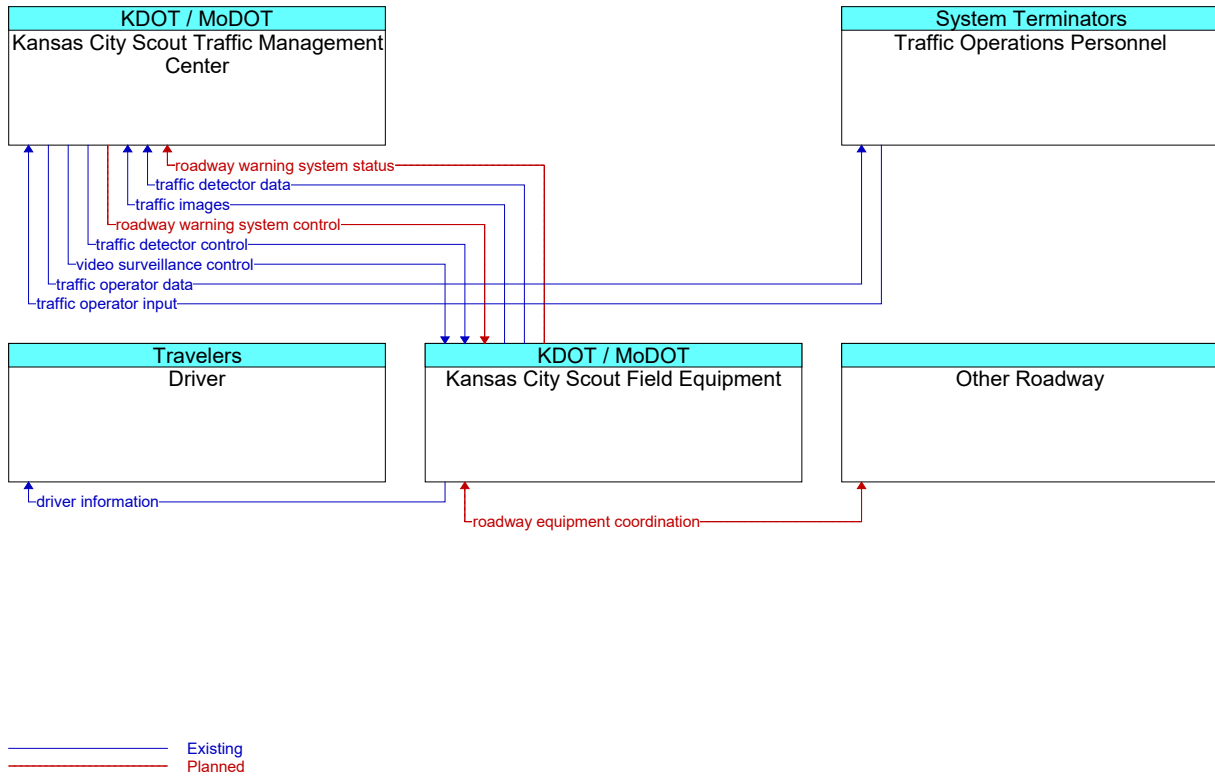


Figure 3 Service TM12 – Dynamic Roadway Warning (KC Scout)

- **TM20 – Variable Speed Limits** - This service package sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway. Based on the measured data, the system calculates and sets suitable speed limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the TM17-Speed Warning and Enforcement service package.

Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM22-Dynamic Lane Management and Shoulder Use and TM23-Dynamic Roadway Warning).

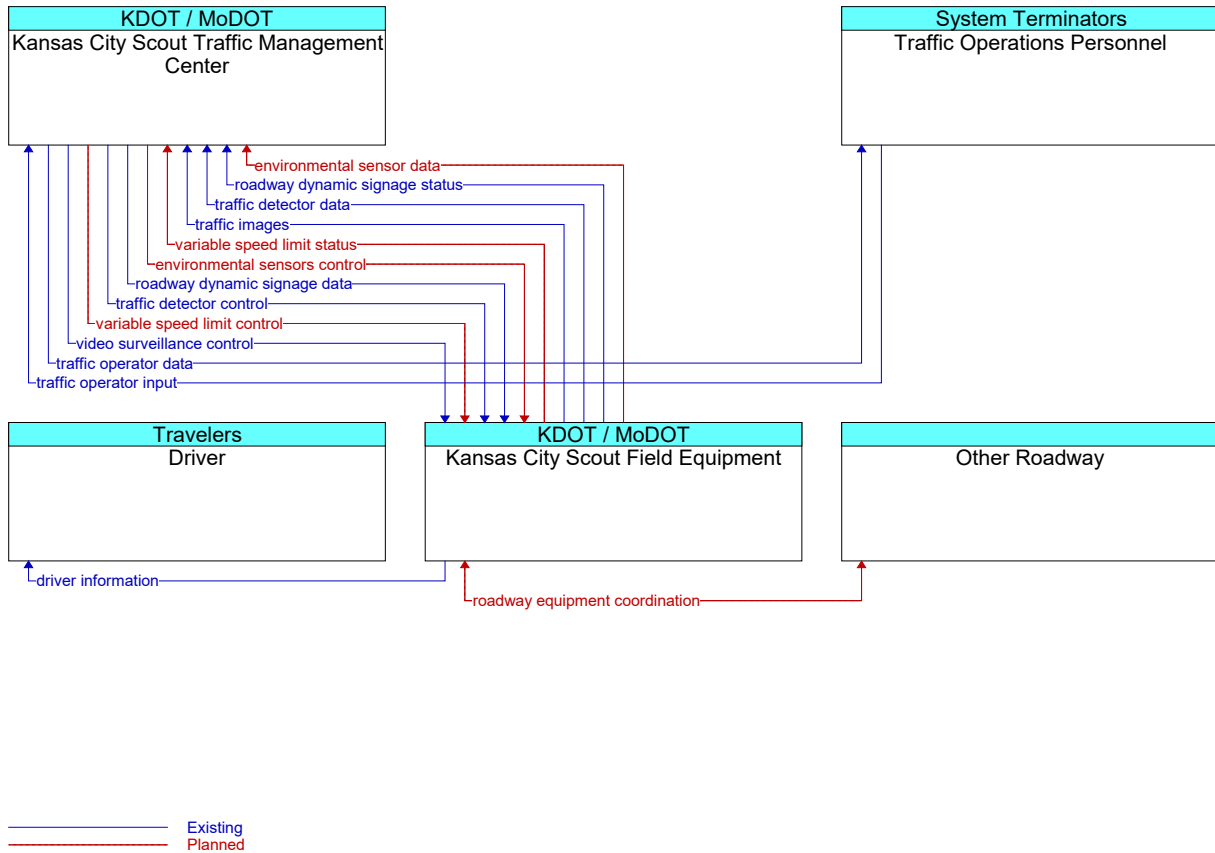


Figure 4 Service TM20 – Variable Speed Limits

- **TM22 – Dynamic Lane Management and Shoulder User (ITS)** - This service package provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented.

The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM12-Dynamic Roadway Warning).

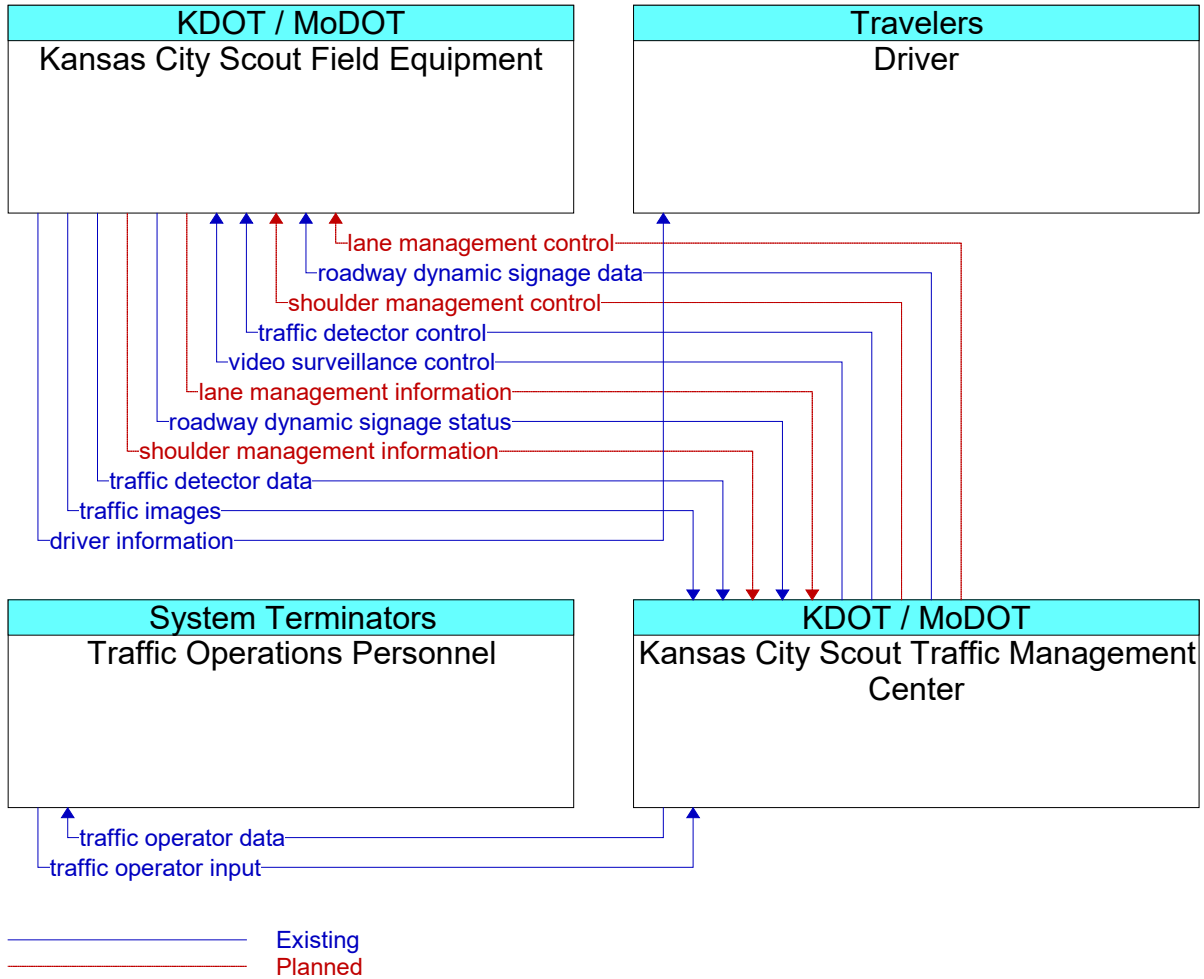


Figure 5 Service TM22 – Dynamic Lane Management and Shoulder User (ITS)

1.2 Regional Communications Plan Development

Stakeholders: Kansas DOT, Missouri DOT, MARC, KCATA, Cities and Counties, Communications Service Providers

Description: Transportation data is on the boundary of significant growth with the emergence of connected vehicles which will generate massive amounts of data about roadway conditions, pavement conditions, incidents, traffic flow, and many other data points. This data is of value to transportation agency operations by providing a higher resolution of information for decision making. To be ready for this opportunity, the region's communications system needs to be capable of handling the volume and latency requirements of the data being exchanged. A uniform communications capacity and throughput should be established to properly support these activities. The Regional Communications Plan will evaluate and define the regional communications bandwidth and performance requirements for the next 20 years and make recommendations on communications infrastructure improvements needed to address the requirements. The scope of the project is as follows:

- Evaluate the existing communication system in the region
- Assess the data exchange requirements by analyzing the services defined for the region in the KC ITS Architecture
- Conceptualize the communication system needed
- Define the communication system requirements
- Develop a high level design for the communication system
- Develop a development/procurement plan for the communication system

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- All of the services identified in the Architecture will have a bearing on the communications system analysis.

1.3 Work Zone Management and Safety

Stakeholders: Kansas DOT, Missouri DOT, Kansas Highway Patrol, Missouri Department of Public Safety, Cities and Counties, Private Information Service Providers

Description: Implement tools to improve the safety and efficiency of work zones. Tools such as cameras to monitor conditions in the work zone, speed warning signs to alert drivers, signs and other means to inform travelers about the work zone. The project may also give maintenance and construction crews improved control over traffic flow, including local signal control and advanced lane barrier systems.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- MC06 - Work Zone Management

Service Diagrams:

- MC06 – Work Zone Management - This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

2.1 Intermittent Transit Vehicle Shoulder Running

Stakeholders: Kansas DOT, Missouri DOT, KCATA

Description: Intermittent Shoulder Running for Transit Vehicles can improve schedule adherence in congested conditions. To be done safely and with public knowledge of the rules, signage and lane controls are needed to guide its operation.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PT10 – Intermittent Bus Lanes (ITS)

Service Diagrams:

- PT10 – Intermittent Bus Lanes (ITS) - This service package provides dedicated bus lanes during peak demand times to enhance transit operations mobility. An intermittent bus lane is a lane that can change its status from regular lane (accessible for all vehicles) to bus lane, for the time strictly necessary for a bus or set of buses to pass. The status of the IBL is communicated to drivers using roadside message signs and through in-vehicle signage. The creation and removal of dedicated bus lanes is managed through coordination between traffic and transit centers.

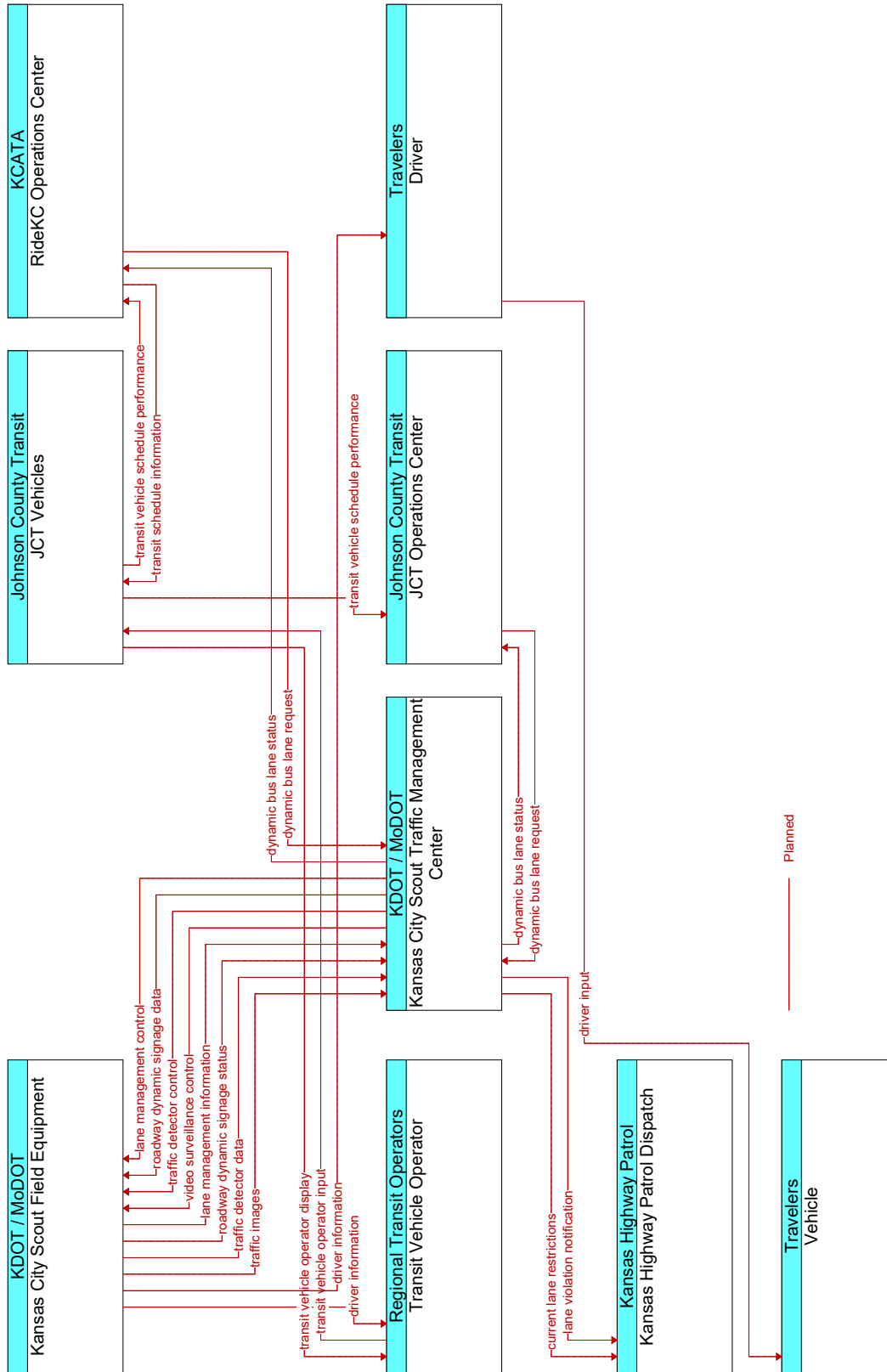


Figure 7 Service PT10 - Intermittent Bus Lanes (ITS)

2.2 Performance Monitoring System - Freeway

Stakeholders: Kansas DOT, Missouri DOT, MARC

Description: This project will implement performance monitoring on the freeway system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- DM02 – Performance Monitoring

Service Diagrams:

- DM02 – Performance Monitoring - The Performance Monitoring service package uses information collected from detectors and sensors, connected vehicles, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

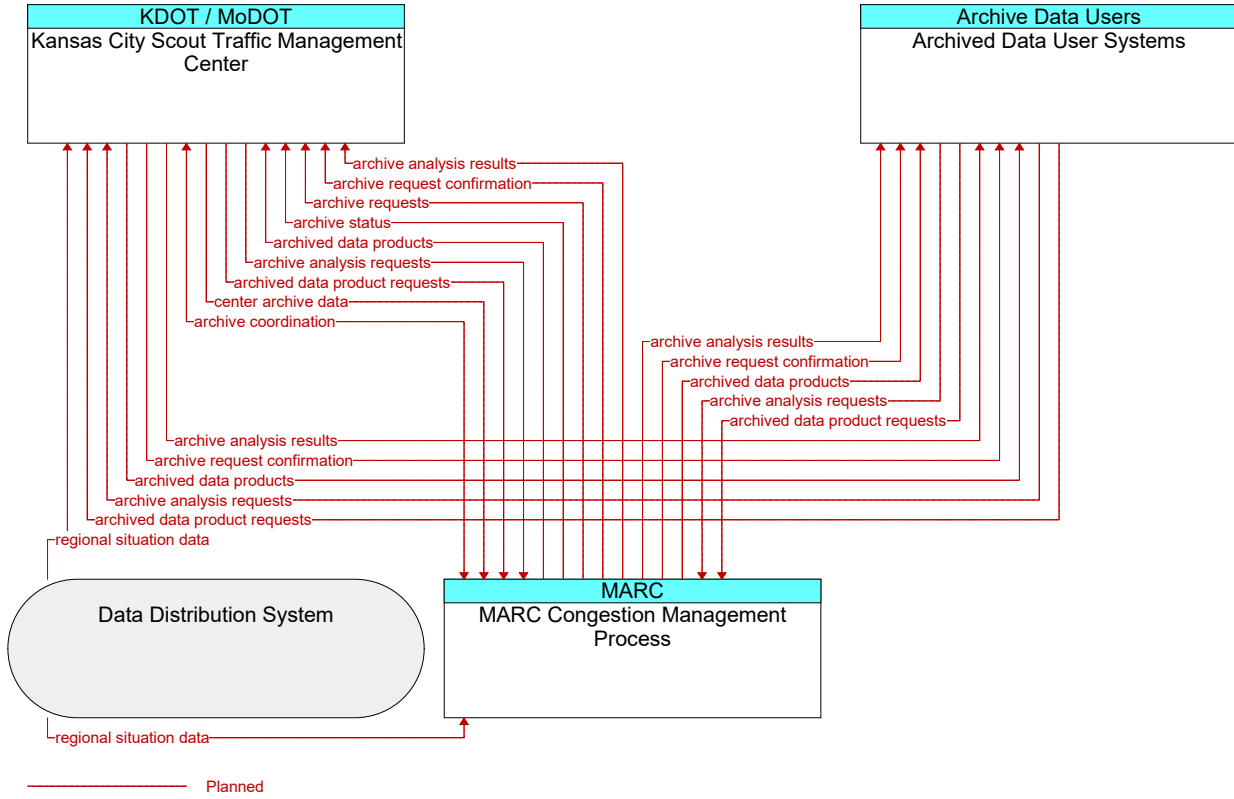


Figure 8 Service DM02 – Performance Monitoring (Freeway)

2.3 Performance Monitoring System - Transit

Stakeholders: KCATA, Regional Transit Operators

Description: This project will implement performance monitoring on the transit system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be schedule adherence or transit probe data information obtained from transit vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

- DM02 – Performance Monitoring

Service Diagrams:

- DM02 – Performance Monitoring - The Performance Monitoring service package uses information collected from detectors and sensors, connected vehicles, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

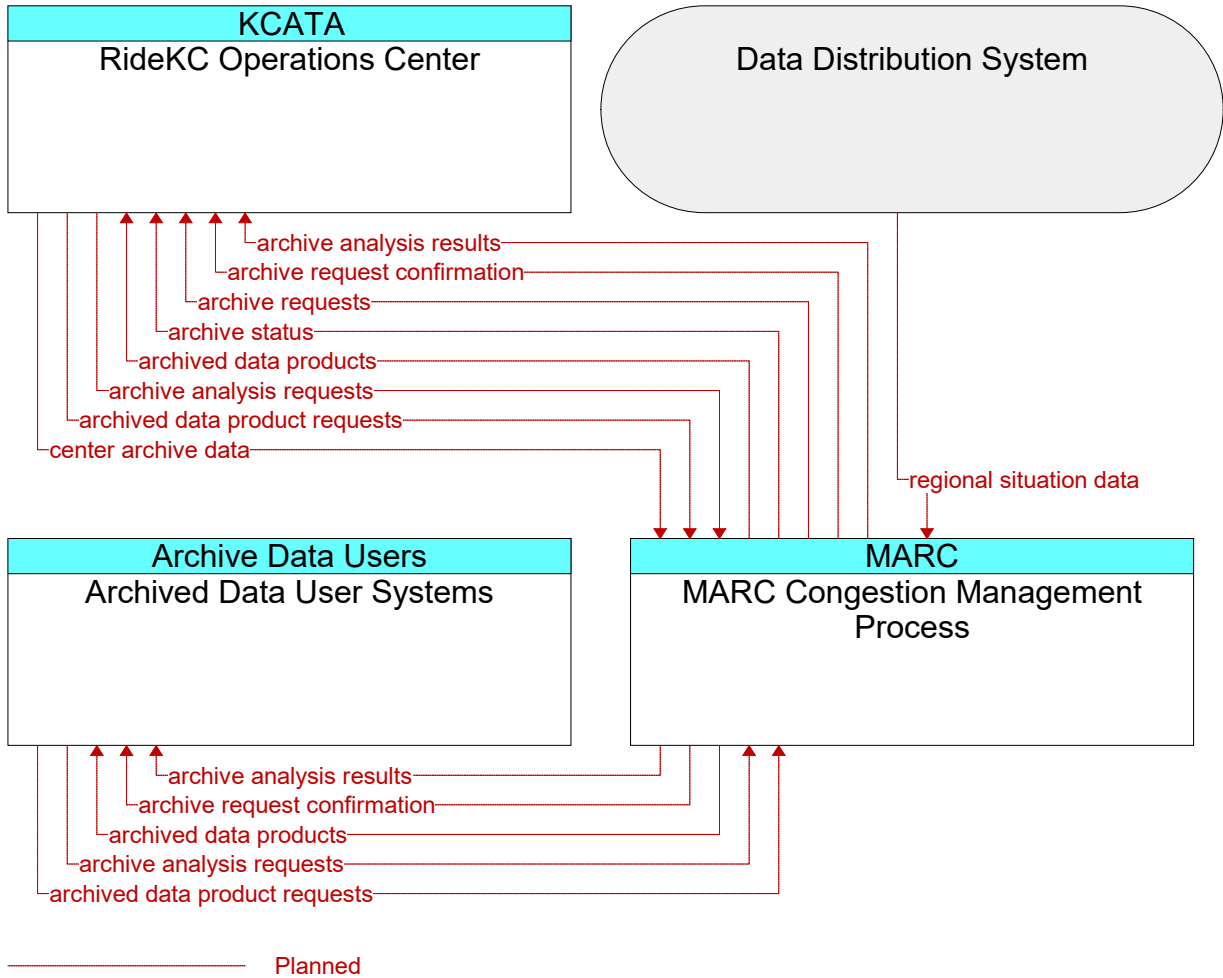


Figure 9 Service DM02 – Performance Monitoring (Transit)

2.4 Performance Monitoring System - Arterial

Stakeholders: KCMO, Olathe, Overland Park

Description: This project will implement performance monitoring on the transit system in Kansas City to collect data, analyze it and make recommendations on operational improvements. Performance Monitoring uses information collected from detectors and sensors, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be schedule adherence or transit probe data information obtained from transit vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

- DM02 – Performance Monitoring

Service Diagrams:

- DM02 – Performance Monitoring - The Performance Monitoring service package uses information collected from detectors and sensors, connected vehicles, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.

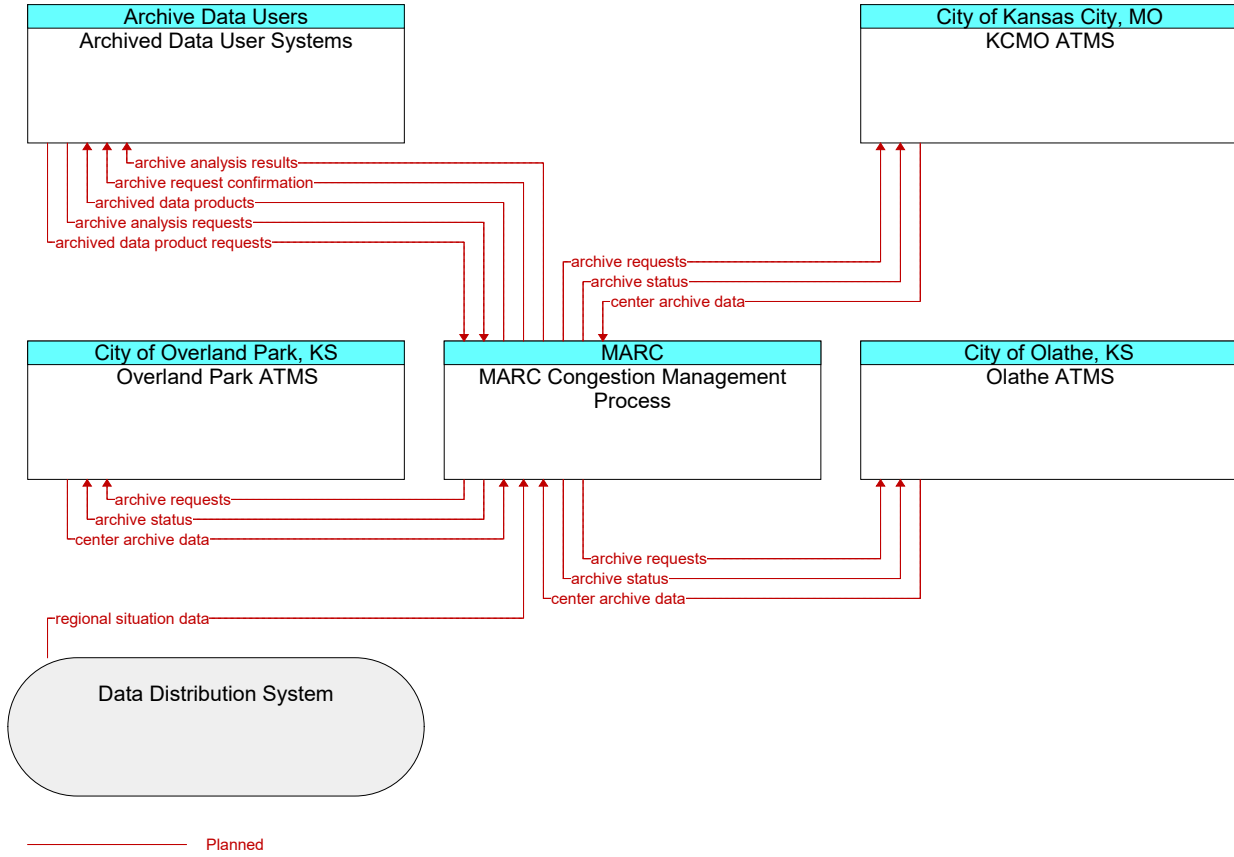


Figure 10 Service DM02 – Performance Monitoring (Arterial)

2.5 Active Traffic Management/ Dynamic Lane Management Design and Development

Stakeholders: Kansas DOT, Missouri DOT

Description: Develop and deploy Active Traffic Management solution on the southern section of Interstate 435 to manage traffic congestion in AM/PM peak periods. Active traffic management (ATM) is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. It increases throughput and safety through the use of integrated systems with new technology to optimize performance. ATM approaches focus on influencing travel behavior with respect to lane/facility choices and operations. ATM strategies can be deployed singularly to address a specific need such as the utilizing adaptive ramp metering to control traffic flow or can be combined to meet system-wide needs of congestion management, traveler information, and safety resulting in synergistic performance gains. Conduct design, develop, and deploy ATM implementation on I-435. The scope of work will include:

- High-level Design
- Detailed Design
- Development
- Testing- Deployment

Service Diagrams:

- TM12 – Dynamic Roadway Warning (KC Scout) - This service package includes systems that dynamically warn drivers approaching hazards on a roadway. Such hazards include roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway and any other transient event that can be sensed. These dynamic roadway warning systems can alert approaching drivers via warning signs, flashing lights, in-vehicle messages, etc. Such systems can increase the safety of a roadway by reducing the occurrence of incidents. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the TM17 – Speed Warning and Enforcement service package.

Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM22-Dynamic Lane Management and Shoulder Use).

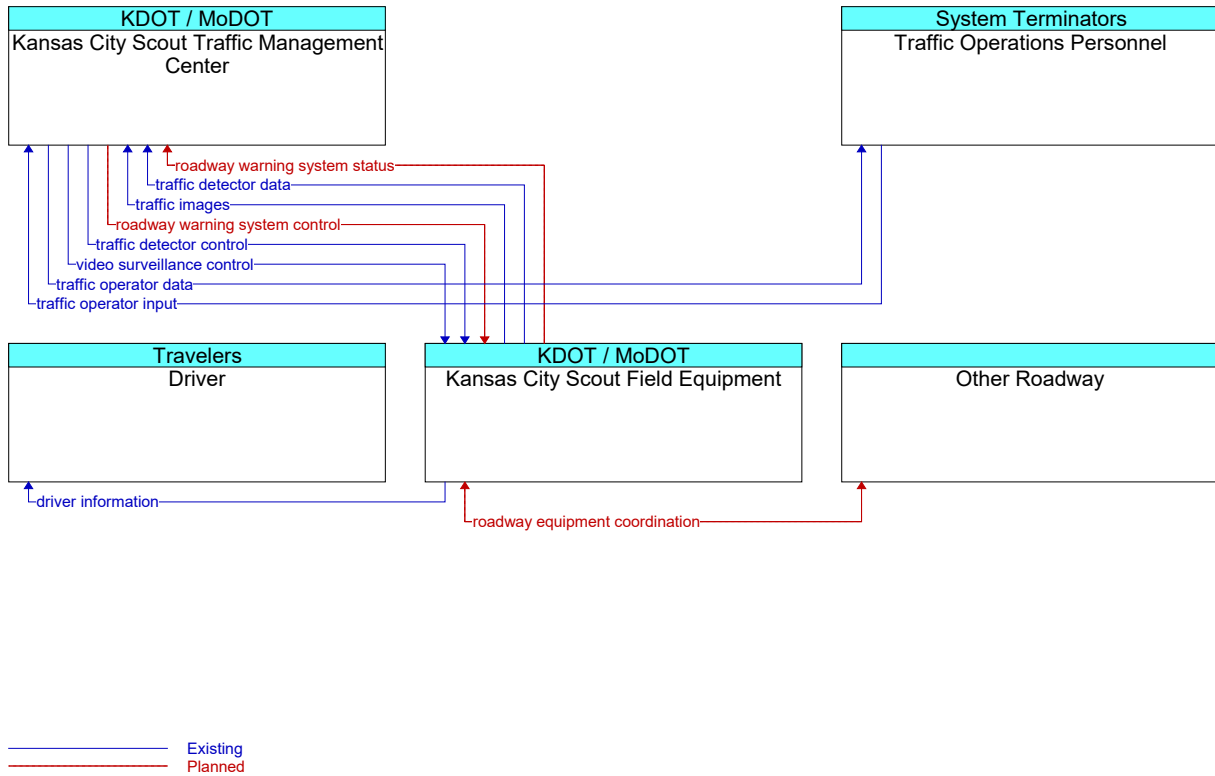


Figure 11 Service TM12 – Dynamic Roadway Warning (KC Scout)

- TM20 – Variable Speed Limits - This service package sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway. Based on the measured data, the system calculates and sets suitable speed limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the TM17-Speed Warning and Enforcement service package.

Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM22-Dynamic Lane Management and Shoulder Use and TM23-Dynamic Roadway Warning).

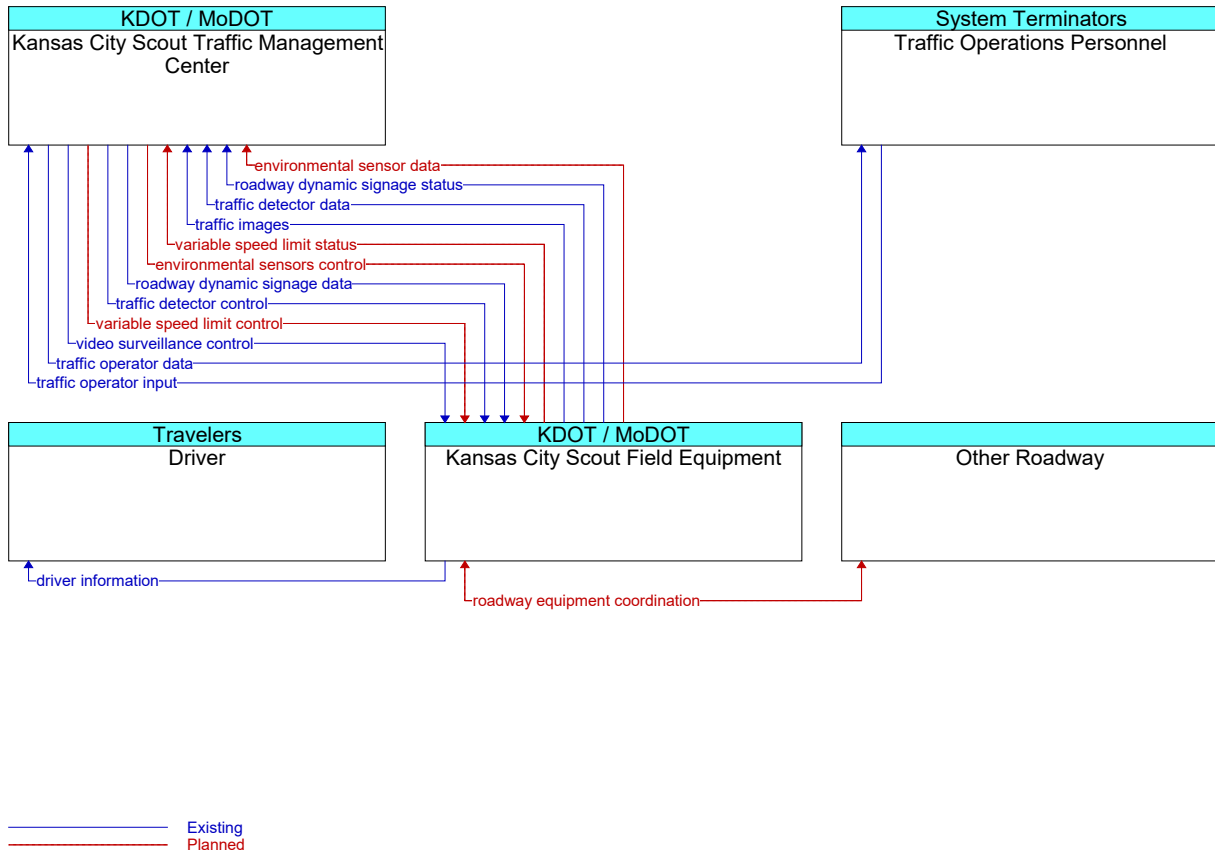


Figure 12 Service TM20 – Variable Speed Limits

- TM22 – Dynamic Lane Management and Shoulder User (ITS) - This service package provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented.

The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM12-Dynamic Roadway Warning).

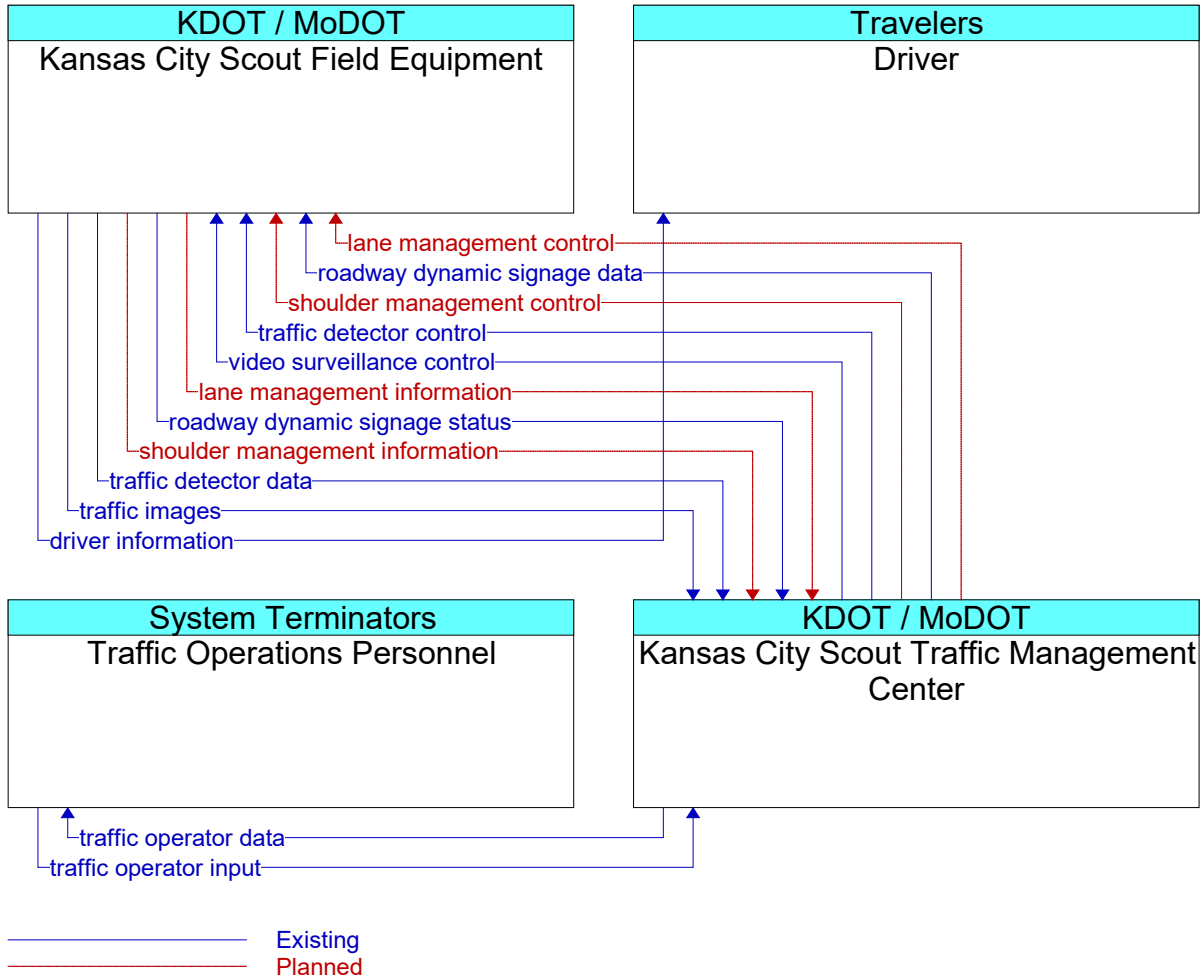


Figure 13 Service TM22 – Dynamic Lane Management and Shoulder User (ITS)

2.6 Event and Incident Management Improvements

Stakeholders: Kansas DOT, Missouri DOT, Kansas Highway Patrol, Missouri Department of Public Safety, Private Information Service Providers, Media, Event Sponsors/Facilities

Description: Expand upon deployment of DMS, increased collection and sharing of traffic images, and improved information sharing among agencies. Implement systems to improve real-time communications among emergency responders and traffic management to coordinate event traffic management plans, respond to incidents, and provide travelers with congestion, parking and alternative mode information.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PM01 - Parking Space Management
- PS07 - Incident Scene Safety Monitoring
- PS08 - Roadway Service Patrols
- PS10 - Wide-Area Alert
- PS14 - Disaster Traveler Information
- PT14 - Multi-modal Coordination
- TI01 - Broadcast Traveler Information
- TM01 - Infrastructure-Based Traffic Surveillance
- TM05 - Traffic Metering
- TM06 - Traffic Information Dissemination
- TM07 - Regional Traffic Management
- TM08 - Traffic Incident Management System

Service Diagrams:

- PM01 - Parking Space Management - This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.

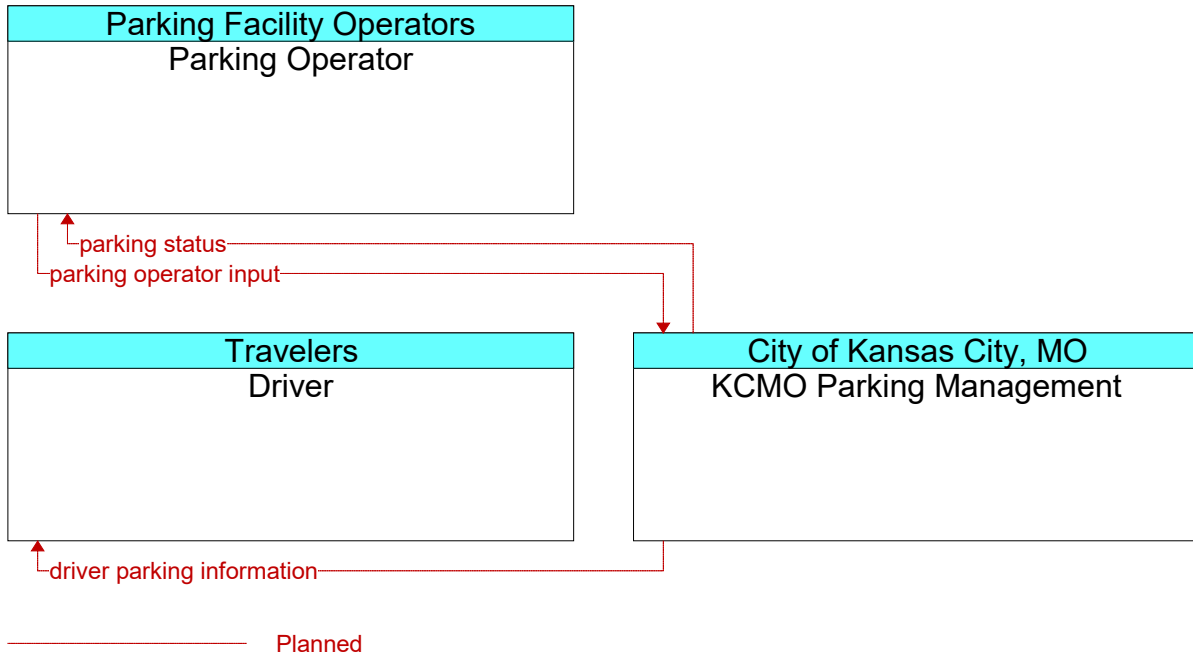


Figure 14 Service PM01 - Parking Space Management

- PS07 - Incident Scene Safety Monitoring - This service package employs communications technologies to provide warnings and alerts relating to incident zone operations. One aspect of the service is an in-vehicle messaging system that provides drivers with merging and speed guidance around an incident. Another aspect is providing in-vehicle incident scene alerts to drivers, both for the protection of the drivers as well as incident zone personnel. A third aspect is a warning system for on-scene workers when a vehicle approaching or in the incident zone is being operated outside of safe parameters for the conditions.

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- PS08 - Roadway Service Patrols - This service package supports roadway service patrol vehicles that monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The service package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

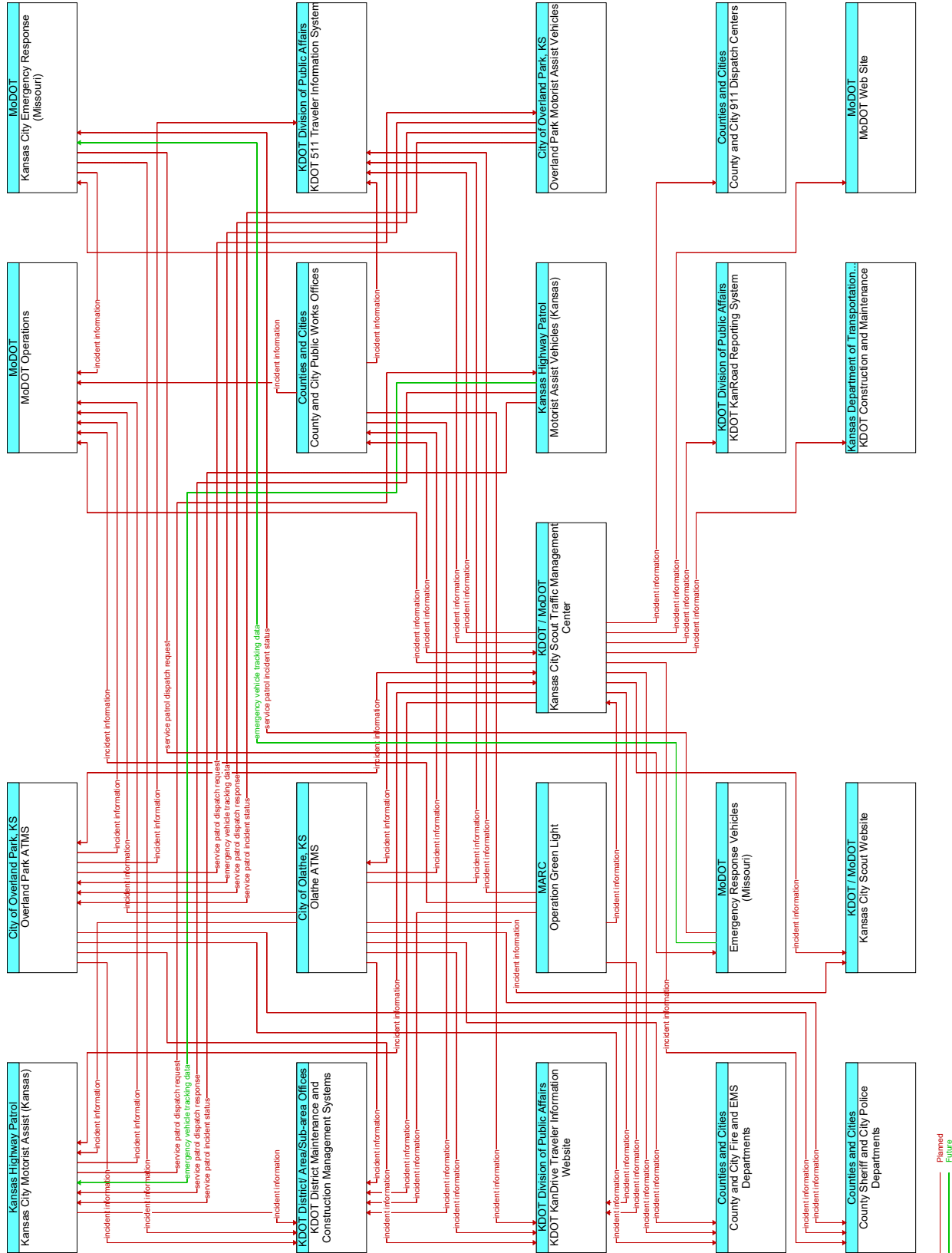


Figure 16 Service PS08 - Roadway Service Patrols

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- PS10 - Wide-Area Alert - This service package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public’s help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information web sites.

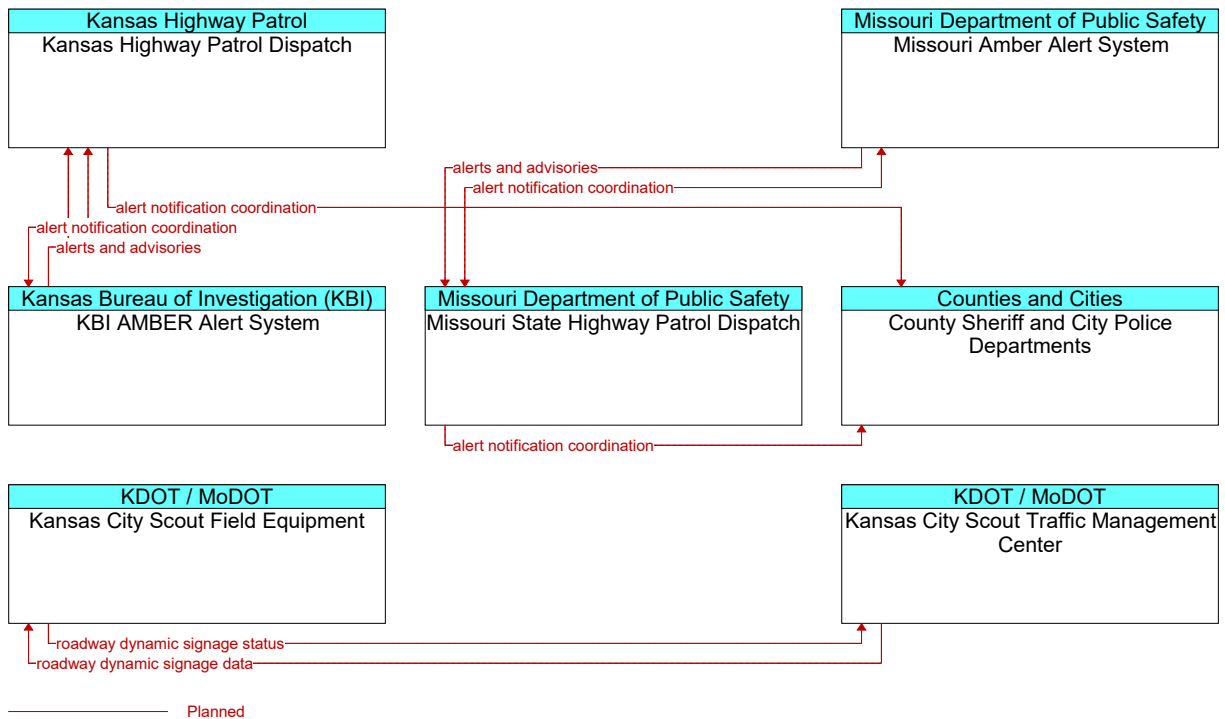


Figure 17 Service PS10 - Wide-Area Alert

- PS14 - Disaster Traveler Information – (2 diagrams) This service package 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. This service package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The

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collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This service package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster.

This service package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this service package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters.

This service package augments the Traveler Information (TI) service packages that provide traveler information on a day-to-day basis for the surface transportation system. This service package provides focus on the special requirements for traveler information dissemination in disaster situations.

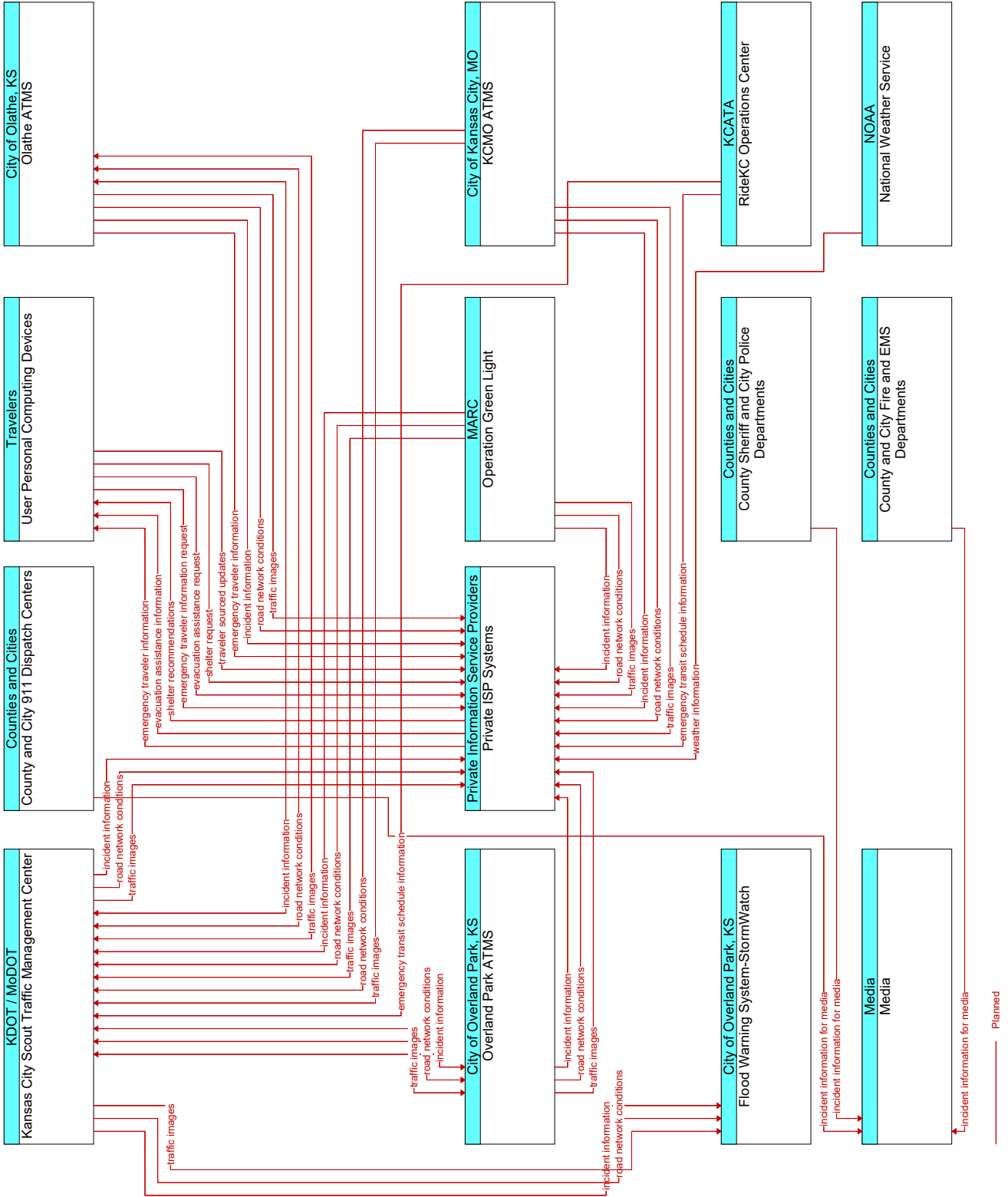


Figure 18 Service PS14 - Disaster Traveler Information (diagram 1)

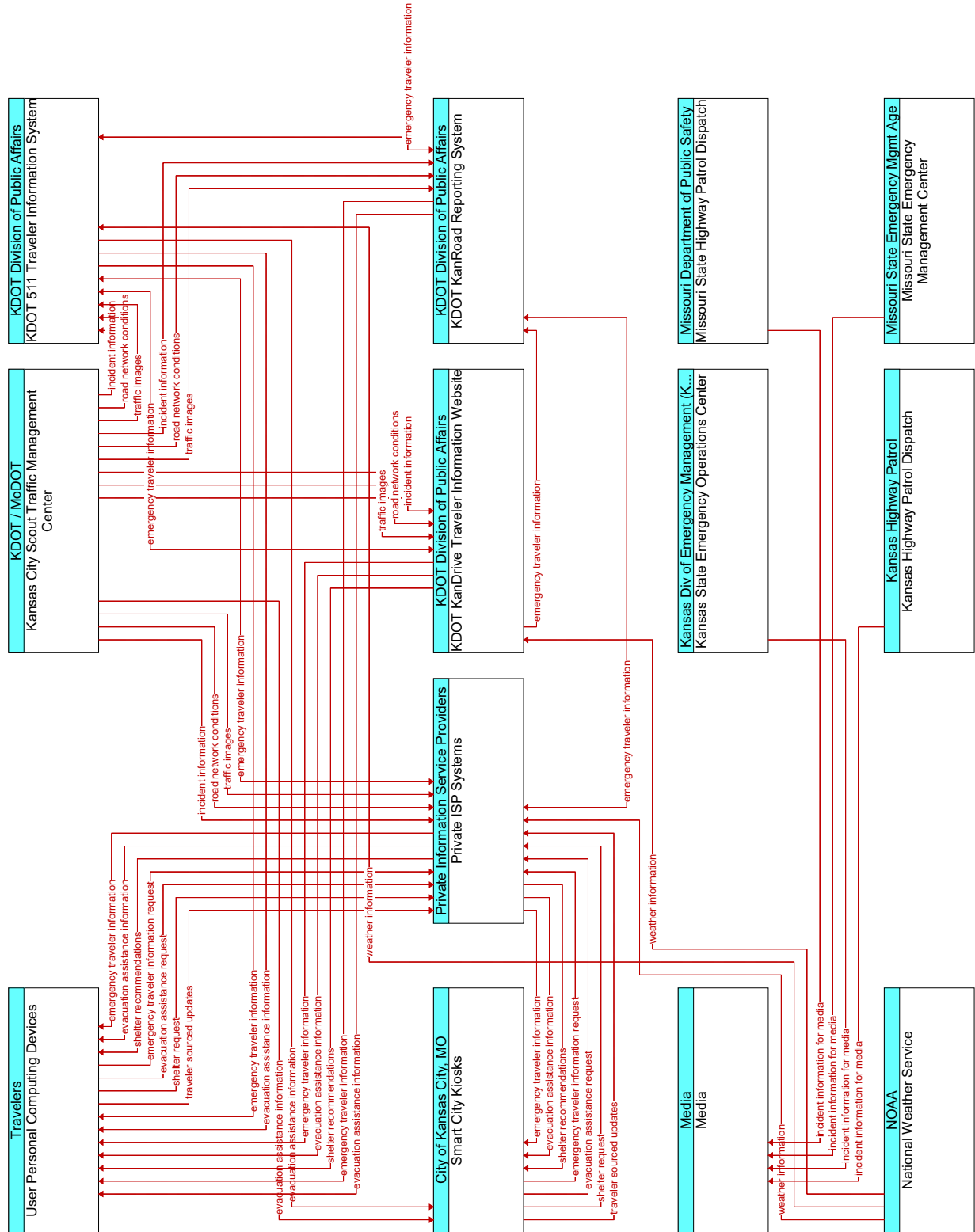


Figure 19 Service PS14 - Disaster Traveler Information (diagram 2)

Planned

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- PT14 - Multi-modal Coordination - This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

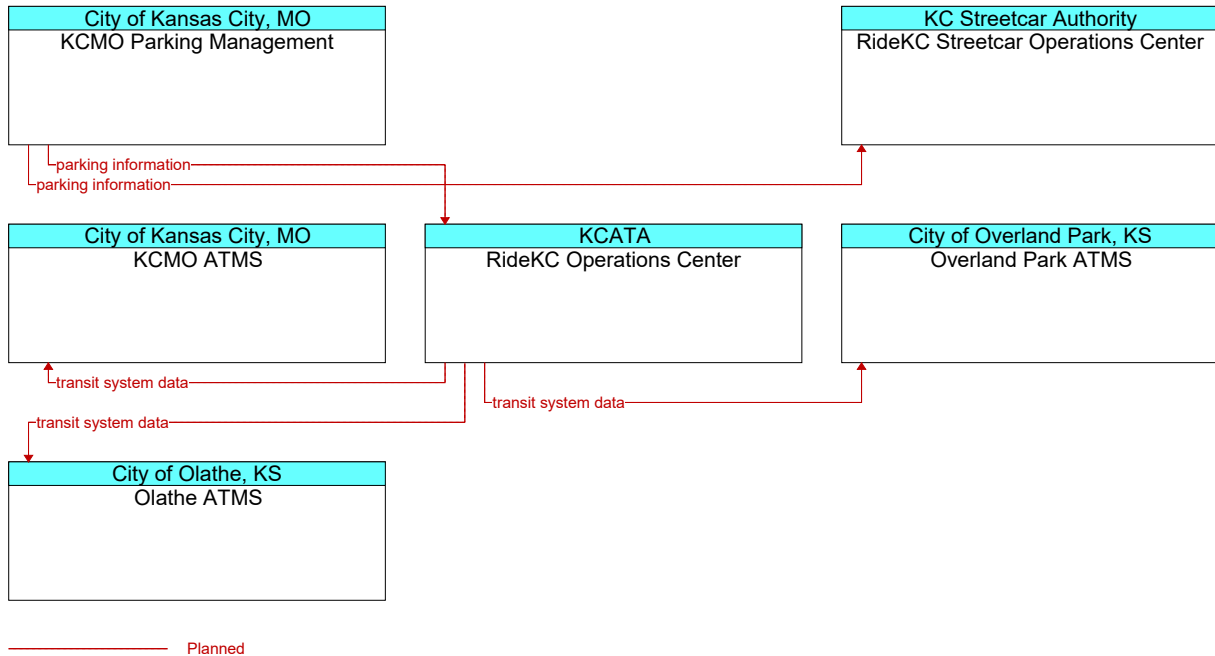


Figure 20 Service PT14 - Multi-modal Coordination

- TI01 - Broadcast Traveler Information - (2 diagrams) This service package provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies.

This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.

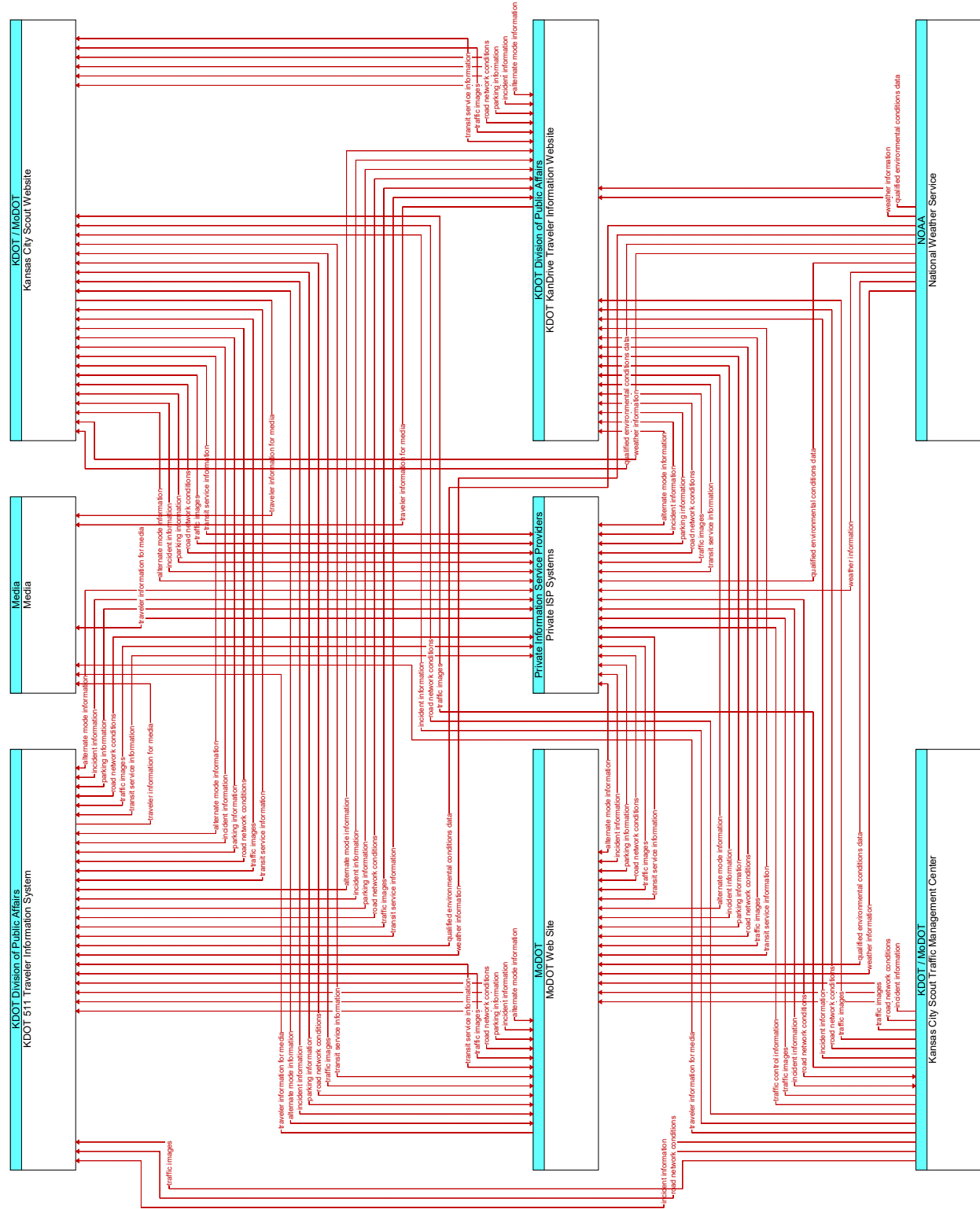


Figure 22 Service TI01 - Broadcast Traveler Information (diagram 2)

- **TM01 - Infrastructure-Based Traffic Surveillance - (2 diagrams)** This service package includes traffic detectors, other surveillance equipment, the supporting field equipment, and Center to Field communications to transmit the collected data back to the Traffic Management Center. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Center). The data generated by this service package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Traveler Information Center physical object.

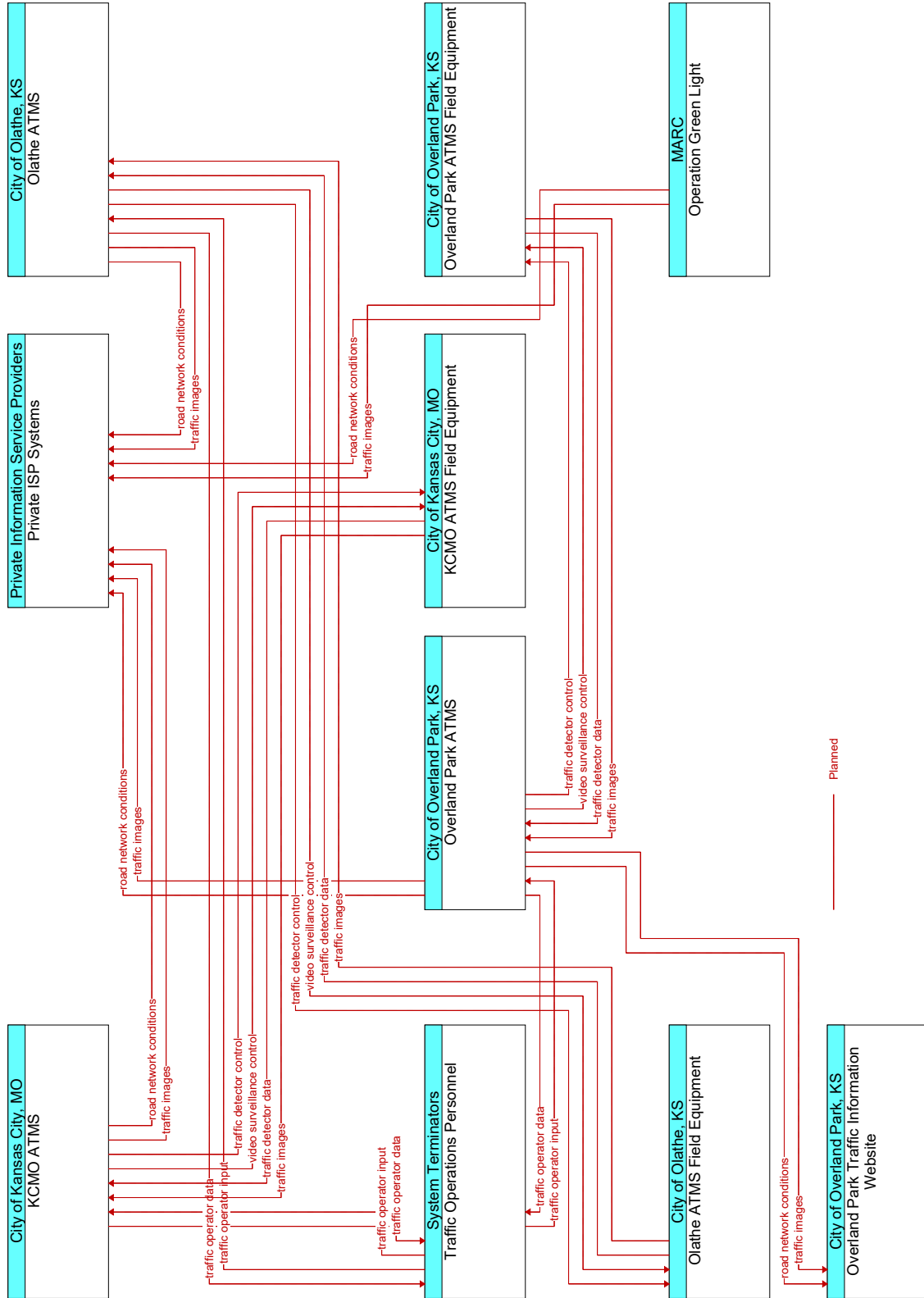


Figure 24 Service TM01 - Infrastructure-Based Traffic Surveillance (diagram 2)

- **TM05 - Traffic Metering** - This service package provides central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the TM01 service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.

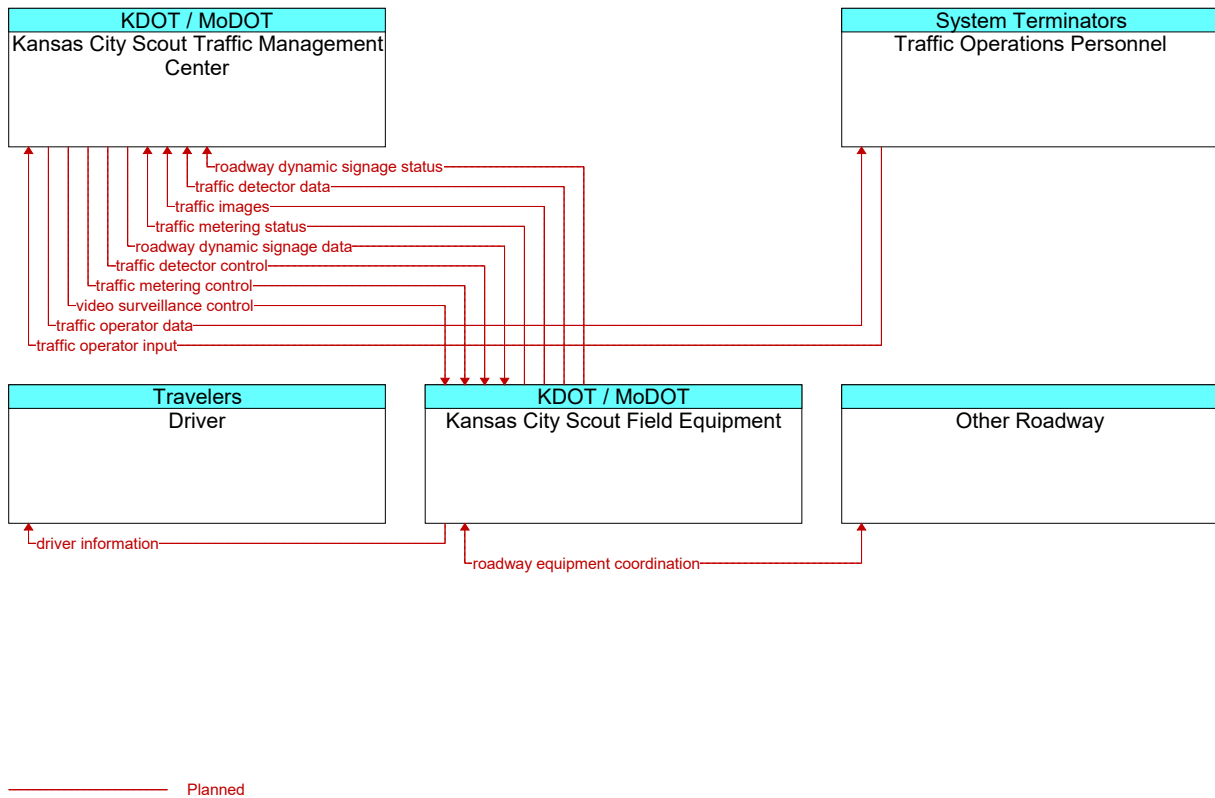


Figure 25 Service TM05 - Traffic Metering

- **TM06 - Traffic Information Dissemination** - (2 diagrams) This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at

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points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.

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supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

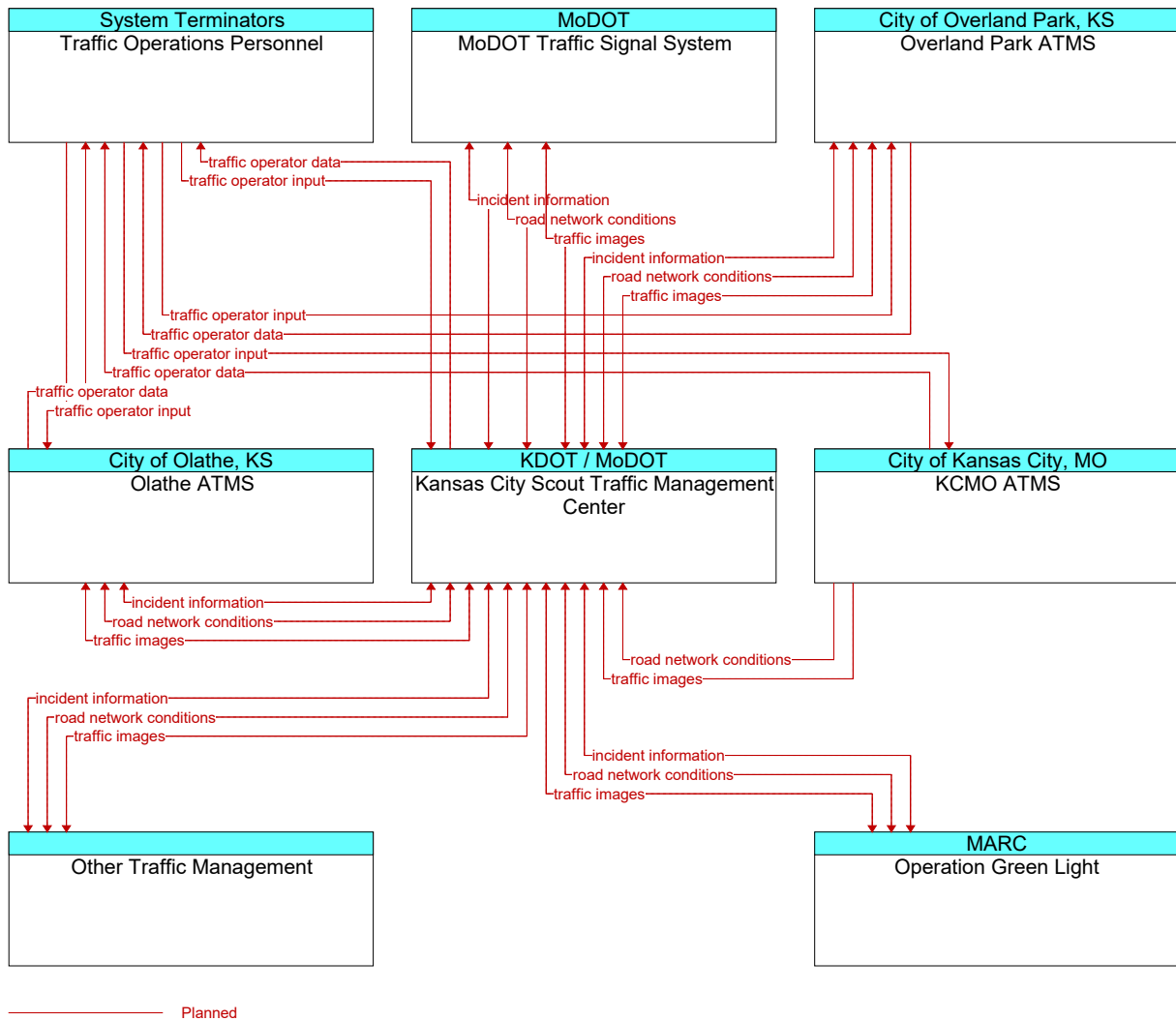


Figure 28 Service TM07 - Regional Traffic Management

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- **TM08 - Traffic Incident Management System - (7 diagrams)** This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this service package to detect and verify incidents and implement an appropriate response. This service package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between centers. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a Computer Aided Dispatch (CAD) system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

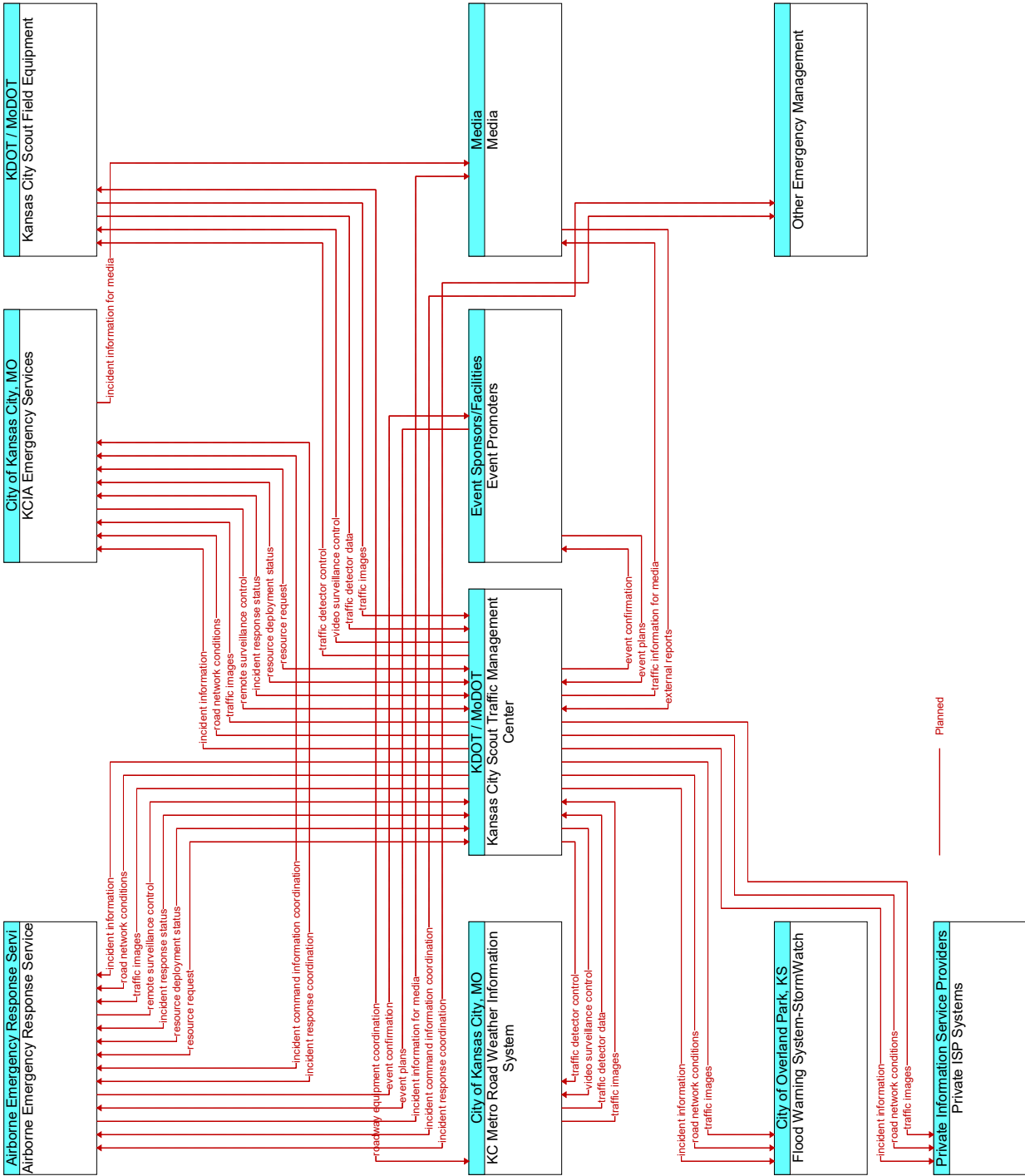


Figure 30 Service TM08 - Traffic Incident Management System (diagram 2)

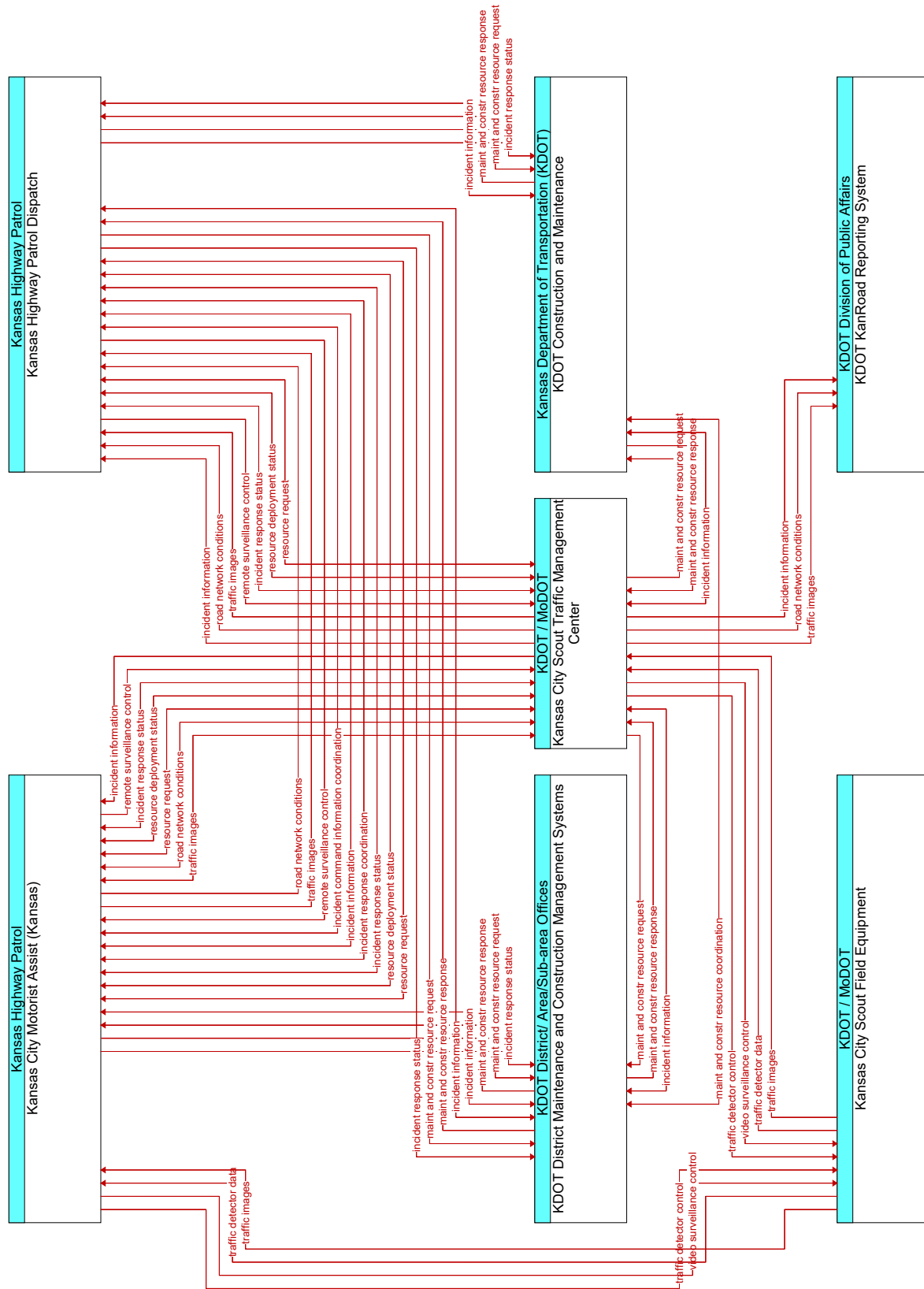


Figure 31 Service TM08 - Traffic Incident Management System (diagram 3)

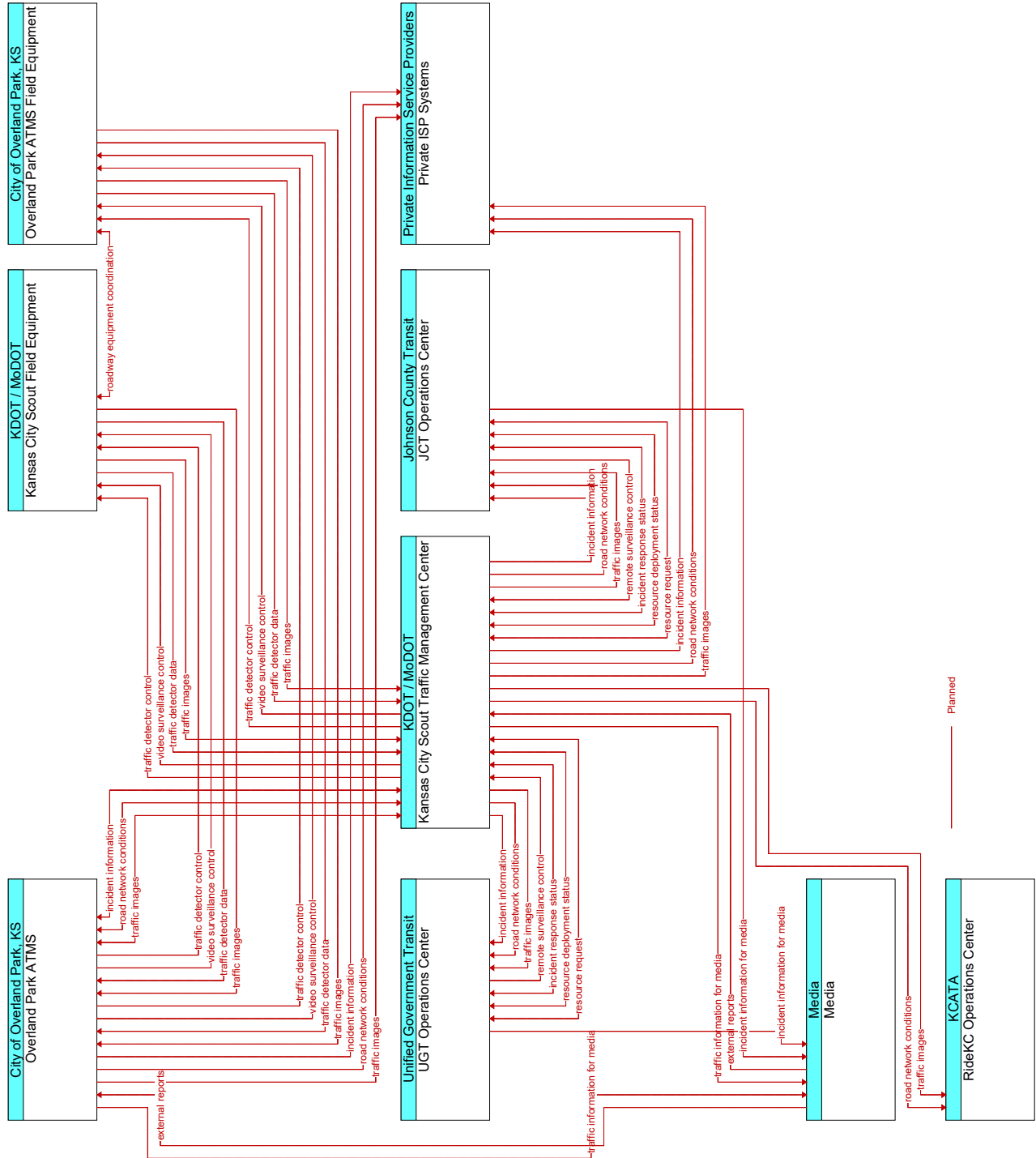


Figure 32 Service TM08 - Traffic Incident Management System (diagram 4)

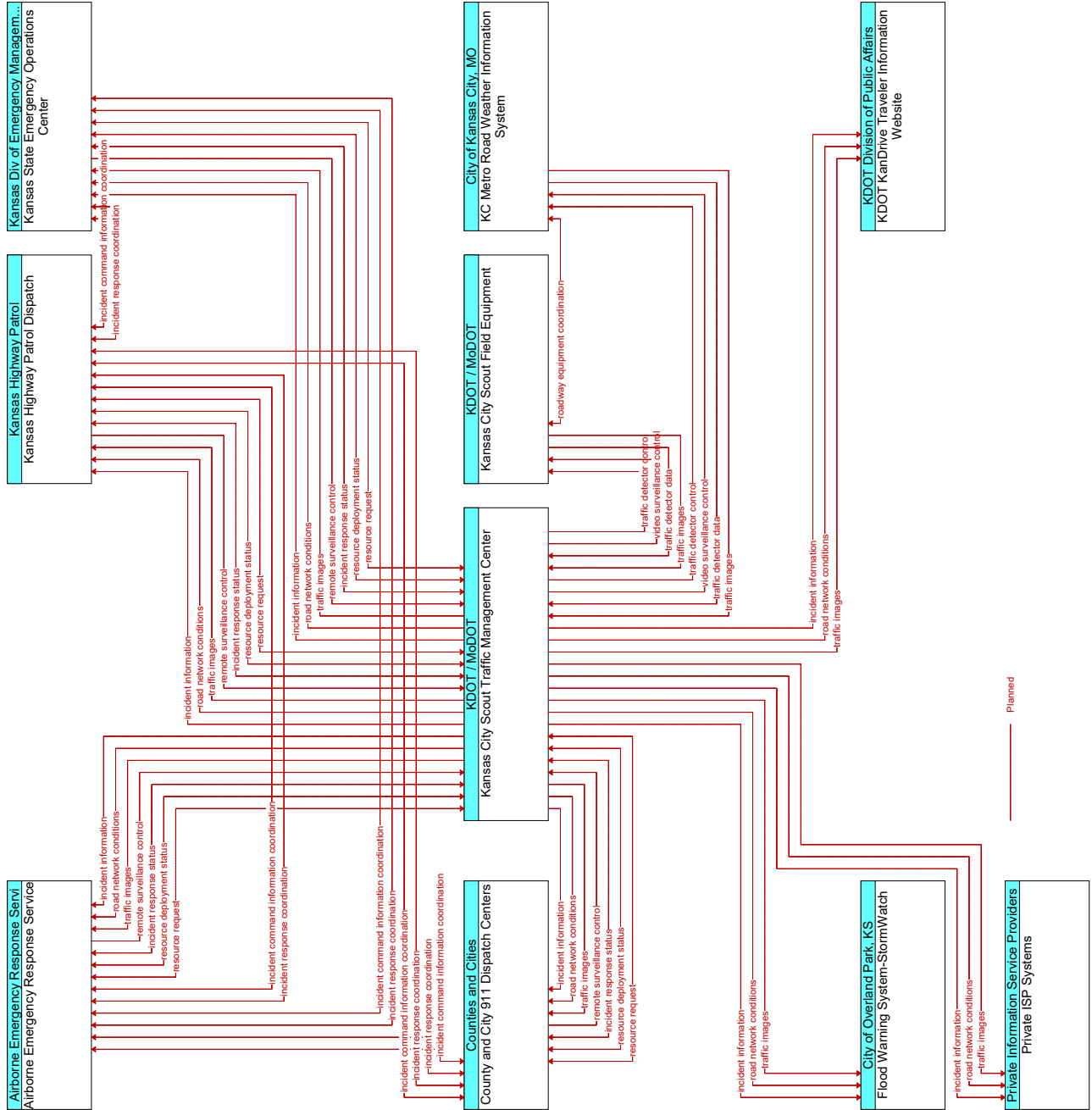


Figure 35 Service TM08 - Traffic Incident Management System (diagram 7)

3.1 Snow Plow Operations Coordination

Stakeholders: Kansas DOT, Missouri DOT, Cities and Counties, KTA, Private Information Service Providers

Description: Snow Plow Operations involved every agency in the region during snow storms. To travelers, road jurisdictions do not exist and coordinated snow plow operations can improve road conditions available throughout the region.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- MC04 - Winter Maintenance

Service Diagrams:

- MC04 - Winter Maintenance - This service package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.

3.2 Connected and Automated Vehicle Support Plan Development

Stakeholders: Kansas DOT, Missouri DOT, Cities and Counties, KCATA, MARC

Description: Develop a plan for supporting connected and automated vehicles in the Kansas City region. The plan should specifically identify initial deployment opportunities within the region as first steps. Numerous functional definitions of connected and autonomous vehicle opportunities have been defined in the 2018 Kansas City ITS Architecture that can be used to scope the candidates and develop the institutional framework within which the projects will be implemented. The deployment of vehicle to infrastructure equipment will be necessary to realize many of the connected vehicle applications. The plan should evolutionary in nature providing guidance on attainable implementations and establishing the supporting infrastructure required to sustain deployment. The scope of this project will include:

- Assessment of existing ITS available in region- Identification of regional transportation needs that can be addressed by connected and automated vehicles
- Evaluation of connected vehicle applications to identify beneficial services
- Definition of connected and autonomous vehicle roadmap for region
Recommendations for next steps

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- MC06 - Work Zone Management (with CV)
- MC07 - Work Zone Safety Monitoring
- MC09 - Infrastructure Monitoring
- PM01 - Parking Space Management (With CV)
- PM03 - Parking Electronic Payment (With CV)
- PS03 - Emergency Vehicle Preemption
- PT09 - Transit Signal Priority
- PT10 - Intermittent Bus Lanes (with CV)
- SU03 - Data Distribution (CV)
- SU06 - Object Registration and Discovery
- SU08 - Security and Credentials Management
- TI07 - In-Vehicle Signage
- TM02 - Vehicle-Based Traffic Surveillance
- TM04 - Connected Vehicle Traffic Signal System
- TM22 - Dynamic Lane Management and Shoulder Use (CV)
- VS13 - Intersection Safety Warning and Collision Avoidance
- VS16 - Automated Vehicle Operations

Service Diagrams:

- MC06 - Work Zone Management (with CV) - This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway

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Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

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- MC07 - Work Zone Safety Monitoring - This service package provides warnings to maintenance personnel within a work zone about potential hazards within the work zone. It enables vehicles or the infrastructure to provide warnings to workers in a work zone when a vehicle is moving in a manner that appears to create an unsafe condition (e.g., moving at high speed or entering the work zone).

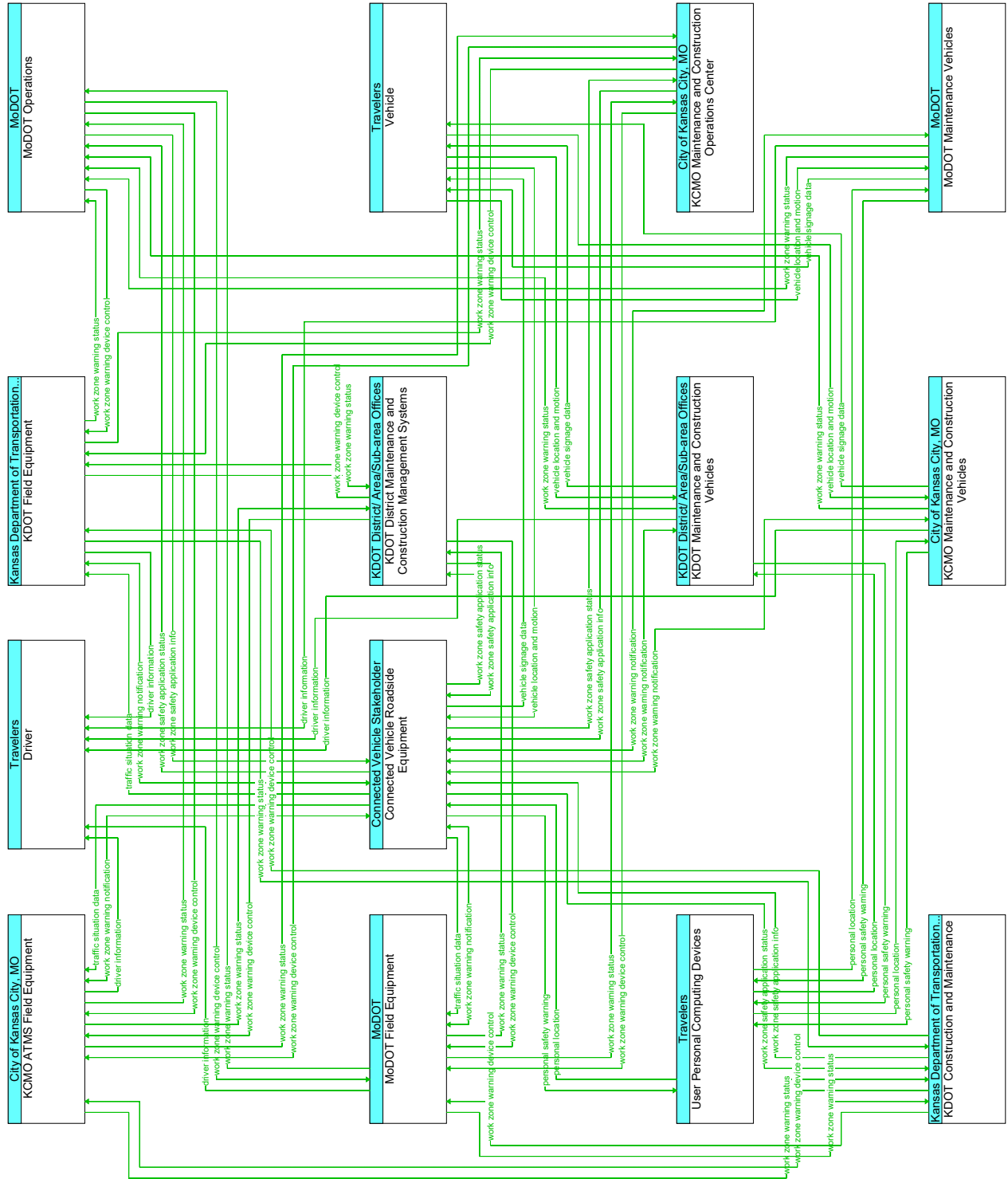


Figure 38 Service MC07 - Work Zone Safety Monitoring

- MC09 - Infrastructure Monitoring - This service package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts) using both fixed and vehicle-based infrastructure monitoring sensors. Fixed sensors monitor vibration, stress, temperature, continuity, and other parameters and mobile sensors and data logging devices collect information on current infrastructure condition. This service package also monitors vehicle probes for vertical acceleration data and other probe data that may be used to determine current pavement condition.

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- PM01 - Parking Space Management (With CV) - This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.

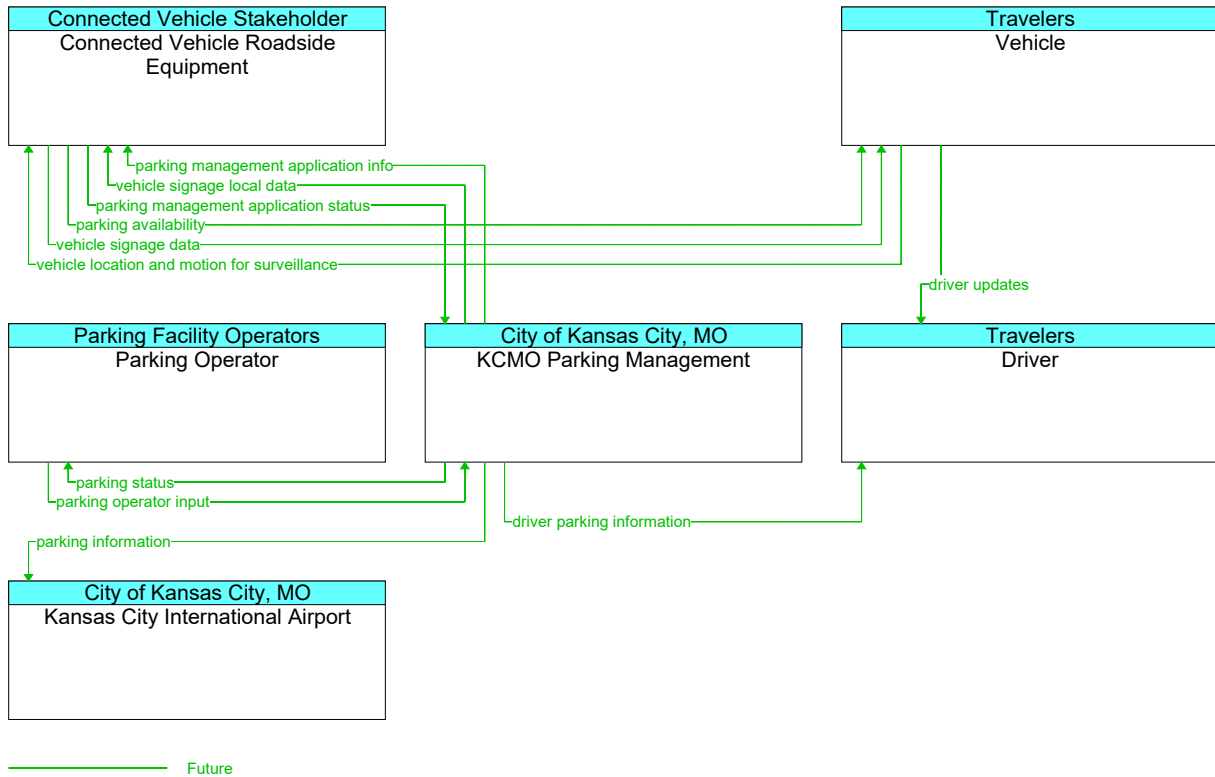


Figure 40 Service PM01 Parking Space Management

- PM03 - Parking Electronic Payment (With CV) - This service package supports electronic collection of parking fees. It collects parking fees from in-vehicle equipment, contact or proximity cards, or any smart payment device. User accounts may be established to enhance services offered to frequent customers.

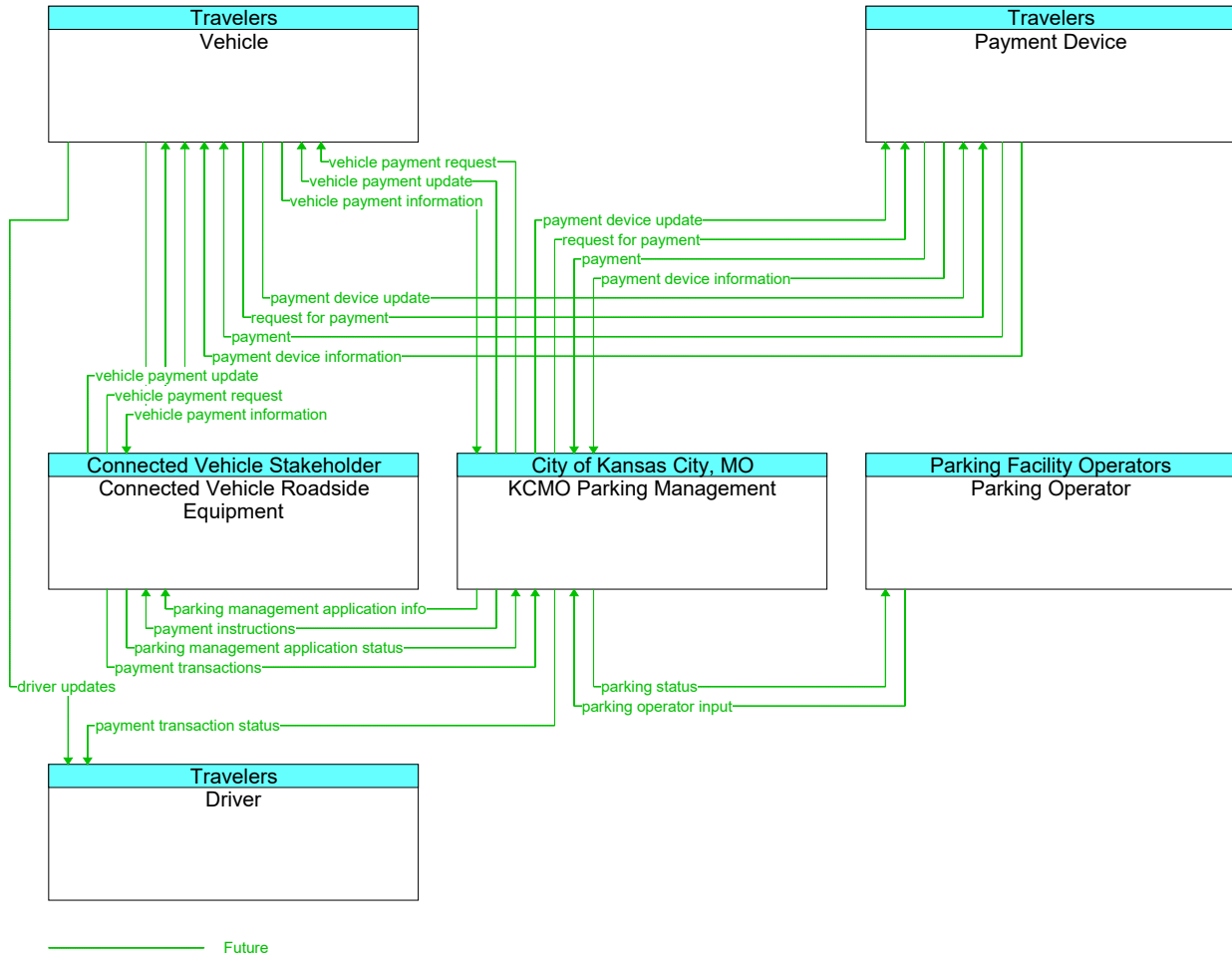


Figure 41 Service PM03 - Parking Electronic Payment (With CV)

- PS03 - Emergency Vehicle Preemption - This service package provides signal preemption for public safety first responder vehicles. Both traditional signal preemption systems and new systems based on connected vehicle technology are covered. In more advanced systems, movement of public safety vehicles through the intersection can be facilitated by clearing queues and holding conflicting phases. In addition, this SP also covers the transition back to normal traffic signal operations after providing emergency vehicle preemption.

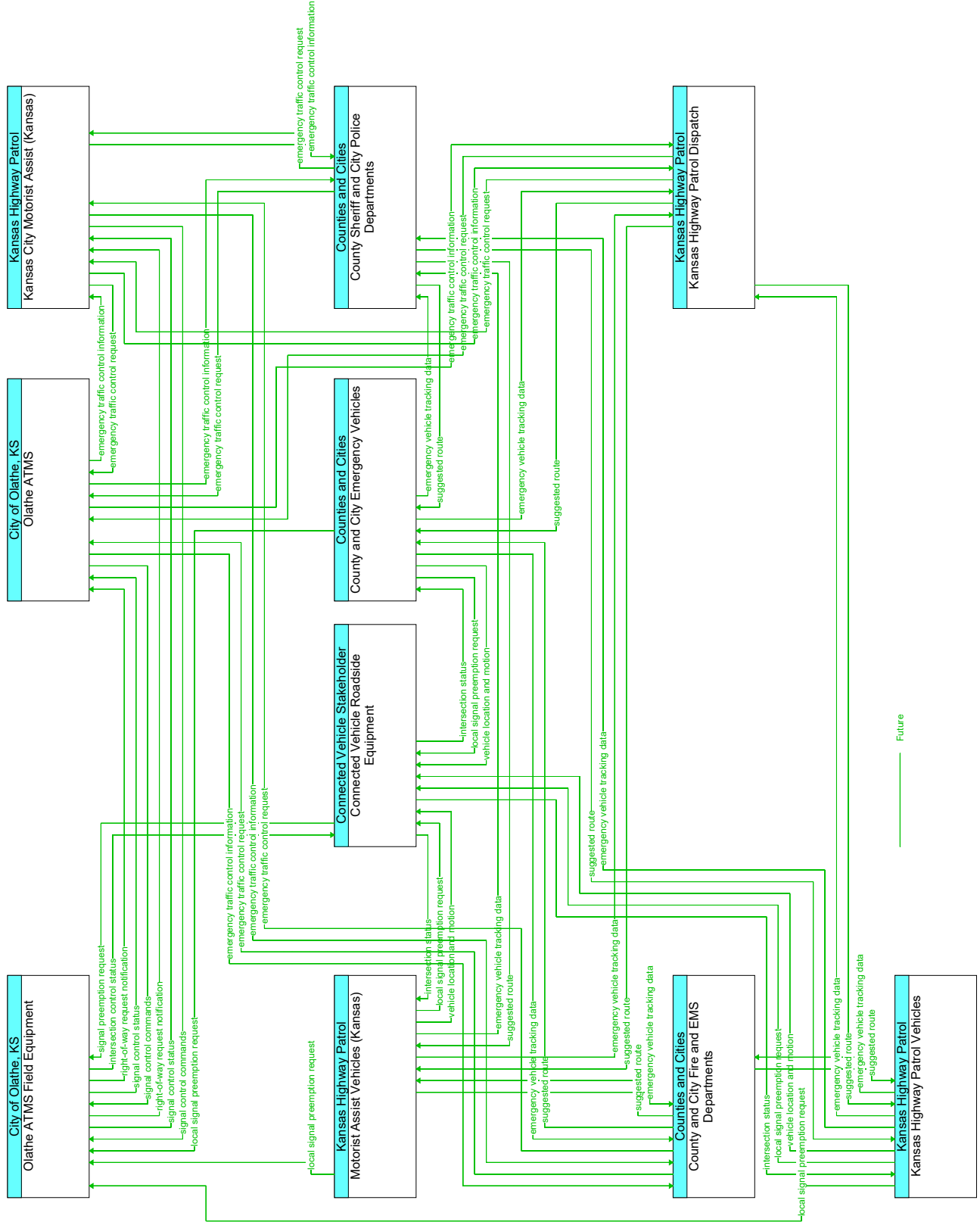


Figure 42 Service PS03 - Emergency Vehicle Preemption (Olathe with CV)

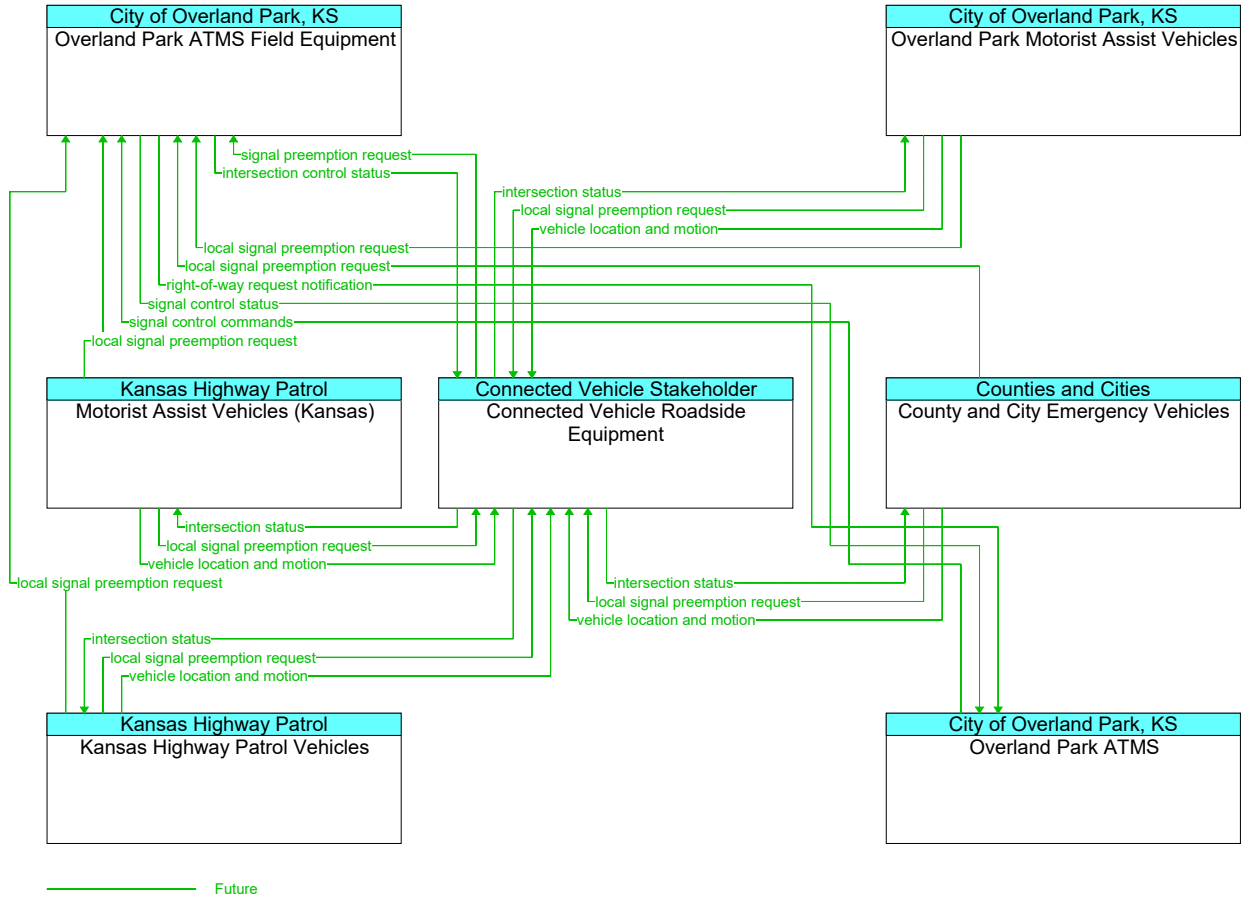


Figure 43 Service PS03 - Emergency Vehicle Preemption (Overland Park with CV)

- **PT09 - Transit Signal Priority** - The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.

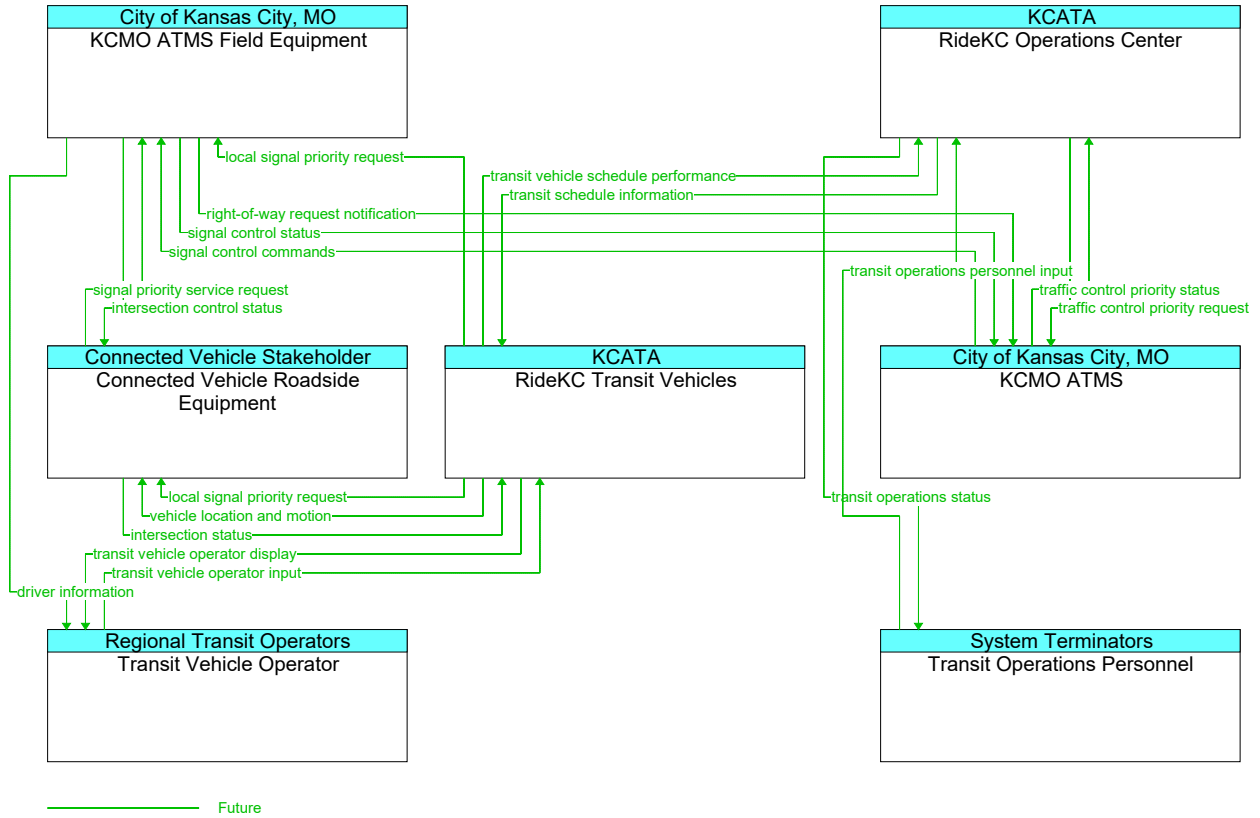


Figure 44 Service PT09 Transit Signal Priority (KCMO with CV)

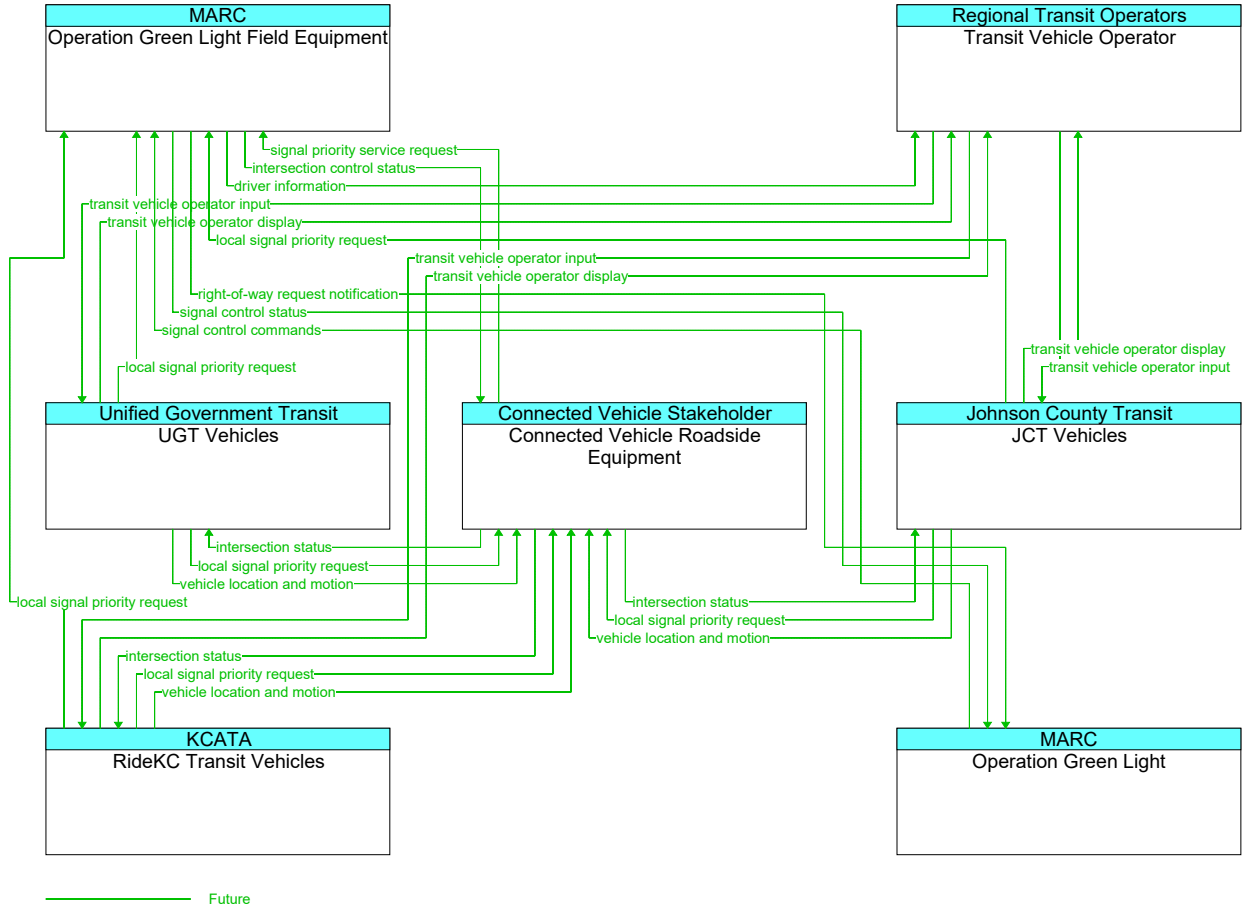


Figure 45 Service PT09 Transit Signal Priority (OGL with CV)

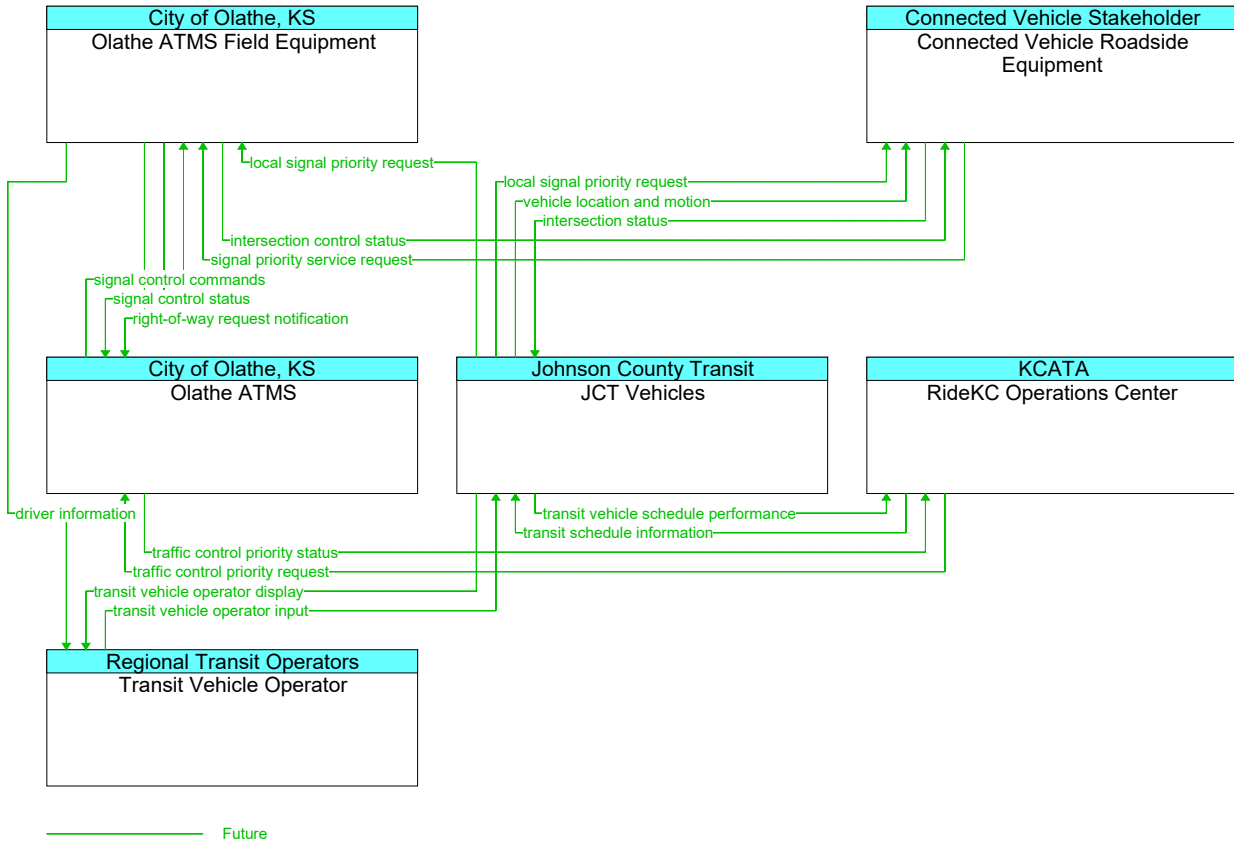


Figure 46 Service PT09 Transit Signal Priority (Olathe with CV)

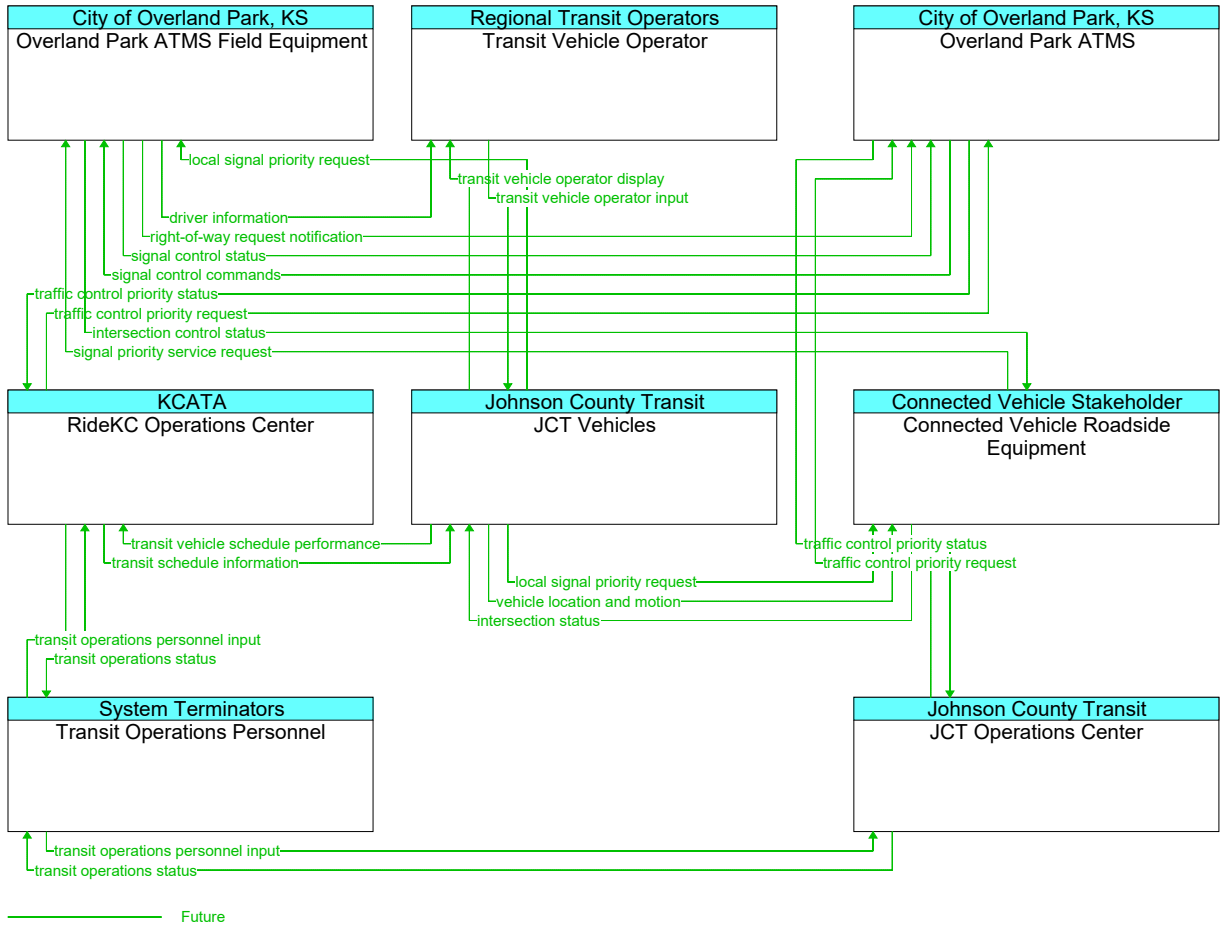


Figure 47 Service PT09 Transit Signal Priority (Overland Park with CV)

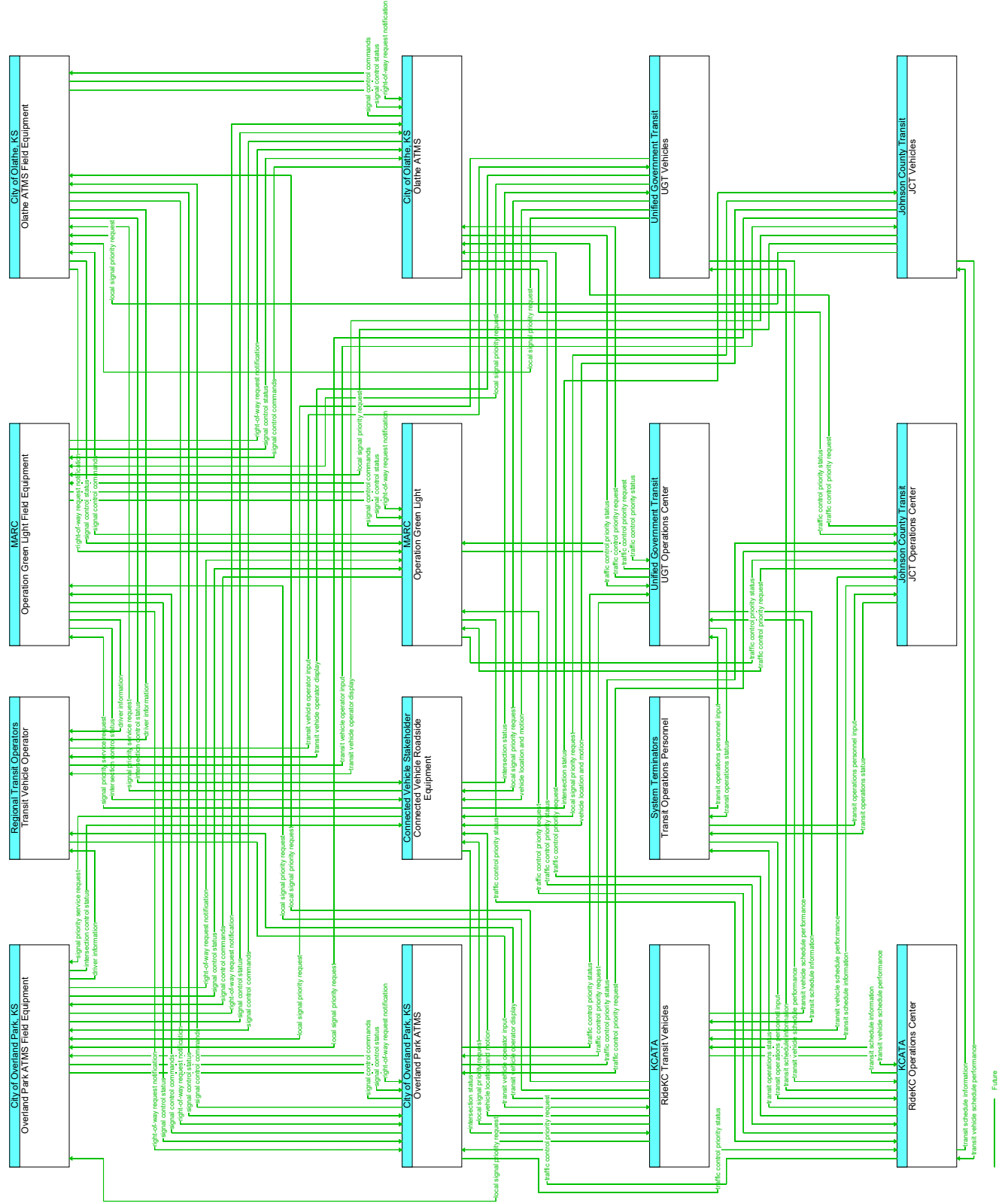


Figure 48 Service PT09 Transit Signal Priority (with CV)

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- PT10 - Intermittent Bus Lanes (with CV) - This service package provides dedicated bus lanes during peak demand times to enhance transit operations mobility. An intermittent bus lane is a lane that can change its status from regular lane (accessible for all vehicles) to bus lane, for the time strictly necessary for a bus or set of buses to pass. The status of the IBL is communicated to drivers using roadside message signs and through in-vehicle signage. The creation and removal of dedicated bus lanes is managed through coordination between traffic and transit centers.

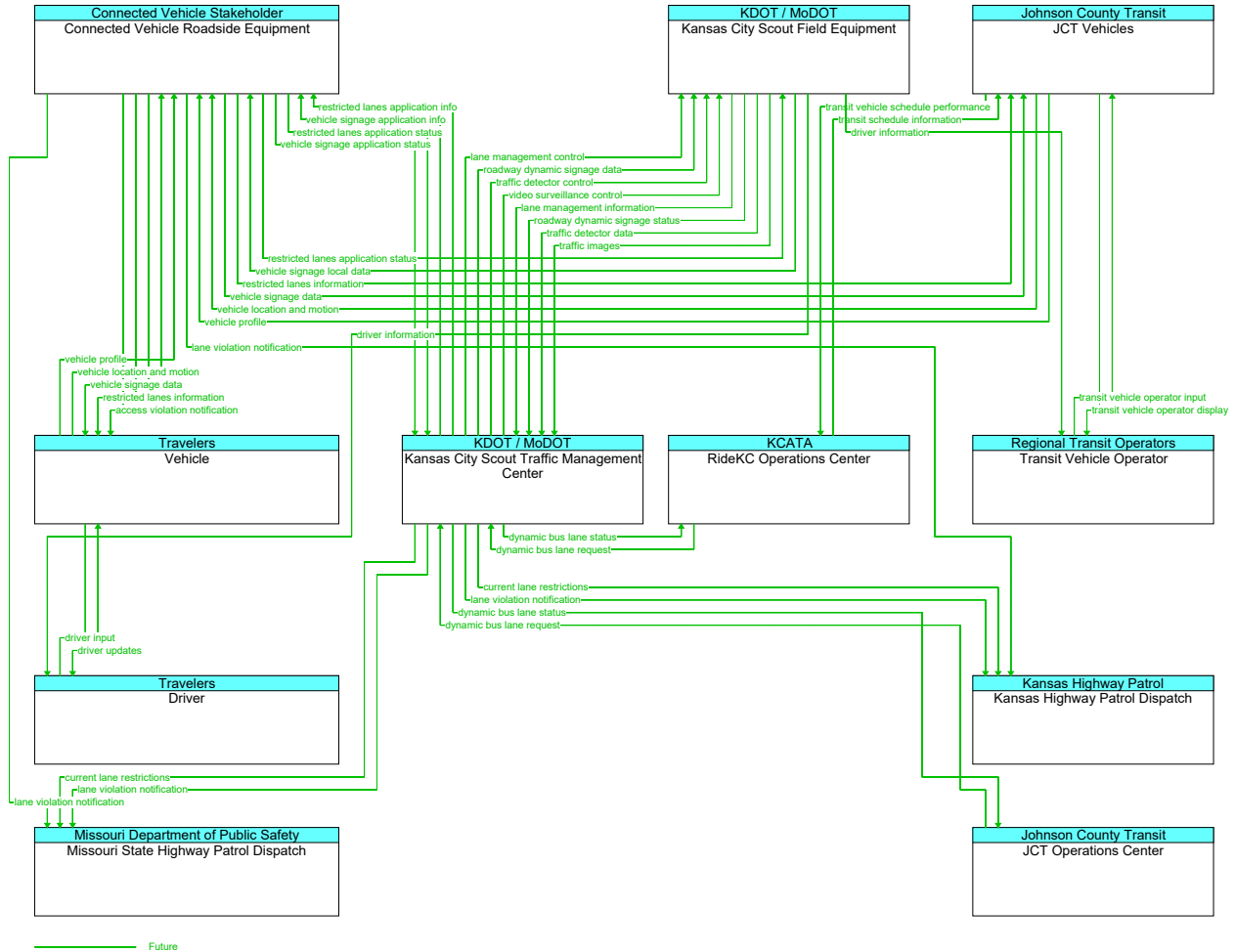


Figure 49 Service PT10 Intermittent Bus Lanes (with CV)

- SU03 - Data Distribution (CV) - This service package manages the distribution of data from data providers to data consumers and protects those data from unauthorized access. It informs data providers of how to provide data, manages data subscriptions, and provides data forwarding capabilities. The service package also maintains a directory of System Users that want data and supports multiple distribution mechanisms including publish-subscribe and directly from data provider to data consumer. It allows data consumers to specify (and change the specification of) data they wish to receive.

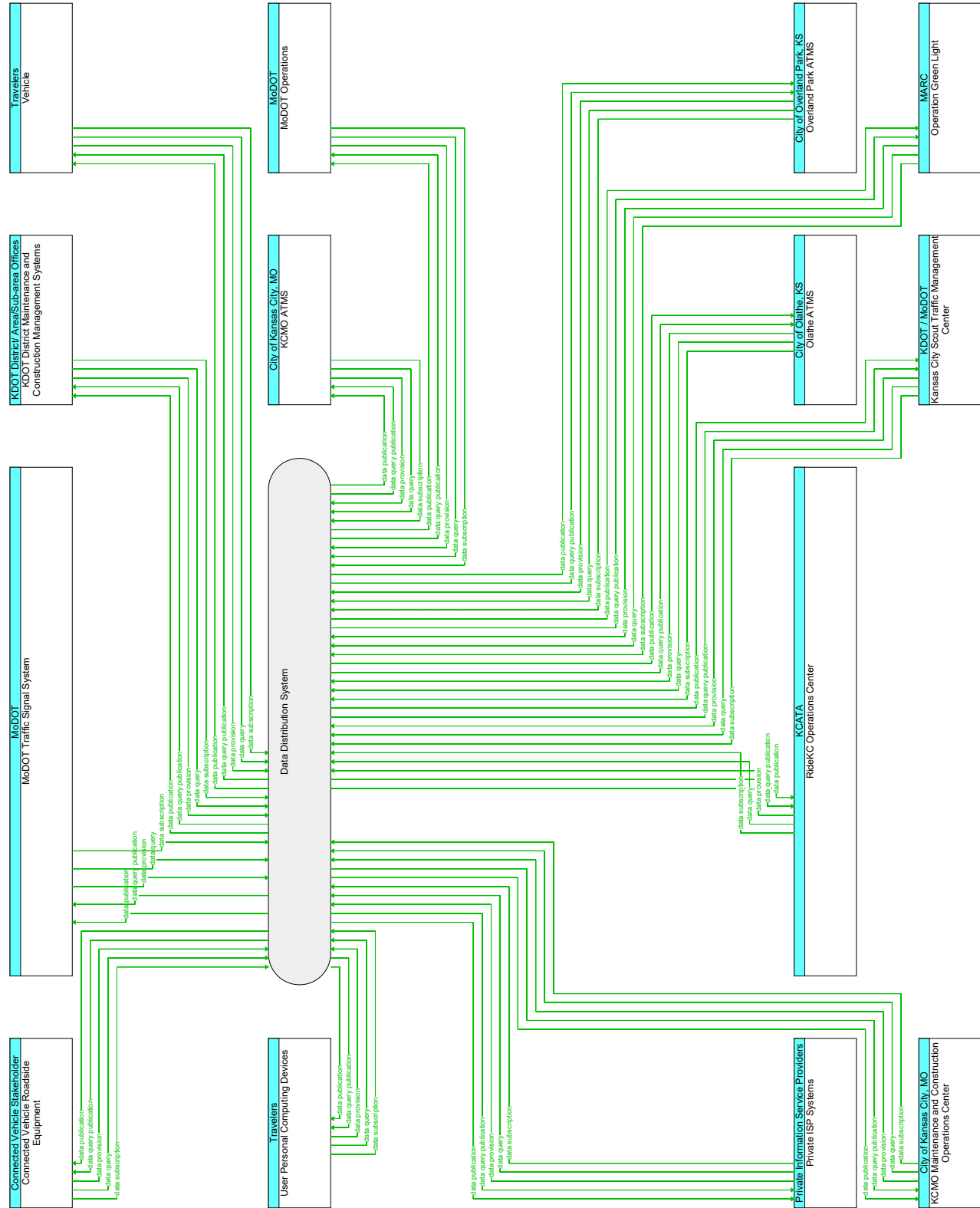


Figure 50 Service SU03 Data Distribution (CV)

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- SU06 - Object Registration and Discovery - This service package provides registration and lookup services necessary to allow objects to locate other objects operating within the Connected Vehicle Environment.

An object registry is like a phone book for all the connected centers, systems, and equipment in the transportation system (the “objects”). In this service package, each object registers itself with the ORDS and tells the registry where it lives in the communication network (e.g., host, port, node name) and information about the services it provides - information that other objects can use to determine the type of service, the geographic scope of the service, and other information that helps users of the registry to make informed decisions about which object(s) support a needed service or information stream. This is the “Discovery” part of the service. Connected objects can use the registry to find (discover) objects that can be used to get needed information or services.

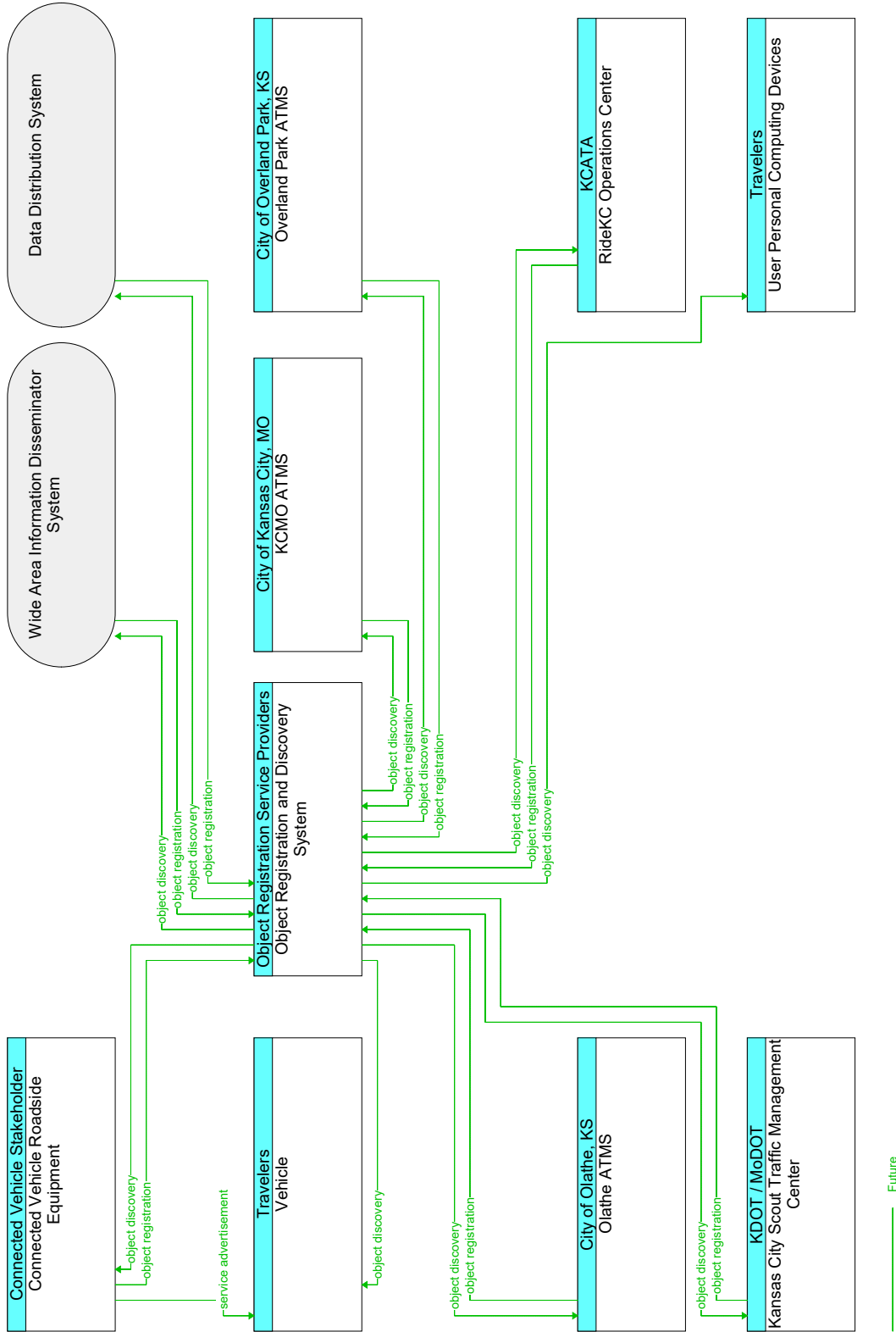


Figure 51 Service SU06 Object Registration and Discovery

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- SU08 - Security and Credentials Management - This service package is used to ensure trusted communications between mobile devices and other mobile devices or roadside devices and protect data they handle from unauthorized access. The service package grants trust credentials to qualified mobile devices and infrastructure devices in the Connected Vehicle Environment so that those devices may be considered trusted by other devices that receive trust credentials from the SCM service package. The service package allows credentials to be requested and revoked and secures the exchange of trust credentials between parties, so that no other party can intercept and use those credentials illegitimately. The service package provides security to the transmissions between connected devices, ensuring authenticity and integrity of the transmissions. Additional security features include privacy protection, authorization and privilege class definition, as well as non-repudiation of origin.

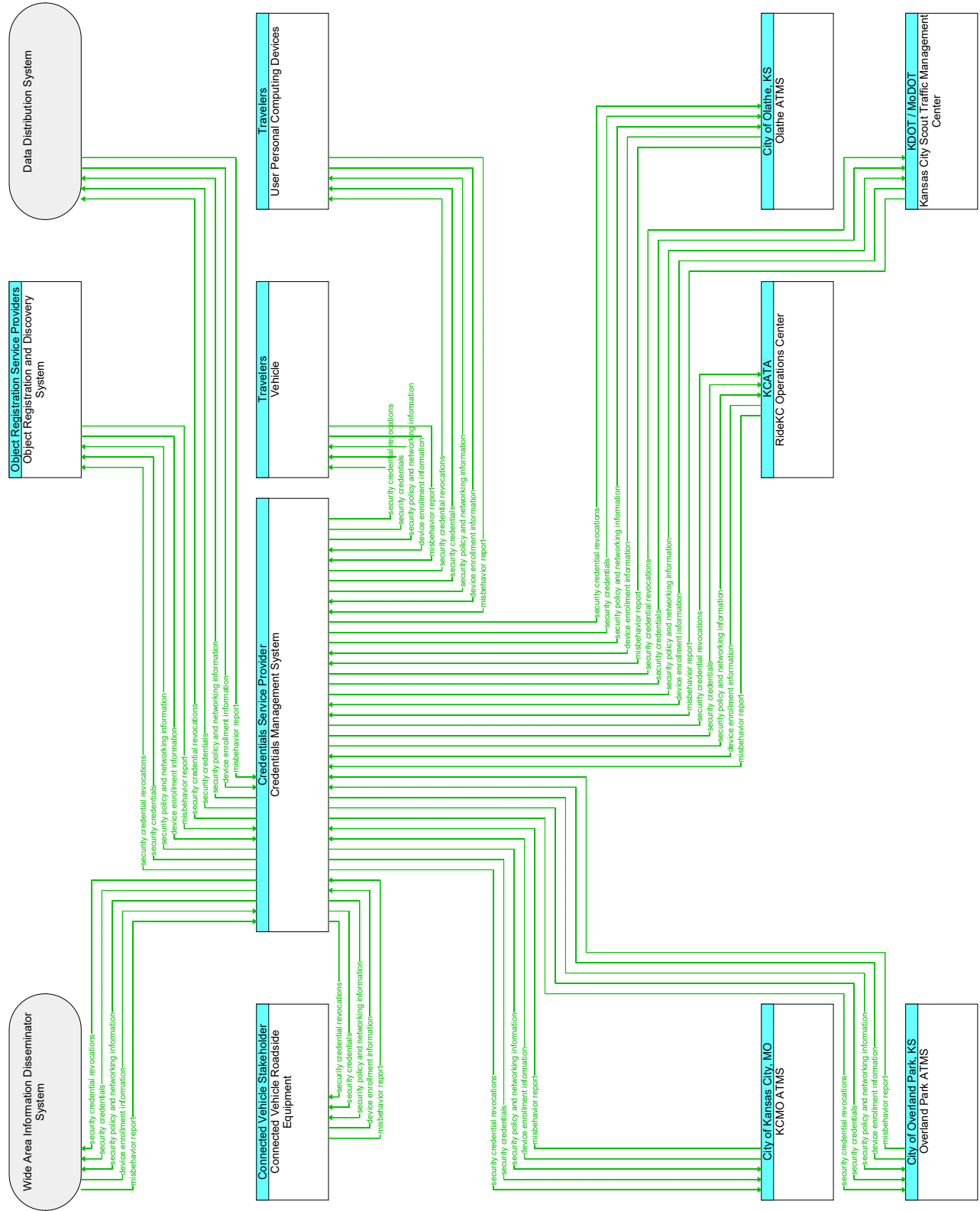


Figure 52 Service SU08 Security and Credentials Management

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- T107 - In-Vehicle Signage – (2 diagrams) This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.

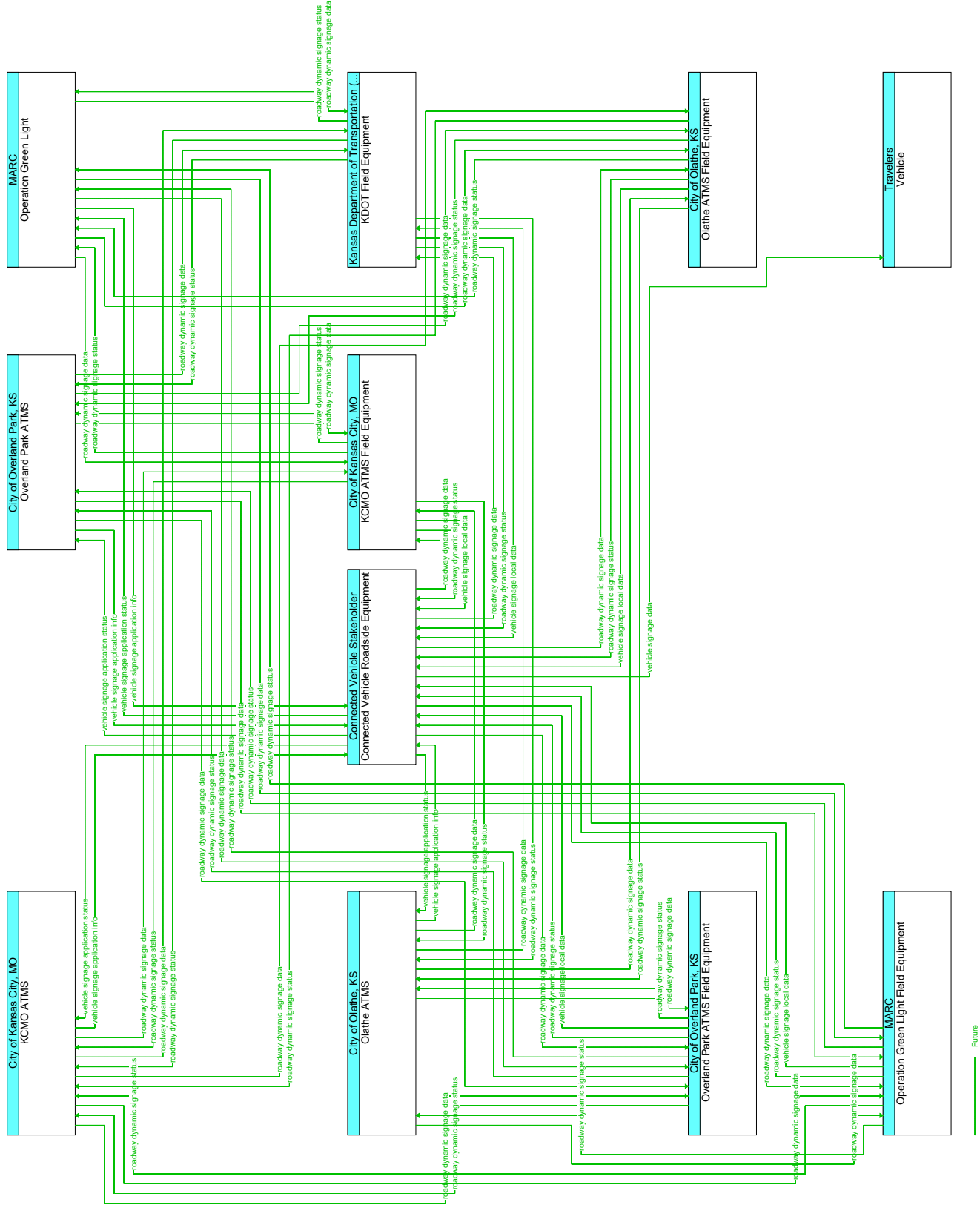


Figure 53 Service T107 In-Vehicle Signage (diagram 1)

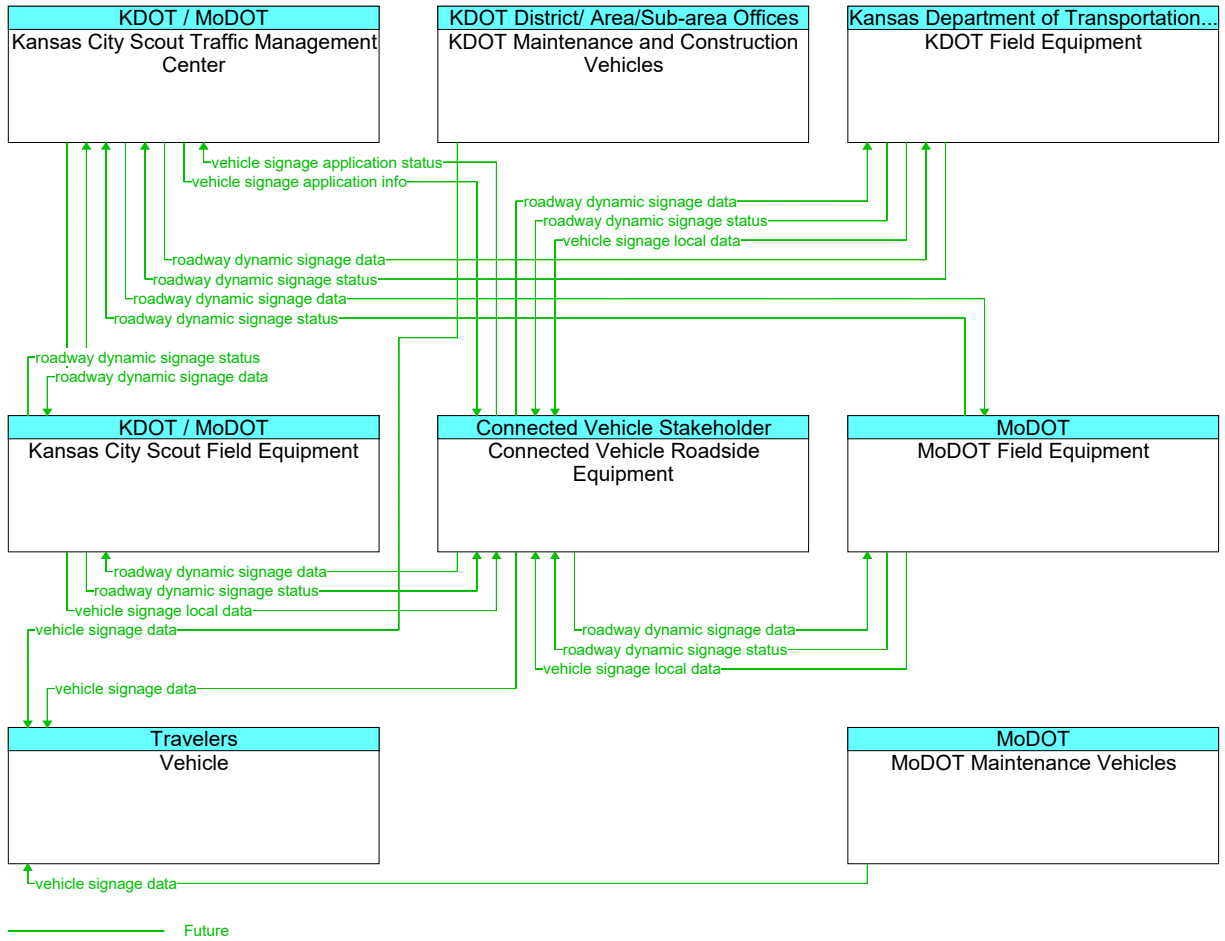


Figure 54 Service TI07 In-Vehicle Signage (diagram 2)

- **TM02 - Vehicle-Based Traffic Surveillance** - This service package uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies. Since traffic data is collected from vehicles, travel times and other related traffic performance measures are available. This service package includes the capability to collect data from Connected Vehicles so that "probe" data can be collected from all equipped vehicles, providing access to a large vehicle population as penetration increases. Incident detection enables transportation agencies to determine the location of potential incidents so the agencies can respond more quickly to the incident and mitigate any negative impacts to the transportation network. Vehicle data that can be used to detect potential incidents include changes in vehicle speeds indicating the disruption of traffic flow, when a vehicle's safety systems have been activated or deployed, or sudden vehicle turns or deceleration at a specific location (indicating a potential obstacle in the roadway).

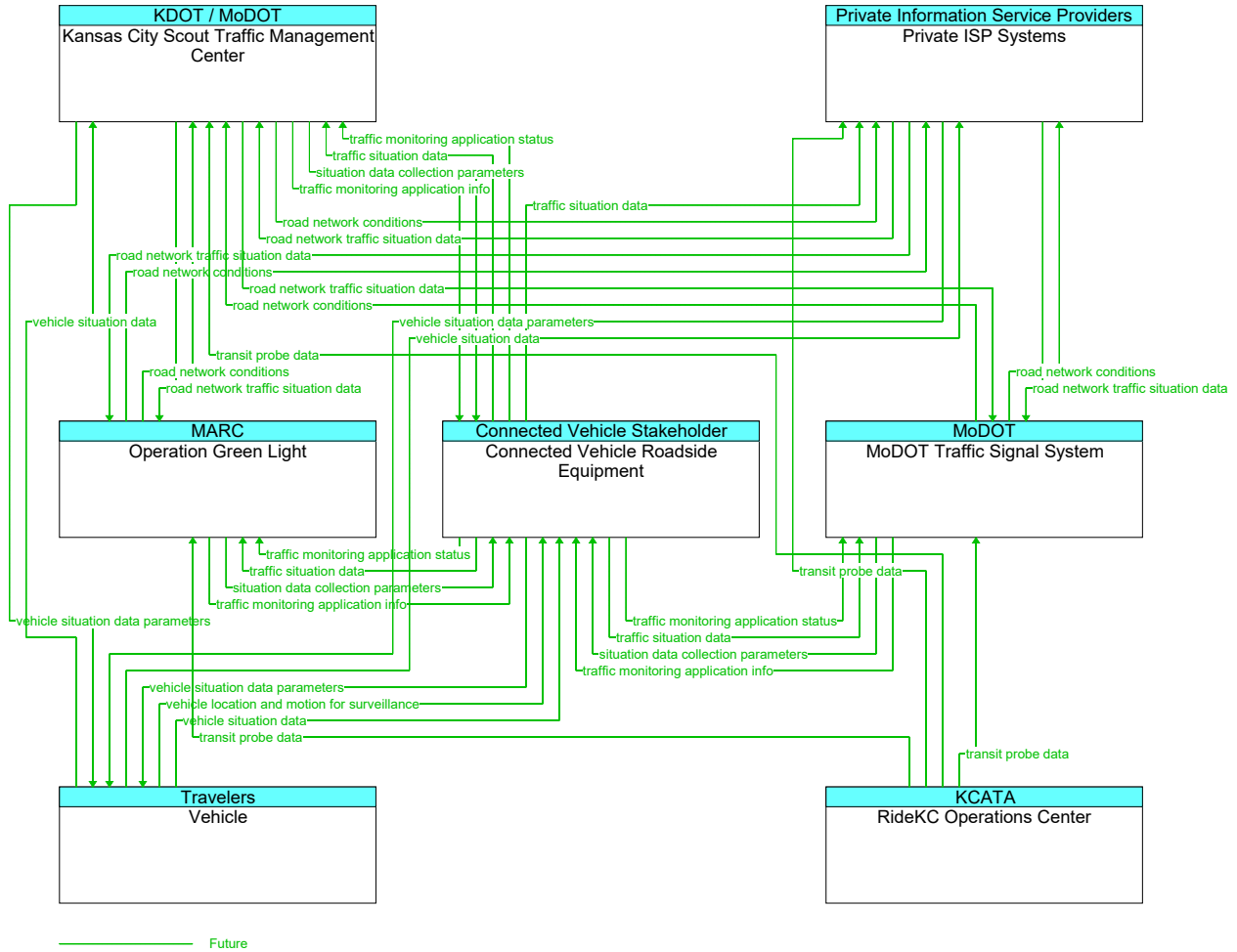


Figure 55 Service TM02 Vehicle-Based Traffic Surveillance

- **TM04 - Connected Vehicle Traffic Signal System – (5 diagrams)** This service package uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The service package utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. Other service package provide related mobility services such as Transit Signal Priority, Freight Signal Priority, Emergency Vehicle Preemption, and Pedestrian Mobility to maximize overall arterial network performance.

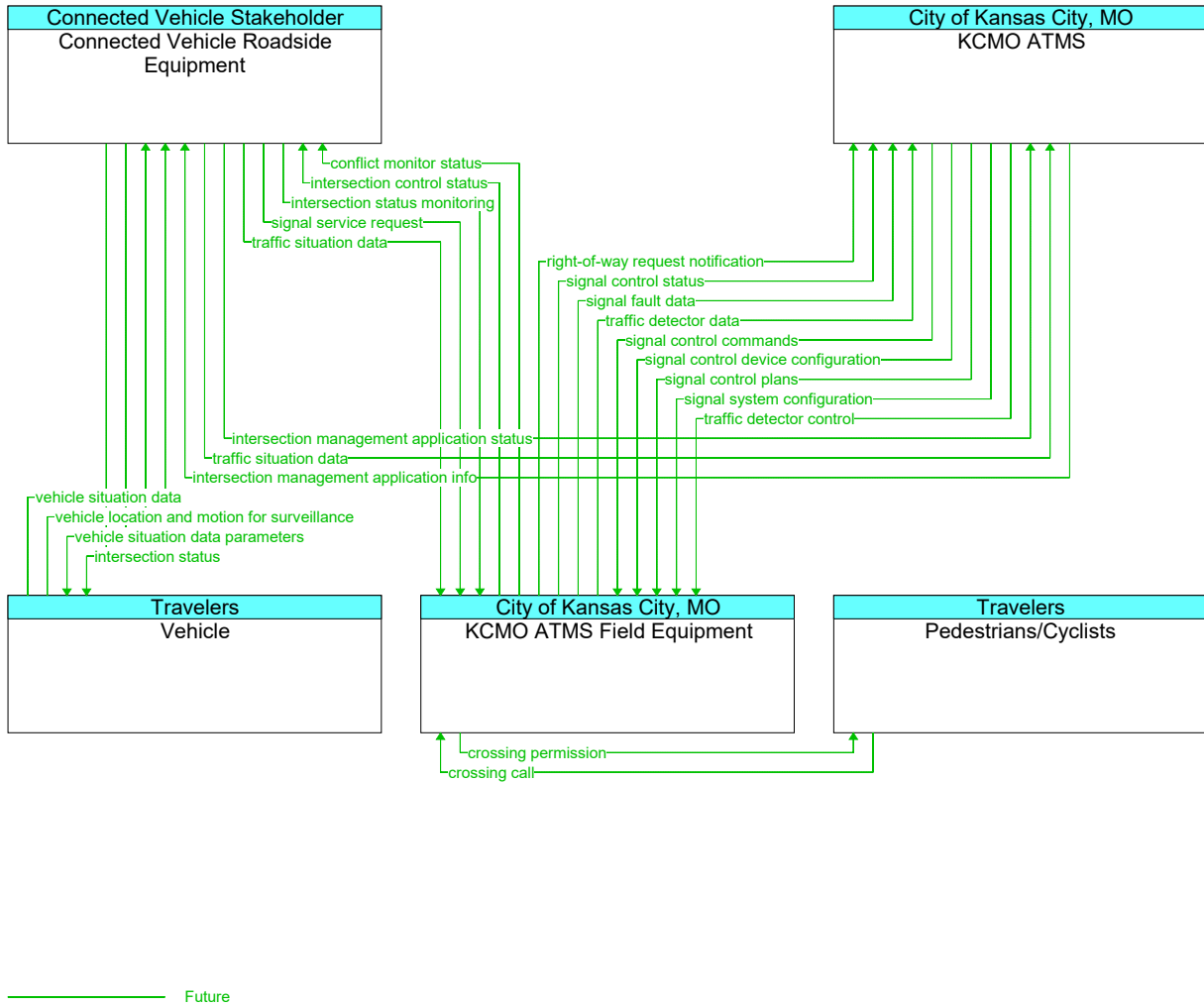
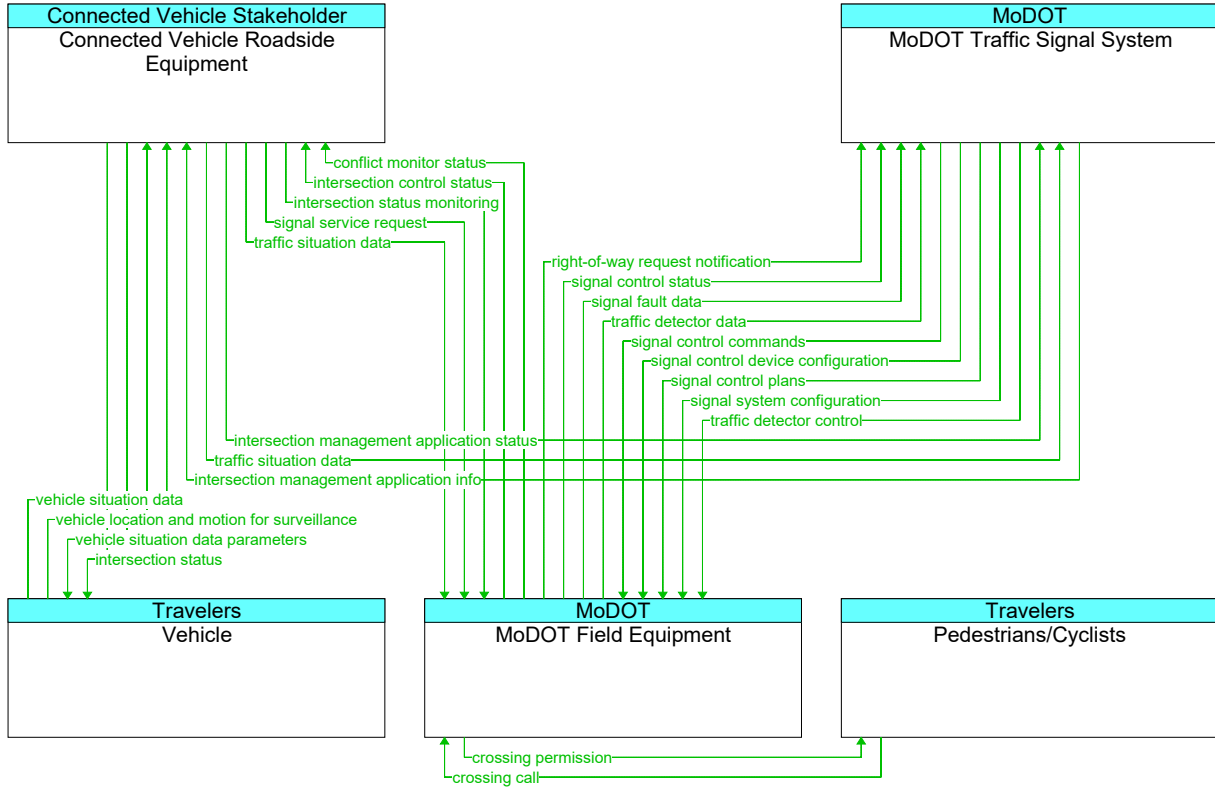
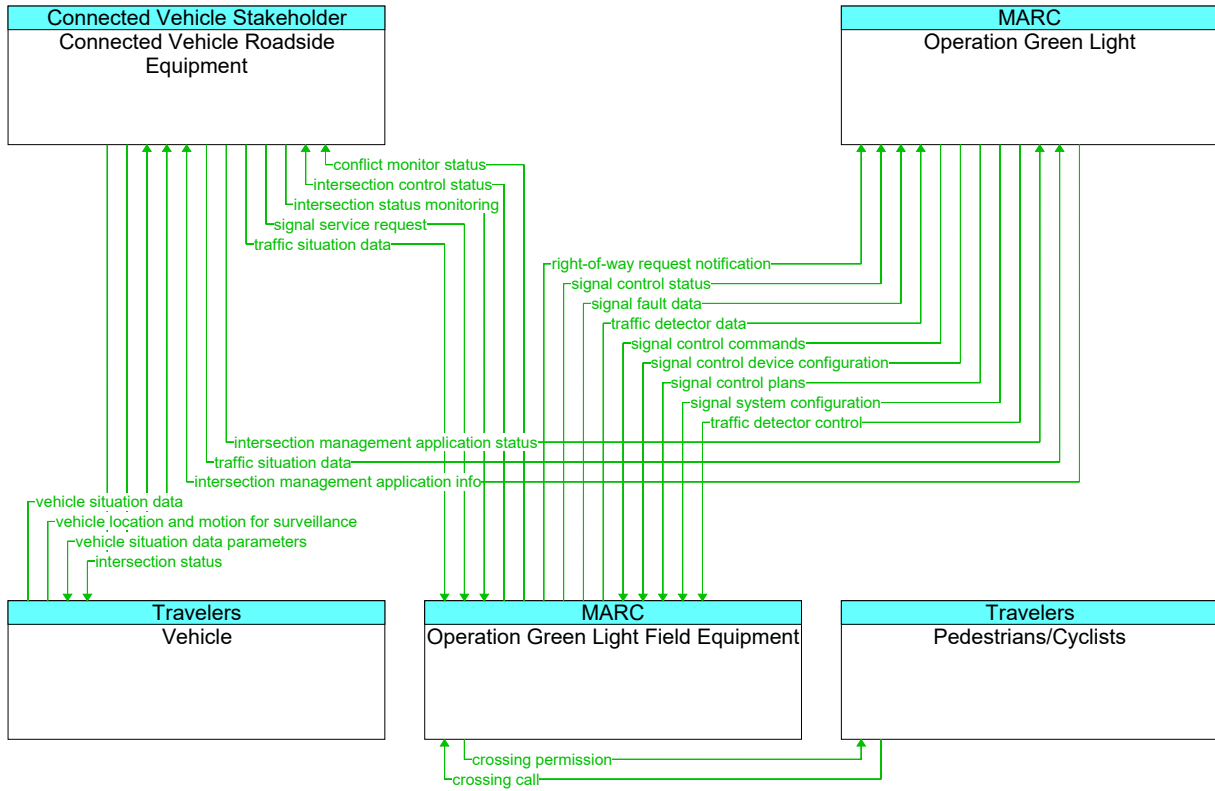


Figure 56 Service TM04 Connected Vehicle Traffic Signal System (KCMO)



— Future

Figure 57 Service TM04 Connected Vehicle Traffic Signal System (MoDOT)



— Future

Figure 58 Service TM04 Connected Vehicle Traffic Signal System (OGL)

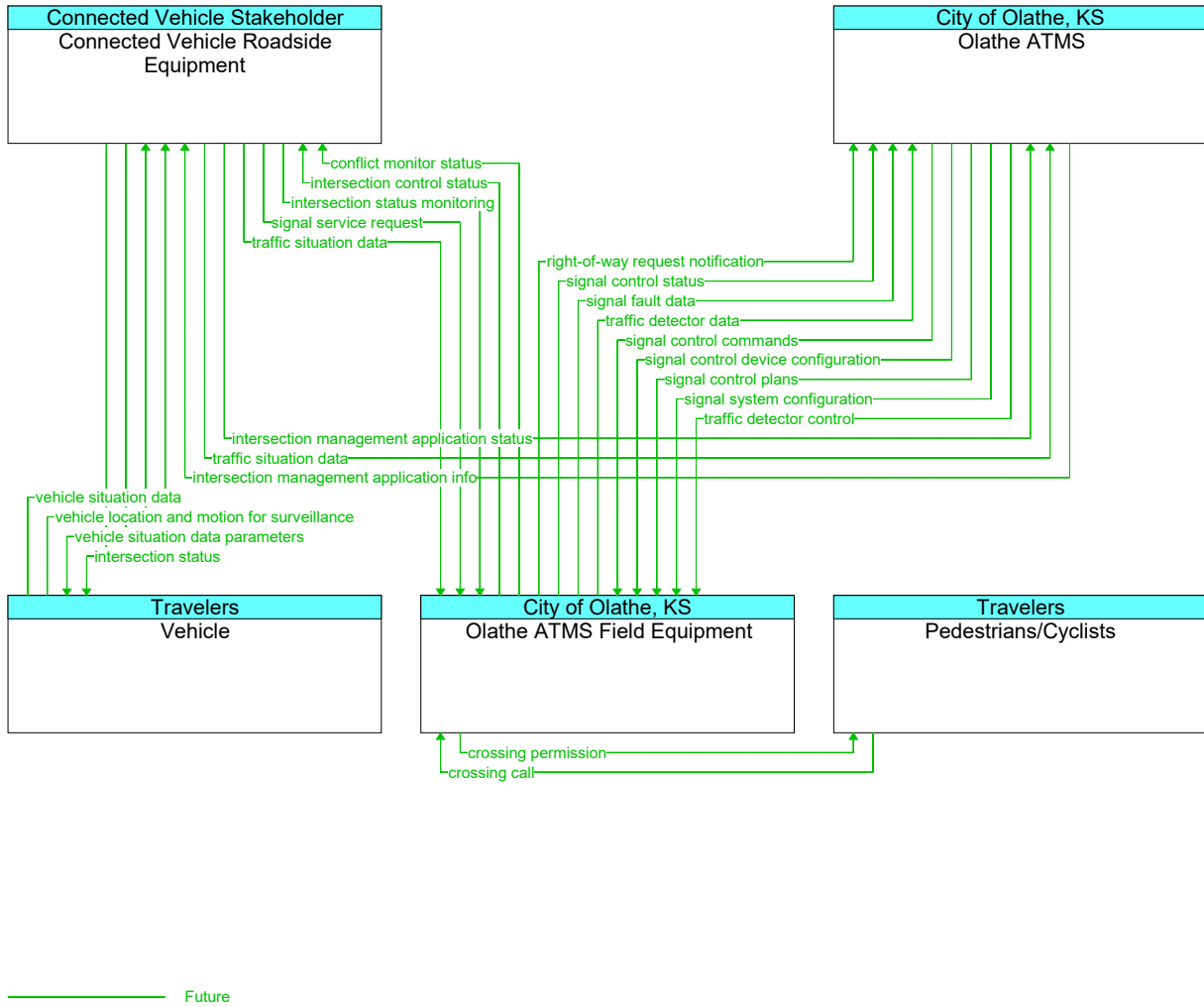


Figure 59 Service TM04 Connected Vehicle Traffic Signal System (Olathe)

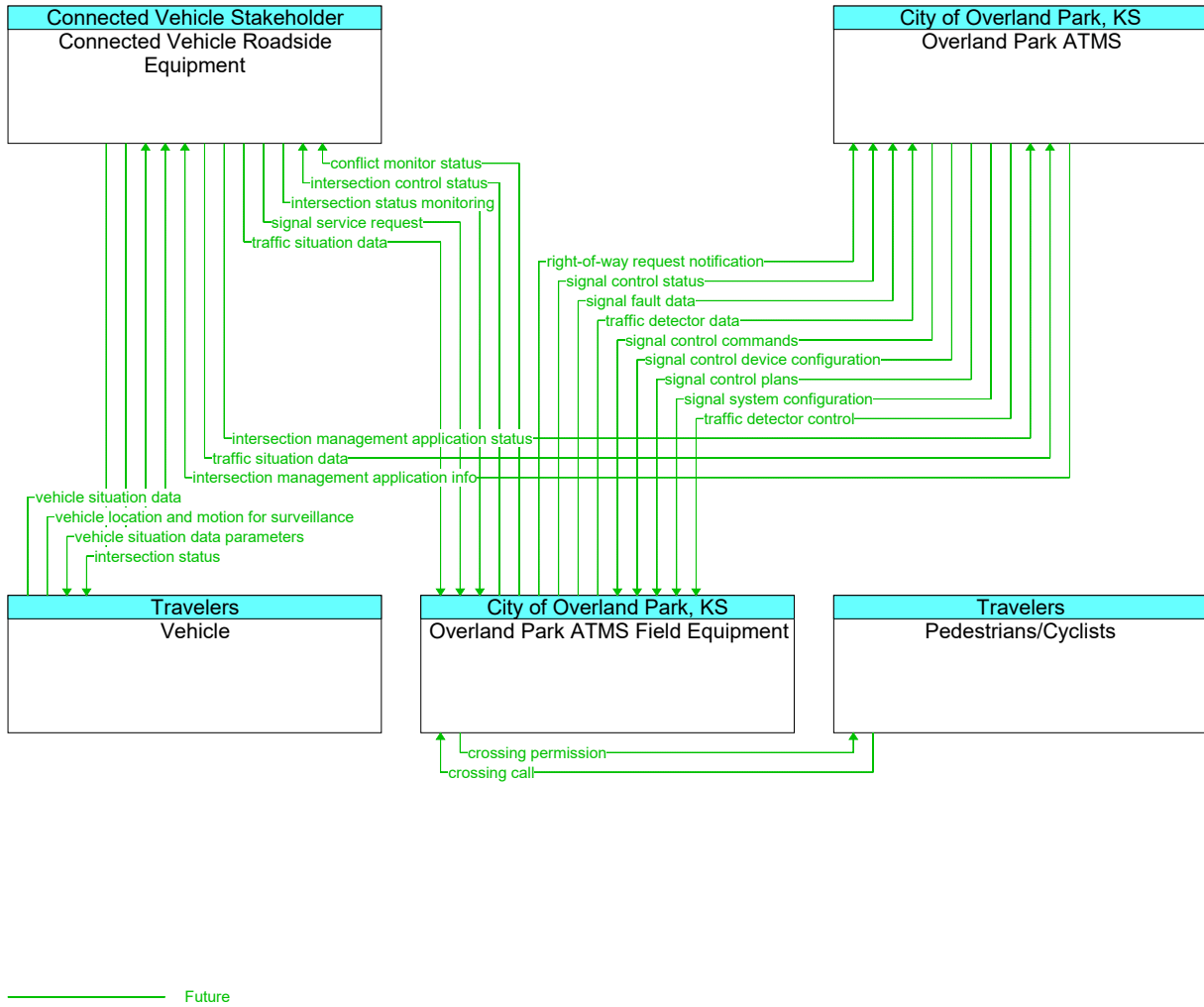


Figure 60 Service TM04 Connected Vehicle Traffic Signal System (Overland Park)

- TM22 - Dynamic Lane Management and Shoulder Use (CV) - This service package provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented.

The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM12-Dynamic Roadway Warning).

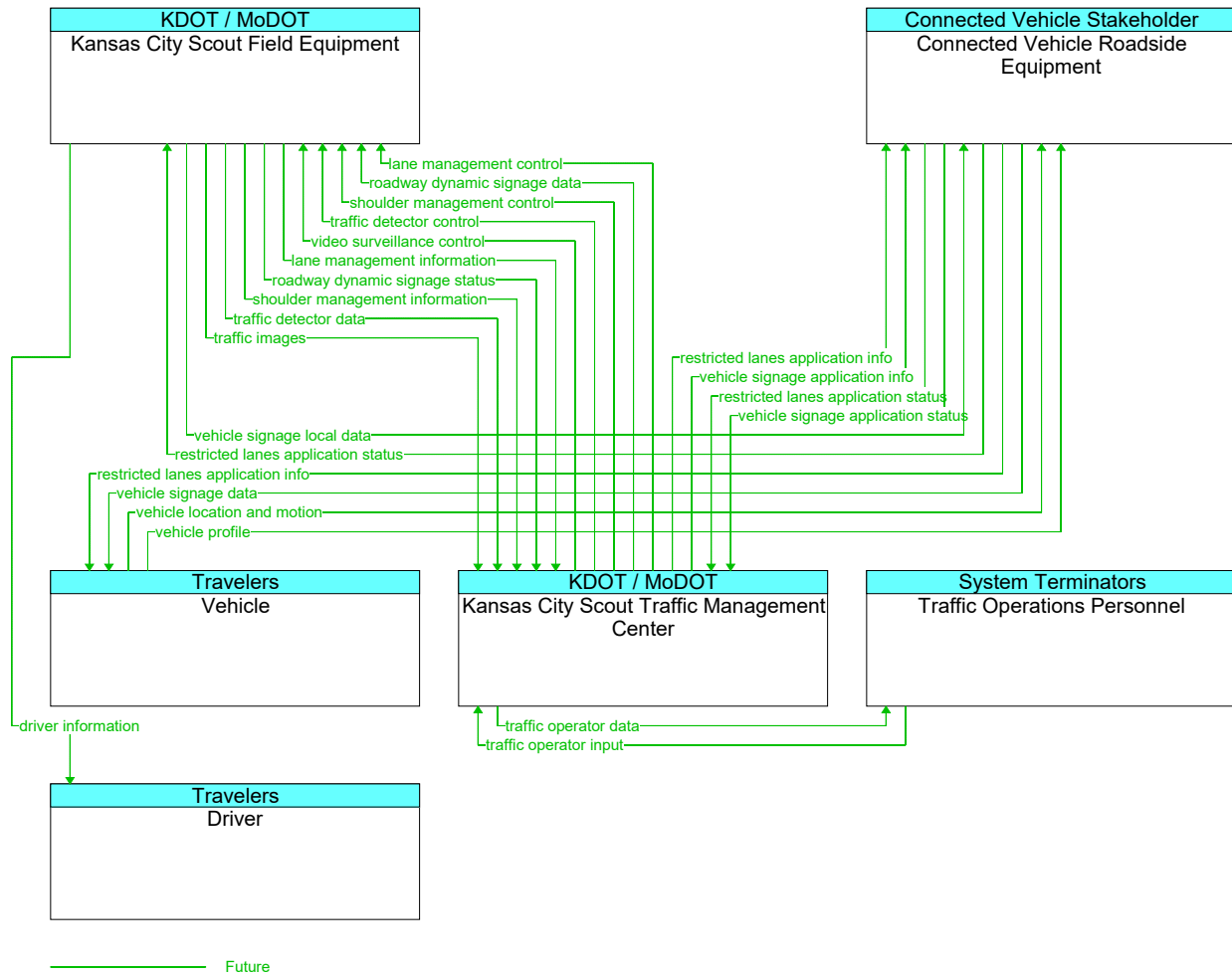


Figure 61 Service TM22 Dynamic Lane Management and Shoulder Use (CV)

- VS13 - Intersection Safety Warning and Collision Avoidance – (3 diagrams) This service package enables a connected vehicle approaching an instrumented signalized intersection to receive information from the infrastructure regarding the signal timing and the geometry of the intersection. The vehicle uses its speed and acceleration profile, along with the signal timing and geometry information to determine if it appears likely that the vehicle will be able to pass safely through the intersection without violating the signal or colliding with other vehicles. If the vehicle determines that proceeding through the intersection is unsafe, a warning is provided to the driver and/or collision avoidance actions are taken, depending on the automation level of the vehicle.

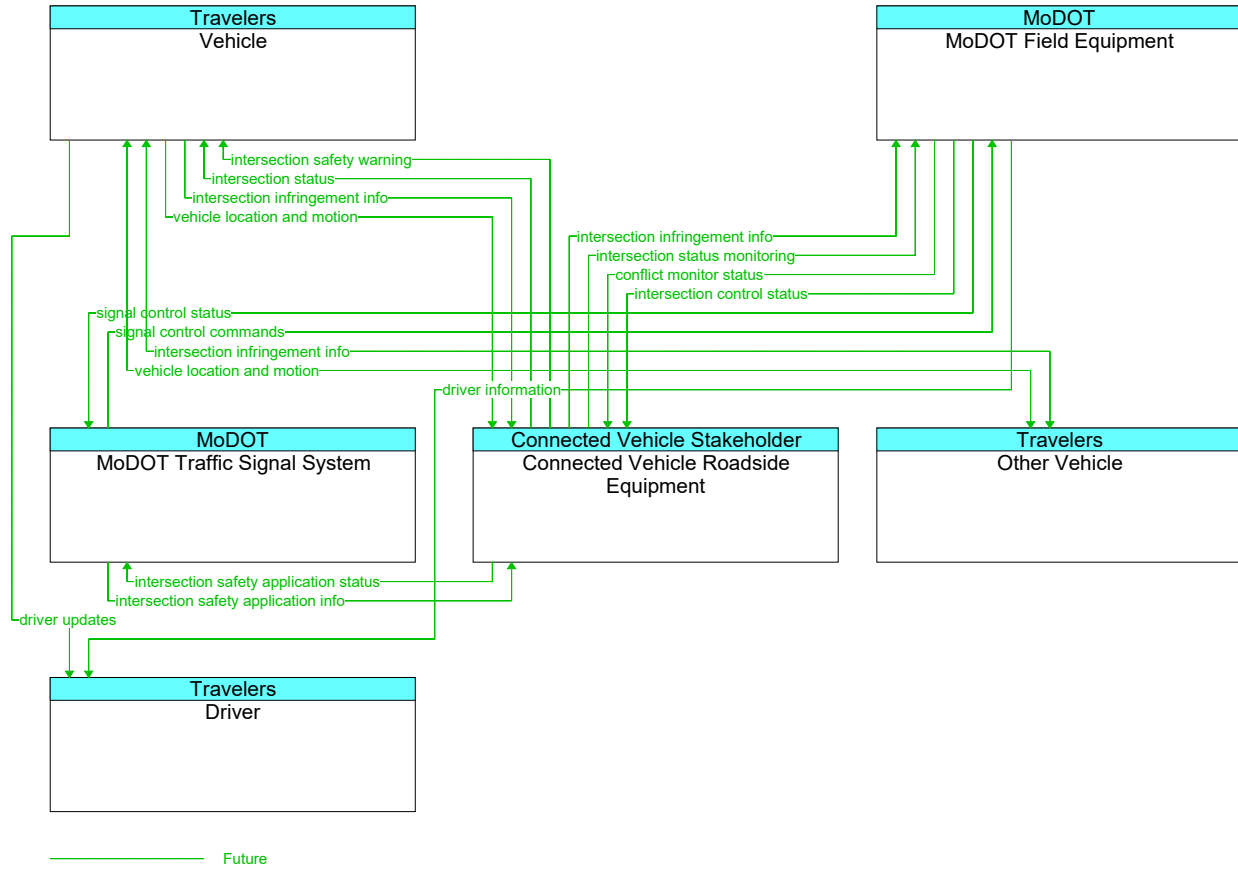


Figure 62 Service VS13 Intersection Safety Warning and Collision Avoidance (MoDOT)

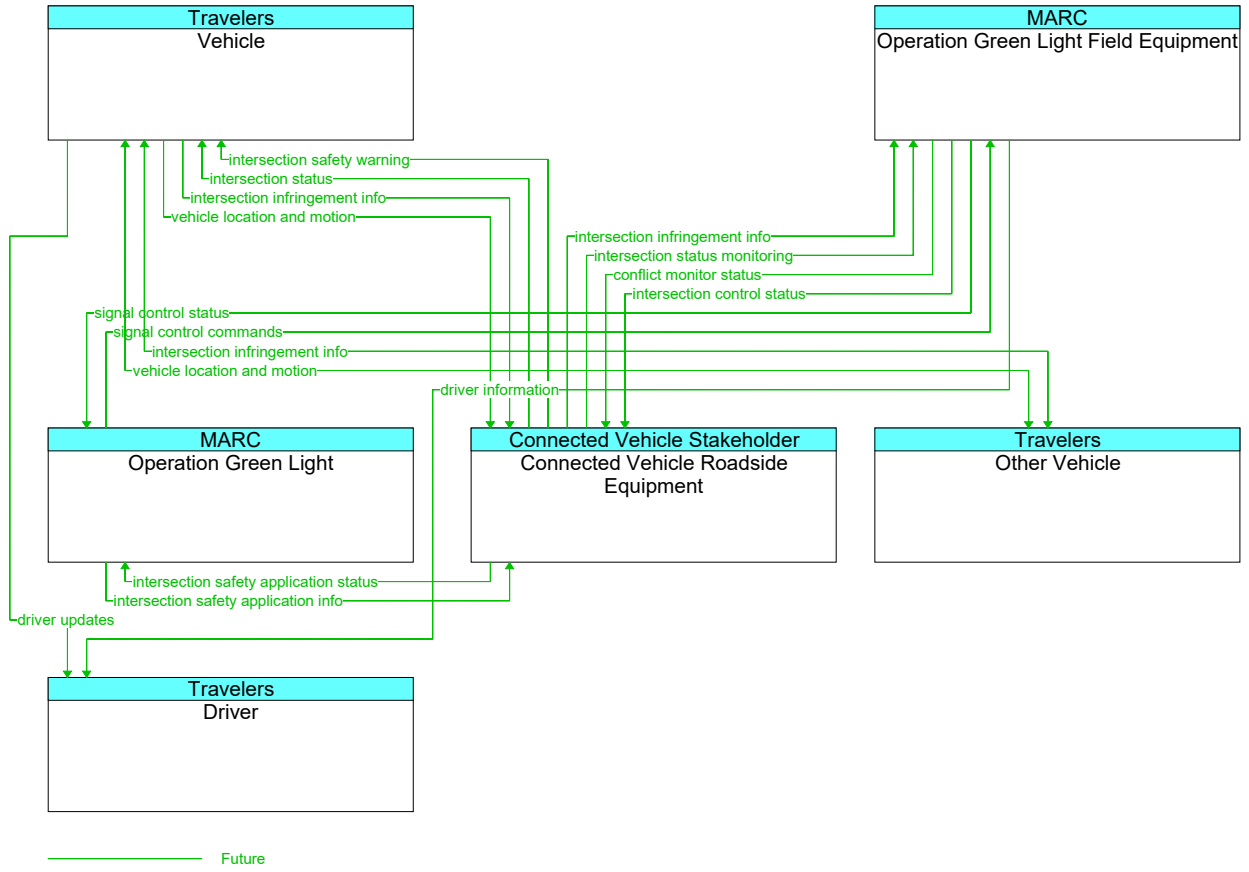


Figure 63 Service VS13 Intersection Safety Warning and Collision Avoidance (OGL)

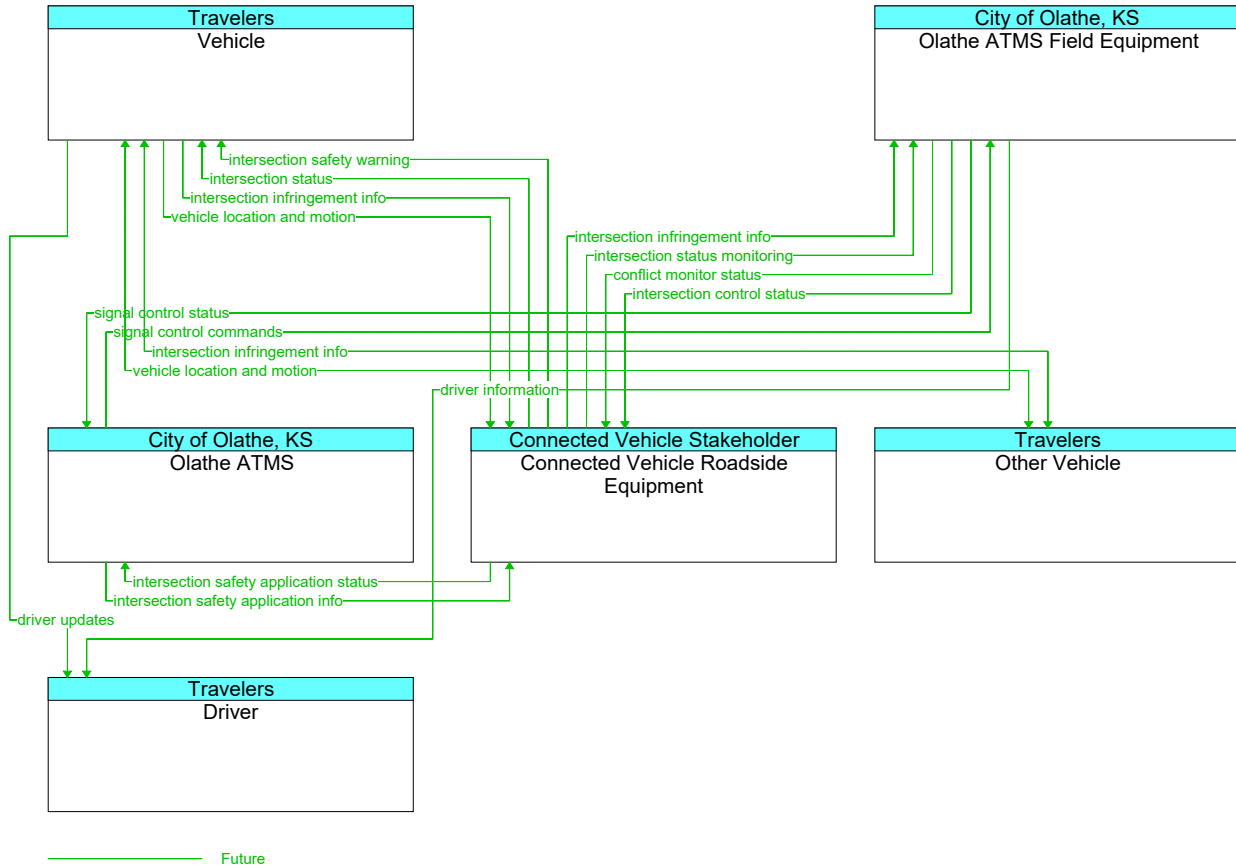


Figure 64 Service VS13 Intersection Safety Warning and Collision Avoidance (Olathe)

- VS16 - Automated Vehicle Operations – (4 diagrams) This service package provides full vehicle automation, controlling both the steering and acceleration/deceleration on areas of the highway system that support full automation. Communications between vehicles and between the vehicles and supporting infrastructure equipment supports cooperative check-in to the automated portion of the system and transition to automated mode, coordination of maneuvers between vehicles in automated mode, and checkout from the automated system. This service package is distinguished from the most advanced CACC systems in that full longitudinal and lateral control automation are supported, enabling closely spaced, tightly coupled platoons of vehicles to operate with short fixed gaps, providing greatly enhanced highway capacity and throughput with enhanced efficiency since aerodynamic drag is reduced.

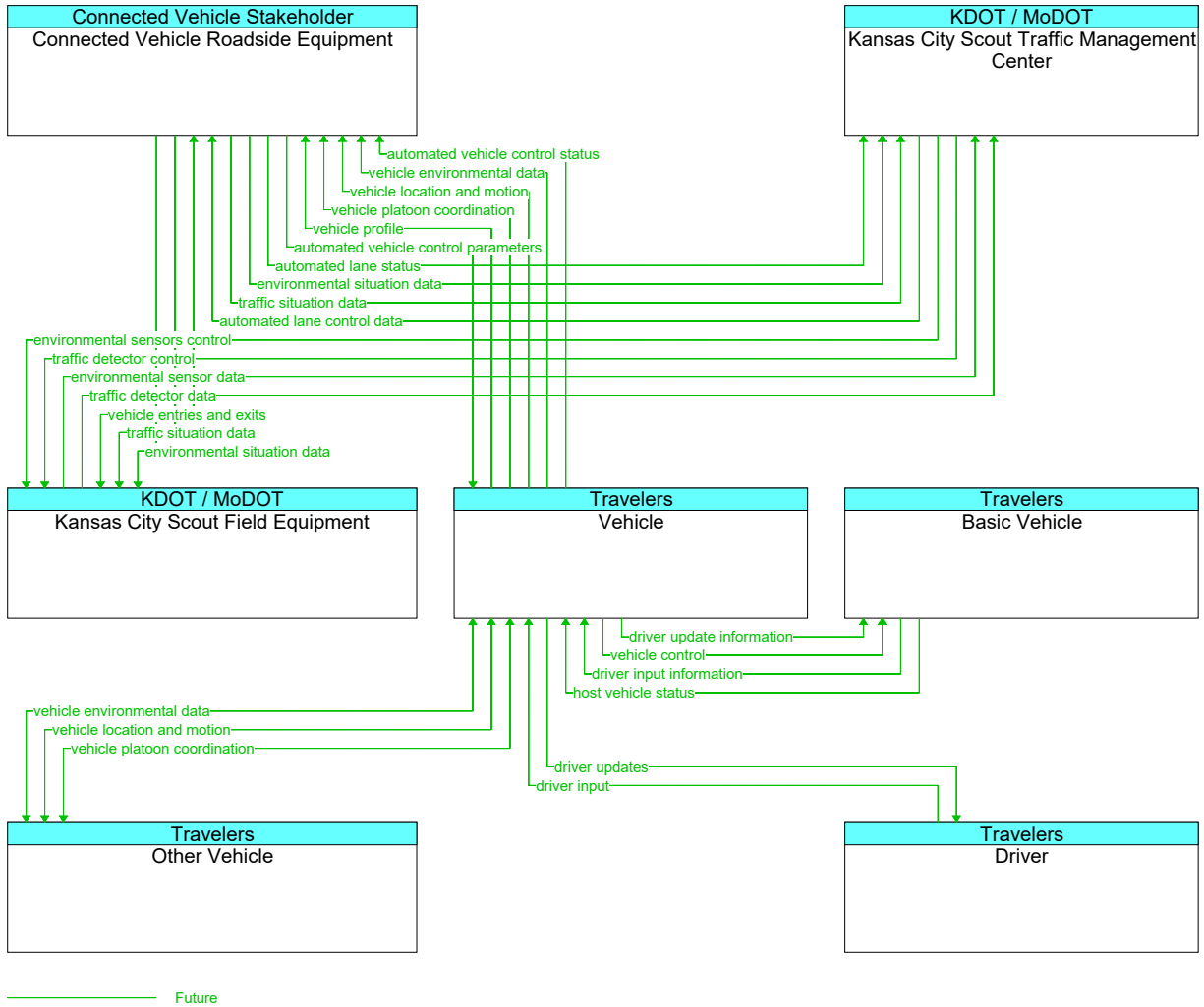


Figure 65 Service VS16 Automated Vehicle Operations (KC Scout)

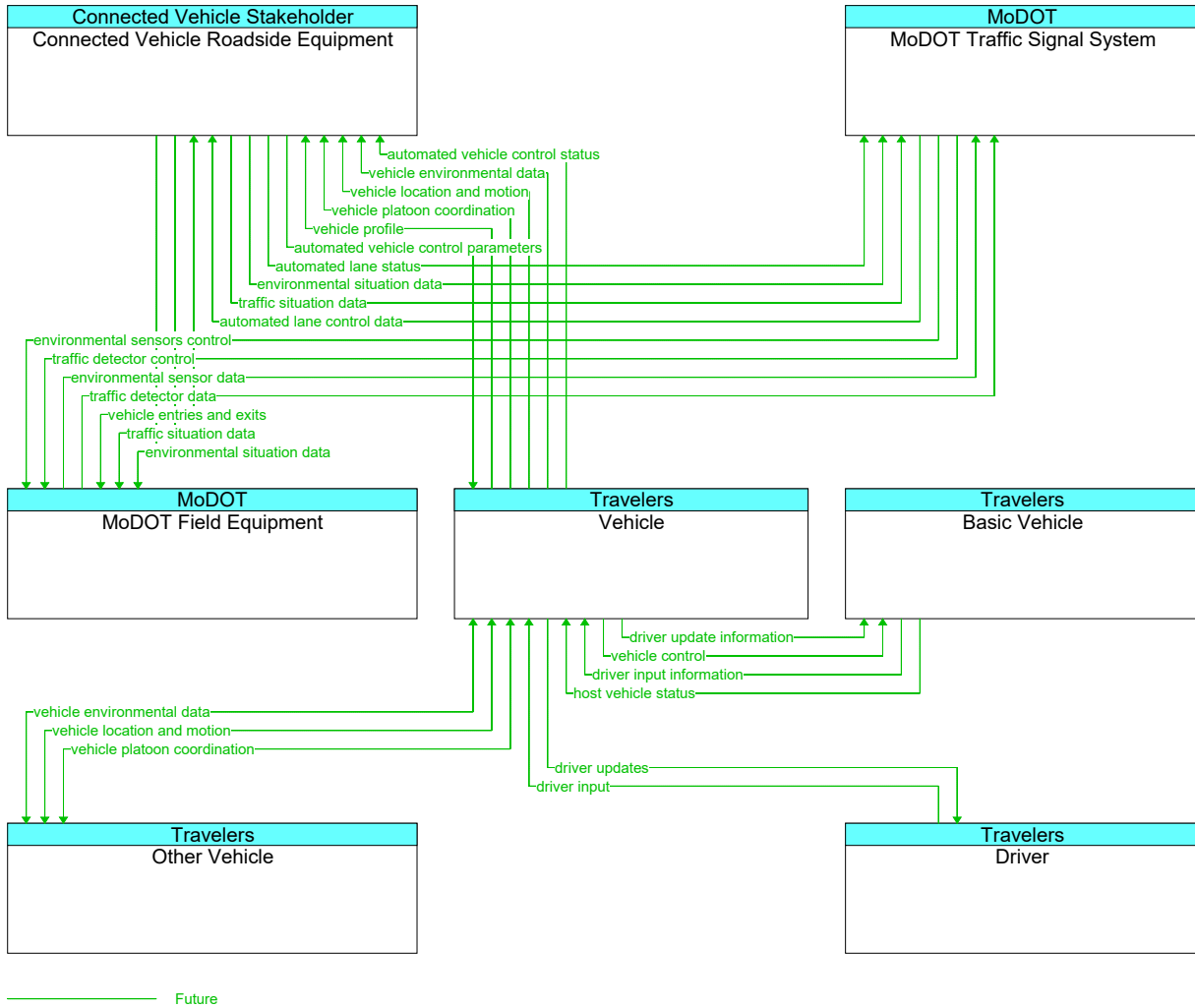


Figure 66 Service VS16 Automated Vehicle Operations (MoDOT)

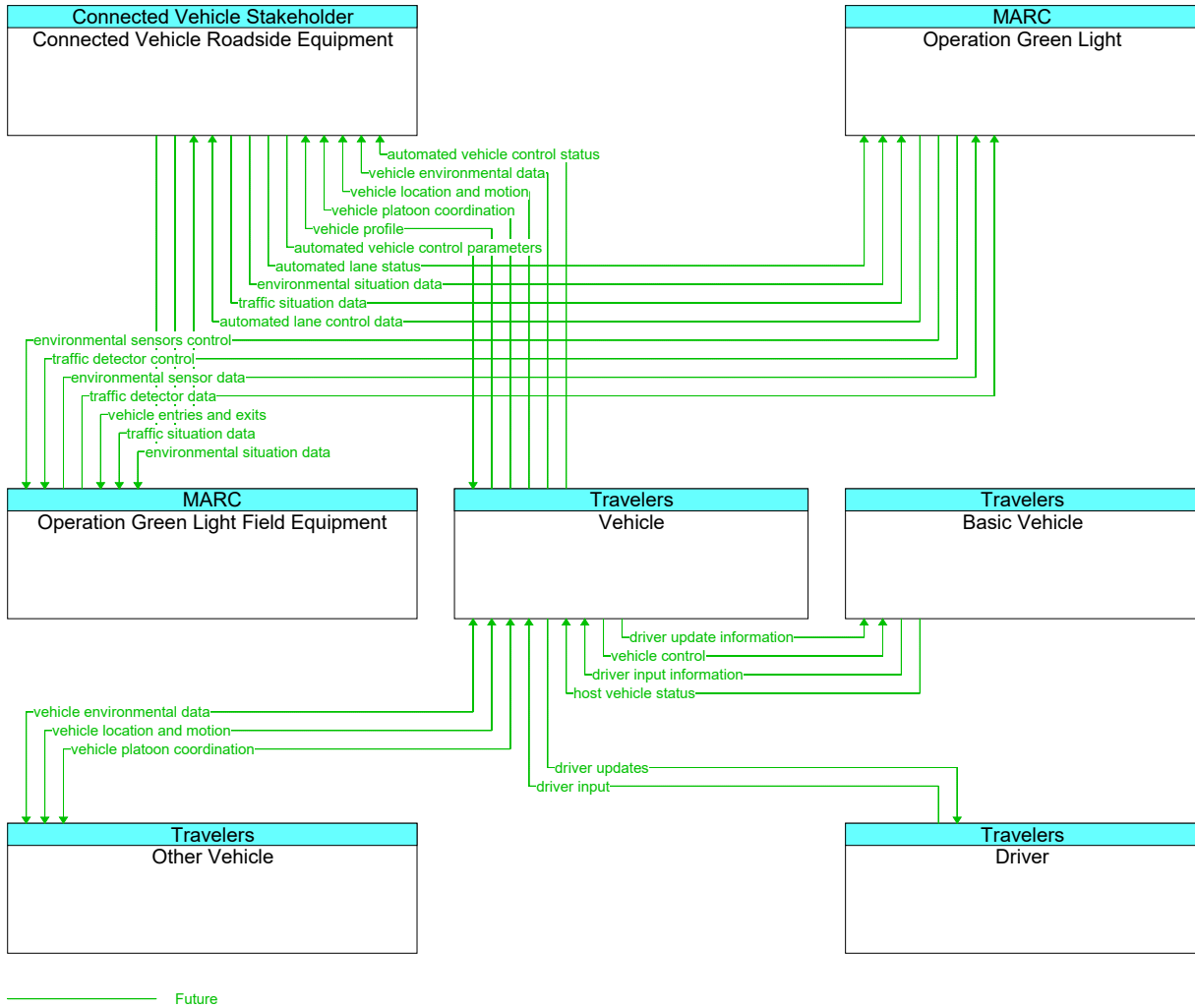


Figure 67 Service VS16 Automated Vehicle Operations (OGL)

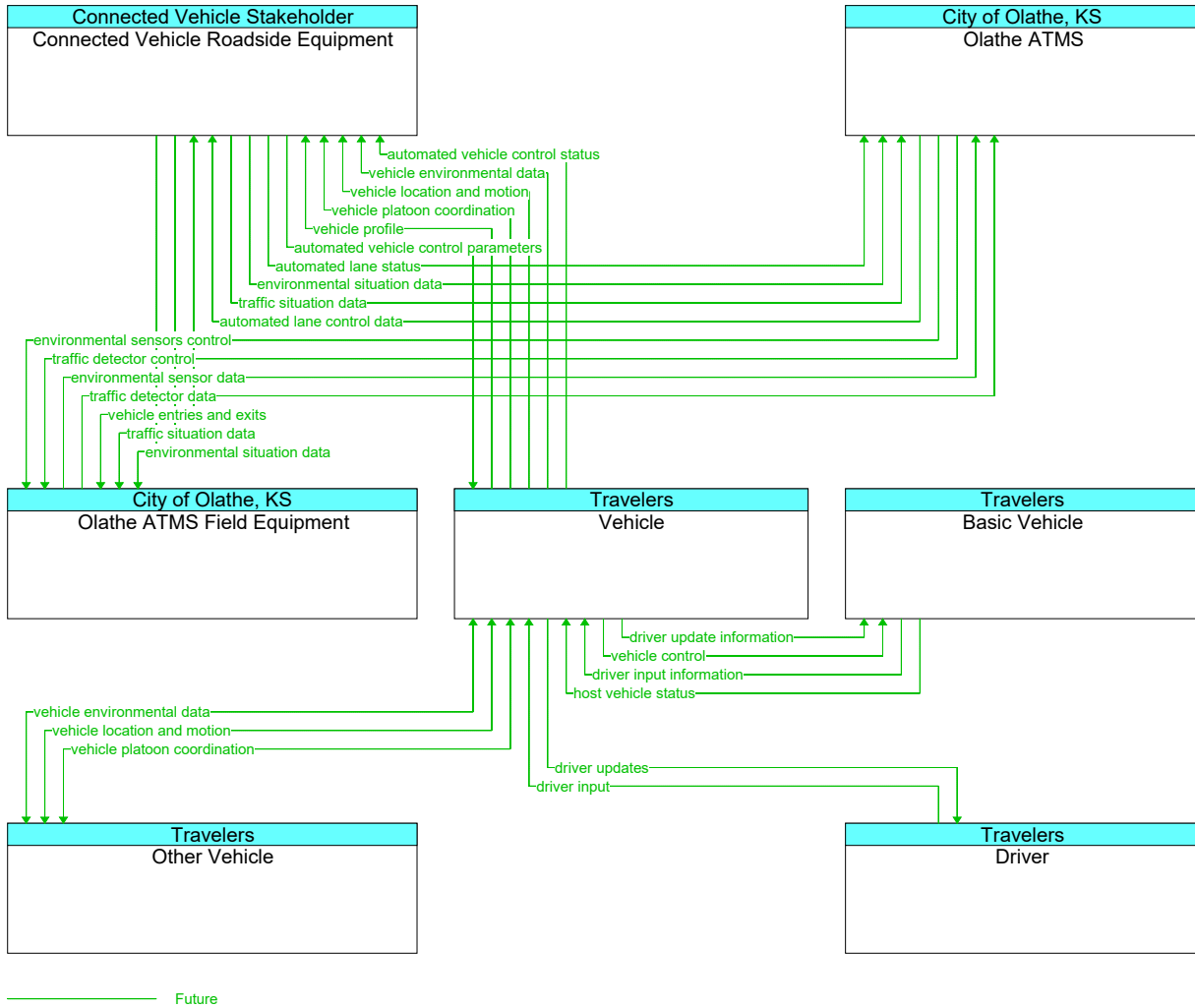


Figure 68 Service VS16 Automated Vehicle Operations (Olathe)

3.3 Mobility Hubs

Stakeholders: KCATA, MARC, Kansas City Power and Lighting, KC Streetcar Authority, Regional Transit Operators, Ride Hailing Services, Private Information Service Providers, Kansas City Health and Social Services

Description: Mobility hubs are central places or districts that act as converging points for public transit and an integrated suite of mobility services, scaled for their respective environments and functions. Mobility hubs are also areas where there is an intensive concentration of working, living, shopping and/or playing in the form of mixed-use development. Mobility hubs serve three critical roles in the new Smart Moves 3.0 system: origin, destination and transfer point.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PT01 - Transit Vehicle Tracking
- PT02 - Transit Fixed-Route Operations
- PT03 - Dynamic Transit Operations
- PT05 - Transit Security
- PT08 - Transit Traveler Information
- PT14 - Multi-modal Coordination
- ST05 - Electric Charging Stations Management
- TI02 - Personalized Traveler Information
- TI06 - Dynamic Ridesharing and Shared Use Transportation

Service Diagrams:

- PT01 - Transit Vehicle Tracking – (2 diagrams) This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system’s schedule in real-time.

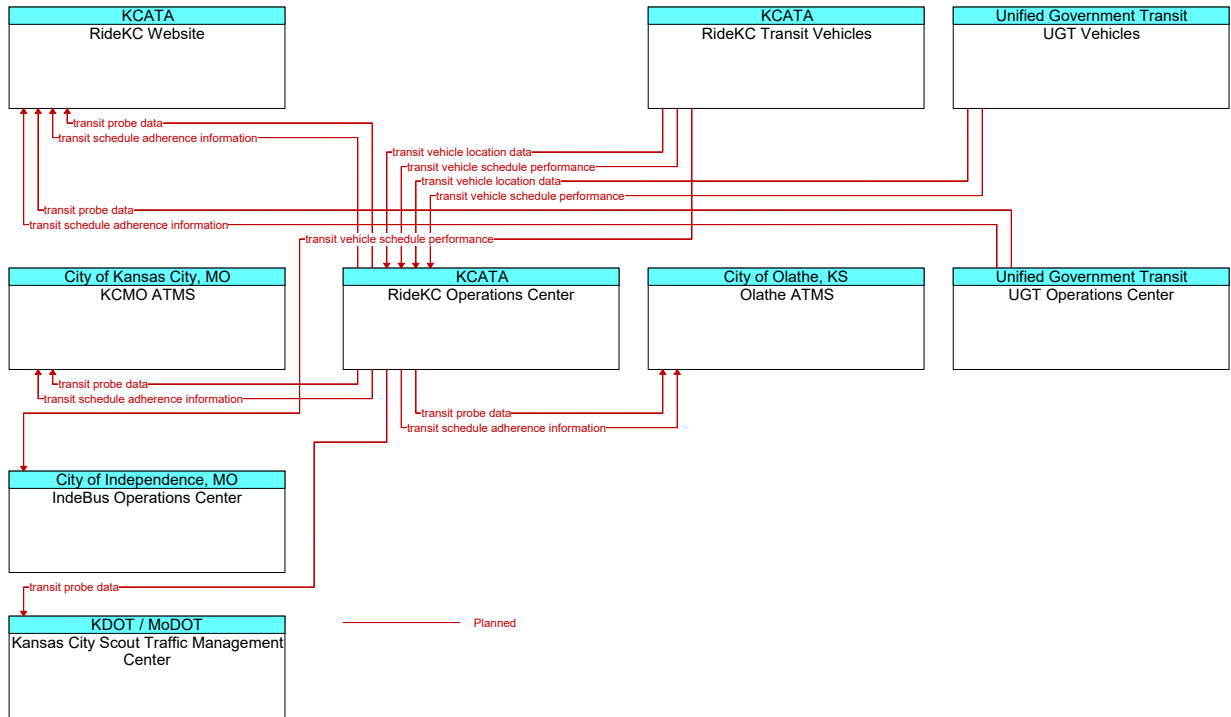


Figure 69 Service PT01 Transit Vehicle Tracking (Bus)

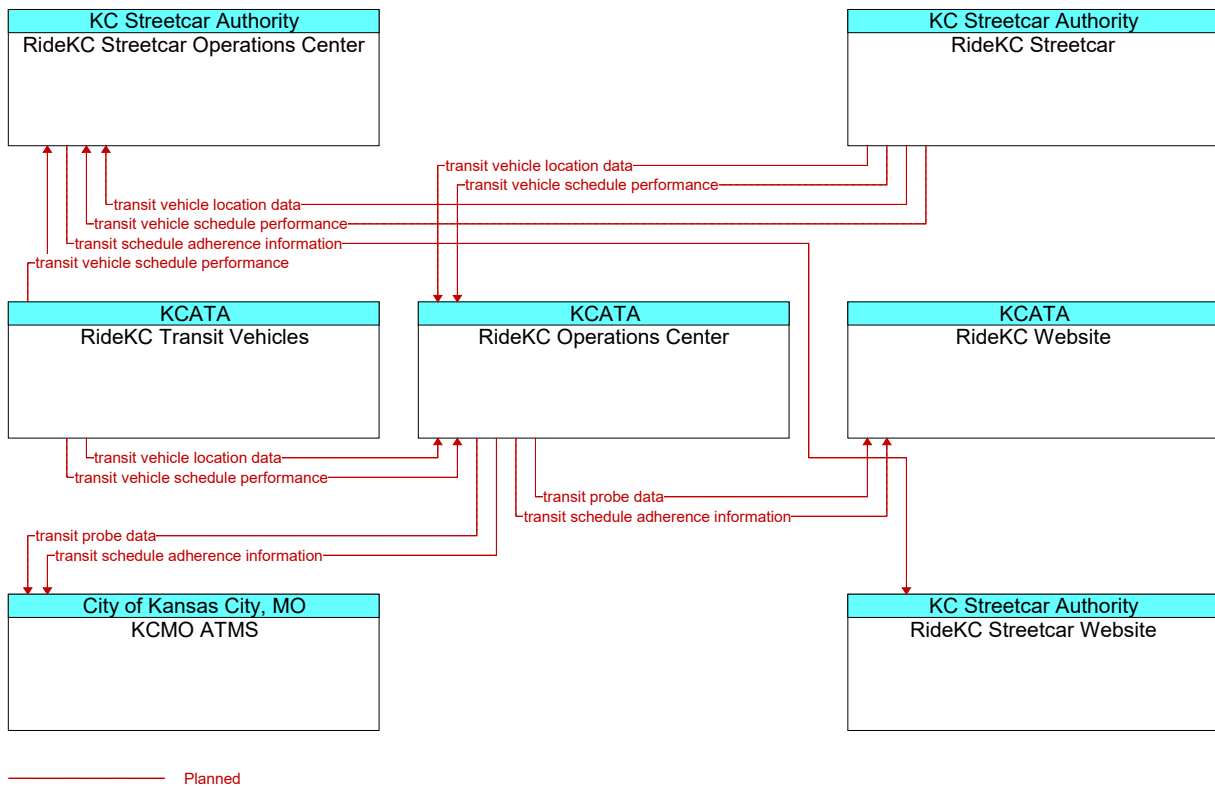


Figure 70 Service PT01 Transit Vehicle Tracking (Streetcar)

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- PT02 - Transit Fixed-Route Operations – (2 diagrams) This service package performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service monitors the transit vehicle trip performance against the schedule and provides information displays at the Transit Management Center.

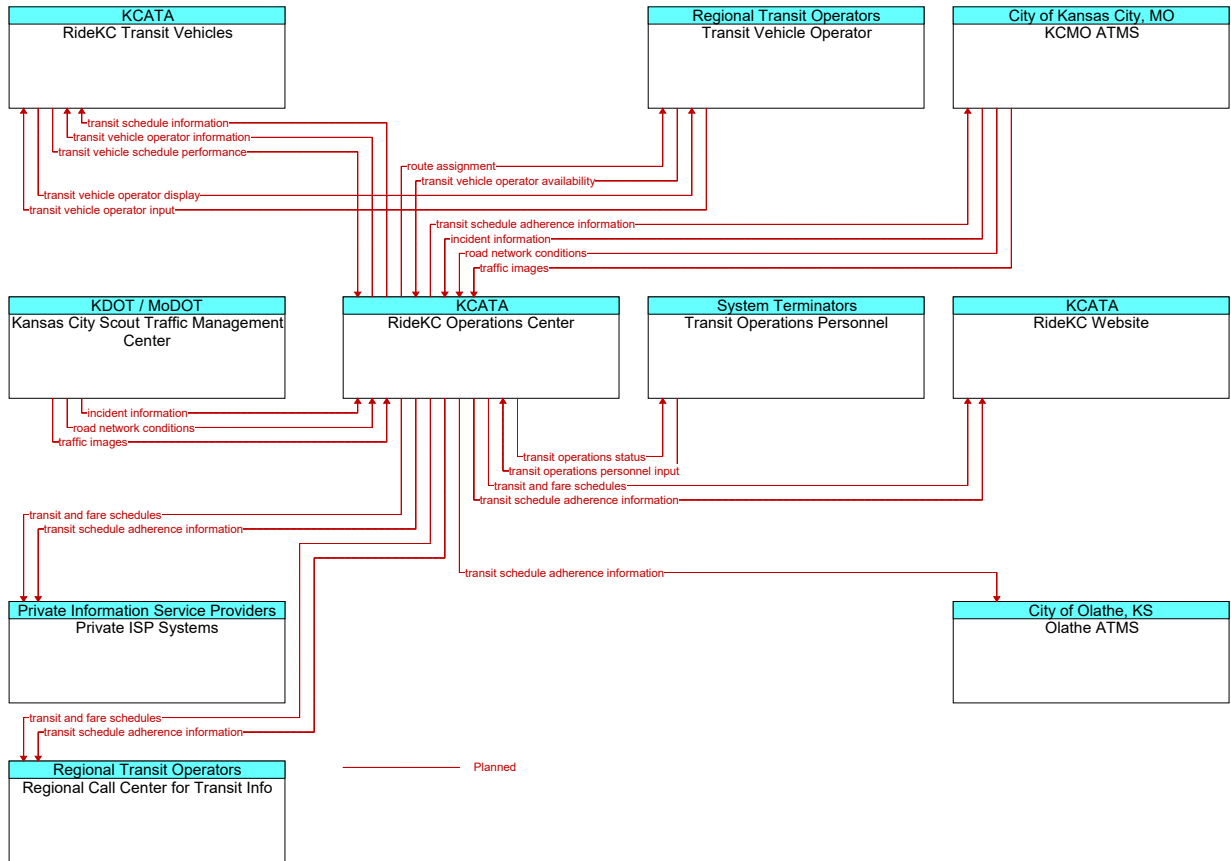


Figure 71 Service PT02 Transit Fixed-Route Operations (Bus)

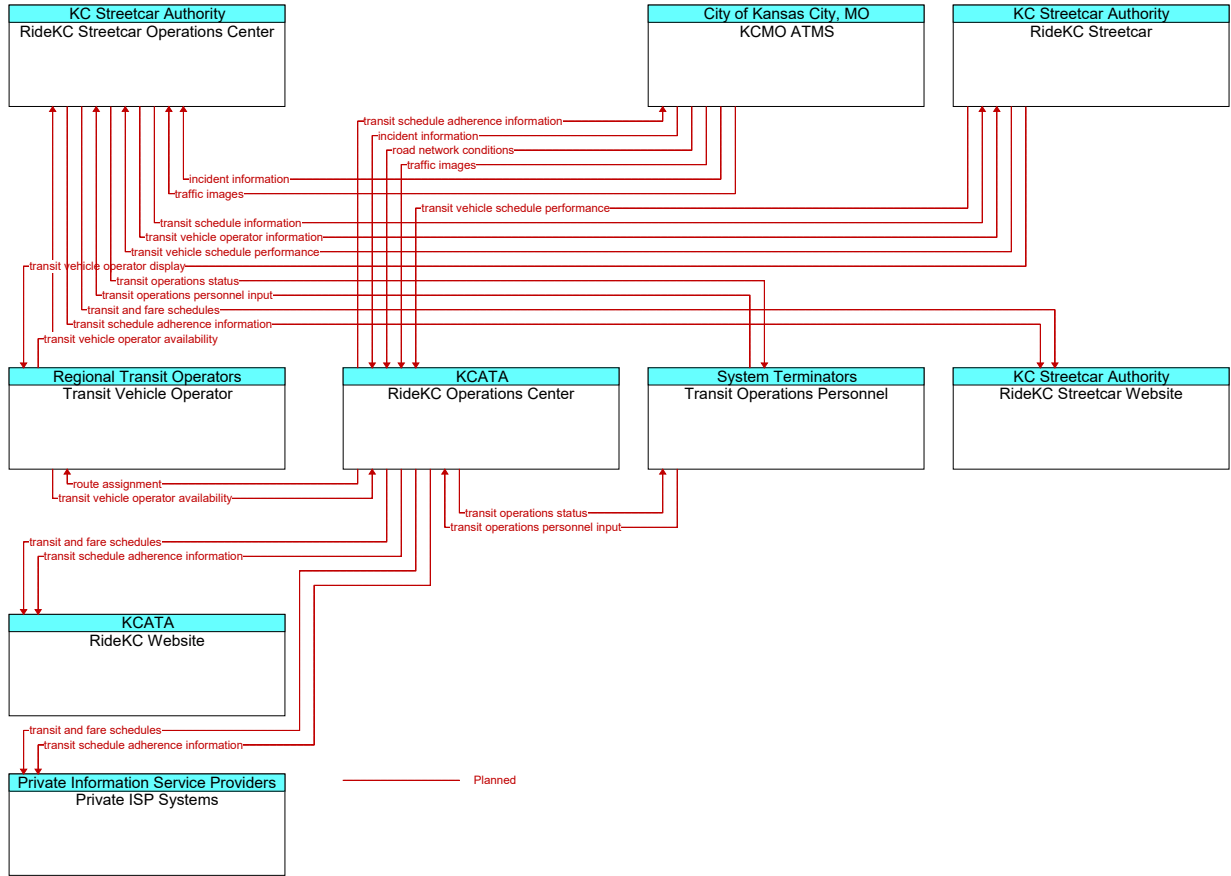


Figure 72 Service PT02 Transit Fixed-Route Operations (Streetcar)

- PT03 - Dynamic Transit Operations - The Dynamic Transit Operations service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This service package builds on existing technology systems such as computer-aided dispatch/ automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. TI06 covers other shared use transportation options.

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- PT05 - Transit Security – (2 diagrams) This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring in order to identify potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).

Most of the surveillance and sensor data that is collected by this service package may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this service package. This service package also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.

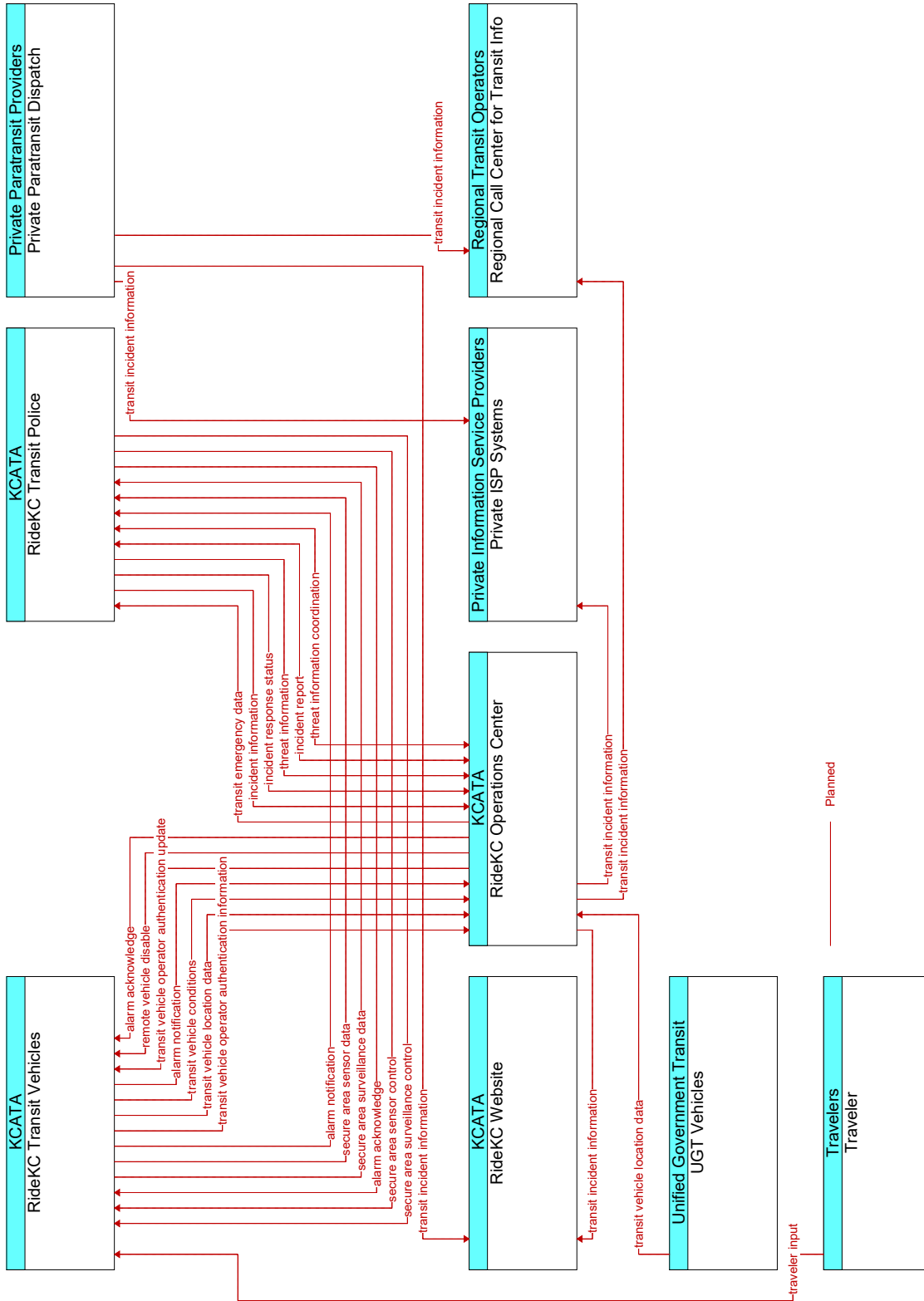


Figure 74 Service PT05 Transit Security (KCATA)

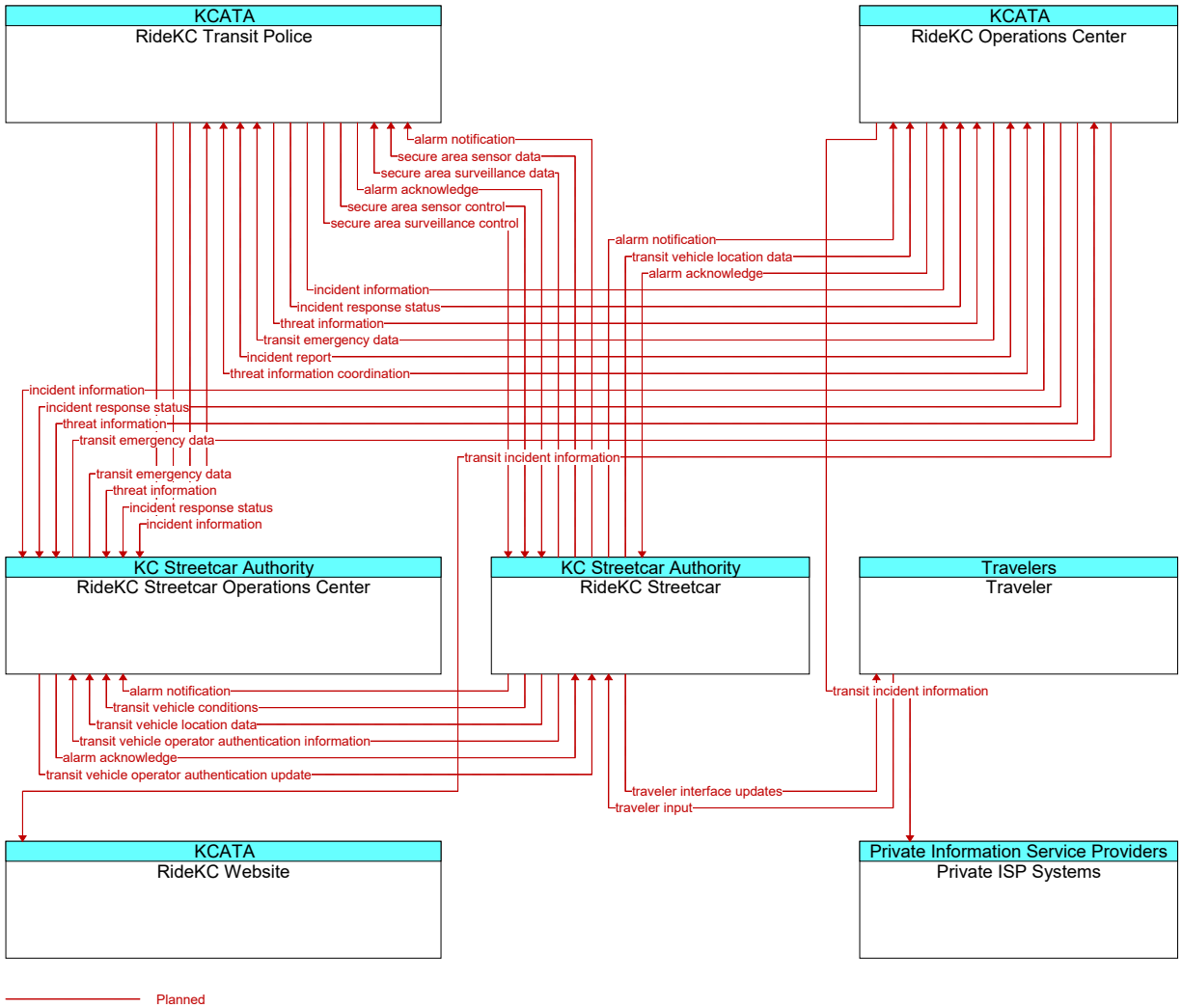


Figure 75 Service PT05 Transit Security (Streetcar)

- PT08 - Transit Traveler Information – (2 diagrams) This service package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this service package.

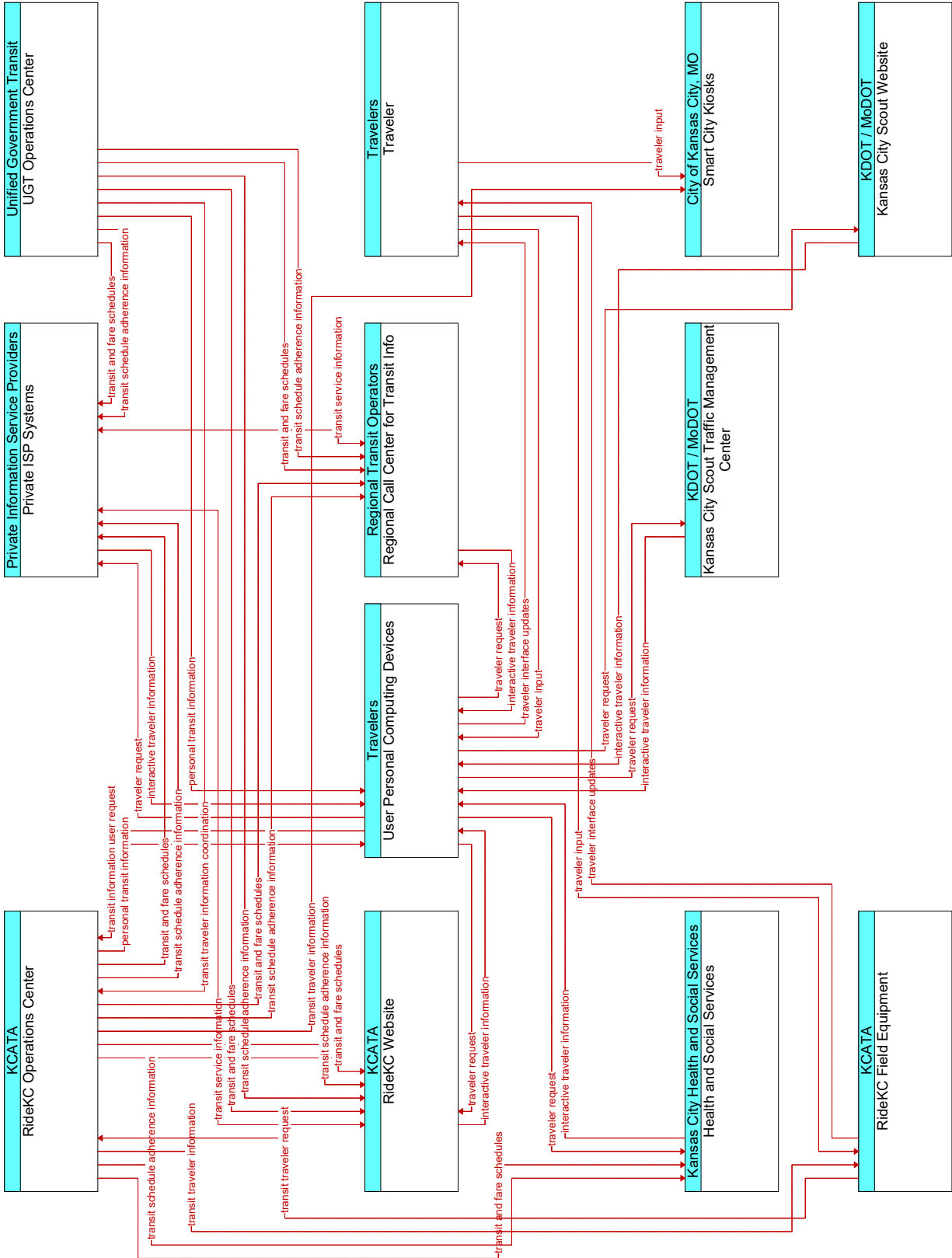


Figure 76 Service PT08 Transit Traveler Information (Bus)

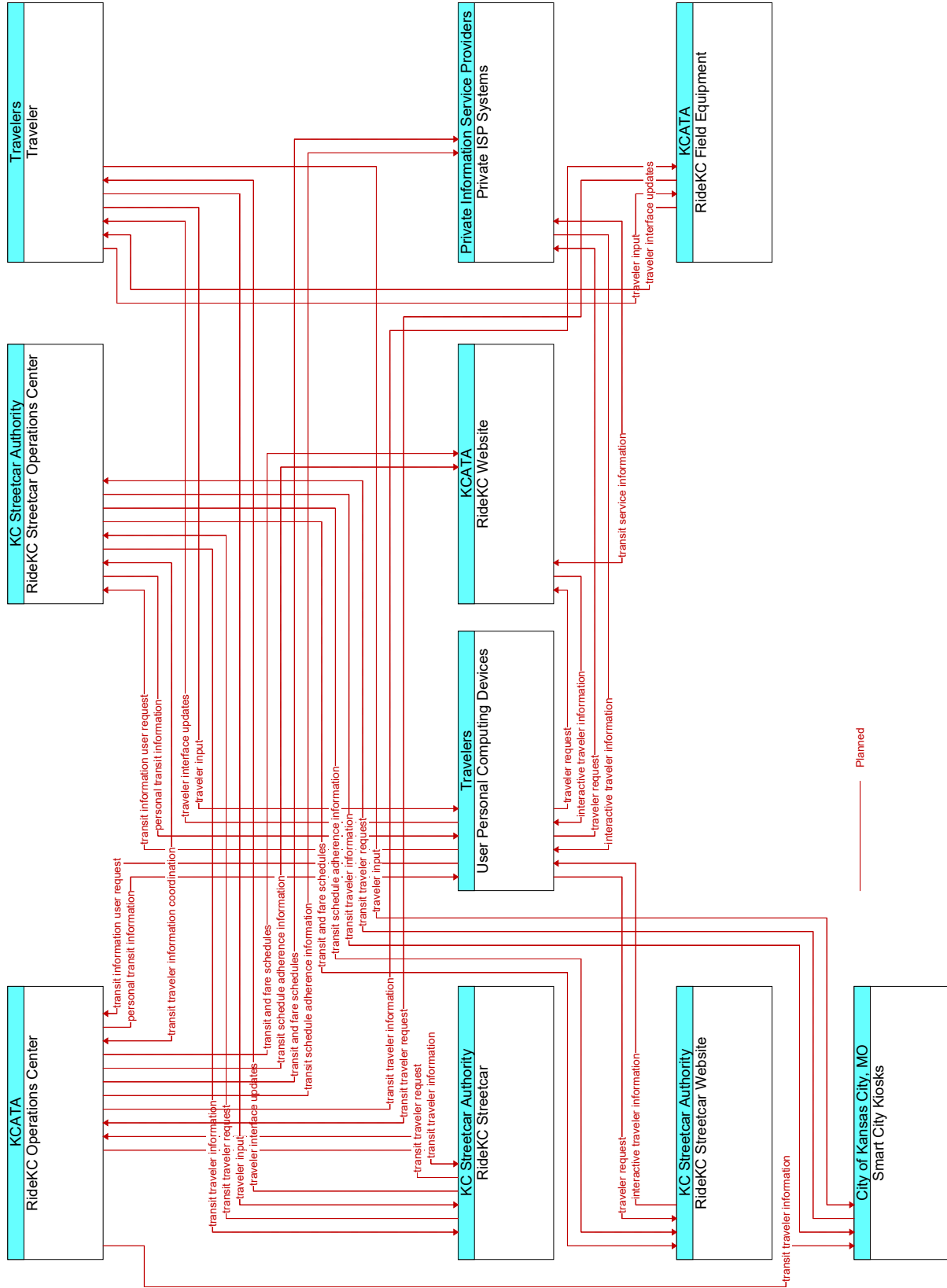


Figure 77 Service PT08 Transit Traveler Information (Streetcar)

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- PT14 - Multi-modal Coordination - This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

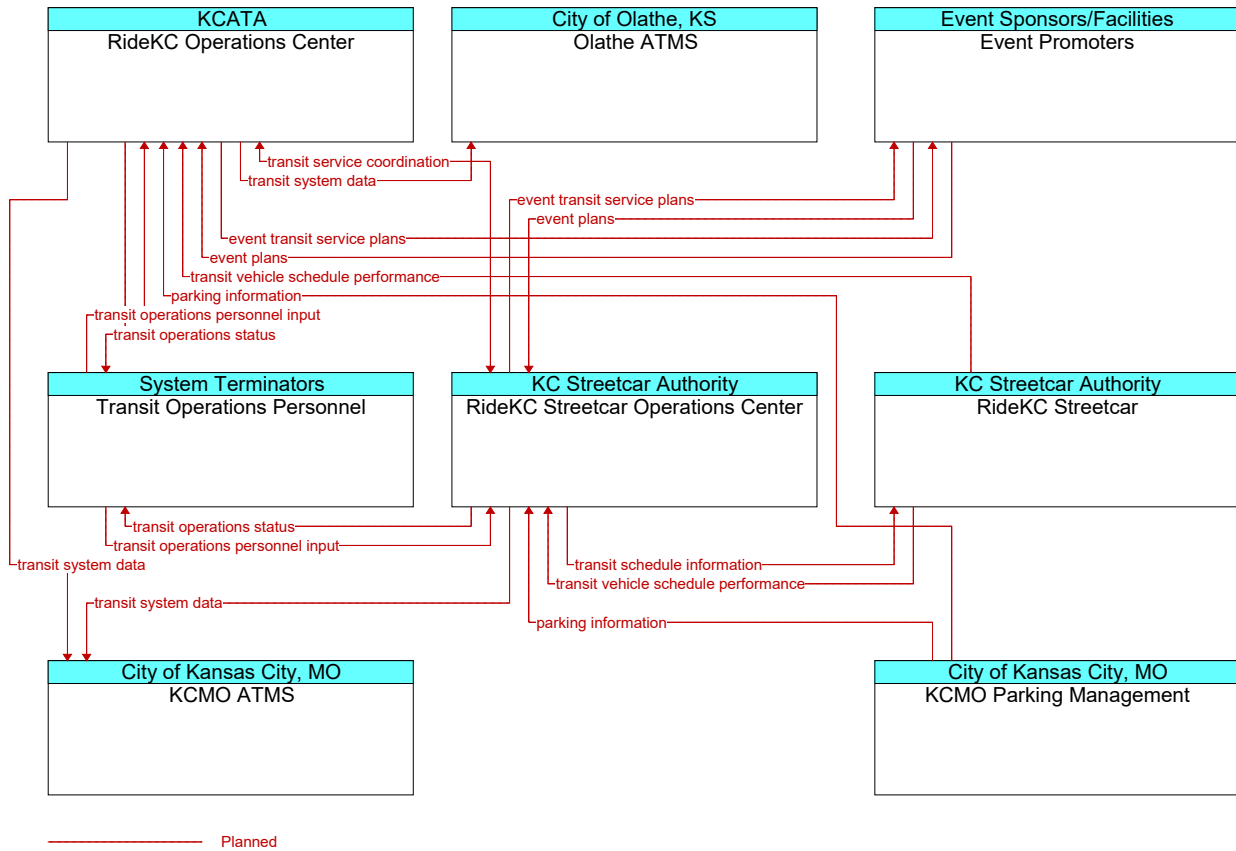


Figure 78 Service PT14 Multi-Modal Coordination

- ST05 - Electric Charging Stations Management - The Electric Charging Station Management service package provides an exchange of information between the electric vehicle and charging station to manage the charging operation. The agency or company operating the charging station can use vehicle information such as the capability of the vehicle (e.g. operational status of the electrical system, how many amps can the vehicle handle, and % charge complete) to determine that the charge is being properly applied and determine an estimated time to complete charging.

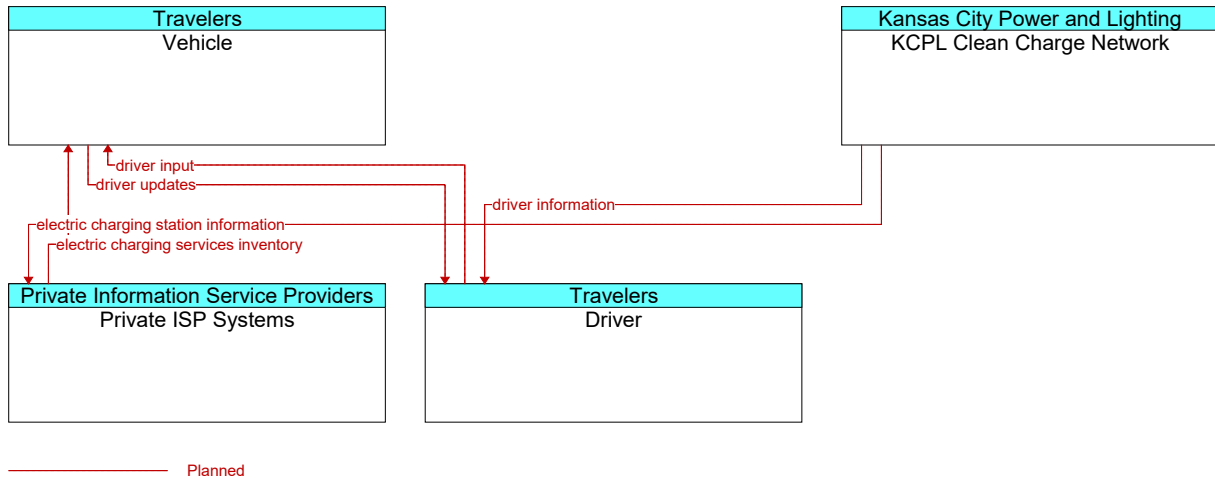


Figure 79 Service ST05 Electric Charging Stations Management

- T102 - Personalized Traveler Information - This service package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. 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. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.

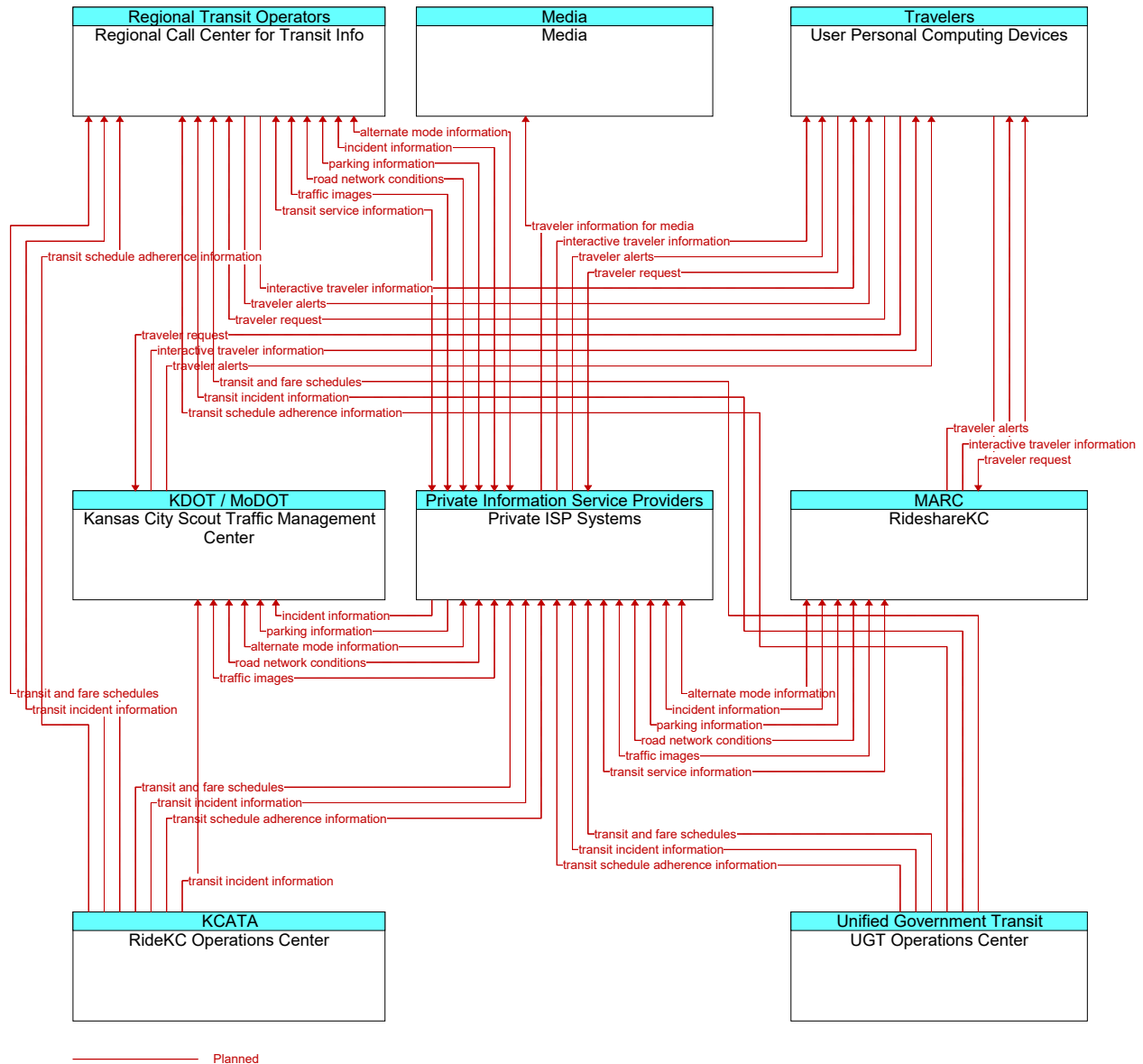


Figure 80 Service TI02 Personalized Traveler Information

- **TI06 - Dynamic Ridesharing and Shared Use Transportation – (3 diagrams)** This service package addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip . These inputs are then translated into “optimal” pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the service package to improve the user’s experience for future trips.

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The shared use aspect of the service package addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.

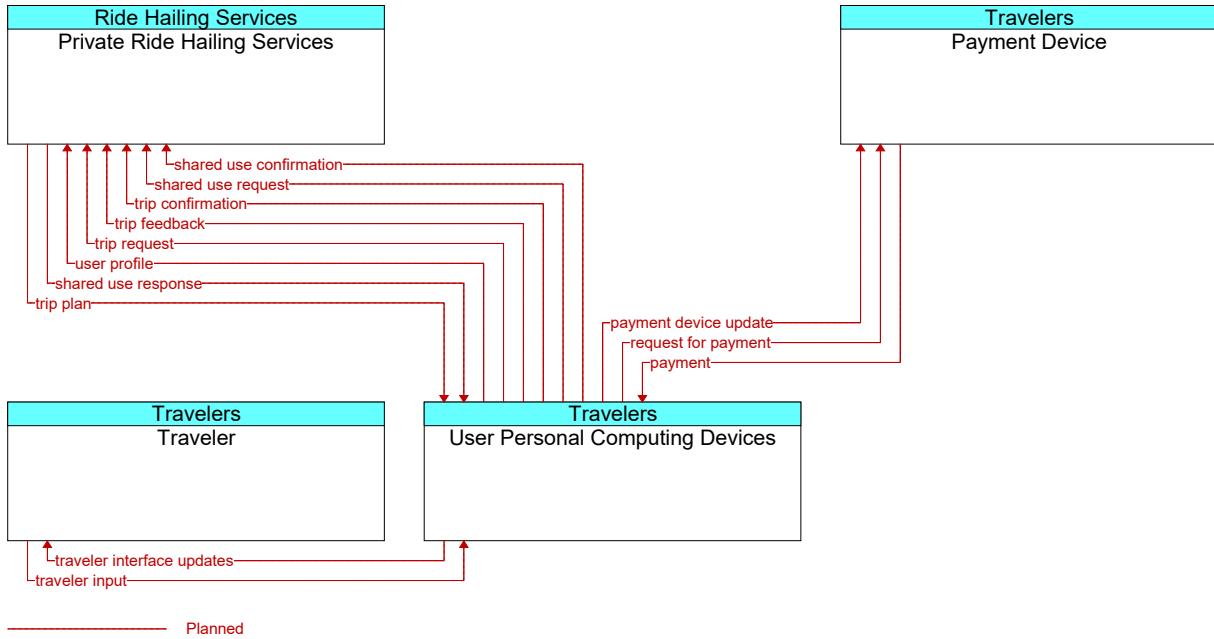


Figure 81 Service TI06 Dynamic Ridesharing and Shared Use Transportation (Ride Hailing Services)

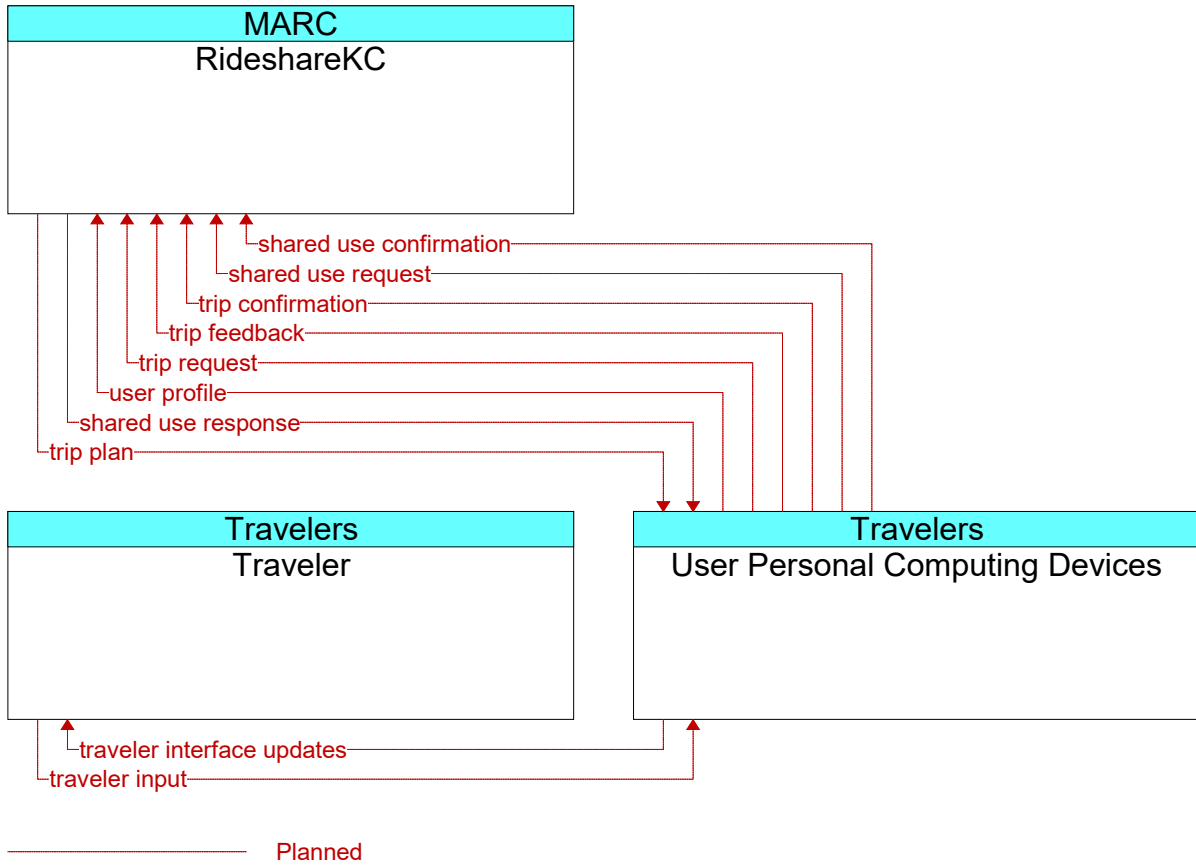


Figure 82 Service Dynamic Ridesharing and Shared Use Transportation (RideshareKC)

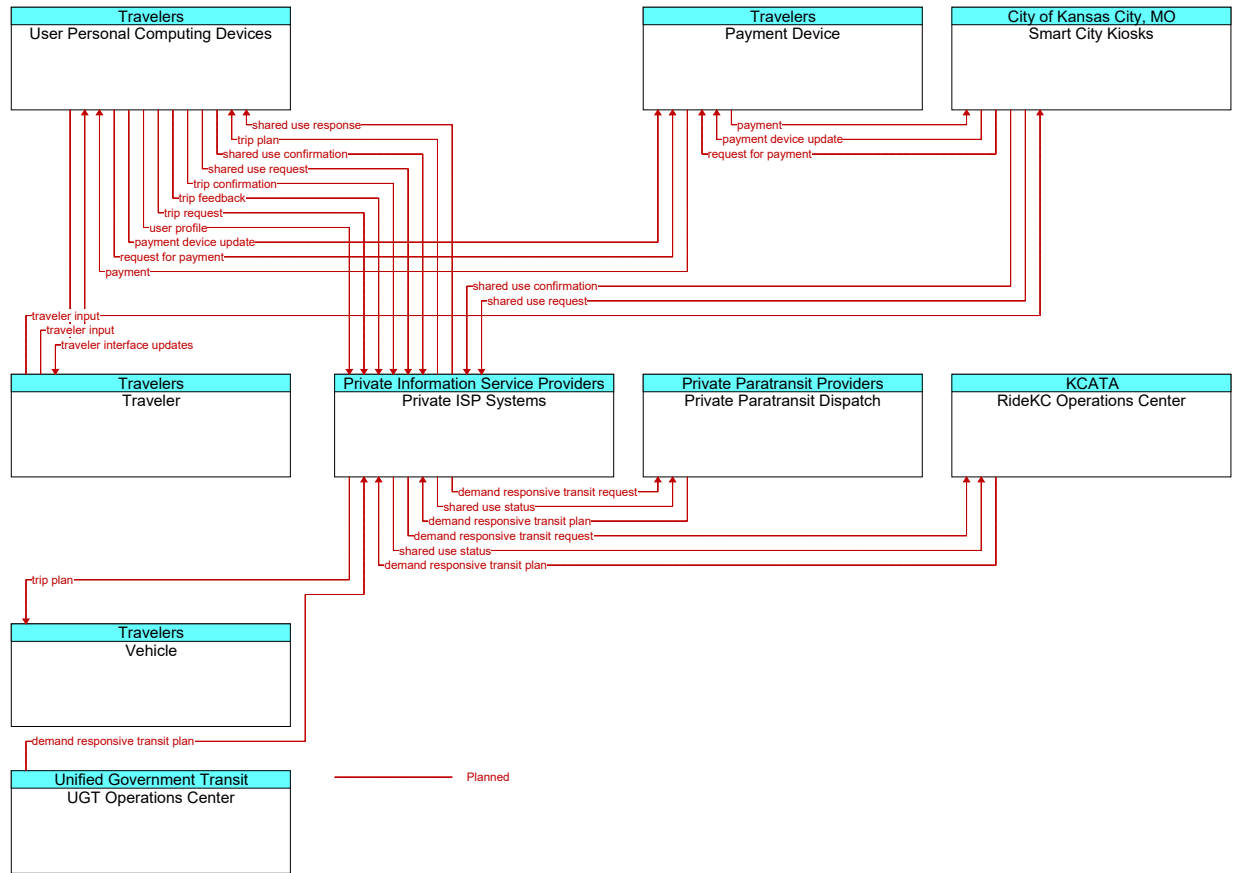


Figure 83 Service TI06 Dynamic Ridesharing and Shared Use Transportation (Transit)

3.4 Transit Signal Priority

Stakeholders: City of Olathe, City of Overland Park, Cities and Counties, KCATA, Regional Transit Operators

Description: Transit Signal Priority is easily accomplished with technology today but the impact on the signal system operation is the challenge. To operate efficiently, transit signal priority requires information about passenger count and transit route schedule performance be evaluated against agreed upon criteria to justify the priority request to the signal system operator. In situations where there is no justification for the priority request yet the request is still made, the relationship between transit and the traffic signal system is negatively affected. To lower the impact of signal priority on the traffic signal system, the establishment of priority request criteria must be established between transit and traffic operations. The criteria will include passenger count and schedule adherence which will be evaluated against the criteria on the transit vehicle prior to the signal priority request being made. This will require passenger counting systems, transit vehicle tracking for schedule adherence, processing of the priority request criteria, and communication of the request to traffic operations. At this time, all TSP is executed at the intersection, locally. This project will implement the transit vehicle and operations systems required to properly assess and communicate the signal priority request. It will be a collaboration between RideKC/KCATA and the various traffic signal operators in the metropolitan area. The scope of this project will include:

- Concept of Operations for TSP using passenger counting and schedule adherence data
- Agreements with traffic signal system operators and RideKC regarding priority request criteria
- Requirements definition
- Design
- System procurement and/or system development
- Testing
- Implementation
- Sustainability

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PT01 - Transit Vehicle Tracking
- PT02 - Transit Fixed-Route Operations
- PT09 - Transit Signal Priority
- PT14 - Multi-modal Coordination
- TM03 - Traffic Signal Control

Service Diagrams:

- PT01 - Transit Vehicle Tracking – (2 diagrams) This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location

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data may be used to determine real time schedule adherence and update the transit system's schedule in real-time.

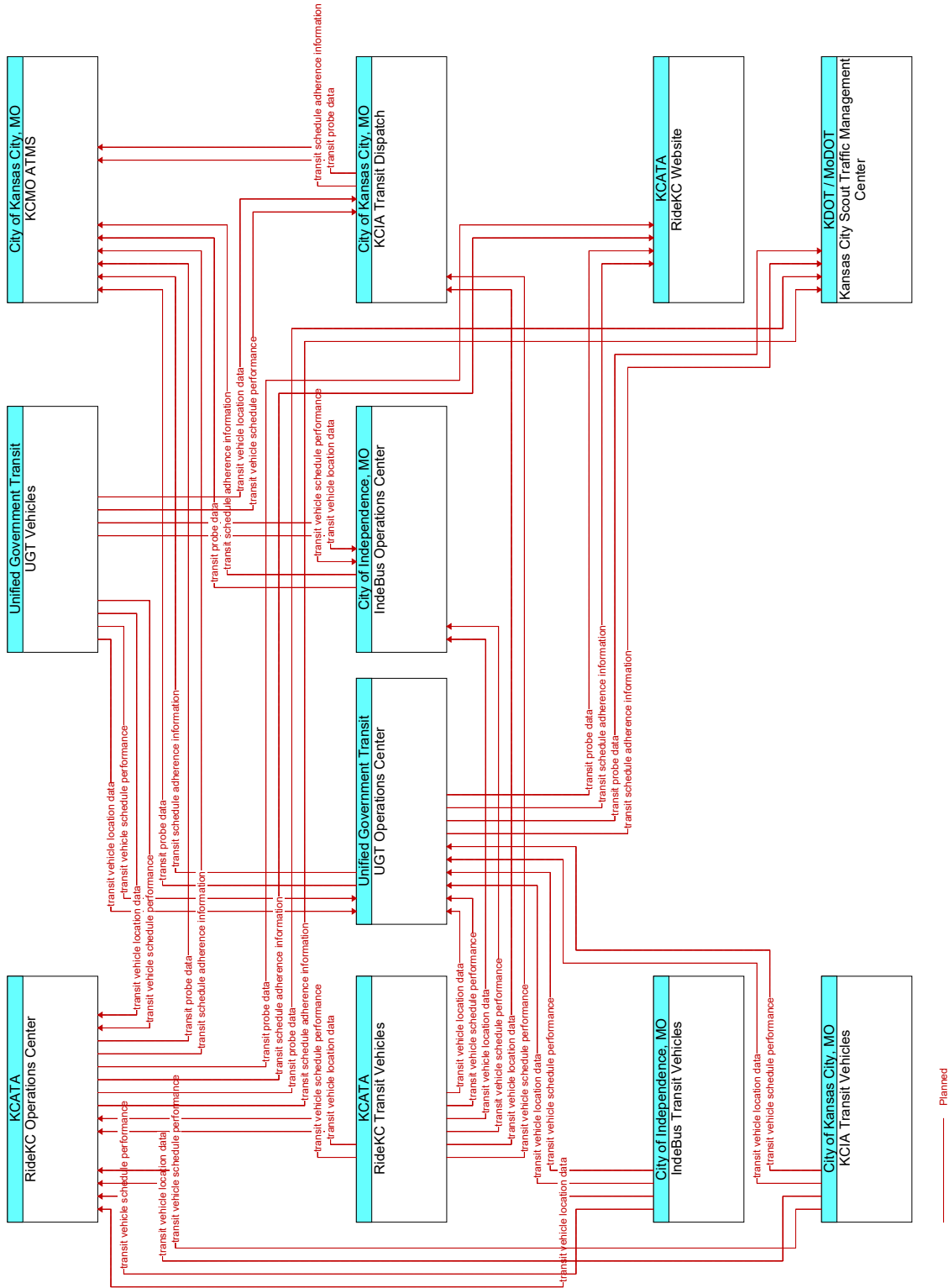


Figure 84 Service PT01 Transit Vehicle Tracking (diagram 1)

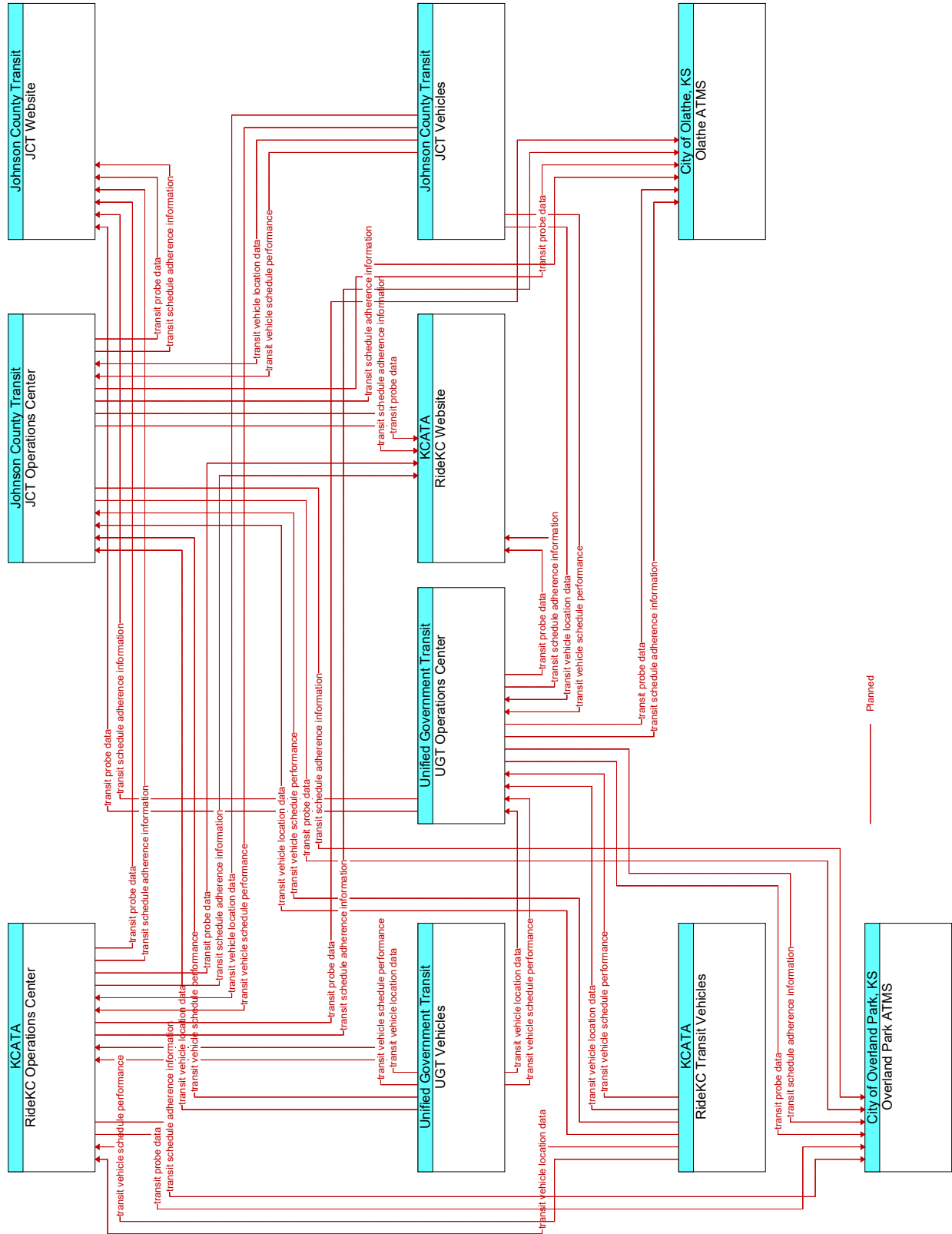


Figure 85 Service PT01 Transit Vehicle Tracking (diagram 2)

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- PT02 - Transit Fixed-Route Operations - This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time.

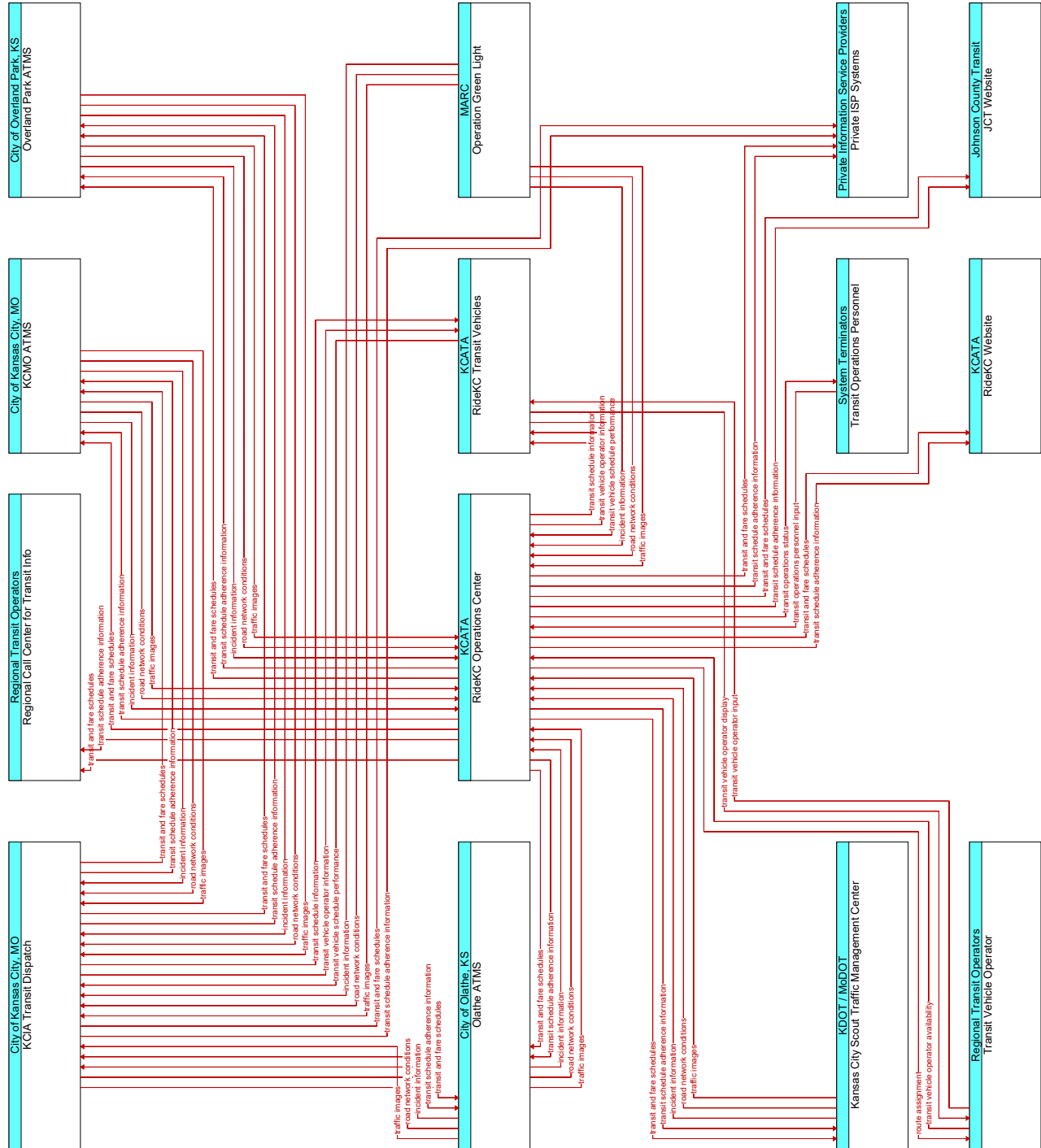


Figure 86 Service PT02 Transit Fixed-Route Operations (Bus)

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- PT09 - Transit Signal Priority – (4 diagrams) The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.

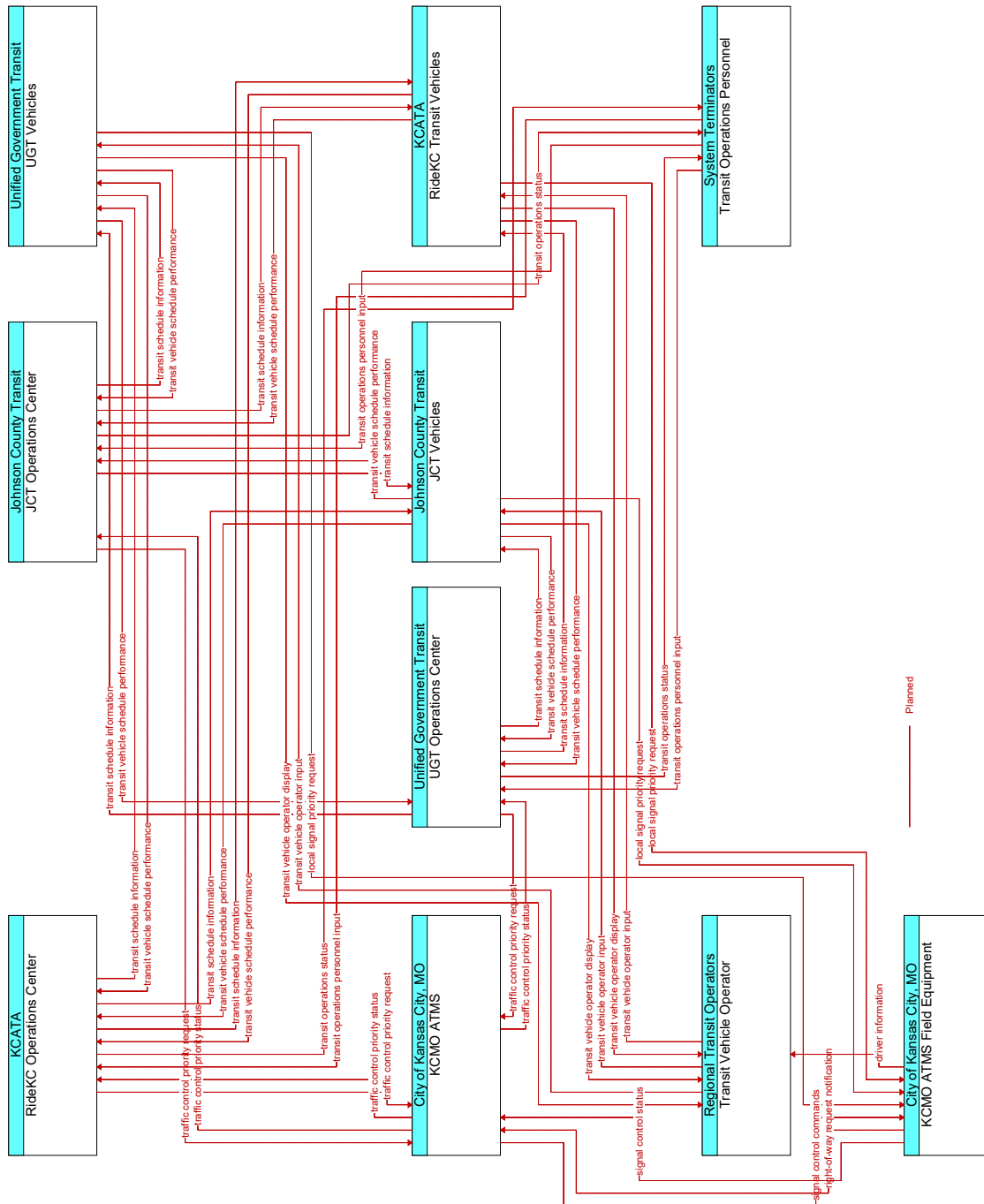


Figure 87 Service PT09 Transit Signal Priority (KCMO)

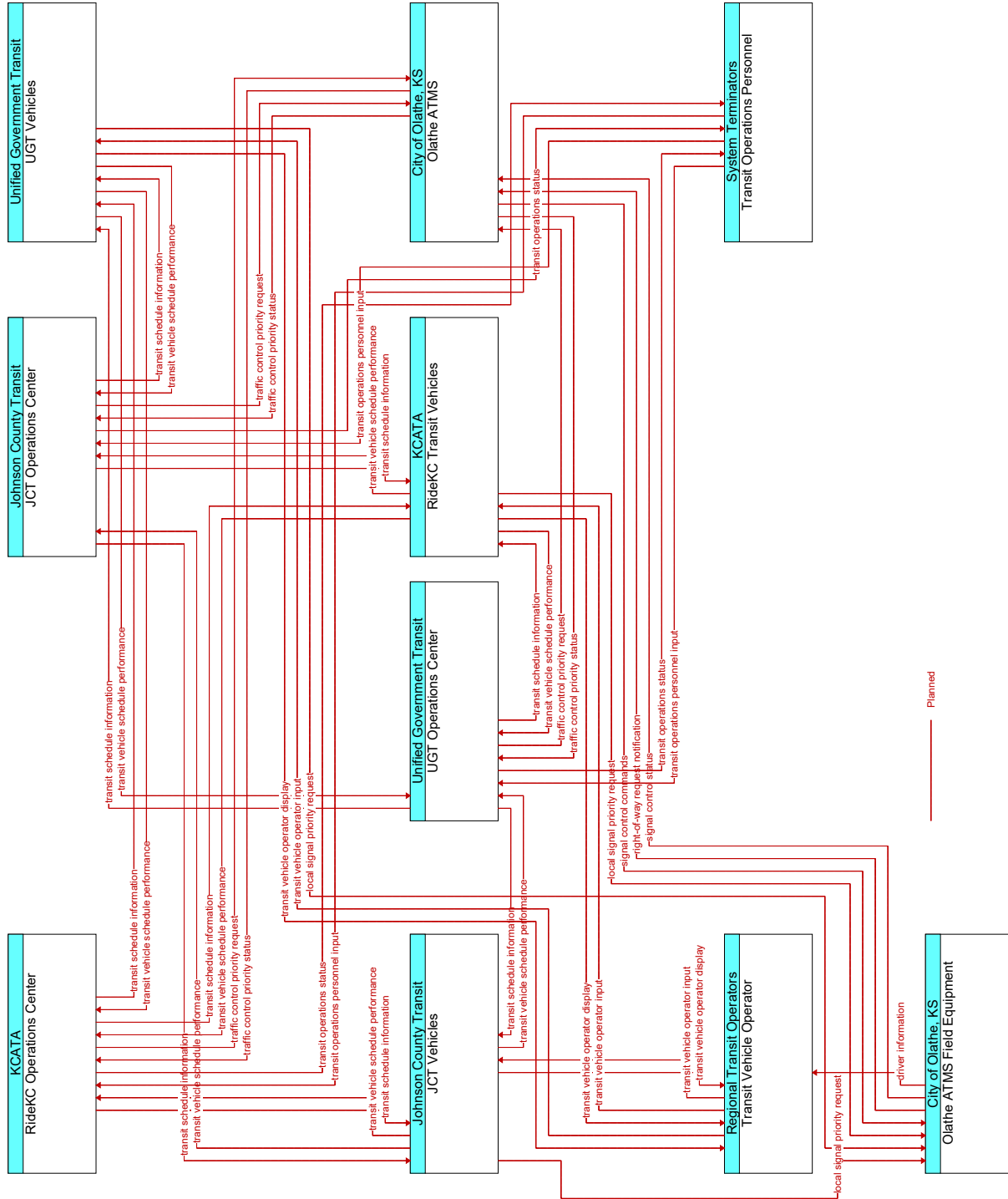


Figure 88 Service PT09 Transit Signal Priority (Olathe)

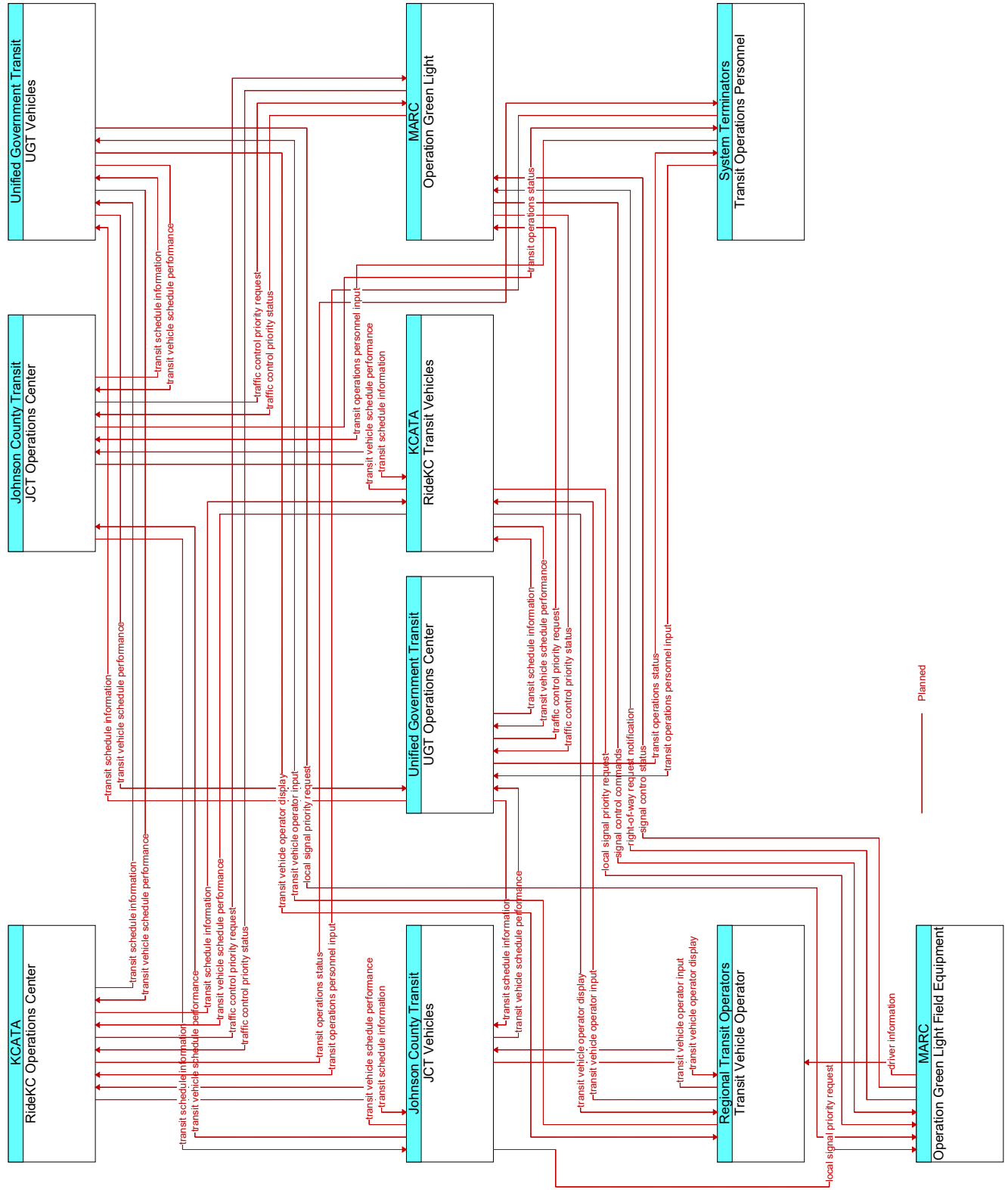


Figure 89 Service PT09 Transit Signal Priority (OGI)

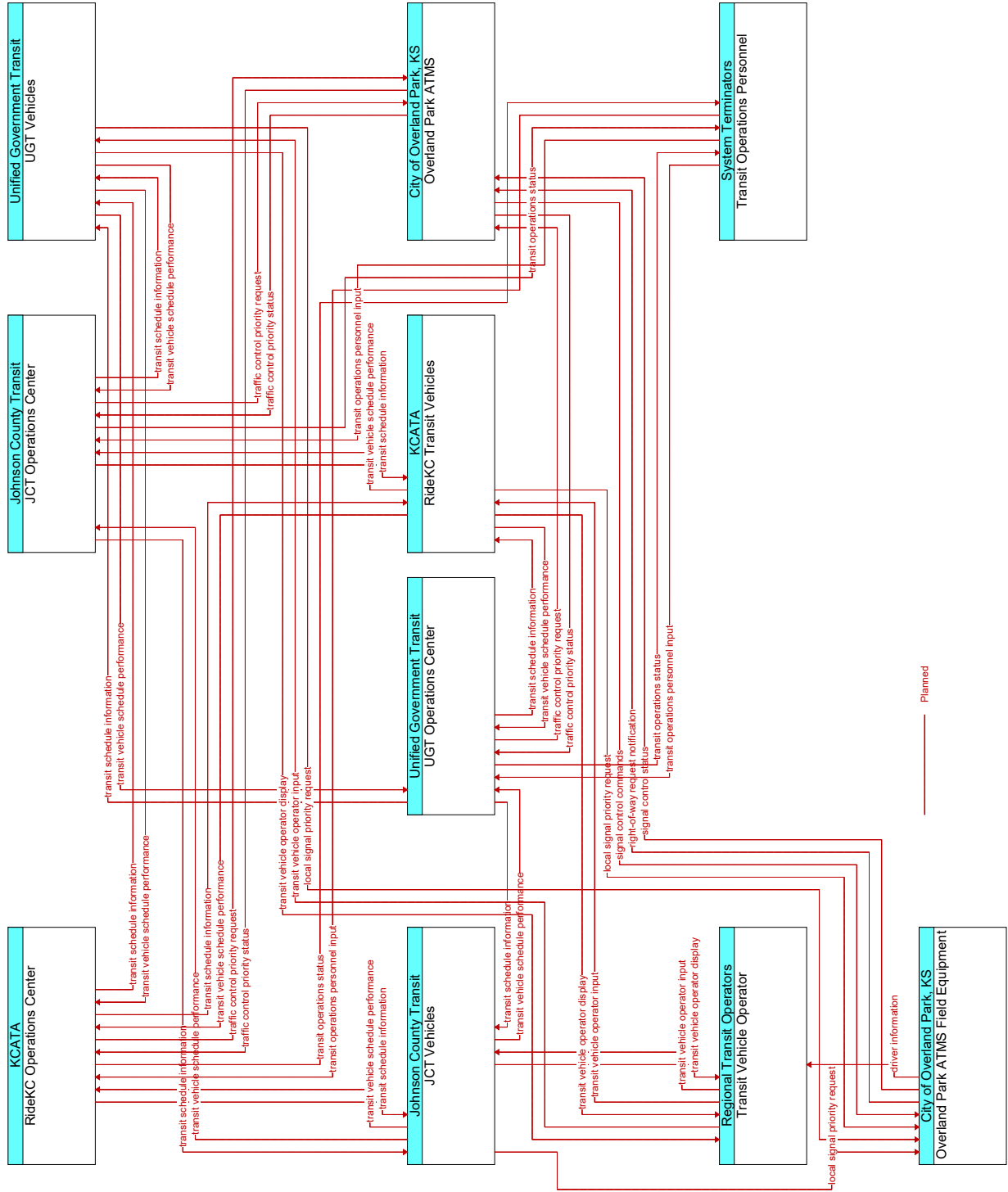


Figure 90 Service PT09 Transit Signal Priority (Overland Park)

- PT14 - Multi-modal Coordination - This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.



Figure 91 Service PT14 Multi-Modal Coordination

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- TM03 - Traffic Signal Control – (5 diagrams) This service package provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this service package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This service package is generally an intra-jurisdictional package. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would also be represented by this package. Coordination of traffic signal systems using real-time communications is covered in the TM07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.

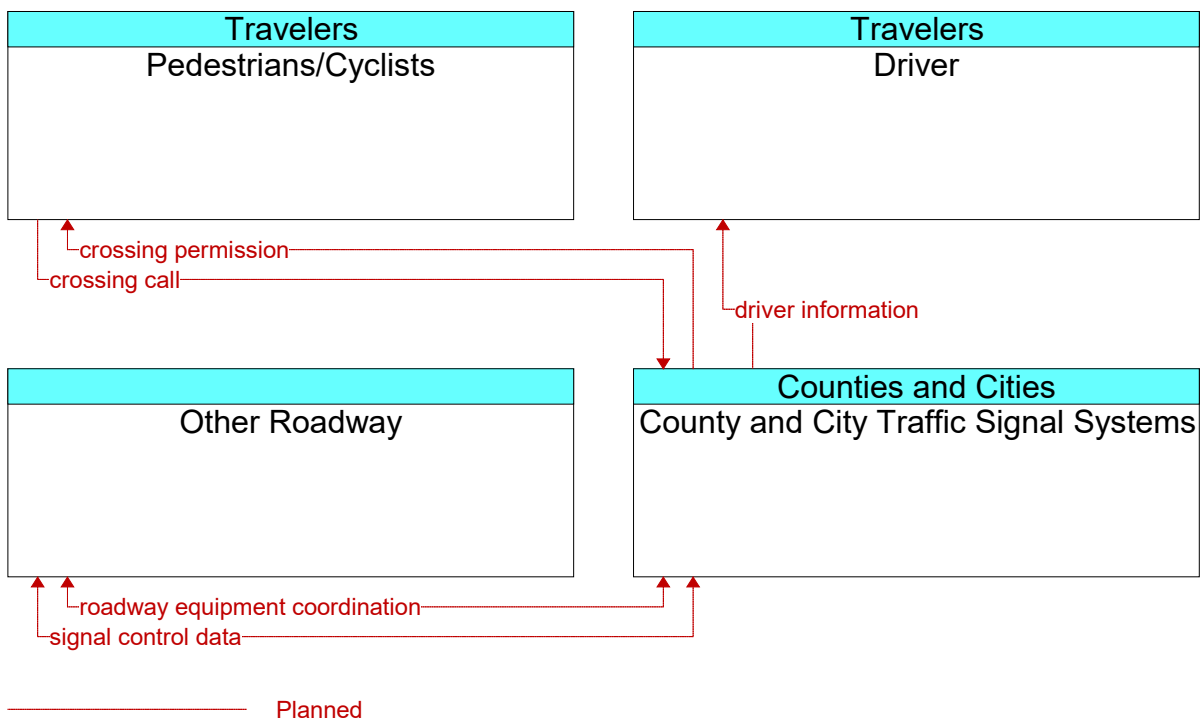


Figure 92 Service TM03 Traffic Signal Control (Cities and Counties)

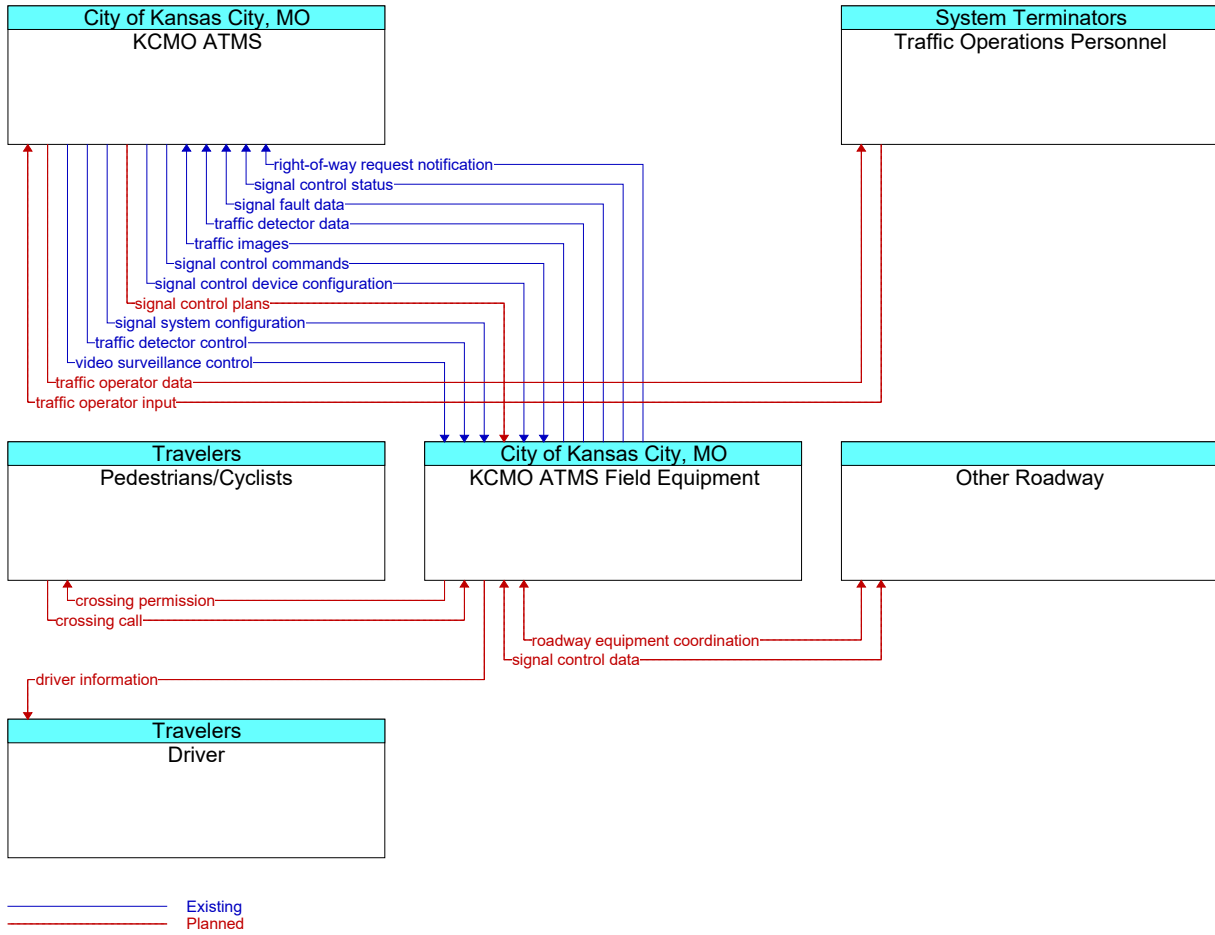


Figure 93 Service TM03 Traffic Signal Control (KCMO)

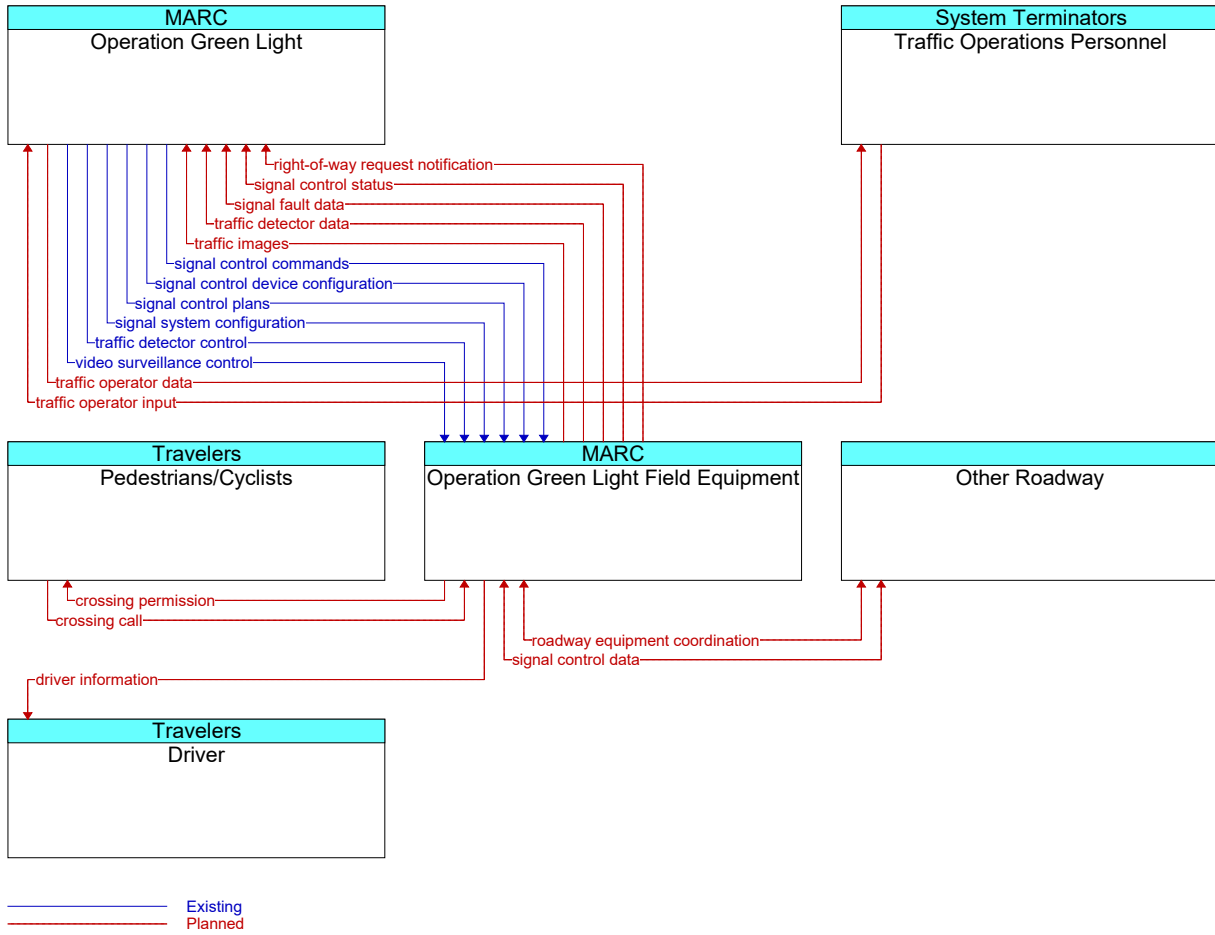


Figure 94 Service TM03 Traffic Signal Control (OGL)

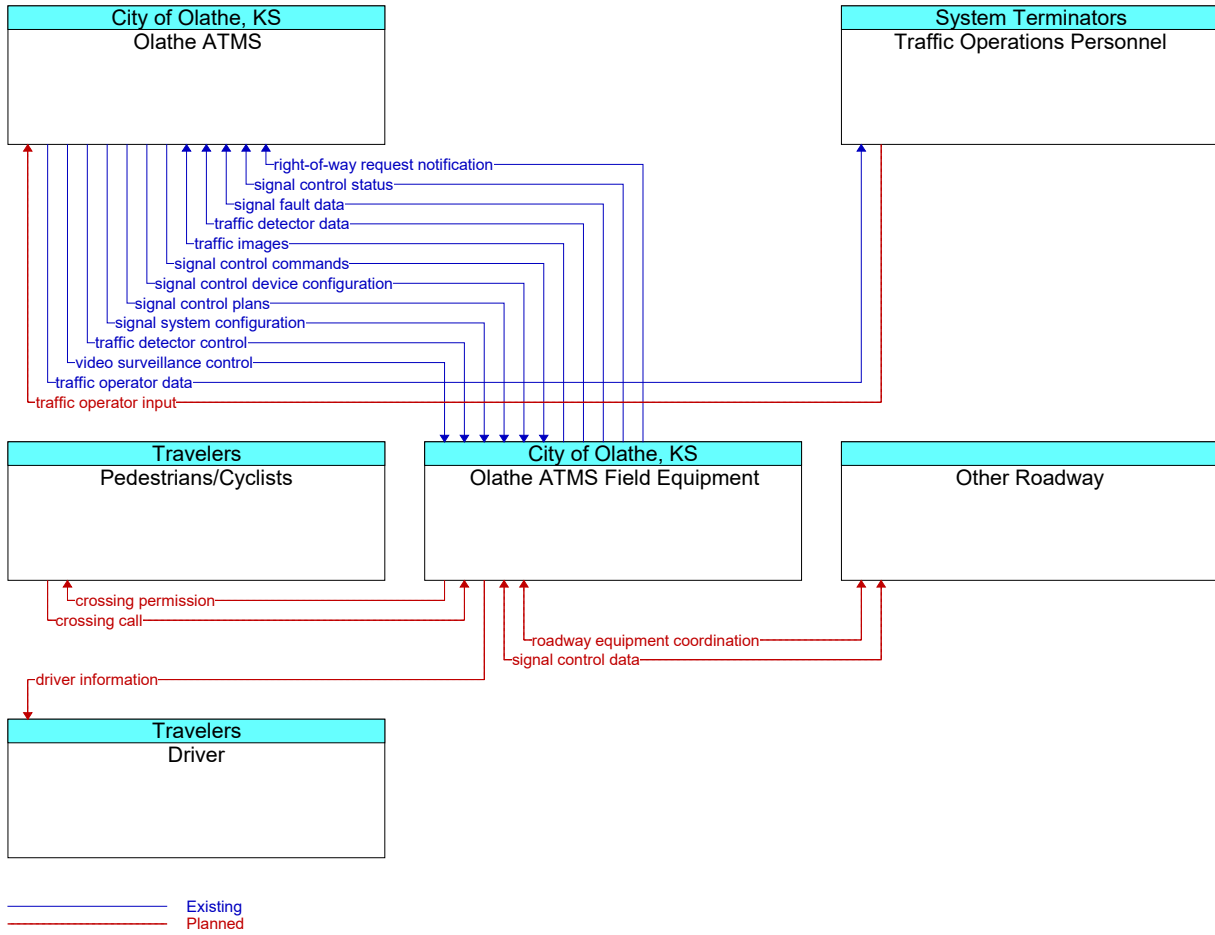


Figure 95 Service TM03 Traffic Signal Control (Olathe)

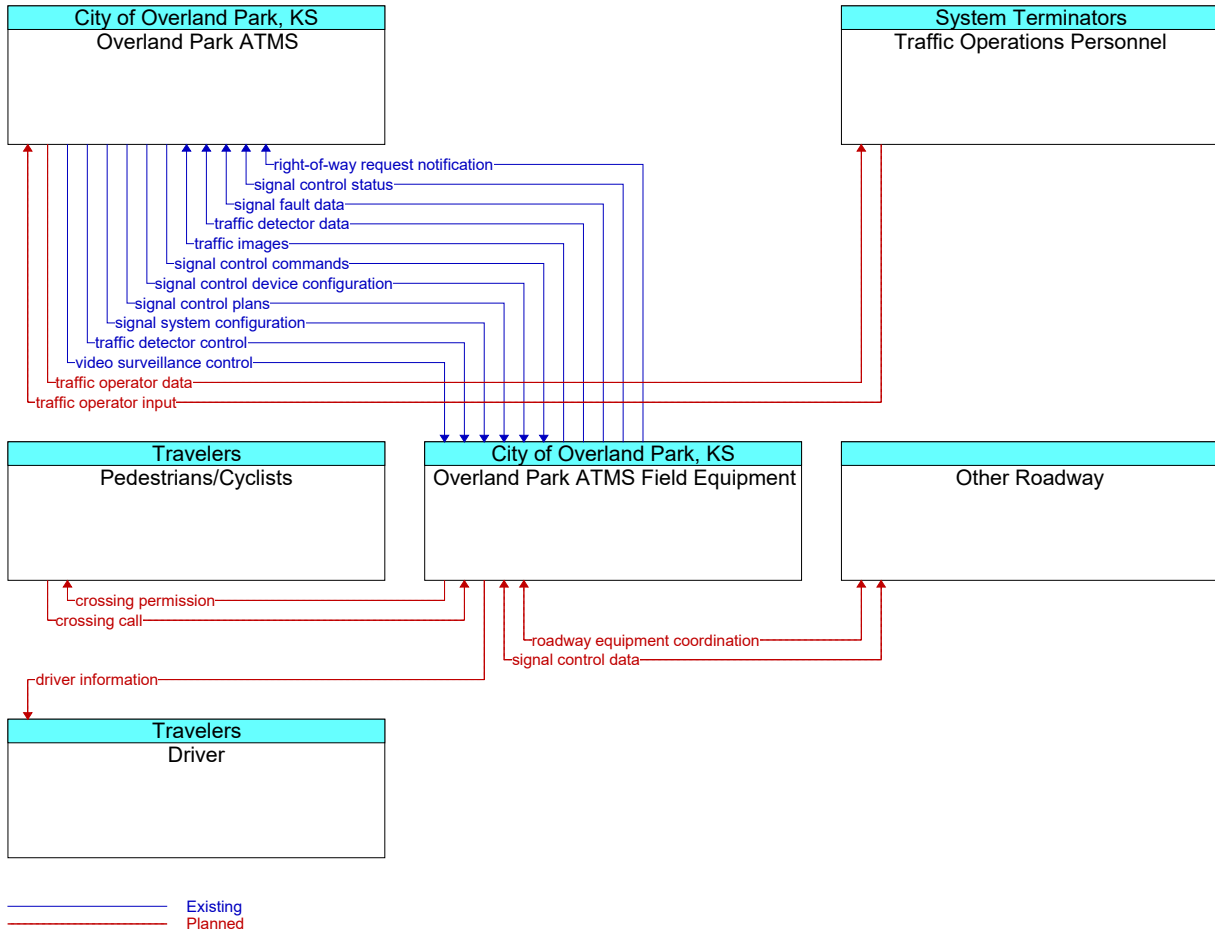


Figure 96 Service TM03 Traffic Signal Control (Overland Park)

3.5 SPaT Challenge – Intersection Approach Countdown (KCMO)

Stakeholders: City of Kansas City, MO

Description: Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations.
Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- ST08 – Eco-Approach and Departure at Signalized Intersections

Service Diagrams:

- ST08 – Eco-Approach and Departure at Signalized Intersections - The Eco-Approach and Departure at Signalized Intersections service package uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service package performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. Finally, the service package may perform engine adjustments that provide increased fuel efficiency.

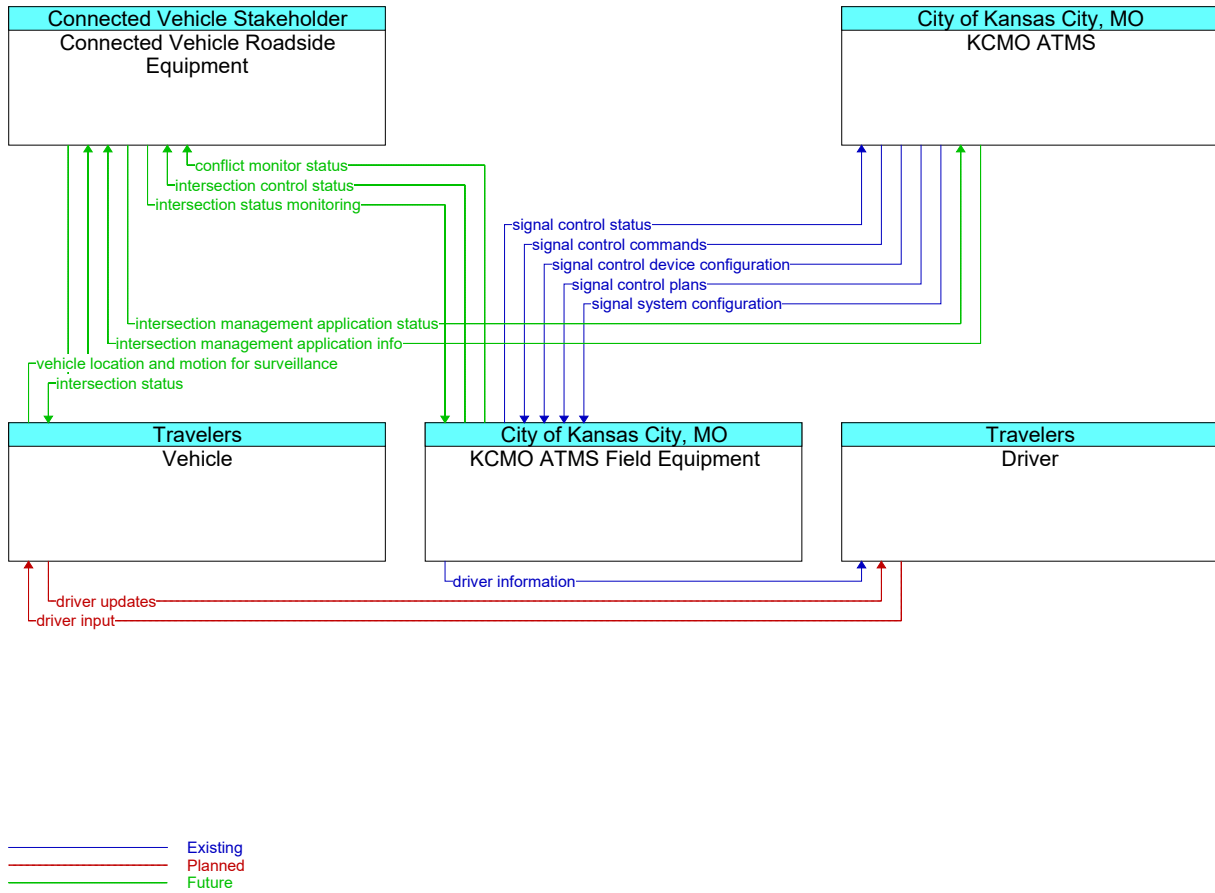


Figure 97 ST08 Eco-Approach and Departure at Signalized Intersections (KCMO)

3.6 SPaT Challenge – Intersection Approach Countdown (Olathe)

Stakeholders: Olathe, KS

Description: Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations. **Service Scope:** This project will include the following services represented in the Kansas City Regional ITS Architecture.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- ST08 – Eco-Approach and Departure at Signalized Intersections

Service Diagrams:

- ST08 – Eco-Approach and Departure at Signalized Intersections - The Eco-Approach and Departure at Signalized Intersections service package uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service package performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. Finally, the service package may perform engine adjustments that provide increased fuel efficiency.

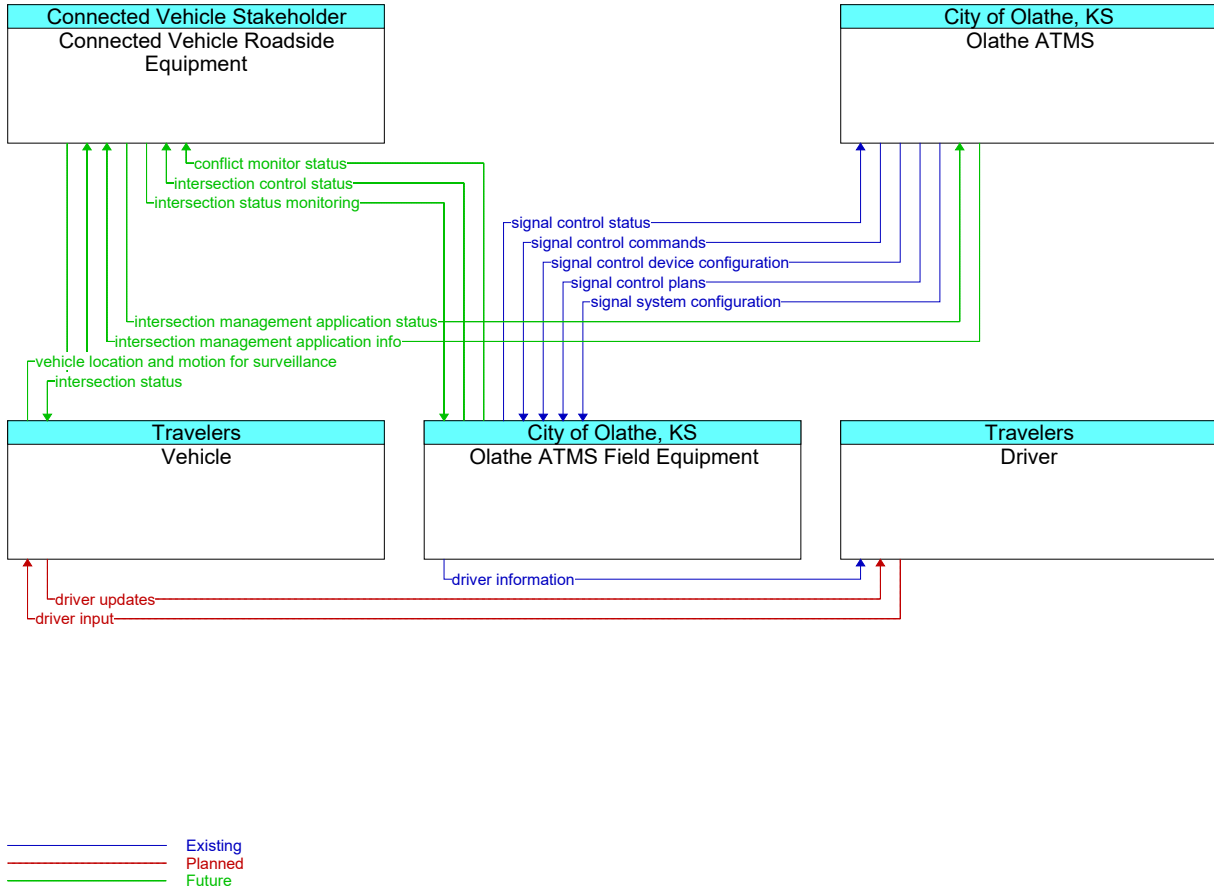


Figure 98 ST08 Eco-Approach and Departure at Signalized Intersections (Olathe)

3.7 SPaT Challenge – Intersection Approach Countdown (Overland Park)

Stakeholders: Overland Park, KS

Description: Signal Phase and Timing (SPaT) data is supported in the connected vehicle environment through the deployment of roadside equipment and onboard equipment in the vehicle to exchange signal timing data. The Eco-Approach and Departure at Signalized Intersections service package, upon which this project is based, uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. In basic applications, this service provides a countdown to the signal change from green to yellow or red to green allowing the driver to adjust their vehicle speed to approach and depart the intersection in an optimal manner. The SPaT challenge is organized by the National Operations Center of Excellence to encourage DSRC device deployment in all states. This particular service is not the only one supported with this technology implementation so more applications can be added in the future using the same RSE and OBE implementations. **Service Scope:** This project will include the following services represented in the Kansas City Regional ITS Architecture.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- ST08 – Eco-Approach and Departure at Signalized Intersections

Service Diagrams:

- ST08 – Eco-Approach and Departure at Signalized Intersections - The Eco-Approach and Departure at Signalized Intersections service package uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service package performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. Finally, the service package may perform engine adjustments that provide increased fuel efficiency.

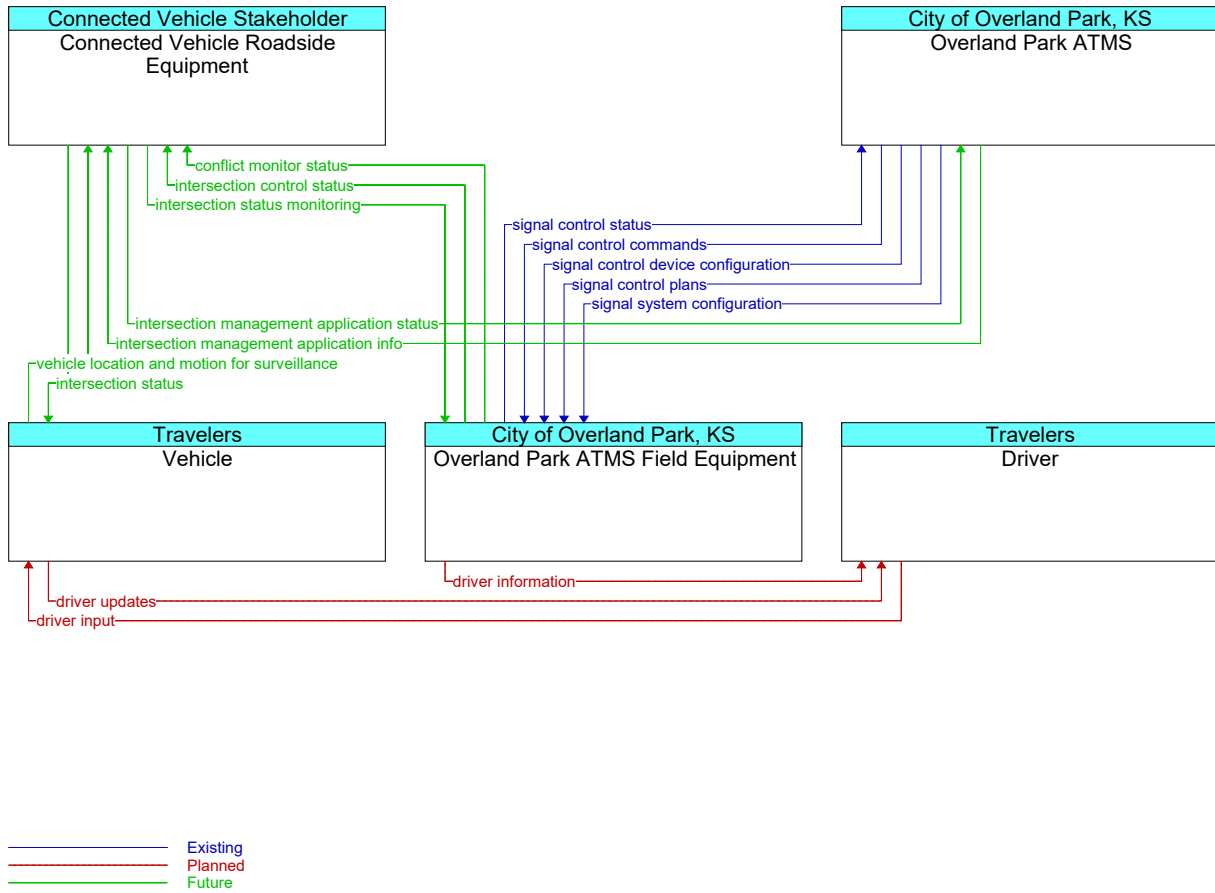


Figure 99 ST08 Eco-Approach and Departure at Signalized Intersections (Overland Park)

4.1 Data Distribution System/ Data Portal

Stakeholders: Kansas DOT, Missouri DOT, MARC, KCATA, Cities and Counties, Event Sponsors/Facilities

Description: Transportation data is available in numerous systems throughout the Kansas City region. There is potential in the data that can be leveraged by organizations beyond the public sector. These opportunities can lead to transformative product developments that move the region forward without the constraints of public budgets. This project will establish a data distribution or portal to make transportation data from systems in the region through a single source. The project scope will include the following:

- Champion Identification
- Concept of Operations
- Requirements Definition
- Design- Development
- Testing- Implementation
- Operation and Maintenance

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- SU03 - Data Distribution

Service Diagrams:

- SU03 - Data Distribution - This service package manages the distribution of data from data providers to data consumers and protects those data from unauthorized access. It informs data providers of how to provide data, manages data subscriptions, and provides data forwarding capabilities. The service package also maintains a directory of System Users that want data and supports multiple distribution mechanisms including publish-subscribe and directly from data provider to data consumer. It allows data consumers to specify (and change the specification of) data they wish to receive.

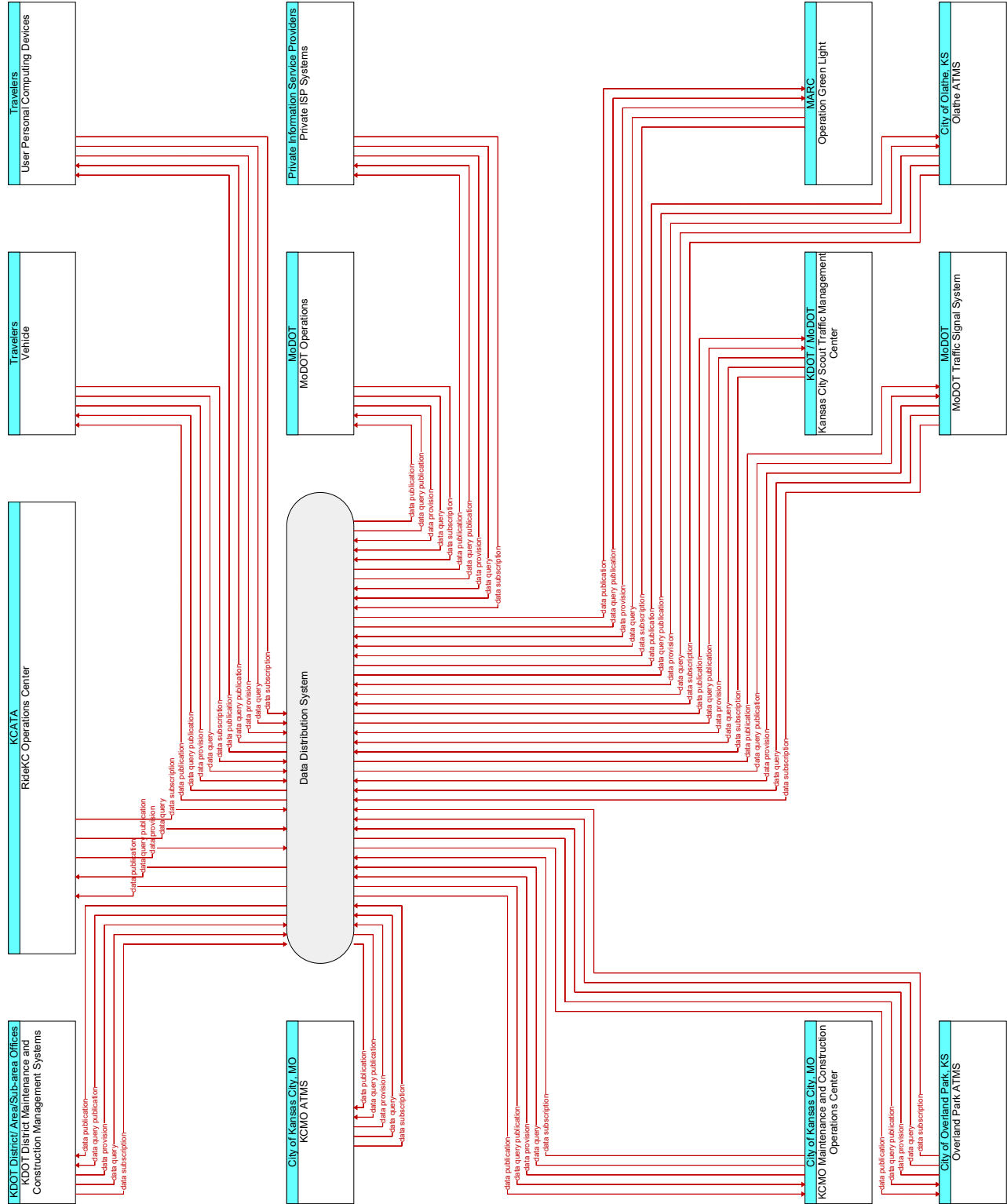


Figure 100 Service SU03 Data Distribution

Planned

4.2 Intermodal Freight Facility Coordination

Stakeholders: Kansas DOT, Missouri DOT, Foreign Trade Zone Facilities, Freight and Intermodal Companies, Intermodal Facilities, Private Information Service Providers

Description: Kansas City is a major intermodal freight hub that brings in and ships out freight on water, rail and roadways. The arrival or departure of freight from these depots can have a negative impact on the surface transportation system. This project will establish communication of major freight movement schedules with transportation agencies to coordinate traffic and transit services to minimize the impact on the transportation system.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- CVO01 - Carrier Operations and Fleet Management
- SU03 - Data Distribution
- TM05 - Traffic Metering
- TM06 - Traffic Information Dissemination
- TM07 - Regional Traffic Management
- TM09 - Integrated Decision Support and Demand Management

Service Diagrams:

- CVO01 - Carrier Operations and Fleet Management - This service package manages a fleet of commercial vehicles. The Fleet and Freight Management Center monitors the vehicle fleet and can provide routes using either an in-house capability or an external provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). A route is electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management Center and routing changes can be made depending on current road network conditions. This service package also supports maintenance of fleet vehicles with on-board monitoring equipment. Records of vehicle mileage, preventative maintenance and repairs are maintained.

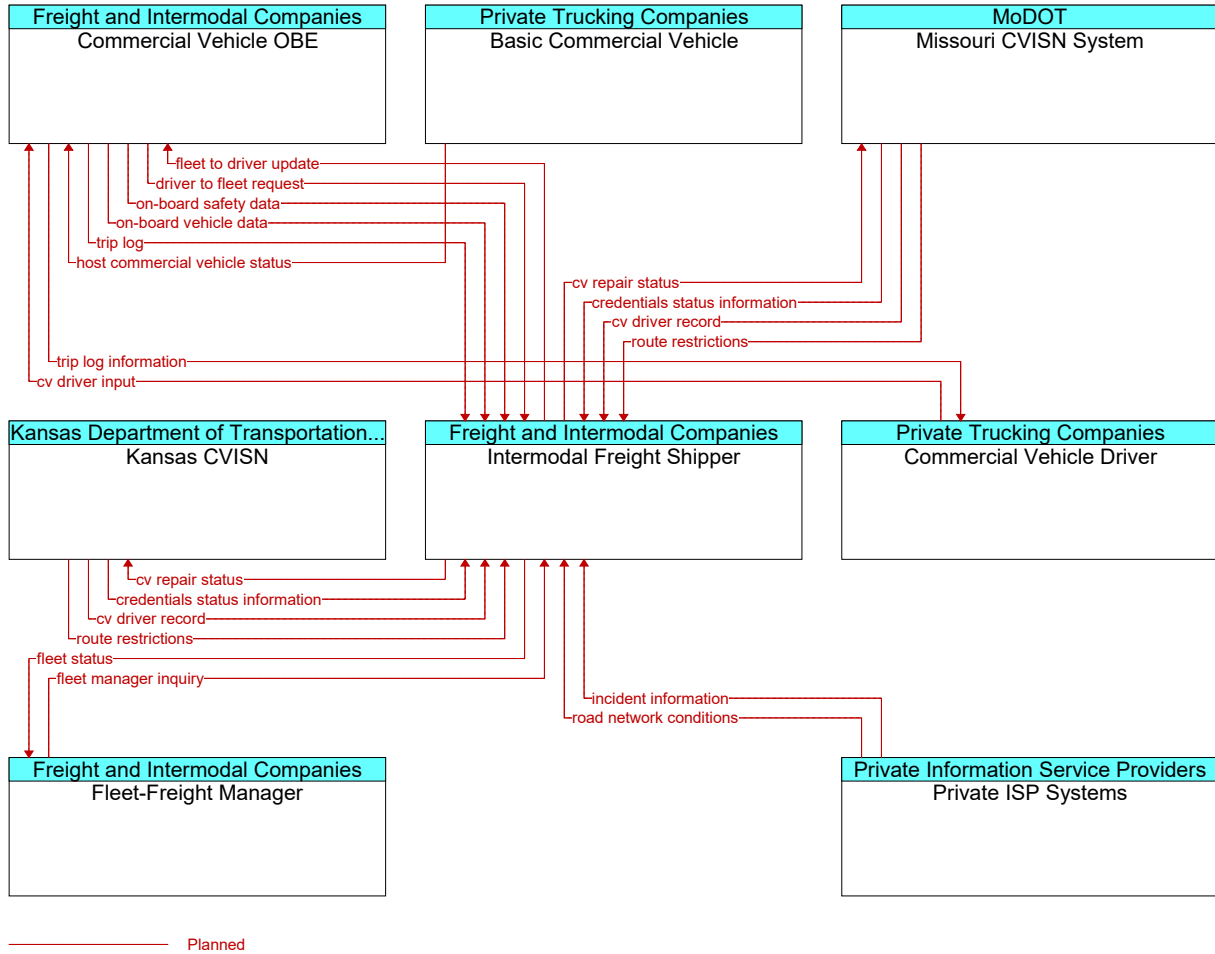


Figure 101 Service CVO01 Carrier Operations and Fleet Management

- SU03 - Data Distribution - This service package manages the distribution of data from data providers to data consumers and protects those data from unauthorized access. It informs data providers of how to provide data, manages data subscriptions, and provides data forwarding capabilities. The service package also maintains a directory of System Users that want data and supports multiple distribution mechanisms including publish-subscribe and directly from data provider to data consumer. It allows data consumers to specify (and change the specification of) data they wish to receive.

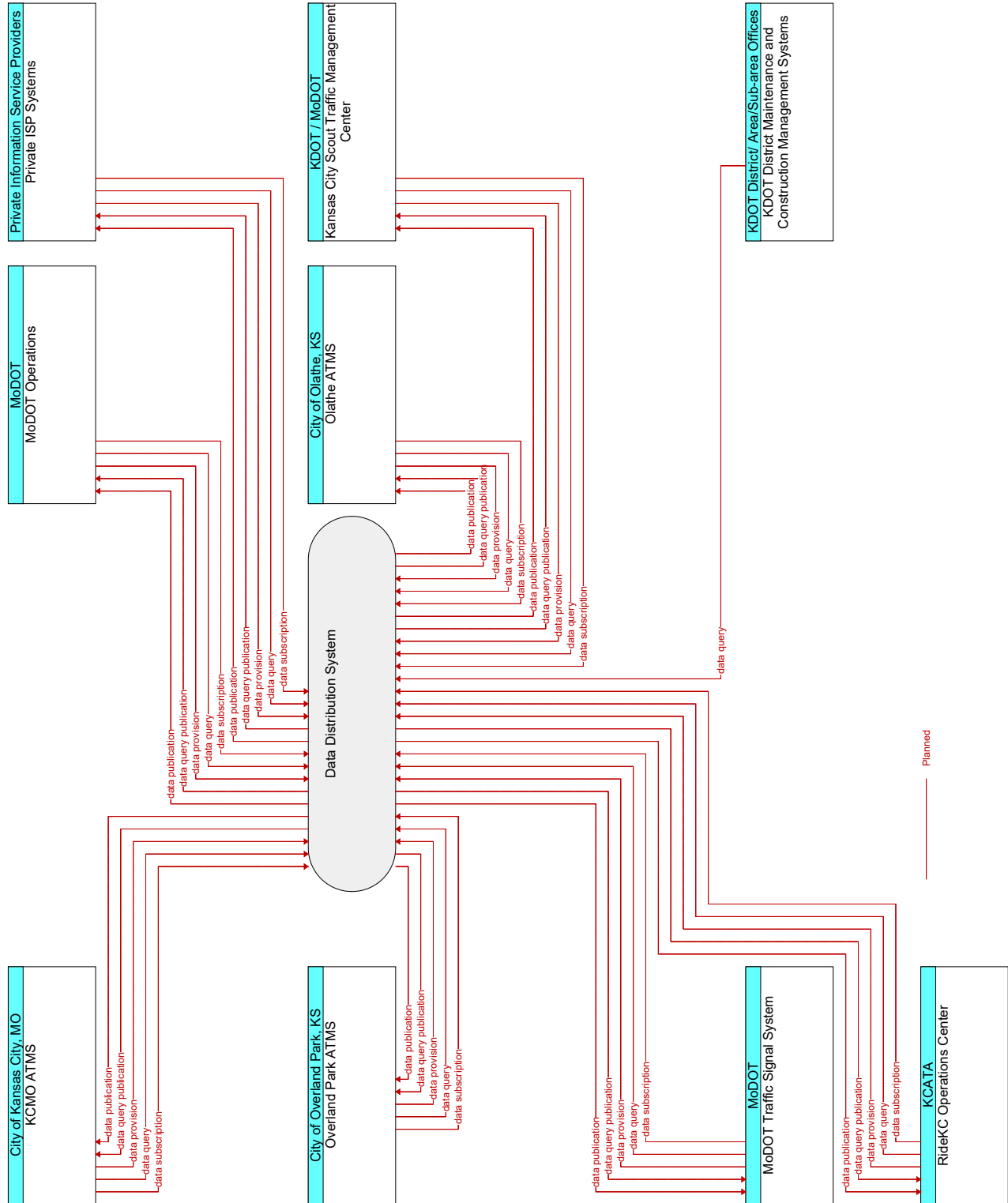


Figure 102 Service SU03 Data Distribution

- TM05 - Traffic Metering - This service package provides central monitoring and control, communications, and field equipment that support metering of traffic. It

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supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the TM01 service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.

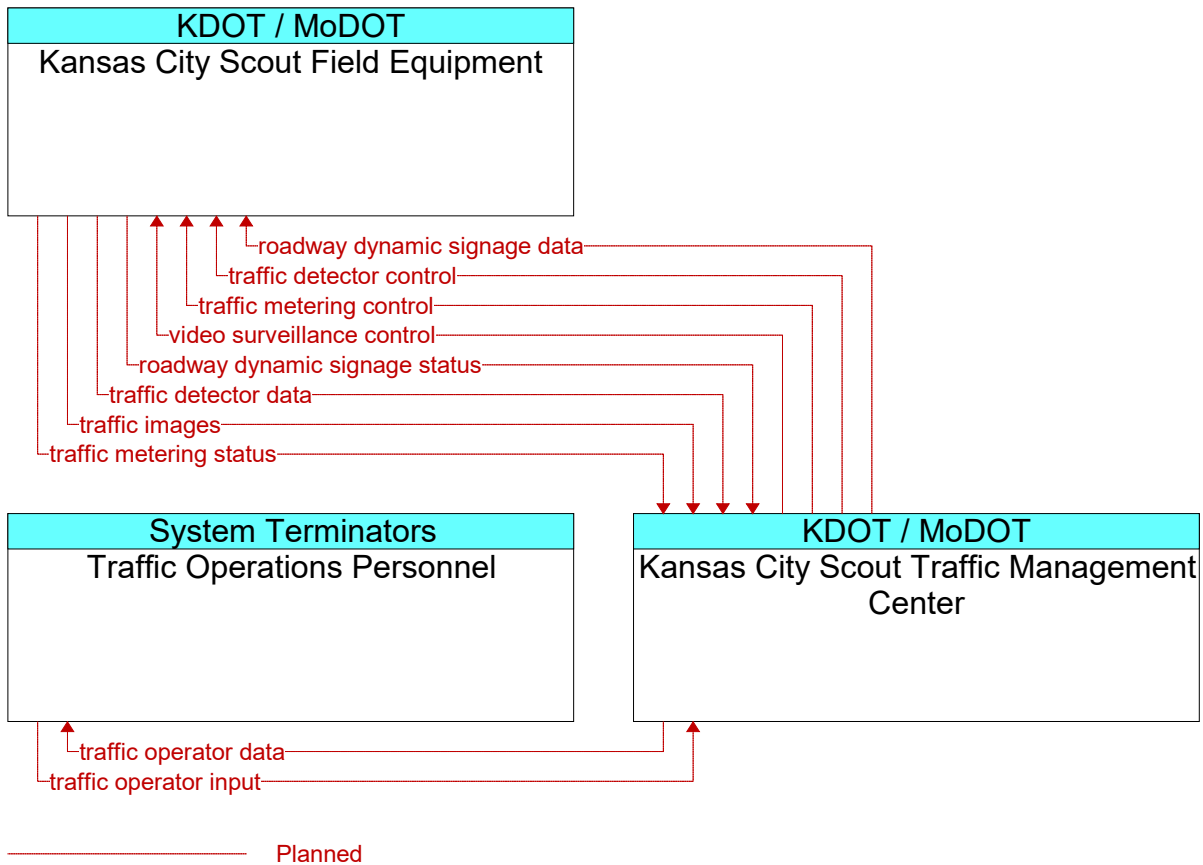


Figure 103 Service TM05 Traffic Metering

- **TM06 - Traffic Information Dissemination** - This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that

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provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.

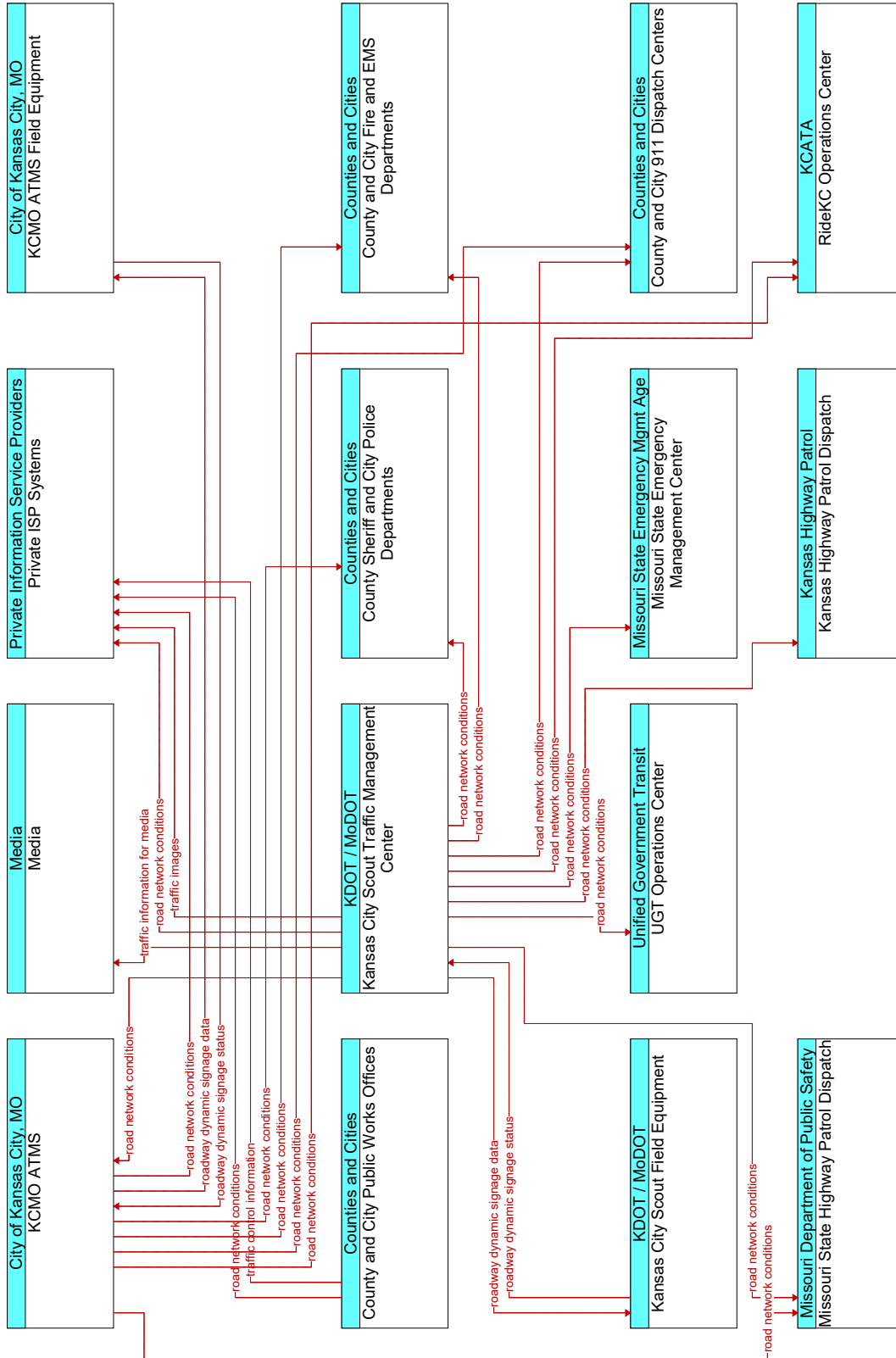
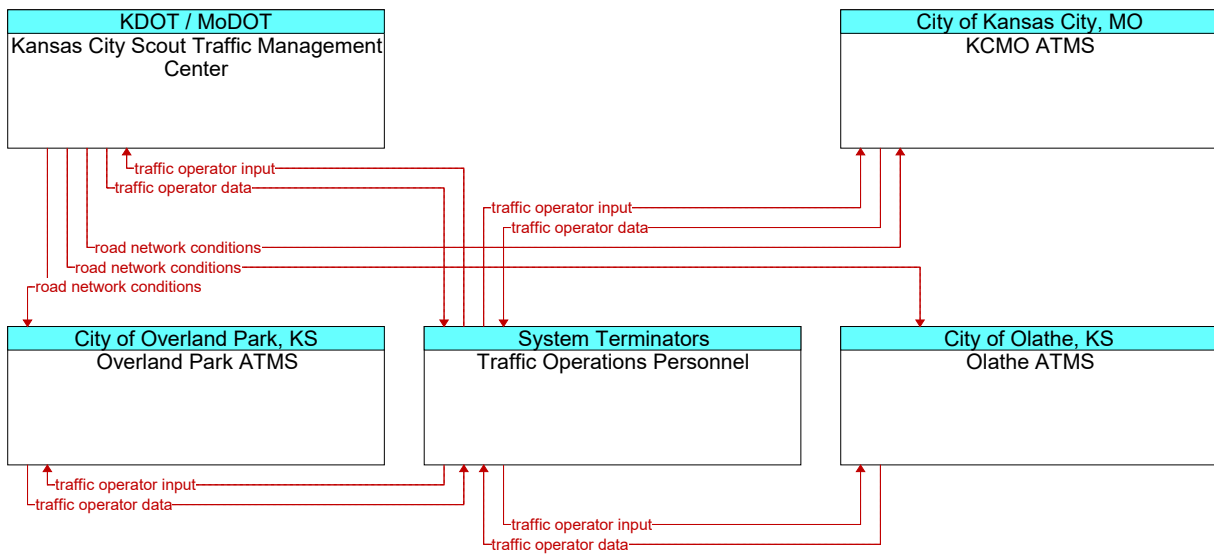


Figure 104 Service TM06 Traffic Information Dissemination

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- TM07 - Regional Traffic Management** - This service package provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.



Planned

Figure 105 Service TM07 Regional Traffic Management

- TM09 - Integrated Decision Support and Demand Management** - This service package recommends courses of action to transportation operators in a corridor, downtown area, or other heavily traveled area. Recommendations are based on an assessment of current and forecast transportation network performance and

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environmental conditions. Multi-modal transportation operational strategies are created that consider all modes and all roads in the travel area to correct network imbalances and effectively manage available capacity. As part of the operational strategies, this service package may also recommend lane restrictions, transit, parking, and toll strategies to influence traveler route and mode choices to support active demand management programs and policies managing both traffic and the environment. Operational strategies, including demand management recommendations, are coordinated to support operational decisions by each transportation operator that are consistent with the recommended strategy. All recommended operational strategies are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support operational strategies that manage and balance capacity and demand.

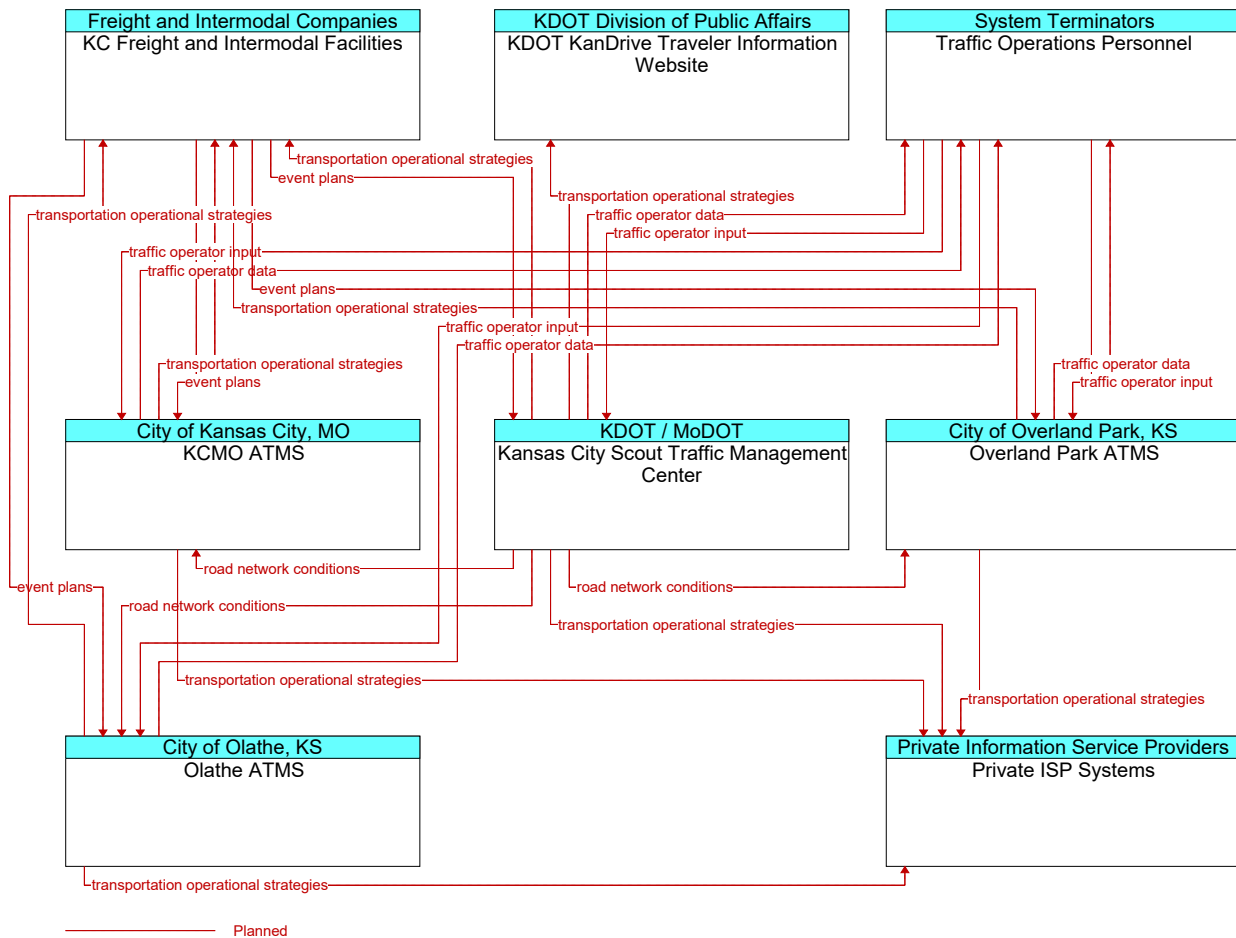


Figure 106 Service TM09 Integrated Decision Support and Demand Management

4.3 Employment Center Coordination

Stakeholders: Kansas DOT, Missouri DOT, City of Olathe

Description: This service package recommends courses of action to transportation operators in a corridor, downtown area, or other heavily traveled area. Recommendations are based on an assessment of current and forecast transportation network performance and environmental conditions. Multi-modal transportation operational strategies are created that consider all modes and all roads in the travel area to correct network imbalances and effectively manage available capacity. As part of the operational strategies, this service package may also recommend lane restrictions, transit, parking, and toll strategies to influence traveler route and mode choices to support active demand management programs and policies managing both traffic and the environment. Operational strategies, including demand management recommendations, are coordinated to support operational decisions by each transportation operator that are consistent with the recommended strategy. All recommended operational strategies are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support operational strategies that manage and balance capacity and demand.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PT03 - Dynamic Transit Operations
- PT14 - Multi-modal Coordination
- TI06 - Dynamic Ridesharing and Shared Use Transportation
- TM06 - Traffic Information Dissemination
- TM07 - Regional Traffic Management
- TM09 - Integrated Decision Support and Demand Management

Service Diagrams:

- PT03 - Dynamic Transit Operations - The Dynamic Transit Operations service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This service package builds on existing technology systems such as computer-aided dispatch/automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. TI06 covers other shared use transportation options.

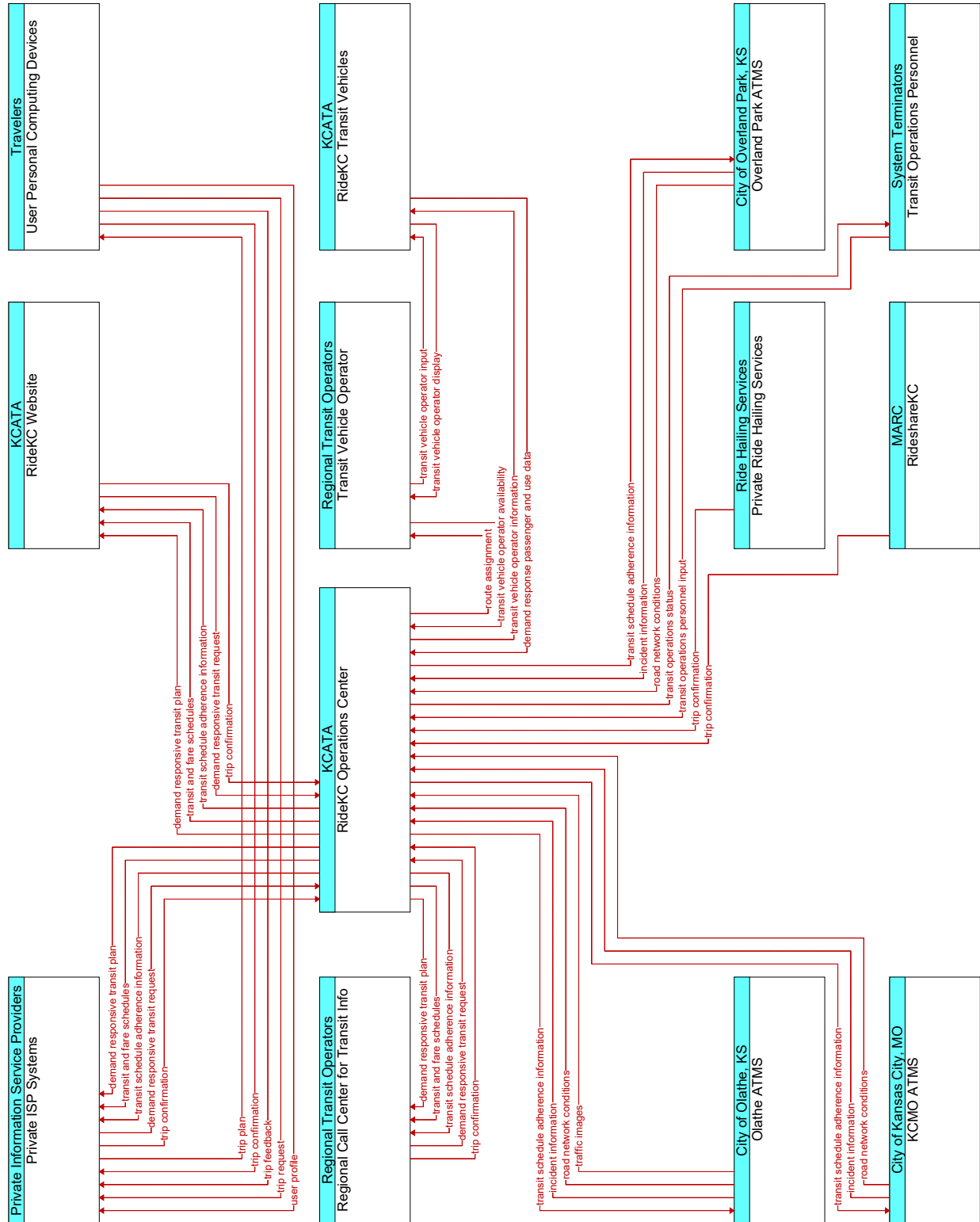


Figure 107 Service PT03 Dynamic Transit Operations

Planned

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- PT14 - Multi-modal Coordination - This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

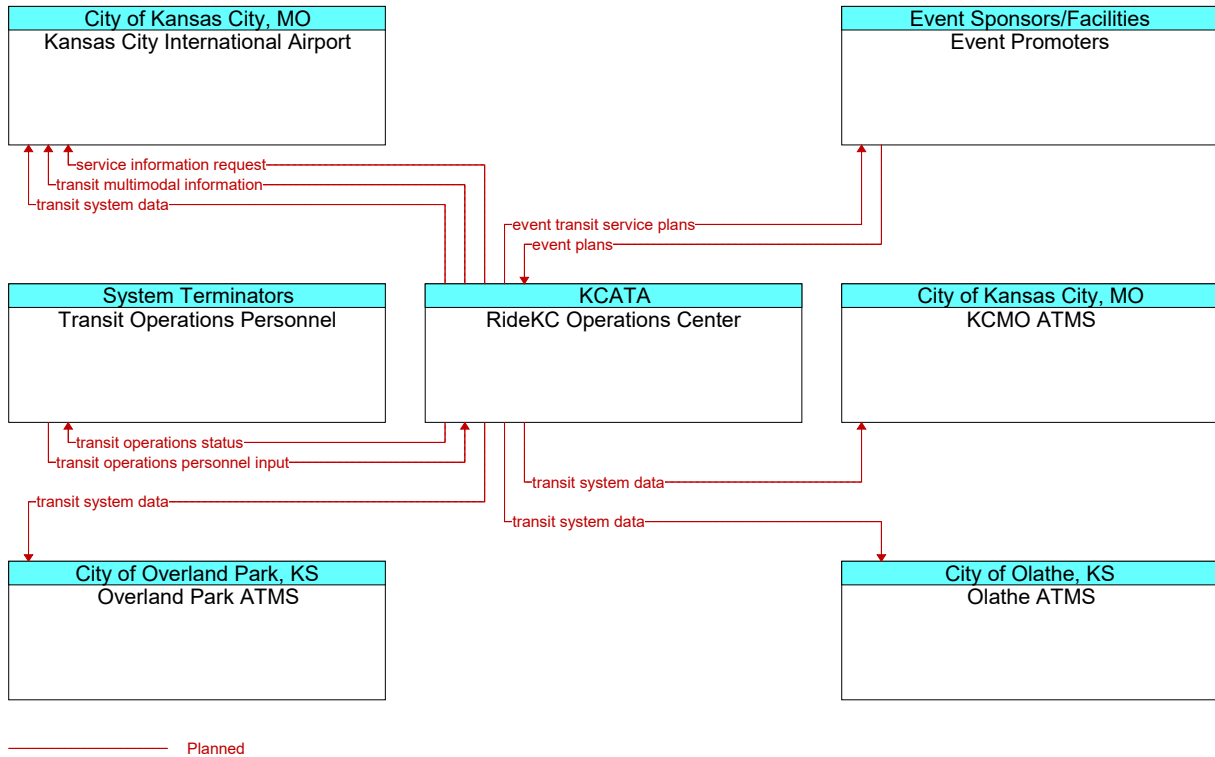


Figure 108 Service PT14 Multi-modal coordination (Employment Center Coordination)

- TI06 - Dynamic Ridesharing and Shared Use Transportation - This service package addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip. These inputs are then translated into "optimal" pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the service package to improve the user's experience for future trips.

The shared use aspect of the service package addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take

them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.

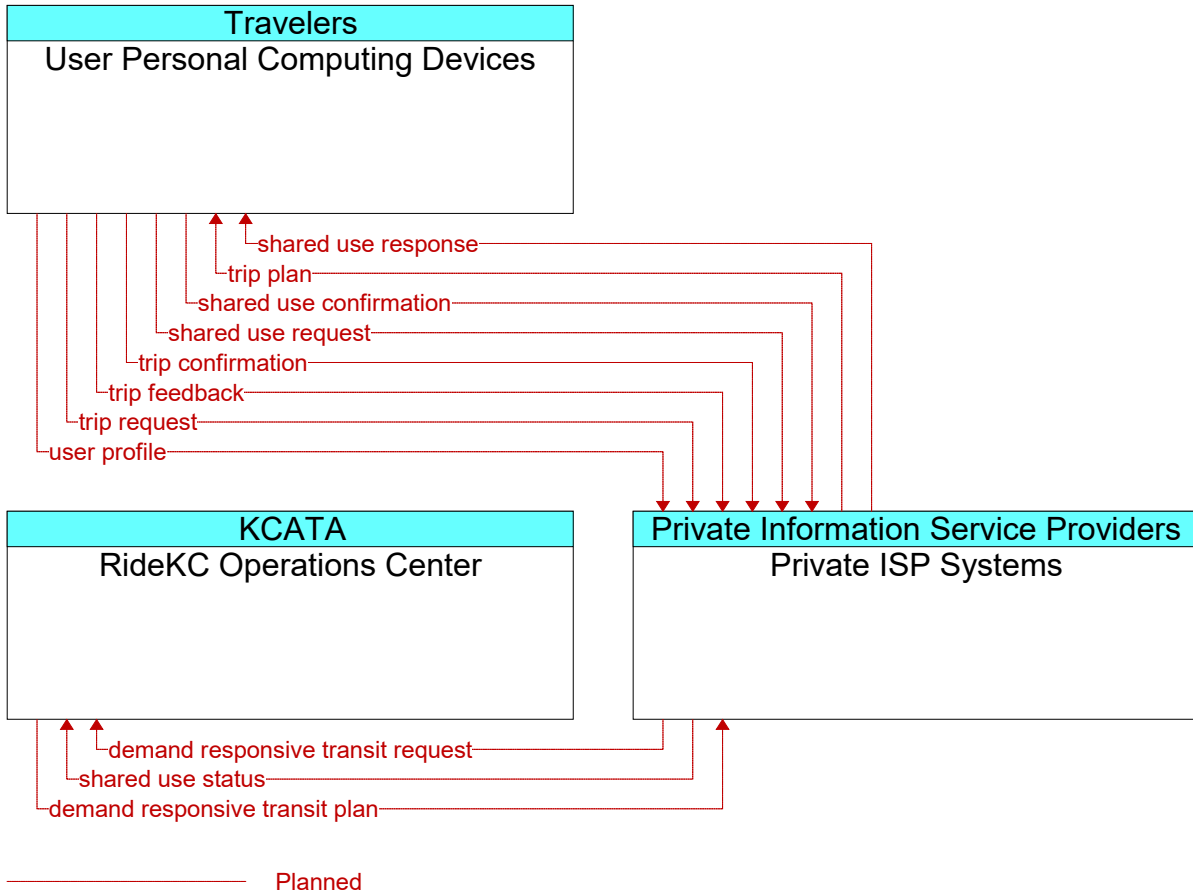


Figure 109 Service TI06 Dynamic Ridesharing and Shared Use Transportation

- TM06 - Traffic Information Dissemination - This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge

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closures and restrictions due to maintenance and construction activities to be disseminated.

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- TM07 - Regional Traffic Management** - This service package provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

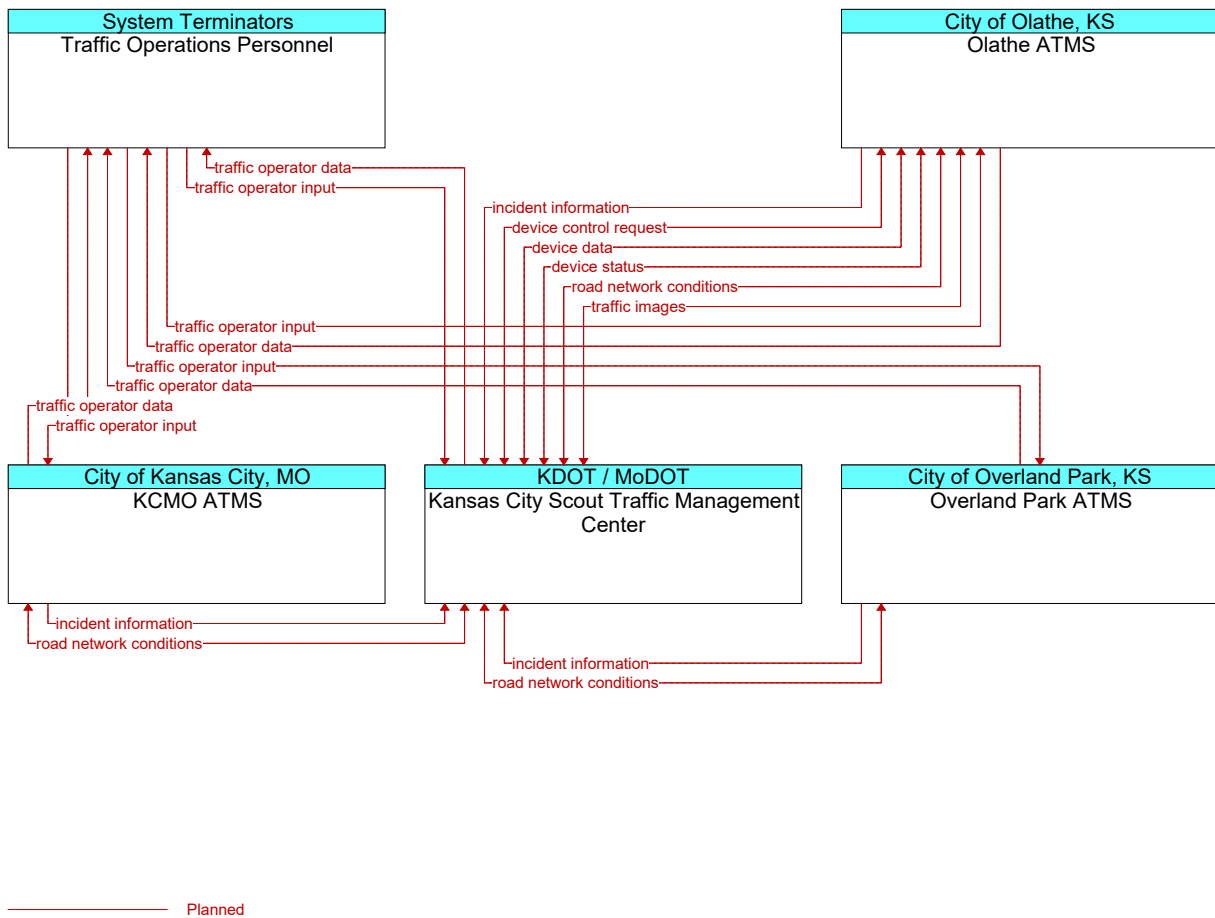


Figure 111 Service TM07 Regional Traffic Management

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- **TM09 - Integrated Decision Support and Demand Management** - This service package provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

4.4 Regional Parking Management

Stakeholders: City of Kansas City MO, MARC, Private Information Service Providers, Parking Facility Operators

Description: Finding Parking in Kansas City, especially in the downtown environment presents a problem for visitors during peak seasons for tourism and activities in the city. Parking venues are operated by a number of providers but there is no information for travelers to know where parking is available. The result is vehicles wandering the streets looking for available parking, creating traffic congestion in the process, and disturbing the flow of traffic. Technology exists to monitor parking availability through space monitoring or entry/exit counters. The objective of this project is to work with the parking operators to implement technology or supply data about parking space availability to a central database to inform travelers before departing, en-route or upon arrival in at their destination about parking availability.

Service Scope: This project will include the following services represented in the Kansas City Regional ITS Architecture.

- PM01 - Parking Space Management
- TI01 - Broadcast Traveler Information
- TI02 - Personalized Traveler Information
- TM06 - Traffic Information Dissemination

Service Diagrams:

- PM01 - Parking Space Management - This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.

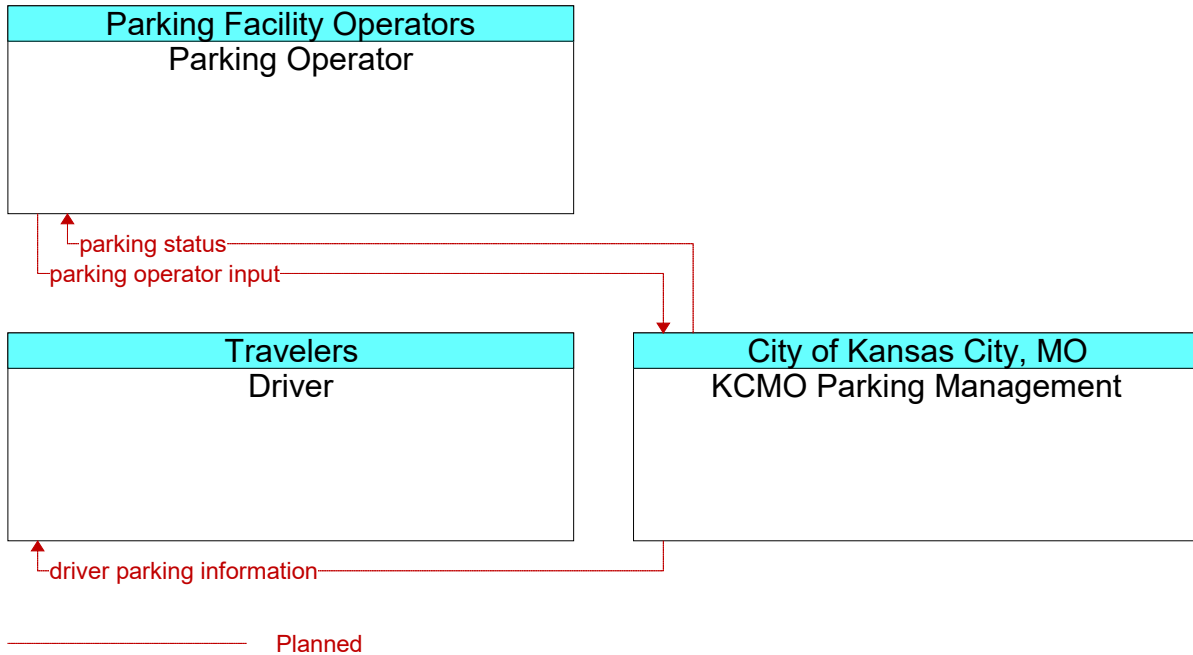
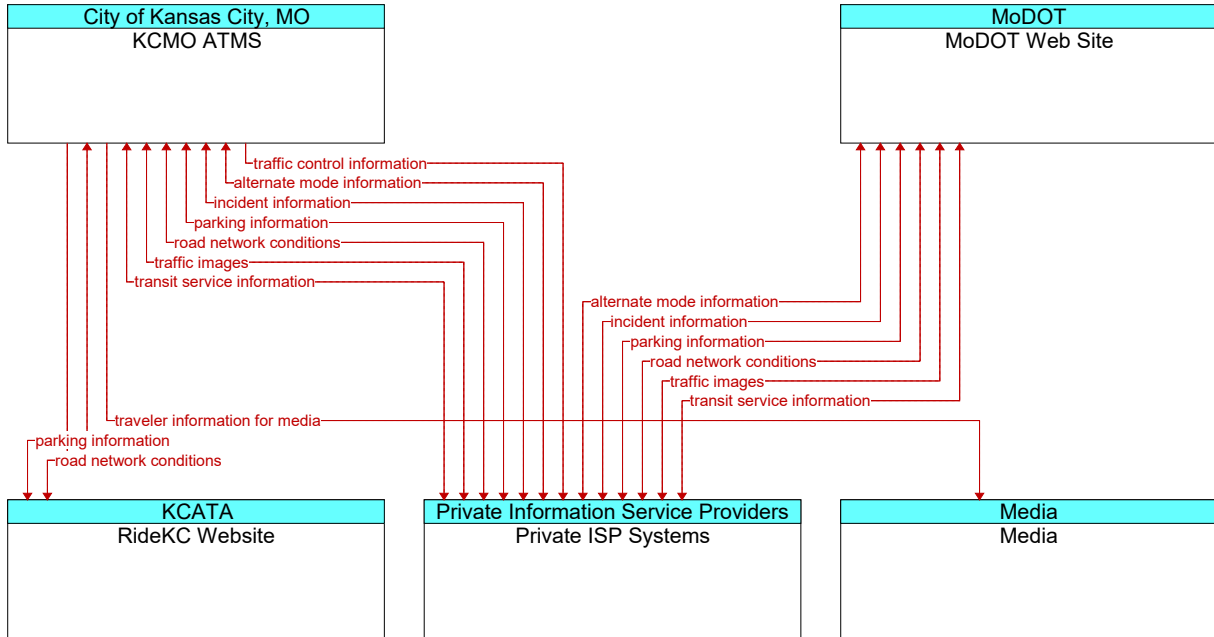


Figure 113 Service PM01 Parking Space Management (ITS)

- **T101 - Broadcast Traveler Information** - This service package provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies.

This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.



Planned

Figure 114 Service TI01 Broadcast Traveler Information

- TI02 - Personalized Traveler Information - This service package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. 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. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.

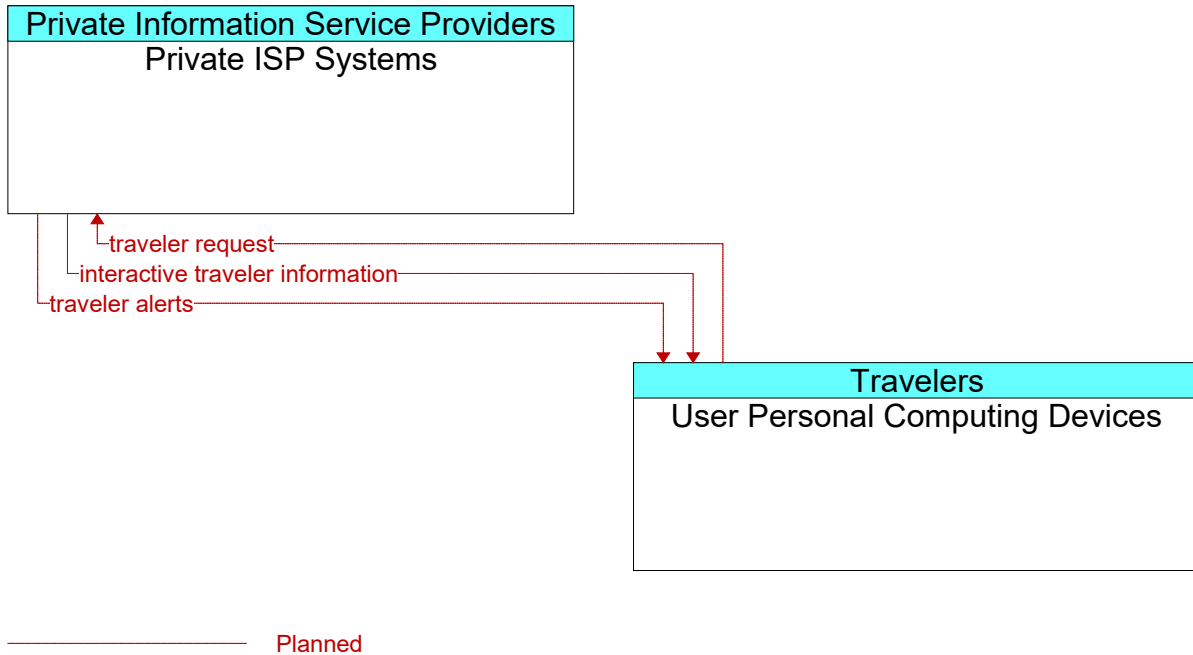


Figure 115 Service TI02 Personalized Traveler Information

- **TM06 - Traffic Information Dissemination** - This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.

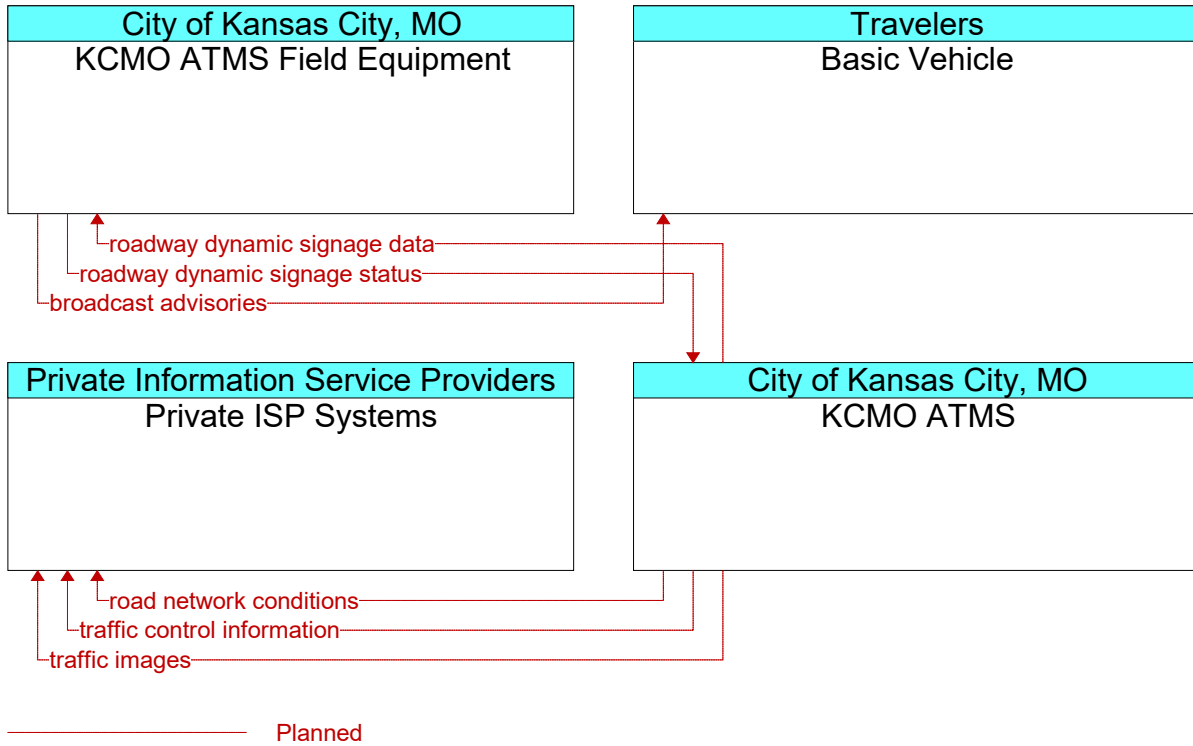


Figure 116 Service TM06 Traffic Information Dissemination

Appendix B – Architecture Inventory of ITS in Kansas City Region

Table 2 provides a list of the inventory from the Kansas City Regional ITS Architecture as a reference supporting the review of the projects defined in the Deployment Strategy. Further information about the inventory and other elements of the ITS Architecture can be found on the Kansas City Regional ITS Architecture website.

Table 2 Inventory of ITS in Kansas City

Element Name	Stakeholder	Element Description	Associated Physical Objects
Airborne Emergency Response Service	Airborne Emergency Response Services	Airborne Emergency Response Services is a collection of medivac services providing aerial transport of critically injured from incident locations.	Emergency Management Center
Archived Data User Systems	Archive Data Users	Archived Data User System represents the systems users employ to access archived data. The general interface provided allows a broad range of users (e.g. planners, researchers, analysts, operators) and their systems (e.g. databases, models, analytical tools, user interface devices) to acquire data and analyses results from the archive.	Archived Data User System
Basic Commercial Vehicle	Private Trucking Companies	Basic Commercial Vehicle represents the commercial vehicle that hosts the on-board equipment that provides ITS capabilities. It includes the heavy vehicle databus and all other interface points between on-board systems and the rest of the commercial vehicle. This vehicle is used to transport goods, is operated by a professional driver and typically administered as part of a larger fleet. Commercial Vehicle classification applies to all goods transport vehicles ranging from small panel vans used in local pick-up and delivery services to large, multi-axle tractor-trailer rigs operating on long haul routes.	Basic Commercial Vehicle
Basic Vehicle	Travelers	Basic Vehicle represents a complete operating vehicle. It includes the vehicle platform that interfaces with and hosts ITS electronics and all of the driver convenience and entertainment systems, and other non-ITS electronics on-board the vehicle. Interfaces represent both internal on-board interfaces between ITS equipment and other vehicle systems and other passive and active external interfaces or views of the vehicle that support vehicle/traffic monitoring and management. External interfaces may also represent equipment that is carried into the vehicle (e.g., a smartphone that is brought into the vehicle). Internal interfaces are often implemented through a vehicle databus, which is also included in this object. Note that 'Vehicle' represents the general functions and interfaces that are associated with personal automobiles as well as commercial vehicles, emergency vehicles, transit vehicles, and other specialized vehicles.	Basic Vehicle

Element Name	Stakeholder	Element Description	Associated Physical Objects
Border Inspection Administration	Customs Agencies	Border Inspection Administration represents back-office systems and databases run by domestic and foreign governmental agencies responsible for the regulation of trade, and the enforcement of customs and immigration laws. These agencies include U.S. Department of Homeland Security (DHS) and its counterparts in Canada and Mexico. DHS includes components like Customs and Border Protection (CBP), Immigration and Customs Enforcement (ICE), and Transportation Security Administration (TSA). Other agencies include secondary trade agencies (e.g., U.S. Food and Drug Administration, U.S. Department of Agriculture, other USDOT departments, etc.), and agencies from other trading nations. The systems they manage coordinate activities related to the border crossings. These systems support import/export cargo processing and enforcement operations at the border, including programs such as FAST, Automated Commercial Environment (ACE), Nexus (Canada), SENTRI (Mexico), and US-VISIT.	Border Inspection Administration Center
Border Inspection Systems	Customs Agencies	'Border Inspection System' represents data systems used at the border or, in Kansas City, a foreign trade zone for the inspection of people or goods. It supports immigration, customs (trade), agricultural, and FDA inspections as applicable. It includes sensors and surveillance systems to identify and classify drivers and their cargo as they approach a border crossing, the systems used to interface with the back-office administration systems and provide information on status of the crossing or events.	Border Inspection System
Commercial Vehicle Driver	Private Trucking Companies	The 'Commercial Vehicle Driver' represents the people that operate vehicles transporting goods, including both long haul trucks and local pick-up and delivery vans. This physical object is complementary to the Driver physical object in that it represents those interactions which are unique to Commercial Vehicle Operations. Information flowing from the Commercial Vehicle Driver includes those system inputs specific to Commercial Vehicle Operations.	Commercial Vehicle Driver
Commercial Vehicle OBE	Freight and Intermodal Companies	The Commercial Vehicle On-Board Equipment (OBE) resides in a commercial vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient commercial vehicle operations. It provides two-way communications between the commercial vehicle drivers, their fleet managers, attached freight equipment, and roadside officials. A separate 'Vehicle OBE' physical object supports vehicle safety and driver information capabilities that apply to all vehicles, including commercial vehicles. The Commercial Vehicle OBE supplements these general ITS capabilities with capabilities that are specific to commercial vehicles.	Commercial Vehicle OBE
Conditions Acquisition and Reporting System	MoDOT	A system to collect and disseminate road condition information.	Transportation Information Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
Connected Vehicle Roadside Equipment	Connected Vehicle Stakeholder	'Connected Vehicle Roadside Equipment' (CV RSE) represents the Connected Vehicle roadside devices that are used to send messages to, and receive messages from, nearby vehicles using Dedicated Short Range Communications (DSRC) or other alternative wireless communications technologies. Communications with adjacent field equipment and back office centers that monitor and control the RSE are also supported. This device operates from a fixed position and may be permanently deployed or a portable device that is located temporarily in the vicinity of a traffic incident, road construction, or a special event. It includes a processor, data storage, and communications capabilities that support secure communications with passing vehicles, other field equipment, and centers.	Connected Vehicle Roadside Equipment
County and City 911 Dispatch Centers	Counties and Cities	This element represents local dispatch centers that receive 911 calls, and dispatch the appropriate sheriff, police, fire and EMS within the jurisdiction area via communication system. Dispatch centers exchanges mutual aid and incident information with other local agencies as necessary. Some centers may be equipped with CAD and AVL technologies.	Center, Emergency Management Center
County and City Emergency Vehicles	Counties and Cities	Emergency vehicles include ITS equipment that provides the processing, sensory, storage, and communications functions necessary to support safe and efficient emergency response at the county and city level.	Emergency Vehicle OBE
County and City Fire and EMS Departments	Counties and Cities	This element represents local fire and EMS departments throughout the region.	Center, Emergency Management Center
County and City Maintenance and Construction Vehicles	Counties and Cities	A collection of maintenance vehicles that include ITS equipment that provides the processing, sensory, storage, and communications functions necessary to support road maintenance and construction. Vehicles may be equipped or plan to be equipped with ITS components, such as AVL, environmental sensors and vehicle monitoring sensors.	Maint and Constr Vehicle OBE
County and City Public Works Offices	Counties and Cities	This element represents county and city Public Works departments that perform the maintenance and construction activity including planned activities (road maintenance, snow plowing, etc.) and unplanned incidents within the jurisdiction area, and communicate maintenance and construction schedules and other related information to other agencies.	Center, Maint and Constr Management Center, Traffic Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
County and City Traffic Signal Systems	Counties and Cities	This element represents traffic signal systems and other roadside equipment used for traffic control and management, and communication of traffic related information with other agencies. Systems may include loop detectors, video detection, and other signal operation equipment used for the control and management of traffic at intersections. Signal systems may be interconnected and/or coordinated with each other. Emergency vehicle signal preemption may be existing or planned at city and/or county levels.	ITS Roadway Equipment
County and City Websites	Counties and Cities	Websites operated at the county and city level to disseminate work zone, road closures and restrictions and detours information to the public.	Transportation Information Center
County Sheriff and City Police Departments	Counties and Cities	This element represents local law enforcement agencies throughout the region.	Center, Emergency Management Center, Enforcement Center
Credentials Management System	Credentials Service Provider	The Credentials Management System is a high-level aggregate representation of the interconnected systems that enable trusted communications between mobile devices and other mobile devices, roadside devices, and centers and protect data they handle from unauthorized access. Representing the different interconnected systems that make up a Public Key Infrastructure (PKI), this physical object represents an end user view of the credentials management system with focus on the exchanges between the CCMS and user devices that support the secure distribution, use, and revocation of trust credentials.	Cooperative ITS Credentials Management System
Data Distribution System	Connected Vehicle Stakeholder	The 'Data Distribution System' collects, processes, and distributes ITS data, connecting data producers with data consumers and facilitating data exchange, such as through a data portal.	Data Distribution System
Driver	Travelers	The 'Driver' represents the person that operates a vehicle on the roadway. Included are operators of private, transit, commercial, and emergency vehicles where the interactions are not particular to the type of vehicle (e.g., interactions supporting vehicle safety applications). The Driver originates driver requests and receives driver information that reflects the interactions which might be useful to all drivers, regardless of vehicle classification. Information and interactions which are unique to drivers of a specific vehicle type (e.g., fleet interactions with transit, commercial, or emergency vehicle drivers) are covered by separate objects.	Driver
Emergency Notification and Evacuation System	City of Overland Park, KS	This is a "reverse 911" system that allows public safety to selectively notify residents about relevant emergencies.	Emergency Telecommunications System

Element Name	Stakeholder	Element Description	Associated Physical Objects
Emergency Response Vehicles (Missouri)	MoDOT	Each vehicle is equipped with a four-way wrench and jack for changing tires, jumper cables, gasoline cans, message boards, push bumpers, and numerous other tools.	Emergency Vehicle OBE
Event Promoters	Event Sponsors/Facilities	Event Promoters represents Special Event Sponsors that have knowledge of events that may impact travel on roadways or other modal means. Examples of special event sponsors include sporting events, conventions, motorcades/parades, and public/political events. These promoters interface to the ITS to provide event information such as date, time, estimated duration, location, and any other information pertinent to traffic movement in the surrounding area.	Event Promoter System
Fleet-Freight Manager	Freight and Intermodal Companies	Fleet-Freight Manager represents the people that are responsible for the dispatching and management of Commercial Vehicle fleets (e.g. traditional Fleet Managers) and Freight Equipment assets. It may be many people in a large tracking organization or a single person (owner driver) in the case of single vehicle fleets. The Fleet-Freight Manager provides instructions and coordination for Commercial Vehicles and Freight Equipment and receives the status of the vehicles and freight equipment in the fleet that they manage. The Fleet-Freight Manager is expected to interface with ITS on a regular basis to enhance productivity. Many interfaces with the system are also provided through normal user interfaces.	Fleet-Freight Manager
Flood Warning System-StormWatch	City of Overland Park, KS	Stormwatch.com presents the user with data collected from a flood warning system consisting of remote weather stations located throughout the Kansas City Metropolitan area. The majority of the stations report real-time rainfall. Some stations also report stream levels, temperature, relative humidity, wind, pavement temperature, pavement state, and other weather data. All data is collected and stored into a database. The earliest stations were installed in the 1980s and information from those sites can be queried directly from this website. This is a joint venture between Overland Park Public Works Department and Johnson County Stormwater Management.	Surface Transportation Weather Service, Transportation Information Center
Foreign Trade Zone Facilities - Inspection Center	Foreign Trade Zone Facilities	The Foreign trade zones (FTZ) Inspection Center represents back-office systems and databases run by domestic and foreign governmental agencies responsible for the regulation of trade, and the enforcement of customs and immigration laws in the Kansas City Area. FTZs manage freight distribution, particularly when foreign cargo is involved. Each FTZ is not a unique real estate asset at a single location, but a set of sites (sub-zones), each enabling to exploit a specific locational advantage such as an airport, intermodal rail yard, or highway interchange.	Border Inspection Administration Center, Border Inspection System

Element Name	Stakeholder	Element Description	Associated Physical Objects
Freight Equipment	Freight and Intermodal Companies	Freight equipment represents a freight container, intermodal chassis or trailer and provides information to support safe, secure and efficient freight operations. It provides equipment safety data and status and can alert the appropriate systems of an incident, breach, or tamper event. It provides accurate position information to support in-transit visibility of freight equipment.	Freight Equipment
Health and Social Services	Kansas City Health and Social Services	Health and Social Services Connectors provide support to connect people with health care and social services they need. These services are designed to be a community service for caregivers, individuals needing personal assistance, healthcare professionals, social workers, discharge planners, and mental health professionals. In Kansas City, an example of this service is Link for Care at www.LinkforCare.org . Link for Care is maintained and managed by the Central Plains Geriatric Staff at the University of Kansas Medical Center, Landon Center on Aging, and was developed in part with funding from the Department of Veteran's Affairs and the Department of Transportation. MARC is also a partner.	Transportation Information Center
IndeBus Operations Center	City of Independence, MO	IndeBus is the transit system serving Independence MO.	Transit Management Center
IndeBus Transit Vehicles	City of Independence, MO	Transit Vehicles of the IndeBus Transit System.	Transit Vehicle OBE
Intermodal Freight Depot	Intermodal Facilities	Intermodal Freight Depot represents the terminal areas corresponding to modal change points. This includes interfaces between roadway freight transportation and air, rail, and/or water shipping modes. The basic unit of cargo handled by the Intermodal Terminal physical object is the container; less-than-container load handling is typically handled at a different facility (i.e., Freight Consolidation Station). The Intermodal Terminal can include electronic gate control for entrance and exit from the facility, automated guidance of vehicles within the facility, alerting appropriate parties of container arrivals and departures, and inventory and location of temporarily stored containers.	Intermodal Terminal

Element Name	Stakeholder	Element Description	Associated Physical Objects
Intermodal Freight Shipper	Freight and Intermodal Companies	The Intermodal Freight Shipper provides the capability for commercial drivers and fleet-freight managers to receive real-time routing information and access databases containing vehicle and/or freight equipment locations as well as carrier, vehicle, freight equipment and driver information. The 'Fleet and Freight Management Center' also provides the capability for fleet managers to monitor the safety and security of their commercial vehicle drivers and fleet. It represents organizations that engage in the shipment of freight, either originator (consigner or shipper) or recipient of the cargo shipment. They enable the movement of goods on routes that require the use of other modes of transportation such as heavy rail, air, sea, etc. The Intermodal Customer System includes those personnel responsible for the movement of freight across international borders.	Center, Fleet and Freight Management Center, Intermodal Customer System
JCT Operations Center	Johnson County Transit	Manages the operations of Johnson County Transit with a third party private operator that KCATA oversees.	Center, Emergency Management Center, Transit Management Center
JCT Traveler Information Field Equipment	Johnson County Transit	JCT Field Equipment provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes. Traveler information access points may include kiosks and informational displays supporting varied levels of interaction and information access.	Traveler Support Equipment
JCT Vehicles	Johnson County Transit	This elements represents the transit vehicles that are dispatched by JCT. These transit vehicles have ITS devices that support the safe and efficient movement of passengers. These systems collect, manage, and disseminate transit-related information to the driver, operations and maintenance personnel, and transit system patrons.	Transit Vehicle OBE
JCT Website	Johnson County Transit	This element represents the JCT website that provides transit related information to aid travelers in their planning. This website display schedules, fares, vehicle location information, and arrival times.	Transportation Information Center
Kansas City Emergency Response (Missouri)	MoDOT	The Missouri Emergency Response patrols some of the busiest interstates in and around the Kansas City metropolitan area offering assistance to disabled motorists, searching for lane obstructions be it stalled vehicles in traffic lanes, on the shoulder, car accidents or debris in the roadway. Emergency Response vehicles are dispatched by Emergency Response staff at the Kansas City Scout Traffic Management Center 24/7. Staffing of the Missouri Emergency Response program is provided by the Missouri Department of Transportation. Each vehicle is equipped with a four-way wrench and jack for changing tires, jumper cables, gasoline cans and numerous other tools.	Center, Emergency Management Center, Traffic Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
Kansas City International Airport	City of Kansas City, MO	Kansas City International Airport was built by the City of Kansas City, Missouri and opened in 1972. Its low congestion, easy terminal access and small number of flight delays have long established it as one of the most convenient commercial airports in the world. The airport complex spans more than 10,000 acres, and its three runways can accommodate up to 139 aircraft operations per hour. Uncongested air and ground space, short taxi time, and a low weather-related closure/cancellation rate are why MCI consistently ranks among the lowest in delays of all U.S. airports. Three runways, two of them parallel with 6,575 feet of separation, Category III instrument Landing System and other features help keep operations smooth in even the worst of weather. New surfaces on the runways, taxiways and terminal aprons, along with ongoing infrastructure improvements, enhance the airport's efficiency and convenience to air carriers.	Alternate Mode Transportation Center, Traffic Management Center
Kansas City Motorist Assist (Kansas)	Kansas Highway Patrol	Motorist Assist and Emergency Response patrol some of the busiest interstates in and around the Kansas City metropolitan area offering assistance to disabled motorists, searching for lane obstructions be it stalled vehicles in traffic lanes, on the shoulder, car accidents or debris in the roadway. Staffing of the Kansas Motorist Assist program is provided by civilian members of the Kansas Highway Patrol. The patrols are dispatched out of Kansas Highway Patrol in Salina, KS. Each vehicle is equipped with a four-way wrench and jack for changing tires, jumper cables, gasoline cans, arrow boards, message boards, and numerous other tools.	Center, Emergency Management Center, Traffic Management Center
Kansas City Scout Field Equipment	KDOT / MoDOT	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This includes 279 cameras to monitor the highways from its traffic management center in Lee's Summit, sensors to gage traffic flow, 72 dynamic message signs to send traffic notices and other information to drivers along the freeways, and ramp metering to manage traffic flow onto the freeway system.	ITS Roadway Equipment
Kansas City Scout Traffic Management Center	KDOT / MoDOT	Kansas City Scout is Kansas City's bi-state traffic management system. The Kansas and Missouri Departments of transportation (KDOT, MoDOT) designed Scout to lessen traffic jams by improving rush-hour speeds, to increase safety by decreasing the number of rush-hour accidents, and to improve emergency response to traffic situations. Scout manages traffic on more than 125 miles of continuous freeways in the greater Kansas City metropolitan area. Scout uses cameras to monitor the highways from its traffic management center in Lee's Summit, relies on sensors to gage traffic flow, uses large electronic message boards to send traffic notices and other information to drivers along the freeways and operates ramp meters to control the traffic entering the freeway system.	Archived Data System, Archived Data User System, Center, Emergency Management Center, Traffic Management Center, Transportation Information Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
Kansas City Scout Website	KDOT / MoDOT	This element represents the Kansas City Scout website that provides traffic related information to aid travelers in their planning. Information displayed on the website includes camera images, incidents, DMS messages, and construction zones.	Transportation Information Center
Kansas CVISN	Kansas Department of Transportation (KDOT)	A collection of information systems and communications networks that support commercial vehicle operations in Kansas.	Commercial Vehicle Administration Center
Kansas Highway Patrol Dispatch	Kansas Highway Patrol	AVL/Dispatch for the Kansas Highway Patrol.	Center, Emergency Management Center, Enforcement Center
Kansas Highway Patrol Vehicles	Kansas Highway Patrol	Kansas Highway Patrol vehicles. Vehicles are equipped with AVL systems.	Emergency Vehicle OBE
Kansas State Emergency Operations Center	Kansas Div of Emergency Management (KDEM)	Located in Topeka, the Kansas State Emergency Operations Center (SEOC) is operated by the Kansas Division of Emergency Management (KDEM). The SEOC provides logistical support and resources to county-level EOC's during local emergencies and helps coordinate response. In the event of a declaration from the governor, KDEM directs and coordinates other agencies as needed to initiate and complete the emergency response. During a national emergency, the SEOC helps disseminate information and coordinate resources.	Center, Emergency Management Center
KBI AMBER Alert System	Kansas Bureau of Investigation (KBI)	KDOT participates in the Kansas AMBER Alert program by using its traveler information systems to assist the Kansas Bureau of Investigation (KBI) in the dissemination of child abduction information. The Kanroad/511 website has a link to the Kansas AMBER Alert website, and Kansas 511 features an alert system that enables it to broadcast AMBER Alert information as needed. AMBER Alert messages are also placed on Dynamic Message Signs (DMS) across the state and disseminated to traffic operations centers (TOCs) such as Kansas City Scout. KDOT's future plans call for improving the efficiency of information dissemination by automating the communication of AMBER Alerts to 511, websites, and TOCs.	Alerting and Advisory System, Emergency Management Center
KC Freight and Intermodal Facilities	Freight and Intermodal Companies		Event Promoter System
KC Metro Road Weather Information System	City of Kansas City, MO	This system is run with a server at KCMO Public Works, but it includes components from other state and local agencies.	ITS Roadway Equipment
KCIA Emergency Services	City of Kansas City, MO	Handles emergency services for the Kansas City International Airport complex.	Center, Emergency Management Center
KCIA Transit Dispatch	City of Kansas City, MO	Coordinates movement of passengers between terminals and parking facilities at the Kansas City International Airport complex.	Center, Transit Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
KCIA Transit Vehicles	City of Kansas City, MO	Transit Vehicles used to transport passengers around the Kansas City International Airport complex.	Transit Vehicle OBE
KCMO ATMS	City of Kansas City, MO	Advanced Traffic Management System for the City of Kansas City, MO.	Center, Traffic Management Center, Transportation Information Center
KCMO ATMS Field Equipment	City of Kansas City, MO	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This includes equipment for traffic signals, video detection, loops, radar detection and ramp metering. Through a PPP, the fiber communications system is being expanded throughout the metropolitan area. KCMO has approximately 650 traffic signals of which about 200 are on fiber and 100 on wireless communication.	ITS Roadway Equipment
KCMO Maintenance and Construction Operations Center	City of Kansas City, MO	KCMO Public Works operations includes AVL and management of maintenance vehicles.	Center, Maint and Constr Management Center
KCMO Maintenance and Construction Vehicles	City of Kansas City, MO	This is a collection of maintenance and construction vehicles that utilize ITS equipment that provides the sensory functions necessary to support maintenance and construction. AVL and on-board environmental sensors are planned to track vehicle locations and monitor roadway conditions.	Maint and Constr Vehicle OBE
KCMO Parking Management	City of Kansas City, MO	The Parking Management Subsystem provides electronic monitoring and management of parking facilities. It also includes the instrumentation, signs, and other infrastructure that monitors parking lot usage and provides local information about parking availability and other general parking information. As part of the Smart Cities initiative, smart street lights were installed to collect on-street parking availability as well as other data.	Parking Management System
KCPL Clean Charge Network	Kansas City Power and Lighting	The KCP&L Clean Charge Network consists of over 1,000 electric vehicle charging stations. Station locations are currently found in the Clean Charge Network website.	Electric Charging Station
KDOT 511 Traveler Information System	KDOT Division of Public Affairs	KanRoad/511 Traveler Information Website provides real time travel information including weather-related road conditions and construction/maintenance work zones and detours. The information covers each of the six KDOT districts and the Kansas City, Topeka, and Wichita metropolitan areas. Road conditions for the Kansas Turnpike are also provided. The Kanroad/511 website provides a link to the Kansas AMBER Alert website. The system has telephony or text distribution and can be accessed by calling 511 or 1-866-511-KDOT (5368) or via the internet.	Center, Transportation Information Center, Traveler Information Voice System
KDOT Construction and Maintenance	Kansas Department of Transportation (KDOT)	Provides maintenance and construction services for the Kansas state highway system.	Center, Maint and Constr Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
KDOT District Maintenance and Construction Management Systems	KDOT District/ Area/Sub-area Offices	KDOT Field offices coordinate the maintenance and construction activity for KDOT including planned field activities (road maintenance, construction projects, snow plowing, etc.) and unplanned incident response within the jurisdiction area, and communicate maintenance and construction schedules and other related information to other agencies and the public. KDOT has maintenance and construction systems that store construction inspections and routine maintenance related information. This information is used to document activities performed and provide assistance in decision making by managers. This element also represents the district operations offices for operating traffic control devices and implementing traffic management and operations strategies.	Archived Data User System, Center, Maint and Constr Management Center
KDOT Field Equipment	Kansas Department of Transportation (KDOT)	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This includes roadway treatment systems and environmental sensors (RWIS).	ITS Roadway Equipment
KDOT KanDrive Traveler Information Website	KDOT Division of Public Affairs	The KanDrive Traveler Information Website provides real time travel information including weather-related road conditions and construction/maintenance work zones and detours, DMS messages and CCTV snapshots. The information covers each of the six KDOT districts and the Kansas City, Topeka, and Wichita metropolitan areas. Road conditions for the Kansas Turnpike are also provided. The KanDrive website provides a link to the Kansas AMBER Alert website, neighboring state's websites and other traveler information sites. The website address is: http://kandrive.org/ .	Transportation Information Center
KDOT KanRoad Reporting System	KDOT Division of Public Affairs	KANROAD is an internet-based software that allows multiple users, primarily KDOT and KTA personnel, to enter information about construction work zones, maintenance work zones, detours, weather-related road conditions and other hazards into a reporting system. Data gathered by the KANROAD is then provided to the KDOT Internet website and the 511 system for public use. Road condition data is fully automated to 511. Construction and maintenance data is only partially automated at the current time but will be fully automated in the future.	Archived Data System, Center, Transportation Information Center
KDOT Maintenance and Construction Vehicles	KDOT District/ Area/Sub-area Offices	This is a collection of maintenance and construction vehicles that utilize ITS equipment that provides the sensory functions necessary to support maintenance and construction. AVL and on-board environmental sensors are planned to track vehicle locations and monitor roadway conditions. Statewide expansion of AVL use and integration of maintenance vehicles with RWIS has been planned. It is planned to install an AVL system on all KDOT paint trucks. In following the KHP AVL model, the KDOT AVL system will use GPS receivers integrated with the 800 MHz radio system. MDSS system interface is also planned to be operational on all KDOT maintenance vehicles.	Maint and Constr Vehicle OBE

Element Name	Stakeholder	Element Description	Associated Physical Objects
KDOT Road Weather Information System	Kansas Department of Transportation (KDOT)	Weather-related information is transmitted by a combination of land lines, cell phones, radios and Local Area- or Wide-Area-Networks (LAN/WAN) from weather stations to a central server located in Topeka. The information is presented both on an Intranet-based Website for KDOT use as well as a KDOT Internet site for the public. KDOT owns and operates 43 RWIS stations located throughout the state. The KDOT RWIS also leverages other Kansas RWIS assets by integrating information from 10 additional weather stations owned by the KTA. It uses sensors both mounted in the road surface as well as mounted away from the road to determine pavement temperature, subsurface temperature, ambient air temperature, wind speed, wind direction, pavement wet/dry, precipitation, and relative humidity.	Surface Transportation Weather Service, Transportation Information Center
KDOT Traffic Data Warehouse	Kansas Department of Transportation (KDOT)	This existing system collects KDOT information.	Archived Data System
KDOT Work Zone Intrusion Detection System	KDOT District/ Area/Sub-area Offices	This element represents field devices that detect vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment.	Connected Vehicle Roadside Equipment, ITS Roadway Equipment
KHP Scales and Weigh Stations	Kansas Highway Patrol	Weigh stations and scales in Kansas.	Commercial Vehicle Check Equipment, Connected Vehicle Roadside Equipment
KTA K-Tag Field Equipment	KTA	Roadside equipment that recognizes K-Tag Electronic Tags attached on the inside of vehicle windshields traveling along the Kansas Turnpike.	ITS Roadway Payment Equipment
KTA Maintenance and Construction Vehicles	KTA	A collection of maintenance vehicles that are utilized to support road maintenance, such as snow plow trucks, salt/sand trucks, and road repair trucks for the Kansas Turnpike Authority. These vehicles support communications with the KTA operations center to receive information and instructions that are provided to vehicle operators. AVL system and automated vehicle maintenance scheduling system may be planned.	Maint and Constr Vehicle OBE

Element Name	Stakeholder	Element Description	Associated Physical Objects
KTA Operations Center	KTA	Located in Wichita, the Kansas Turnpike Authority (KTA) operations center manages the toll collection process on the Kansas Turnpike. The center also receives call from KHP Salina central dispatch (transferring 911 calls) and from the public who dial *582 (*KTA) which is an automated number for motorists using their cell phones to call in traffic incidents along the Kansas Turnpike. The KTA center dispatches KHP Troop G and KTA's maintenance, as well as emergency and towing services as necessary. The KTA center also communicates with KDOT's RCRS by providing up to date road and road surface conditions. The center operates a Traveler Advisory Radio system along the route to disseminate motorist information and is in the process of deploying variable message signs along the Turnpike.	Center, Emergency Management Center, Maint and Constr Management Center, Payment Administration Center, Traffic Management Center, Transportation Information Center
KTA Travel Information Website	KTA	The KTA Travel Information website provides weather information, traffic alerts and advisories, toll schedules, and construction information to users planning to travel along the Kansas Turnpike.	Transportation Information Center
Large Employment Centers	Major KC Shipping and Industrial Firms	Large Employment Centers represent companies with large campuses or building facilities that employ more than 500 employees in one location. These centers are important because they are major traffic generators.	Event Promoter System
MARC Congestion Management Process	MARC	The MARC Congestion Management Process is intended to be a systematic way of: Monitoring, measuring and diagnosing the causes of current and future congestion on a region's multi-modal transportation systems; Evaluating and implementing strategies to manage current and future regional congestion; and Monitoring the effectiveness of strategies implemented to manage congestion. The CMP includes an ongoing method to provide information on the performance of the transportation system and on alternative strategies to manage congestion and enhance mobility and safety. The CMP uses an objectives-driven, performance-based approach to managing congestion, and emphasizes effective management of existing facilities through use of travel demand and operational management strategies.	Archived Data System
Media	Media	Represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media. Traffic and travel advisory information that are collected by ITS are provided to this terminator. It is also a source for traffic flow information, incident and special event information, and other events which may have implications for the transportation system.	Media

Element Name	Stakeholder	Element Description	Associated Physical Objects
Missouri Amber Alert System	Missouri Department of Public Safety	The mission of the AMBER Alert Program is to develop and coordinate the efforts of law enforcement, the media, and transportation in order to increase public participation in safely recovering abducted children through targeted education, increased communication, and effective sharing of resources.	Alerting and Advisory System, Emergency Management Center
Missouri CVISN System	MoDOT	A collection of information systems and communications networks that support commercial vehicle operations in Missouri.	Commercial Vehicle Administration Center
Missouri State Emergency Management Center	Missouri State Emergency Mgmt Agency	The SEMC provides logistical support and resources to county-level EOC's during local emergencies and helps coordinate response. In the event of a declaration from the governor, SEMC directs and coordinates other agencies as needed to initiate and complete the emergency response. During a national emergency, the SEMC helps disseminate information and coordinate resources.	Center, Emergency Management Center
Missouri State Highway Patrol Dispatch	Missouri Department of Public Safety	AVL/Dispatch for the Missouri State Highway Patrol.	Center, Emergency Management Center, Enforcement Center
Missouri State Highway Patrol Vehicles	Missouri Department of Public Safety	Missouri State Highway Patrol Vehicles. Vehicles are equipped with AVL systems.	Emergency Vehicle OBE
MoDOT Field Equipment	MoDOT	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This can include equipment for ramp metering, count stations, cameras, roadway treatment systems and environmental sensors.	ITS Roadway Equipment
MoDOT Maintenance Vehicles	MoDOT	This is a collection of maintenance and construction vehicles that utilize ITS equipment that provides the sensory functions necessary to support maintenance and construction. AVL and on-board environmental sensors are planned to track vehicle locations and monitor roadway conditions. Statewide expansion of AVL use and integration of maintenance vehicles with RWIS has been planned.	Maint and Constr Vehicle OBE
MoDOT Operations	MoDOT	Provides maintenance and construction services for the Missouri state highway system.	Center, Maint and Constr Management Center
MoDOT Road Weather Information System	MoDOT	Weather-related information is transmitted by a combination of land lines, cell phones, radios and Local Area- or Wide-Area-Networks (LAN/WAN) from road weather stations to a central server. It uses sensors both mounted in the road surface as well as mounted away from the road to determine pavement temperature, subsurface temperature, ambient air temperature, wind speed, wind direction, pavement wet/dry, precipitation, and relative humidity.	Transportation Information Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
MoDOT Traffic Signal System	MoDOT	This element represents 600 traffic signal systems (200 in the OGL program) and other roadside equipment used for traffic control and management, and communication of traffic related information with other agencies. Systems may include loop detectors, video detection, and other signal operation equipment used for the control and management of traffic at intersections. Signal systems may be interconnected and/or coordinated with others. Includes the operation of Jefferson City traffic signals.	Center, Traffic Management Center
MoDOT Transportation Management System	MoDOT	TMS allows users to integrate data from multiple sources such as bridge, pavement, safety, traffic monitoring/congestion, outdoor advertising (billboards), junkyards, and travelways. TMS allows the user to graphically view and analyze data to make better decisions concerning preservation and construction of MoDOT's transportation systems.	Archived Data System, Center
MoDOT Web Site	MoDOT	Website maintained by MoDOT to disseminate transportation related information including road work, incidents, and camera images..	Transportation Information Center
Motorist Assist Vehicles (Kansas)	Kansas Highway Patrol	Each vehicle is equipped with a four-way wrench and jack for changing tires, jumper cables, gasoline cans and numerous other tools.	Emergency Vehicle OBE
MSHP Scales and Inspection Facilities	Missouri Department of Public Safety	Weigh stations and scales in Missouri.	Commercial Vehicle Check Equipment, Connected Vehicle Roadside Equipment
National Weather Service	NOAA	The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life.	Weather Service System
Object Registration and Discovery System	Object Registration Service Providers	Object Registration and Discovery System represents one or more center-based applications that provide registration and lookup services necessary to allow objects to locate (for communications purposes) other objects operating within the Connected Vehicle Environment.	Object Registration and Discovery System
Olathe ATMS	City of Olathe, KS	Advanced Traffic Management System for the City of Olathe, KS. The ATMS operates in an environment including freight rail, intermodal centers, and interstate shipping.	Center, Traffic Management Center, Transportation Information Center
Olathe ATMS Field Equipment	City of Olathe, KS	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This includes 130 traffic signals, 60 CCTV cameras, 40 fixed video detection, inductive loops and radar. Maintenance vehicles have AVL.	ITS Roadway Equipment
Olathe Maintenance Vehicles	City of Olathe, KS	Olathe Maintenance Vehicles support Roadway Patrol services.	Emergency Vehicle OBE

Element Name	Stakeholder	Element Description	Associated Physical Objects
Operation Green Light	MARC	Operation Green Light is a cooperative effort to improve the coordination of traffic signals and incident response on major routes throughout the Kansas City area on both sides of the state line. Operation Green Light helps synchronize traffic signals on major routes throughout the region, especially those that cross city limits. This will help reduce unnecessary delay, improve traffic flow and reduce emissions that contribute to ozone pollution.	Center, Emissions Management Center, Traffic Management Center
Operation Green Light Field Equipment	MARC	Operation Green Light is a cooperative effort to improve the coordination of traffic signals and incident response on major routes throughout the Kansas City area on both sides of the state line. Operation Green Light helps synchronize traffic signals on major routes throughout the region, especially those that cross city limits. This will help reduce unnecessary delay, improve traffic flow and reduce emissions that contribute to ozone pollution. Operation Green Light field equipment consists of communications equipment that connects directly to traffic signals and vehicle detection sensors that are part of the Operation Green Light program.	ITS Roadway Equipment
Overland Park ATMS	City of Overland Park, KS	Advanced Traffic Management System (ATMS) for the City of Overland Park, KS. The ATMS collects transportation-related data from traffic surveillance sensors and cameras, manages the traffic signal system, and disseminates information to travelers through dynamic message signs with information such as travel times.	Center, Emissions Management Center, Traffic Management Center, Transportation Information Center
Overland Park ATMS Field Equipment	City of Overland Park, KS	Field Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This can include equipment for ramp metering, roadway treatment systems, traffic surveillance, traveler information such dynamic message signs, and environmental sensors.	ITS Roadway Equipment
Overland Park Motorist Assist Vehicles	City of Overland Park, KS	Motorist Assistance Vehicles operated by the City of Overland Park and dispatched by the Overland Park Police Department (County Sheriff and City Police Departments).	Emergency Vehicle OBE
Overland Park Traffic Information Website	City of Overland Park, KS	This element represents the Overland Park Traffic Information website that provides traffic related information to aid travelers in their planning.	Center, Transportation Information Center
Parking Operator	Parking Facility Operators	This terminator is the human entity that may be physically present at the parking lot facility to monitor the operational status of the facility.	Parking Operator

Element Name	Stakeholder	Element Description	Associated Physical Objects
Payment Device	Travelers	Payment devices enable the electronic transfer of funds from the user of a service (i.e. a traveler) to the provider of the service. Potential implementations include smart cards that support payment for products and services such as transportation services, and general purpose devices like smart phones that support a broad array of services such as electronic payment. In addition to user account information, the payment device may also hold and update associated user information such as personal profiles, preferences, and trip histories.	Payment Device
Pedestrians/Cyclists	Travelers	'Pedestrian' participates in ITS services that support safe, shared use of the transportation network by motorized and non-motorized transportation modes. Representing those using non-motorized travel modes, pedestrians provide input (e.g. a call signal requesting right of way at an intersection) and may be detected by ITS services to improve safety. Pedestrians may comprise those on foot and those in wheelchairs. 'Cyclist' participates in ITS services that support safe, shared use of the transportation network by motorized and non-motorized transportation modes. Representing those using non-motorized travel modes, and in particular bicyclists that sometimes share motor vehicle lanes, cyclists provide input (e.g. a call signal requesting right of way at an intersection) and may be detected by ITS services to improve safety.	Cyclist, Pedestrian
Private ISP Systems	Private Information Service Providers	Examples are Road Watch America, Airborne News Network, and WAZE.	Center
Private ISP Systems	Private Information Service Providers	Examples are Road Watch America, Airborne News Network, and WAZE.	Transportation Information Center
Private Mayday Services	Private Mayday Service Providers	Allows users to signal a need for emergency assistance to a monitored response center.	Emergency Management Center
Private Paratransit Dispatch	Private Paratransit Providers	Private transit systems that provide service to elderly and handicapped riders.	Transit Management Center
Private Ride Hailing Services	Ride Hailing Services	Ride matching or ridesharing service in which a traveler schedules pickup through a website or smartphone application. This is a private sector service.	Transportation Information Center
Private Trucking Companies	Private Trucking Companies	Private trucking companies represent those companies that own and manage their own commercial fleets of vehicles traveling through the region.	Fleet and Freight Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
Private Trucking Companies Commercial Vehicles	Private Trucking Companies	This ITS element represents commercial vehicles equipped with the sensory, processing, storage, and communications functions to promote the safe and efficient operation of commercial vehicles in the state of Kansas. These vehicles may be equipped with two-way communications allowing commercial vehicle drivers to communicate with their fleet managers, and roadside officials. The vehicle may also have the capability to collect and process vehicle, cargo information from the attached freight equipment, and driver safety data and status and alert the driver whenever there is a potential safety or security problem. Basic identification, security and safety status data may be supplied to inspection facilities at mainline speeds.	Commercial Vehicle OBE
Railroad Operations Central Dispatch	Railroad Companies	Railroad Dispatch	Rail Operations Center
Regional Call Center for Transit Info	Regional Transit Operators	Provides transit information and language translation services.	Center, Transportation Information Center
RideKC Field Equipment	KCATA	KCATA Field Equipment provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access such as real-time arrival information at BRT stations. Fare Payment Kiosks at stations and stops and mobile fare payment support are planned.	Traveler Support Equipment
RideKC Freedom	KCATA	RideKC Freedom is an on-demand paratransit service offered by KCATA as part of the RideKC system.	Transit Vehicle OBE
RideKC Operations Center	KCATA	This element is responsible for the management and maintenance of KCATA's RideKC transit fleet for the service area.	Archived Data User System, Center, Emergency Management Center, Transit Management Center
RideKC Streetcar	KC Streetcar Authority	The KC Streetcar is a rail system that runs through the heart of downtown Kansas City and connects to Ride KC buses at either end of the route and at the 10th & Main Transit Center.	Transit Vehicle OBE
RideKC Streetcar Operations Center	KC Streetcar Authority	RideKC Streetcar operations center monitors and controls streetcar operations. RideKC Streetcar operations use the same radio and scheduling system as KCATA RideKC Bus system.	Transit Management Center
RideKC Streetcar Website	KC Streetcar Authority	RideKC Streetcar website provides information about streetcar route, attractions, parking and RideKC bus service connections.	Transportation Information Center
RideKC Transit Police	KCATA	The Transit Police provide security for the RideKC transit system.	Emergency Management Center

Element Name	Stakeholder	Element Description	Associated Physical Objects
RideKC Transit Vehicles	KCATA	This element represents the transit vehicles that are dispatched by RideKC operated by KCATA. These transit vehicles have ITS devices that support the safe and efficient movement of passengers. These systems collect, manage, and disseminate transit-related information to the driver, operations and maintenance personnel, and transit system patrons.	Transit Vehicle OBE
RideKC Website	KCATA	This element represents the RideKC website that provides transit related information to aid travelers in their planning. This website displays schedules, fares, vehicle location information, and arrival times.	Transportation Information Center
RideshareKC	MARC	RideshareKC is a publicly funded program that provides commuter resources to individuals and employers in the Kansas City region — helping to create transportation options for area workers. Established in 1980, the program serves commuters from five counties in Missouri and four counties in Kansas. The program offers a commuter-matching service for anyone who lives, works or attends school in the greater Kansas City area or within 75 miles of downtown Kansas City, Missouri. RideshareKC.org provides a free carpool matching service, information and links to regional transportation options and facilitates the annual Green Commute Challenge. These resources are also available on the RideshareKC mobile app for iPhone and Android devices	Center, Transportation Information Center
Smart City Kiosks	City of Kansas City, MO	The Smart City Kiosks are 25 transportation information kiosks at platforms along the downtown Kansas City streetcar route on nearby streets. They have information about where the streetcar vehicle is along its route; what restaurants are offering specials that day; and what theater, arts and sporting events are scheduled. There is a 911 button to report emergencies and ways to report problems with city services to the 311 Action Center.	Traveler Support Equipment
Traffic Operations Personnel	System Terminators	'Traffic Operations Personnel' represents the people that operate a traffic management center. These personnel interact with traffic control systems, traffic surveillance systems, incident management systems, work zone management systems, and travel demand management systems. They provide operator data and command inputs to direct system operations to varying degrees depending on the type of system and the deployment scenario.	Traffic Operations Personnel

Element Name	Stakeholder	Element Description	Associated Physical Objects
Transit Operations Personnel	System Terminators	'Transit Operations Personnel' represents the people that are responsible for fleet management, maintenance operations, and scheduling activities of the transit system. These different roles represent a variety of individuals in the transit industry. Within the transit industry the person responsible for fleet management is known by many names: Street Supervisor, Starter, Dispatcher, Supervisor, Traffic Controller, Transportation Coordinator. This person actively monitors, controls, and modifies the transit fleet routes and schedules on a day to day basis (dynamic scheduling). The modifications will take account of abnormal situations such as vehicle breakdown, vehicle delay, detours around work zones or incidents (detour management, connection protection, and service restoration), and other causes of route or schedule deviations. Transit operations personnel are also responsible for demand responsive transit operation and for managing emergency situations within the transit network such as silent alarms on board transit vehicles, or the remote disabling of the vehicle. In addition the Transit Operations Personnel may be responsible for assigning vehicle operators to routes, checking vehicle operators in and out, and managing transit stop issues. This object also represents the personnel in the transit garage that are responsible for maintenance of the transit fleets, including monitoring vehicle status, matching vehicles with operators, and maintenance checking of transit vehicles. Finally, it represents the people responsible for planning, development, and management of transit routes and schedules.	Transit Operations Personnel
Transit Vehicle Operator	Regional Transit Operators	The 'Transit Vehicle Operator' represents the person that receives and provides additional information that is specific to operating the ITS functions in all types of transit vehicles. The information received by the operator would include status of on-board systems. Additional information received depends upon the type of transit vehicle. In the case of fixed route transit vehicles, the Transit Vehicle Operator would receive operator instructions that might include actions to take to correct schedule deviations. In the case of flexible fixed routes and demand response routes the information would also include dynamic routing or passenger pickup information.	Transit Vehicle Operator
Traveler	Travelers	The 'Traveler' represents any individual who uses transportation services. The interfaces to the traveler provide general pre-trip and en-route information supporting trip planning, personal guidance, and requests for assistance in an emergency that are relevant to all transportation system users. It also represents users of a public transportation system and addresses interfaces these users have within a transit vehicle or at transit facilities such as roadside stops and transit centers.	Traveler

Element Name	Stakeholder	Element Description	Associated Physical Objects
UGT Operations Center	Unified Government Transit	This element is responsible for the management and maintenance of the UGT fleet for the service area.	Center, Emergency Management Center, Transit Management Center
UGT Vehicles	Unified Government Transit	This elements represents the transit vehicles that are dispatched by UGT. These transit vehicles have ITS devices that support the safe and efficient movement of passengers. These systems collect, manage, and disseminate transit-related information to the driver, operations and maintenance personnel, and transit system patrons.	Transit Vehicle OBE
User Personal Computing Devices	Travelers	The 'Personal Information Device' provides the capability for travelers to receive formatted traveler information wherever they are. Capabilities include traveler information, trip planning, and route guidance. Frequently a smart phone, the Personal Information Device provides travelers with the capability to receive route planning and other personally focused transportation services from the infrastructure in the field, at home, at work, or while en-route. Personal Information Devices may operate independently or may be linked with connected vehicle on-board equipment.	Personal Information Device

Element Name	Stakeholder	Element Description	Associated Physical Objects
Vehicle	Travelers	<p>The Vehicle On-Board Equipment (OBE) provides the vehicle-based sensory, processing, storage, and communications functions that support efficient, safe, and convenient travel. The Vehicle OBE includes general capabilities that apply to passenger cars, trucks, and motorcycles. Many of these capabilities (e.g., see the Vehicle Safety service packages) apply to all vehicle types including personal vehicles, commercial vehicles, emergency vehicles, transit vehicles, and maintenance vehicles. From this perspective, the Vehicle OBE includes the common interfaces and functions that apply to all motorized vehicles. The radio(s) supporting V2V and V2I communications are a key component of the Vehicle OBE. Both one-way and two-way communications options support a spectrum of information services from basic broadcast to advanced personalized information services. Route guidance capabilities assist in formulation of an optimal route and step by step guidance along the travel route. Advanced sensors, processors, enhanced driver interfaces, and actuators complement the driver information services so that, in addition to making informed mode and route selections, the driver travels these routes in a safer and more consistent manner. This physical object supports all six levels of driving automation as defined in SAE J3016. Initial collision avoidance functions provide 'vigilant co-pilot' driver warning capabilities. More advanced functions assume limited control of the vehicle to maintain lane position and safe headways. In the most advanced implementations, this Physical Object supports full automation of all aspects of the driving task, aided by communications with other vehicles in the vicinity and in coordination with supporting infrastructure subsystems.</p>	Vehicle OBE
Wayside Equipment	Railroad Companies	<p>'Wayside Equipment' represents train interface equipment (usually) maintained and operated by the railroad and (usually) physically located at or near a grade crossing. It is a source and destination for information for, or about, approaching trains and their crews (e.g. the time at which the train will arrive and the time it will take to clear a crossing, crossing status or warnings, etc.). Generally one wayside equipment interface would be associated with one highway rail intersection. However, multiple crossings may be controlled using information based on data from one wayside equipment interface.</p>	Wayside Equipment
Wide Area Information Disseminator System	Communication System Providers	<p>Systems and communications equipment used to send messages to equipped vehicles using wide-area wireless communications such as satellite radio, terrestrial FM broadcast subcarrier, or cellular data networks.</p>	Wide Area Information Disseminator System