Spokane Regional Transportation Management Center (SRTMC)

SPOKANE REGION ITS ARCHITECTURE

2019 Update

SRTMC Operating Board

FINAL PLAN – ACCEPTED BY SRTC BOARD ON NOVEMBER 14, 2019

9/30/2019

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1 Introduction

The Spokane Region ITS Architecture is a plan that helps coordinate and prioritize Intelligent Transportation System (ITS) project planning among six partnering agencies within the Spokane region and in consideration of many additional stakeholders. With a coordinated and prioritized focus, the Spokane Region ITS Architecture Plan improves the ability to leverage federal funds, fulfill federal requirements, and aid in the consideration of new technologies.

A regional ITS architecture is the cornerstone to developing effective interagency coordination to deliver and operate technology related projects. It provides the regional framework to ensure multijurisdictional agreement and technical integration during the implementation of ITS projects in the region. It is important that ITS solutions are economical and utilize public funds in a responsible manner.

In 1998, TEA-21 legislation went into effect, which required all ITS projects, funded through the Highway Trust Fund, to be in conformance with the National ITS Architecture and applicable standards. This requirement has continued through the current legislation, the "Fast Act" of 2015.

In 2001, USDOT published the FHWA Final Rule and FTA Policy that requires that the National ITS Architecture be used as the framework for developing Region ITS Architectures and that any region deploying ITS projects also deploy a Region ITS Architecture.

The federally required elements for all regional ITS architecture plans are as follows:

- DESCRIPTION OF THE REGION

- IDENTIFICATION OF STAKEHOLDERS

- OPERATIONAL CONCEPT INCLUDING ROLES AND RESPONSIBILITIES

- SYSTEM FUNCTIONAL REQUIREMENTS

- INTERFACE FUNCTIONAL REQUIREMENTS AND INFORMATION FLOWS

- ITS STANDARDS

- AGREEMENTS

- SEQUENCE OF PROJECTS

- MAINTENANCE PLAN

These elements are included in the various chapters of the Spokane Region ITS Architecture Document and in the Regional Architecture Development for Intelligent Transportation (RAD-IT) software database that interfaces with the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) database. RAD-IT

replaces the previously used Turbo Architecture software. ARC-IT, also referred to as the National ITS Reference Architecture, replaces the previous National ITS Architecture.

The Spokane Region ITS Architecture was last updated in 2013 and utilized Turbo Architecture software. In 2017, version 7.1 of the National ITS Architecture and the Connected Vehicle Reference Implementation Architecture (CVRIA) merged to create the current Architecture Reference for Cooperative & Intelligent Transportation (ARC-IT). This is the new framework for which Region ITS Architectures will reference. Several modifications were made to the framework to include additional service packages, revised terminology, and additional database and software tools.

This update to the Spokane Region ITS Architecture will follow the format set forth in ARC-IT and reference the service packages, functional objects, physical objects, and information flows as found in the ARC-IT database.

Spokane Regional Transportation Management Center (SRTMC)

The Spokane Regional Transportation Management Center is a multi-jurisdictional enterprise made up of six partners that include the City of Spokane, City of Spokane Valley, Spokane Transit Authority, Spokane County, Washington State Department of Transportation and Spokane Regional Transportation Council. The SRTMC is the hub, or nerve center of the transportation management system for the region. It is where information about the transportation network is collected, processed, and fused with other operational and control data to produce information. This information is then used by system operators to monitor operations, implement control strategies, coordinate and initiate response to situations, and relay information to the public.

The SRTMC operates 24 hours a day, seven days a week, and 365 days a year. Center operators monitor traffic and coordinate closely with local first response agencies, the regional 911 center, and the Washington State Patrol. From the center, the operators have access and control of most of the regions field surveillance and information broadcasting equipment used to monitor traffic and provide information to travelers.

The vision for the SRTMC is to be recognized as a leader in providing innovative and practical Intelligent Transportation System (ITS) and Transportation Systems Management & Operations (TSMO) solutions to alleviate congestion, efficiently manage the movement of people and goods, increase safety, and reduce the region's carbon footprint.

2 Architecture Scope

The Spokane Region ITS Architecture 2019 is a roadmap for transportation systems integration. The architecture was developed through a cooperative effort by the region's transportation agencies, covering all modes and all roads in the region. It represents a shared vision of how each agency's systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The architecture provides an overarching framework that spans all of the region's transportation organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time. This chapter establishes the scope of the architecture in terms of its geographic breadth, the scope of services that are covered, and the time horizon that is addressed.

Description

The Spokane Region ITS Architecture is a plan that helps coordinate and prioritize Intelligent Transportation System (ITS) project planning among six partnering agencies within the Spokane region. With a coordinated and prioritized focus, the Spokane Region ITS Architecture Plan improves the ability to leverage federal funds, fulfill federal requirements, and aid in the consideration of new technologies.

This Architecture is maintained by the Spokane Regional Transportation Management Center. SRTMC is a multi-jurisdictional control facility to enhance and support advanced transportation management capabilities. The SRTMC partners include the City of Spokane, City of Spokane Valley, Spokane Transit Authority, Spokane County, Washington State Department of Transportation, and the Spokane Regional Transportation Council.

The Purpose of the SRTMC is to increase mobility, safety, and economic vitality in our region.

Timeframe

2019-2024 (six-year planning horizon)

Geographic Scope

The Spokane Region ITS Architecture covers the Spokane metropolitan area of Eastern Washington, including incorporated cities and unincorporated Spokane County.

Spokane County is the planning area for the Spokane Regional Transportation Council (SRTC), the federally-designated Metropolitan Planning Organization (MPO) and the state designated Regional Transportation Planning Organization (RTPO) for this region.

Adjacent portions of northern Idaho (ITD Districts 1 and 2, particularly urbanized Kootenai County and the I-90 corridor) and WSDOT Eastern Region (Counties of Adams, Ferry, Lincoln, Pend Oreille, Spokane, Stevens, Whitman and portions of Franklin County) are also included to ensure continuity with adjacent rural areas and travel corridors.
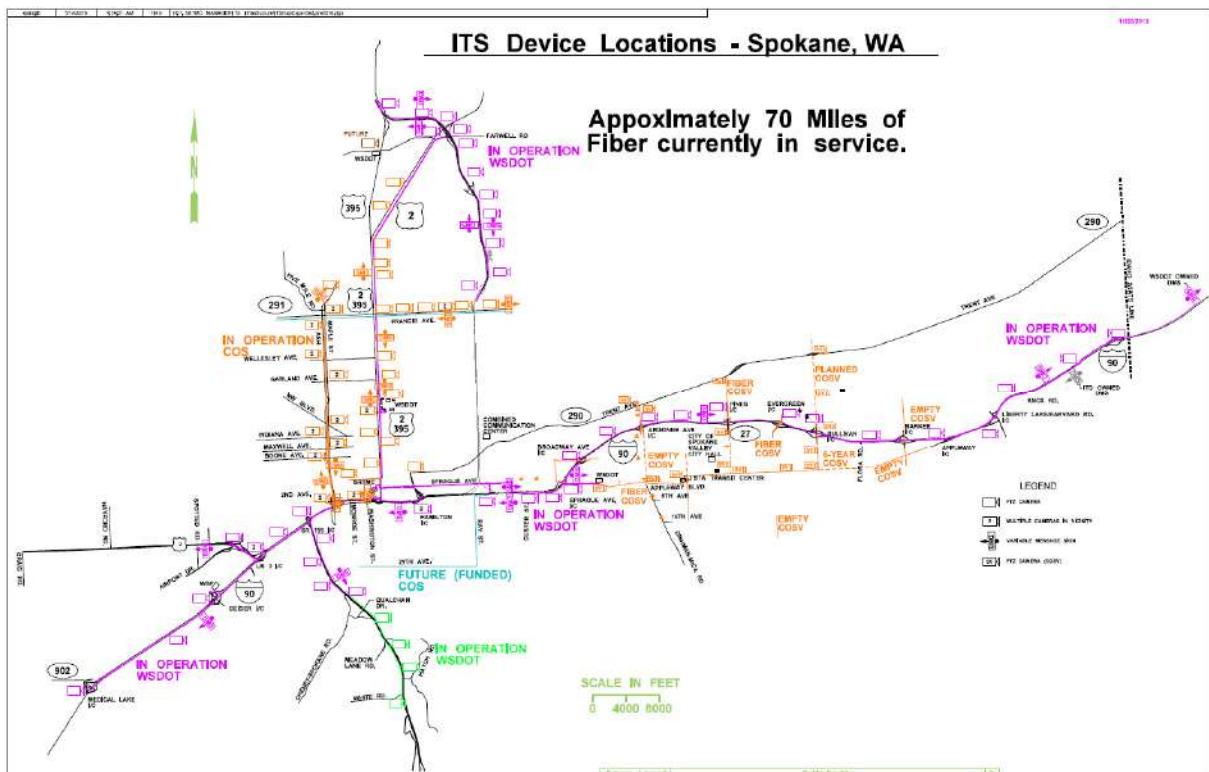
Service Scope

The Spokane Region ITS Architecture includes service packages that support data management, maintenance and construction systems, public safety systems, public transportation operations, support systems, sustainable travel, traffic management, traveler information systems, vehicle safety and weather systems.

The Region ITS Architecture is a planning tool to be used in conjunction with other region plans such as Horizon 2040 and the Congestion Management Process (CMP) plan and other local transportation plans and programs.

Developer

SRTMC Operating Board and SRTMC Manager

Maintainer & Maintenance Plan

SRTMC Manager

The Spokane Region ITS Architecture will be maintained with annual updates, at a minimum, during SRTMC Operating Board meetings. The architecture will be reviewed and updated after any major ITS projects are implemented or when new projects are scoped or programed.

Version

2019-a

Revision Date

9/30/2019 6:45:07 AM

3 Relationship to Planning

The Spokane Region ITS Architecture 2019 is an integral part of planning for the Transportation System Management and Operations (TSMO) strategies that are addressed by the regional transportation planning process. The architecture provides a framework that connects management and operations objectives and strategies with the integrated transportation system improvements that are implemented as a progressive series of ITS projects. The architecture is also used to define the data needs associated with performance monitoring that supports an informed planning process. This chapter identifies the planning objectives, strategies, and associated performance measures from regional plans including Horizon 2040 and the Congestion Management Process (CMP) Plan. Both of these region plans are found at the following link:

https://www.srtc.org/

Congestion Management Process (CMP)

The Congestion Management Process (CMP) is a federally required process for managing new and existing transportation systems in reducing congestion and maximizing safety in the movement of people and goods. The CMP can be enhanced by receiving archived ITS travel data that is generated by deployed ITS systems and networks. ITS and TSMO strategies support the CMP and federal requirements to address congestion through the use of operational management strategies.

The CMP lists "Operational Improvements, ITS, TSM" as a toolkit category in the strategy matrix and identifies specific "Tier 1 & Tier 2" corridor locations where ITS strategies should be considered. The CMP determined corridors will influence the prioritization and implementation of ITS projects and project locations.

Following is a list of Tier 1 & Tier 2 Corridors and a map from the CMP:

Tier 1 and Tier 2 Corridors Identified	
2013 Identified CMP Tier 1 Corridors	
Argonne Rd	Appleway Ave to Upriver Dr
Division St	Interstate 90 to US 2/US 395
Francis Ave	Indian Trail Rd to Market St
Freya Greene	Hartson Ave to Euclid Ave
Sullivan Rd	4th Ave to Wellesley Ave
I-90 Central	US 2 to Broadway Exit
I-90 East	Broadway Exit to Harvard Exit
US 2 East	Craig Rd to Interstate 90
2013 Identified CMP Tier 2 Corridors	
29th Avenue	Grand Blvd to Freya St
Division US 395	US 2/US 395 Intersection to NSC
Grand Blvd	Interstate 90 to 14th Ave
Hamilton	Interstate 90 to North Foothills Dr
Maple Ash	Interstate 90 to Francis Ave/SR 291
Market Freya	Euclid to Francis
I 90 West	US 2 to SR 904
US 2 West	Craig Rd to Mitchell (FAFB)
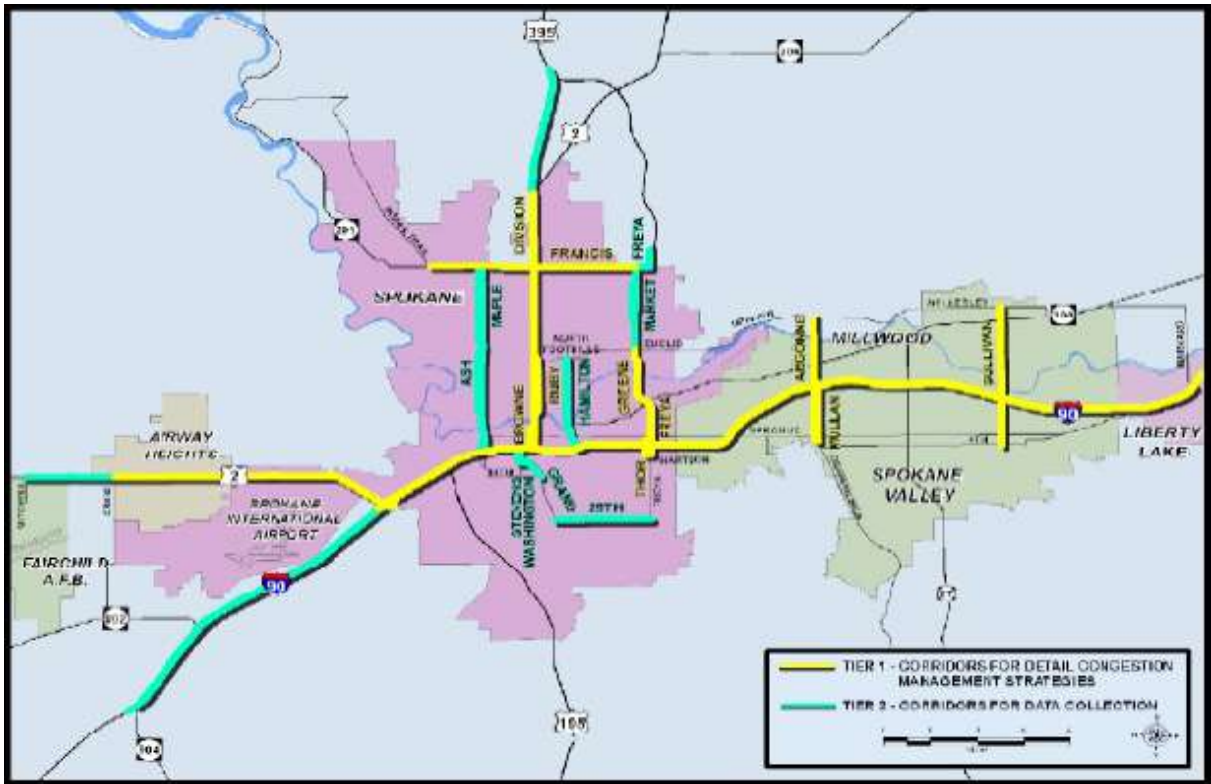
Horizon 2040 Long Range Transportation Plan

Horizon 2040 is a transportation plan for the Spokane metropolitan planning area that covers all of Spokane County. Horizon 2040 contains six categories of guiding principles and polices developed by the SRTC Board:

1. Economic Vitality

2. Cooperation and Leadership

3. Stewardship

4. System Operations, Maintenance and Preservation

5. Safety and Security

6. Quality of Life

Horizon 2040 also contains implementation strategies to overcome transportation challenges and capitalize on opportunities. The eight implementation strategies were developed through continuous collaboration with member jurisdictions and the public and are as follows:

1. Prioritize Transportation Preservation, Maintenance and Operations

2. Support Transportation Demand Management and Transportation System Management and Operations

3. Pursue cost-effective transportation investments

4. Invest in Public Transit

5. Improve Safety and Security

6. Protect the natural environment

7. Provide multimodal options

8. Promote Regional Leadership

Effective use of the Region ITS Architecture is an important tool in transportation planning, programming, and project implementation. It can provide solutions for making ITS investments in a cost-effective way.

The Spokane Regional ITS Architecture plan will be used to support planning for ITS within the context of other existing region transportation planning processes.
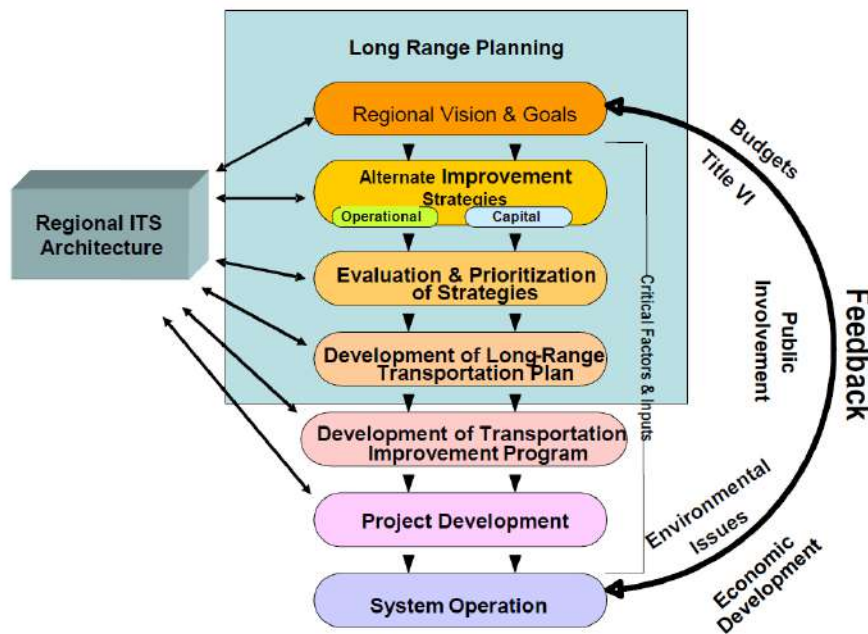
The following table describes operational objectives and strategies that can be achieved through the use of ITS related service packages. The table shows how the ITS plan objectives and strategies relate to other regional plan strategies and guiding principles. Each objective and strategy in the table describes possible performance measures that can be used for a performance based approach.

Table 1 – Relationship to Planning

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
1.1	Objective	Enhance Transportation Planning and Performance Measurement with Operational Data	Collect, analyze, and disseminate operational data from all transportation agency data sources. Compare historical with current data to measure performance of the systems.	Horizon 2040 - Strategy 2		Data Collection	1. Number of agencies and modes that share their data with other agencies and modes 2. Amount of operations data gathered from ITS enhancements used in infrastructure and operations planning 3. Years of operational data in database that is easily searchable and extractable
1.1.1	Strategy	Operations Data Collection and Dissemination	Improve the detection of travel conditions by operators, the sharing of traveler information between jurisdictions and modes, and the dissemination of information to the travelers	Horizon 2040 - Guiding Principle 2	Enhance Transportation Planning and Performance Measurement with Operational Data	Traveler Information Data Collection	1. Percent of the transportation system in which travel conditions can be detected remotely and information can be shared over field devices in those locations 2. Amount of data gathered from ITS enhancements used in infrastructure and operations planning

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
1.1.2	Strategy	Increase System Performance Analysis and Reporting	Increase the amount of operational data gathered and the geographic footprint, for where data is gathered, so that performance of the system can be measured and changes can be analyzed to determine benefit	CMP	Enhance Transportation Planning and Performance Measurement with Operational Data	Arterial Management	1. Travel Time or Buffer Time Index 2. Percent of major and minor arterials equipped with roadway surveillance and/or detection used for real-time monitoring and traffic management
2.1	Objective	Increase use of SRTMC traveler information website in the next 3 years	Promote the use of the SRTMC Website by providing more real-time travel information, informing the public of its availability and educate travelers on the use of the information. Create a mobile application	Horizon 2040 - Strategy 2		Data Collection Traveler Information	1. Number of agencies and modes that share their data with other agencies and modes 2. Percent of the transportation system in which travel conditions can be detected remotely and information can be shared over field devices in those locations
2.1.1	Strategy	Enhance information available and use of SRTMC website by expanding Traveler Information System coverage and integration of data	Promote the use of the SRTMC Website by providing more real-time travel information, informing the public of its availability and educate travelers on the use of the information. Create a mobile application	Horizon 2040 - Strategy 2	Increase use of SRTMC traveler information website in the next 3 years	Data Collection	1. Amount of data gathered from ITS enhancements used in infrastructure and operations planning

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
2.2	Objective	Develop SRTMC multimodal trip planning tool by year 2021	Providing alternatives to single occupancy vehicle trips by enhancing the integration and connectivity of transportation systems across and between modes	Horizon 2040 - Strategy 7		Integration System Options	1. Average door-to-door trip time 2. Percent of trips made using alternative modes
3.1	Objective	Increase percentage of transportation agencies in the region that integrate operational data and use SRTMC for Information and as a management resource	Increase data sharing and coordination between all region transportation agencies and utilize SRTMC as the central information and management hub	Horizon 2040 - Strategy 8		Data Collection Traveler Information Emergency/ Incident Management	1. Number of agencies and modes that share their data with other agencies and modes 2. Percent of the transportation system in which travel conditions can be detected remotely and information can be shared over field devices in those locations 3. Total area covered by IRT patrols

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
3.1.1	Strategy	Deploy operational data collection and information exchange networks	Increase the capacity to store and disseminate operational data across jurisdictional and agency boundaries	Horizon 2040 - Guiding Principle 2	Increase percentage of transportation agencies in the region that integrate operational data and use SRTMC for Information and as a management resource	Data Collection	1. Number of agencies and modes that share their data with other agencies and modes
3.1.2	Strategy	Deploy a Region Wide Communications Network.	Deploy a region wide wireless communication network and expand the fiber optic network as necessary to increase data exchange, center to field, and center to center communications between agencies	Horizon 2040 - Guiding Principle 2	Increase percentage of transportation agencies in the region that integrate operational data and use SRTMC for Information and as a management resource	Integration	1. Total percent of geographical area with communication connectivity and capability

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
3.2	Objective	Decrease road departure crashes along WSDOT ER highways.	Reduce the potential for run off the road instances by providing real-time roadway condition information to travelers, receiving roadway information from maintenance vehicles and communicating needs to maintenance personnel. Increasing IRT coverage. Implementing systems that provide safety benefit such as automatic roadway spray or lighting systems	Horizon 2040 - Strategy 1		Travel Weather Management Traveler Information Emergency/ Incident Management	1. Average time to clear selected surface transportation facilities of weather related impacts 2. Number of Maintenance vehicles equipped with weather sensors and AVL equipment 3. Time to alert motorists of an incident/emergency 4. Total area covered by IRT patrols
3.2.1	Strategy	Deploy weather related messaging and implement weather related variable speed limits	Use Variable Message Signs on I-90 to warn of inclement weather that impacts the roadway. Use Variable Speed Limit Signs to regulate speeds to increase safety when weather conditions warrant slower speeds	Horizon 2040 - Strategy 2	Decrease road departure crashes along WSDOT ER highways.	System Efficiency	1. Number of crashes and fatalities related to weather conditions

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
3.3	Objective	Decrease amount of time to warn travelers of dangerous conditions or emergency situations	Detect and warn travelers of roadway impacts, incidents, or emergencies with ITS infrastructure on the roadway	Horizon 2040 - Strategy 5		Traveler Information	1. Time to alert motorists of an incident/ emergency
3.3.1	Strategy	Deploy additional ITS devices on arterial roadways for remote monitoring and warning	Install Variable Message Signs, Automated Flashing Signs, and other warning devices to warn drivers of unexpected conditions on their route. This also includes detection and monitoring devices to trigger automated signs or alert operators of an incident	Horizon 2040 - Strategy 2	Decrease amount of time to warn travelers of dangerous conditions or emergency situations.	Emergency/Incident Management Arterial Management Travel Weather Management	1. Number of ITS-related assets 2. Number of Regional road miles covered by ITS-related assets 3. Percent of major and minor arterials equipped with roadway surveillance and/or detection used for real-time monitoring and traffic management 4. Number of Maintenance vehicles equipped with weather sensors and AVL equipment

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
3.3.2	Strategy	Deploy additional ITS infrastructure on I-90 for detection and warning systems	Install infrastructure to support detection of and warning for wrong way drivers and queuing caused by incidents and congestion on I-90 and ramps	Horizon 2040 - Strategy 2	Decrease amount of time to warn travelers of dangerous conditions or emergency situations.	Traveler Information System Efficiency Freeway Management	1. Percent of the transportation system in which travel conditions can be detected remotely and information can be shared over field devices in those locations 2. Number of crashes and fatalities related to unexpected congestion 3. Total number of congestion-inducing incidents on freeway during peak period
4.1	Objective	Increase the percent of the primary arterial corridors in which travel conditions can be detected remotely via CCTV, speed detectors, etc. to 75 percent by 2023.	Increase the number of primary arterials in the region for which congestion can be monitored and measured	Congestion Management Process (CMP) Plan		Data Collection	1. Amount of operational data gathered from ITS enhancements used in infrastructure and operations planning

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
4.1.1	Strategy	Deploy network monitoring devices along primary arterial network.	Deploy passive monitoring devices that can measure travel time, speed, and origin-destination and measure congestion related impacts on primary arterial networks so that performance can be measured and changes made to reduce congestion	Congestion Management Process (CMP) Plan	Increase the percent of the primary arterial corridors in which travel conditions can be detected remotely via CCTV, speed detectors, etc. to 75 percent by 2023	Arterial Management	1. Travel Time or Buffer Time Index 2. Percent of major and minor arterials equipped with roadway surveillance and/or detection used for real-time monitoring and traffic management
4.2	Objective	Maintain a program of evaluating primary corridor signals for automated performance measures and increase capabilities for remote monitoring and retiming	A program that will allow agencies to actively monitor and measure performance of traffic signals at intersections along primary corridors and to quickly recognize the benefit of any changes that are made through improved travel times and reduced congestion	Horizon 2040 - Strategy 2		Arterial Management	1. Average travel time during peak periods (minutes)

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
4.2.1	Strategy	Implement active performance monitoring on primary traffic signal corridors including increased detection capabilities and data collection and reporting	Install or enable enhanced data features at traffic signals and upgrade detection to provide performance data at signalized intersections	Horizon 2040 - Strategy 2	Maintain a program of evaluating primary corridor signals for automated performance measures and increase capabilities for remote monitoring and retiming	Arterial Management System Efficiency	1. Number of intersections with automated performance monitoring capabilities 2. Control delay in seconds per vehicle
4.3	Objective	Reduce the daily hours of recurring congestion on I-90 by 3 percent by year 2023	Improve the efficiency of the surface transportation system by reducing the daily hours of recurring delay on I-90	Congestion Management Process (CMP) Plan		Freeway Management	1. Hours per day at LOS F or V/C > 1.0
4.3.1	Strategy	Deploy ramp metering.	I-90 Ramp Meters will be installed at EB US 195, EB Walnut, EB Monroe, EB Division, EB Hamilton, and WB Division	Horizon 2040 - Strategy 2	Reduce the daily hours of recurring congestion on I-90 by 3 percent by year 2023	Freeway Management	1. Average travel time during peak periods (minutes) 2. Total number of ramp meters
4.3.2	Strategy	Deploy variable speed limits on select freeways.	Determined by I-90 Safety Study to be a viable solution as a safety measure	Horizon 2040 - Strategy 2	Reduce the daily hours of recurring congestion on I-90 by 3 percent by year 2023	Arterial Management Freeway Management	1. Travel Time or Buffer Time Index 2. Hours per day at LOS F or V/C > 1.0

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
4.3.3	Strategy	Implement active traffic management (ATM) on freeways.	ATM on I-90 to include Queue Detection and Warning, Wrong Way Detection and Warning, Speed Harmonization, and potential dedicated lane assignments including shoulder use	Horizon 2040 - Strategy 2	Reduce the daily hours of recurring congestion on I-90 by 3 percent by year 2023	Arterial Management Emergency/ Incident Management	1. Travel Time or Buffer Time Index 2. Number of Regional road miles covered by ITS-related assets
4.4	Objective	Reduce time between incident verification and posting of traveler alert to dynamic message signs and TMC log to 3 minutes.	Reduce the time it takes to verify an incident and post a message on a roadside sign to warn motorists of an incident ahead in order to reduce the potential for secondary crashes	Horizon 2040 - Strategy 2		Emergency/ Incident Management	1. Number of secondary crashes
4.4.1	Strategy	Train SRTMC Operators on ATMS and increase ATMS capabilities	Enhance the ATMS System and Train operators on its function to improve efficiency and reduce the time it takes to verify an incident and post an alert	Horizon 2040 - Strategy 2	Reduce time between incident verification and posting of traveler alert to dynamic message signs and TMC log to 3 minutes	Traveler Information	1. Time to alert motorists of an incident/emergency

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
5.1	Objective	Reduce transit wait time at key intersections in the PTBA	Strategy 4 of the Horizon 2040 Long Range Plan for the region is to invest in public transportation	Horizon 2040 - Strategy 4			
5.1.1	Strategy	Deploy Transit Signal Priority (TSP) and bus-only signals at key intersections	Signal equipment and fiber to accommodate TSP at intersections system-wide, upgrade technology on STA coaches to accommodate TSP	Horizon 2040 - Strategy 4	Reduce transit wait time at key intersections in the PTBA	Arterial Management System Efficiency	1. Average door-to-door trip time 2. Percent of trips made using alternative modes 3. Number of Regional road miles covered by ITS-related assets
5.2	Objective	Increase access to information for STA routes	Provide increased service and traveler information systems	Horizon 2040 - Strategy 4		Traveler Information System Options	1. Increase in STA ridership
5.2.1	Strategy	Develop real-time traveler information and multi-modal planning tools	Integrate STA Scheduling with real-time traveler information sources to develop a multi-modal planning system and improve travel mode options	Horizon 2040 - Strategy 4	Increase access to information for STA routes	Integration System Options	1. Average door-to-door trip time 2. Percent of trips made using alternative modes 3. Number of Regional road miles covered by ITS-related assets
5.3	Objective	Utilize Weather Data for transportation mobility and management decision making	Incorporate real-time weather data with traffic management systems and multi-modal traveler information for operational function and decision making	Horizon 2040 - Strategy 2 & 4		Arterial Management Freeway Management Traveler Information	1. Reduce weather related crashes 2. Increase STA ridership during bad weather 3. Increased mobility options during bad weather

No.	Type	Name	Description	Source	Supports	PM Category	Performance Measure
5.4	Objective	Increase intersection safety for non-vehicular users of the intersection	Enhance signalized intersections with the ability to accommodate Leading Pedestrian Intervals (LPI) and bike signal heads	Horizon 2040 - Strategy 5		System Options System Efficiency Integration	1. Number of LPI and bike signal heads installed

4 ITS Stakeholders

Identifying stakeholders is an important task in ITS architecture development since effective ITS involves the integration of multiple stakeholders and their transportation systems. This section describes the stakeholders who either participated in the creation of the Spokane Region ITS Architecture 2019 or whom the participating stakeholders felt were needed to be included in the architecture. Some stakeholders have been grouped in order to better reflect mutual participation or involvement in transportation services and elements. Every stakeholder in this section is related to one or more of the transportation inventory elements described in the next chapter, either as an individual stakeholder or as a member of a stakeholder group.

Table 2 – ITS Stakeholders

Stakeholder Name	Stakeholder Description
Archived Data Users	Systems, individuals, or agencies that utilize archive data. These users may be part of public agencies or external third parties.
City of Spokane	Municipal government of the City of Spokane, including Public Works. Owns and operates ITS and communications infrastructure throughout the City. A participating agency of the Spokane Regional Transportation Management Center.
City of Spokane Valley	Municipal government of the City of Spokane Valley, including Public Works. Owns and operates ITS and communications infrastructure throughout the City. A participating agency of the Spokane Regional Transportation Management Center.
Idaho Transportation Department (ITD)	Agency responsible for transportation infrastructure, operations, maintenance, and planning in Idaho, including Transportation System Management and Operations and statewide ITS infrastructure. Headquartered in Boise, Idaho. ITD District 1 encompasses the northern panhandle adjacent to the Spokane region, including urbanized Kootenai County. In recent years ITD has strengthened its partnership with the Spokane Regional Transportation Management Center given the bi-state nature of the metropolitan area along the I-90 corridor.
Local Emergency Responders	Local emergency response agencies in the region, including sheriffs' departments, police, fire, ambulance, etc.
Local Media	News, radio, and other public/broadcast media that disseminate traveler information.
Other Weather Service	Sources for weather forecast information that may be distributed through information service providers.
Private Utilities	Entities that own and operate electric, cable, gas and other utility services. Maintenance and construction of this infrastructure may cause closures or delays on area roadways, and are a significant factor in coordination of regional construction activity.

Stakeholder Name	Stakeholder Description
Spokane County	Government of Spokane County, including Public Works. Owns and operates ITS and communications infrastructure throughout the County. A participating agency of the Spokane Regional Transportation Management Center. Also includes the Spokane County Department of Emergency Management, a key player in regional emergency preparedness and response. Also includes Spokane County Commute Trip Reduction, which promotes many programs including ridesharing.
Spokane County Sheriff's Office	The sheriff's office for Spokane County, its law enforcement arm.
Spokane Regional Transportation Council (SRTC)	The federally designated Metropolitan Planning Organization (MPO) and the state designated Regional Transportation Planning Organization (RTPO) for Spokane County. The agency is responsible for collecting transportation data, projecting the need for infrastructure, and prioritizing projects based on available funding. SRTC is a "consumer" of operations data for planning and performance measurement purposes, and is granted authority over CMAQ and STBG federal funding for ITS implementation projects.
Spokane Regional Transportation Management Center (SRTMC)	The SRTMC is a multi-jurisdictional control facility to enhance and support advanced transportation management capabilities. Its Transportation Management Center provides 24/7 traffic management capabilities for the Spokane region. SRTMC is controlled and funded by the Cities of Spokane and Spokane Valley, Spokane Transit Authority, Spokane County, Washington State Department of Transportation, and the Spokane Regional Transportation Council.
Spokane Transit Authority	The primary public transportation authority for the Spokane region, operating both fixed-route and paratransit services. STA is a participating agency in the Spokane Regional Transportation Management Center.
Third-Party Transportation Data Sources	Entities that provide real-time and/or historical data on the transportation system, e.g. through probe data. May be used to support traffic management, incident detection, travel time calculation, performance measurement, etc.
Third-Party Traveler Information Service Providers	Entities that provide real-time traveler information products to the public, using public agency data, third-party probe data, or a combination of sources. Delivers information through a variety of media including personal handheld devices and in-vehicle devices.
Travelers	Represents public users of the multimodal transportation system.
Washington State Department of Transportation (WSDOT)	The Department of Transportation for Washington State, which coordinates and implements statewide ITS initiatives and administers the statewide transportation system through its regional offices. Spokane County is located within WSDOT Eastern Region. WSDOT is a participating agency of the Spokane Regional Transportation Management Center.
Washington State Emergency Operations Center	Statewide Emergency Operations Center located at Camp Murray, WA.
Washington State Patrol (WSP)	Statewide law enforcement agency for Washington, with significant traffic and emergency management related functions.

Stakeholder Name	Stakeholder Description
WSDOT Eastern Region Office	The regional office of WSDOT overlapping with jurisdiction over the Spokane region. Responsible for planning, implementation, operations, and maintenance of regional ITS infrastructure in the Spokane region and the surrounding rural counties.
WSDOT Incident Response Team	WSDOT has two incident response teams (IRT) who patrol the highway system 7 days a week and respond to unplanned roadway incidents. IRT provides traffic control support to other emergency responders during incidents.

5 ITS Inventory

An inventory of existing and planned transportation systems is the basis for the Spokane Region ITS Architecture 2019. The transportation system inventory was developed based on input from stakeholders throughout the region. The inventory includes a list of ITS elements and the associated stakeholder responsible for system operation.

Existing ITS equipment, for the Spokane region, consists mainly of:

- Traffic Signals

- Vehicle Detectors

- Variable Message Signs (VMS)

- Highway Advisory Radio (HAR)

- Video Cameras

- Weather Stations

Most of the ITS equipment is operated by the SRTMC and is owned and maintained by the partner agencies which include City of Spokane, City of Spokane Valley, Spokane County, Spokane Transit Authority, and Washington State Department of Transportation.

Inventory elements can be one of five classes:

- Center

- Field

- Support

- Vehicle

- Traveler

For example, the Spokane Regional Transportation Management Center is an inventory element in the "Center" class. Each of the partner agencies, as well as other stakeholders, are also inventory elements in the "Center" class. The ITS equipment is an inventory element in the "Field" class.

This section describes every surface transportation inventory element for the region. Each transportation element listed below has one or more stakeholders associated with it. In order to reduce the complexity of the architecture, some transportation elements with like functionality have been grouped together. Each transportation inventory element is mapped to at least one ARC-IT physical object.

The following transportation subsystem diagram shows an example of the Spokane region subsystem elements organized by the five classes listed above and the general communication links used to exchange information between the subsystems. This is an example of the highest level diagram of the Physical View.
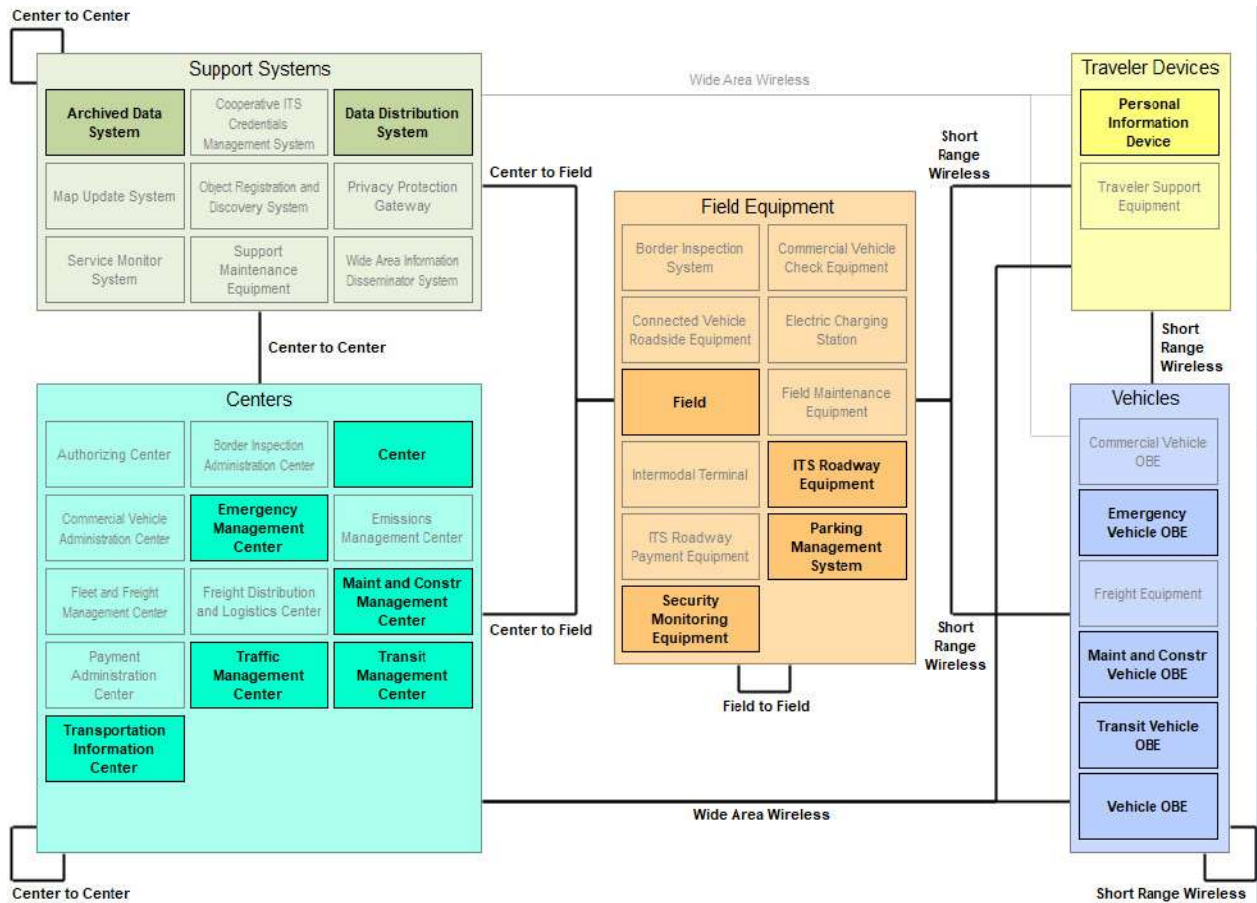
Table 3 – ITS Inventory

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
Agency/Subsystem Data Archive	Represents a small-scale data archived for a specific ITS system (e.g. a traffic signal or transit management system) or agency. May push information to a larger regional or statewide Archived Data Warehouse.	Spokane Regional Transportation Management Center (SRTMC)	Existing	Support	Archived Data System
Archived Data Users	Systems, individuals, or agencies that utilize archive data (agencies or third parties).	Archived Data Users	Existing		Archived Data User System Center
City of Spokane Arterial Operations Centers	TACTICS central system for traffic signal control, monitoring, maintenance, and reporting.	City of Spokane	Existing	Center	Center
City of Spokane Central Traffic Signal System	TACTICS central system for traffic signal control, monitoring, maintenance, and reporting.	City of Spokane	Existing	Center	Center
City of Spokane DPW Maintenance Dispatch	Dispatch center for City of Spokane Dept. of Public Works (road and winter maintenance)	City of Spokane	Existing	Center	Maintenance and Construction Management Center
City of Spokane DPW Maintenance Vehicles	Roadway and winter maintenance vehicles operated by the City of Spokane, including snowplows.	City of Spokane	Existing	Vehicle	Maintenance and Construction Vehicle OBE
City of Spokane Emergency Management Dispatch Center	Dispatch center for police, fire, EMS and other purposes in the City of Spokane.	City of Spokane	Existing	Center	Emergency Management Center

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
City of Spokane ITS Field Devices	Represents all City of Spokane ITS devices including Dynamic Message Signs (DMS), Surveillance Cameras, Traffic Data Sensors, Traffic Signals, and other ITS devices.	City of Spokane	Existing	Field	ITS Roadway Equipment
City of Spokane Public Information Website	City of Spokane website, including an interactive snow plow activity map.	City of Spokane	Existing	Support	Other Data Sources
City of Spokane Public Safety Vehicles	City of Spokane police vehicles, fire trucks, and ambulances that are used to respond to a variety of emergencies.	City of Spokane	Existing	Vehicle	Emergency Vehicle OBE
Federal Emergency Management Operations Centers	Agencies such as FEMA are responsible for coordination of emergency and disaster response at the Federal level, in conjunction with state and local authorities.	U.S. Department of Homeland Security	Existing	Center	Emergency Management Center
Idaho State Communications Center (StateComm)	Statewide emergency and transportation coordination center that provides emergency, incident, and medical response across Idaho. Provides transportation operations services and operates ITS equipment across the state under contract to Idaho Transportation Department. Located in Boise, Idaho.	Idaho Transportation Department (ITD)	Existing	Center	Center
ITD ITS Field Devices	Represents all ITD ITS devices including Dynamic Message Signs (DMS), Road Weather Information Systems (RWIS), Surveillance Cameras, Traffic Data Sensors, and other ITS devices.	Idaho Transportation Department (ITD)	Existing	Field	ITS Roadway Equipment
ITD Statewide Traveler Information System (511)	Statewide traveler information system including the WSDOT 511 website, mobile applications, and telephone traveler information.	Idaho Transportation Department (ITD)	Existing	Support	Other Data Sources
Media	News, radio, Internet, or other public information dissemination media.	Local Media	Existing	Center	Center Media
Personal Information Devices	Personal electronic devices used to access traveler information, including smart phones, cellular phones, in-vehicle devices, and tablet computers.	Travelers	Existing	Traveler	Personal Information Device

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
Private Utility Services	Private utility companies or employees that may provide information about work that may impact travel, such as through road closures - e.g. Avista.	Private Utilities	Existing	Center	Center Other Maintenance and Construction Mgmt Centers
Regional Traveler Information Broker	A traveler information dissemination "clearinghouse" that provides real-time information from multiple agency sources to a variety of public and private traveler dissemination resources, including website, WSDOT 511, and private traveler information services.	Spokane Regional Transportation Management Center (SRTMC)	Planned	Center	Center Transportation Information Center
Spokane County Arterial Operations Center	Workstation for management of traffic signals and ITS devices on arterial roadways. Includes a link to SRTMC's systems.	Spokane County	Planned	Center	Center
Spokane County Commute Trip Reduction (CTR) Website	Website used by Spokane County to provide traveler information, and connect residents to alternative modes. http://www.mycommute.org/	Spokane County	Existing	Support	Government Reporting Systems Other Data Sources
Spokane County Dept. Emergency Management Dispatch	Dispatch for emergency and maintenance and construction purposes for Spokane County.	Spokane County	Existing	Center	Emergency Management Center
Spokane County DPW Maintenance Dispatch	Dispatch center for Spokane County Dept. of Public Works (road and winter maintenance)	Spokane County	Existing	Center	Maintenance and Construction Management Center
Spokane County DPW Maintenance Vehicles	Maintenance vehicles, including snowplows and deicers, for Spokane County. Many vehicles, including snowplows and deicers, are equipped with GPS for vehicle location.	Spokane County	Existing	Vehicle	Maintenance and Construction Vehicle OBE

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
Spokane County ITS Field Devices	Represents all Spokane County ITS devices including existing Traffic Signals and planned Dynamic Message Signs (DMS), Road Weather Information Systems (RWIS), Surveillance Cameras, Traffic Data Sensors, and other ITS devices.	Spokane County	Existing	Field	ITS Roadway Equipment
Spokane County Public Information Website	Public information website for Spokane County	Spokane County	Existing	Support	Data Distribution System
Spokane County Sheriff's Office Dispatch	The law enforcement dispatch center for the Spokane County Sheriff's Office.[NTD - may be redundant with Spokane Co Emergency Management]	Spokane County Sheriff's Office	Existing	Center	Emergency Management Center
Spokane County Sheriff's Office Vehicles	Spokane Sheriff's Office vehicles used for regular patrols as well as to respond to emergencies.	Spokane County Sheriff's Office	Existing	Vehicle	Emergency Vehicle OBE
Spokane Region Archived Data Warehouse	This data warehouse would serve as a regional data clearinghouse and analytic tools for collecting, archiving, and sharing information.	Spokane Regional Transportation Council (SRTC)	Planned	Support	Archived Data System
Spokane Regional Construction and Maintenance Event Clearinghouse	This web-based system provides regional information about planned construction and maintenance event information to facilitate interagency coordination and traveler information dissemination. The system includes the participation of SRTC, SRTMC, City of Spokane, Spokane Valley, WSDOT Eastern Region, Spokane County, Spokane Transit, and private utility services.	Spokane Regional Transportation Management Center (SRTMC)	Planned	Support	Archived Data System

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
Spokane Regional Transportation Management Center (SRTMC)	Multi-modal regional transportation management facility for the Spokane region, including control capabilities for WSDOT and certain local agency ITS devices. Currently co-located with the Spokane Regional Transportation Council in downtown Spokane. The Advanced Transportation Management System (ATMS) is a key hardware and software platform for TMC activities. Additional functionality for ATMS is planned for the future.	Spokane Regional Transportation Management Center (SRTMC)	Existing	Center	Archived Data User System Traffic Management Center
Spokane Valley Arterial Operations Center	Workstation for management of traffic signals and ITS devices on arterial roadways. Includes a link to SRTMC's systems.	City of Spokane Valley	Existing	Center	Traffic Management Center
Spokane Valley Emergency Management Dispatch Center	Dispatch center for police, fire, and EMS in the City of Spokane Valley.	City of Spokane Valley	Existing	Center	Emergency Management Center
Spokane Valley ITS Field Devices	Represents all City of Spokane ITS devices including Dynamic Message Signs (DMS), Surveillance Cameras, Traffic Data Sensors, Traffic Signals, and other ITS devices.	City of Spokane Valley	Existing	Field	ITS Roadway Equipment
Spokane Valley Public Information Website	Public information website for the City of Spokane Valley	City of Spokane Valley	Existing	Support	Other Data Sources
Spokane Valley Public Safety Vehicles	City of Spokane Valley fire trucks and ambulances that are used to respond to a variety of emergencies.	City of Spokane Valley	Existing	Vehicle	Emergency Vehicle OBE
SRTMC Central Traffic Signal System	SRTMC's central signal system (MaxView/MaxTime) is used by WSDOT, the City of Spokane Valley, and Spokane County. The system provides regional control capabilities across multiple jurisdictions/facility types to improve regional arterial traffic flow and management.	Spokane Regional Transportation Management Center (SRTMC)	Existing	Center	Archived Data User System Traffic Management Center

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
SRTMC Multimodal Traveler Information System	A public-facing website (srtmc.org) providing information such as an interactive traffic map, live video camera feeds, construction and incidents, transit information, and other real-time information that allows for trip planning using different modes of transportation.	Spokane Regional Transportation Management Center (SRTMC)	Planned	Center	Transportation Information Center
SRTMC Operators	Operators working in the regional traffic management center to operate regional traffic control functions on behalf of the SRTMC Board partner agencies and WSDOT Eastern Region. Functions include traffic management, incident management, emergency incident coordination, traveler information dissemination, and other duties.	Spokane Regional Transportation Management Center (SRTMC)	Existing		Traffic Operations Personnel
STA Facilities Surveillance Cameras	Fixed facility cameras (e.g. at transit centers and park and rides) used primarily for security surveillance and in support of transit operations.	Spokane Transit Authority	Existing	Field	Security Monitoring Equipment
STA Fare Payment Smart Card	A reloadable transit contactless fare card currently used for STA services. Includes electronic pass programs with local schools, colleges, universities, and employers.	Spokane Transit Authority	Existing	Traveler	Payment Device Traveler Card
STA Fixed Route Dispatch	The dispatch center for STA fixed route vehicles that uses Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) software as well as voice and data communications to assist in transit operations.	Spokane Transit Authority	Existing	Center	Transit Management Center
STA Fixed Route Operators	Coach (bus) operator of STA fixed route vehicles.	Spokane Transit Authority	Existing		Transit Vehicle Operator

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
STA Fixed Route Vehicles	Buses equipped with Smart Bus technologies, including on-board fare boxes that have smart card functionality, as well as video and audio surveillance. STA is currently implementing additional Smart Bus technologies, including automatic vehicle location, automated passenger counters, automatic stop annunciation, as well as equipment supporting future transit signal priority.	Spokane Transit Authority	Existing	Vehicle	Transit Vehicle OBE
STA Operations Personnel	Spokane Transit operations personnel managing transit operations in real time, either in the central dispatch facility or as field supervisors.	Spokane Transit Authority	Existing		Transit Operations Personnel
STA Paratransit Dispatch	The dispatch center for STA paratransit vehicles that uses computer assisted reservations/scheduling software to assist with operations.	Spokane Transit Authority	Existing	Center	Transit Management Center
STA Paratransit Operators	Operator of STA paratransit vehicles.	Spokane Transit Authority	Existing		Transit Vehicle Operator
STA Paratransit Vehicles	Paratransit vehicles for STA, which have mobile data terminals for coordinating with dispatch.	Spokane Transit Authority	Existing	Vehicle	Transit Vehicle OBE
STA Park and Ride Facilities	Transit park-and-ride facilities, which are often key passenger hubs and include ITS equipment such as security surveillance cameras, ticket vending machines, and real-time traveler information.	Spokane Transit Authority	Existing	Field	Parking Management System
STA Real-Time Customer Information Systems	Transit customer information system based on real-time information obtained from Smart Bus technologies, including electronic message signs at strategic locations, enhanced web and mobile applications, a real-time transit trip planner, and subscription-based transit information alerts.	Spokane Transit Authority	Existing	Center	Transit Management Center Transportation Information Center
Third-Party Transportation Data Sources	A private company, public agency, or other external organization that provides transportation data.	Third-Party Transportation Data Sources	Planned	Support	Other Data Sources

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
Third-Party Traveler Information Service Provider	A private company, public agency, or other external organization that provides traveler information to the public, such as real-time traffic or incident information.	Third-Party Traveler Information Service Providers	Existing	Support	Archived Data System
Travelers	Includes personal and commercial vehicle operators.	Travelers	Existing		Traveler
Vehicles	Traveling vehicles that receive and transmit information to roadside devices.	Travelers	Existing	Vehicle	Vehicle OBE
Washington State Emergency Operations Center	State emergency operations center located at Camp Murray, WA for coordination of large-scale emergencies and natural disasters.	Washington State Emergency Operations Center	Existing	Center	Emergency Management Center
Washington State Patrol (WSP) Dispatch	Dispatch for WSP vehicles to carry out statewide policing and to enforce commercial vehicle violations.	Washington State Patrol (WSP)	Existing	Center	Emergency Management Center
Washington State Patrol (WSP) Vehicles	Vehicles used by the WSP.	Washington State Patrol (WSP)	Existing	Vehicle	Emergency Vehicle OBE
Weather Information Services	A service or system that can provide forecast information for the purposes of road conditions forecasting and/or dissemination to the public through information service providers, such as WeatherNet.	Other Weather Service	Existing	Center	Weather Service System
WSDOT Eastern Region Maintenance Dispatch	Incident Response Team and Maintenance Dispatch for the Eastern Region office of WSDOT.	WSDOT Eastern Region Office	Existing	Center	Maintenance and Construction Management Center
WSDOT Incident Response Team Vehicle Operators	Operators of WSDOT Incident Response Team vehicles.	WSDOT Incident Response Team	Existing		Emergency Personnel
WSDOT Incident Response Team Vehicles	WSDOT vehicles used for the Incident Response Team to patrol and respond to incidents on the roadway.	WSDOT Incident Response Team	Existing	Vehicle	Emergency Vehicle OBE

Element Name	Element Description	Stakeholder	Element Status	Element Class	Associated Physical Objects
WSDOT ITS Field Devices	Represents all WSDOT ITS devices including Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), Road Weather Information Systems (RWIS), Surveillance Cameras, Traffic Control Devices, Traffic Data Sensors, Traffic Signals, and other ITS devices.	WSDOT Eastern Region Office	Existing	Field	ITS Roadway Equipment
WSDOT Maintenance Vehicles	Roadway and winter maintenance vehicles operated by WSDOT Eastern Region, including snowplows.	WSDOT Eastern Region Office	Existing	Vehicle	Maintenance and Construction Vehicle OBE
WSDOT Park and Ride Lots	Park and Ride lots and accompanying customer information systems in the eastern region of WSDOT.	WSDOT Eastern Region Office	Existing	Field	Parking Management System
WSDOT Statewide Traveler Information System (511)	Statewide traveler information system including the WSDOT 511 website, mobile applications, and telephone traveler information.	Washington State Department of Transportation (WSDOT)	Existing	Center	Transportation Information Center
WSDOT TMC Log	Interactive web-based application for recording events and incident information. From this web-based application, operators are able to view and manage the region's freeway traffic flow, view CCTV camera images, post messages to dynamic message signs (DMS), and access WSDOT's Performance Management System (PeMS) data.	WSDOT Eastern Region Office	Existing	Center	Archived Data User System
WSDOT Work Zone Database	This database is a tool for scheduling and reporting construction and maintenance activity along state highways, and is used by SRTMC. It can be expanded to be used by other agencies.	WSDOT Eastern Region Office	Existing	Center	Maintenance and Construction Management Center

6 ITS Services

Service Packages provide an accessible, deployment-oriented perspective to the National ITS Reference Architecture. Service Packages group various elements of the physical architecture (subsystems, physical objects, architecture flows, and terminators) together to provide a specific ITS service. A key step in the Regional ITS Architecture development process is selecting which Service Packages are applicable to the region and the status of deployment (existing or planned) of each. From that point, the Service Packages are reviewed individually to determine which physical architecture components in each are applicable to the region.

Service Packages are grouped in ARC-IT based upon the category of the service provided and within the following Service Areas:

- Commercial Vehicle Operations (CV)
- Data Management (DM)
- Maintenance and Construction (MC)
- Parking Management (PM)
- Public Safety (PS)
- Public Transportation (PT)
- Support (SU)
- Sustainable Travel (ST)
- Traffic Management (TM)
- Traveler Information (TI)
- Vehicle Safety (VS)
- Weather (WX)

ITS services, or service packages, describe what can be done to improve the efficiency, safety, and convenience of the regional transportation system through better information, advanced systems and new technologies. Some services are specific to one primary stakeholder while others require broad stakeholder participation. This section describes the ITS services that meet the transportation needs in the Spokane region.

Table 4 – ITS Services

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
DM01	ITS Data Warehouse	This service package provides access to transportation data to support transportation planning, condition and performance monitoring, safety analysis, and research. Configurations range from focused repositories that house data collected and owned by a single agency, district, private sector provider, or research institution to broad repositories that contain multimodal, multidimensional data from varied data sources covering a broader region. Both central repositories and physical distributed ITS data repositories are supported. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package may be parsed by the local repository and dynamically translated to requests to other repositories that relay the data necessary to satisfy the request.	Existing – With Planned Expansion	1. Agency/Subsystem Data Archive 2. Archived Data Users 3. Spokane Region Archived Data Warehouse 4. SRTMC 5. STA Real-Time Customer Information Systems 6. Third-Party Transportation Data Sources 7. Weather Information Services

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Planned	1. Agency/Subsystem Data Archive 2. Archived Data Users 3. COS Arterial Operations Centers 4. COS Central Traffic Signal System 5. Spokane County Arterial Operations Center 6. CoSV Arterial Operations Center 7. Spokane Region Archived Data Warehouse 8. SRTMC 9. SRTMC Central Traffic Signal System

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
MC01	Maintenance and Construction Vehicle and Equipment Tracking	This service package tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. Checks can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.	Planned	1. COS DPW Maintenance Dispatch 2. COS DPW Maintenance Vehicles 3. Spokane County DPW Maintenance Dispatch 4. Spokane County DPW Maintenance Vehicles 5. WSDOT ER Maintenance Dispatch 6. WSDOT Maintenance Vehicles 7. WSDOT Work Zone Database
MC02	Maintenance and Construction Vehicle Maintenance	This service package performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance and construction vehicles, and the systems that collect this diagnostic information and use it to schedule and manage vehicle and equipment maintenance.	Planned	1. COS DPW Maintenance Vehicles 2. Spokane County DPW Maintenance Vehicles 3. WSDOT Maintenance Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
MC03	Roadway Automated Treatment	This service package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The service package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.	Planned	1. WSDOT ITS Field Devices
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.	Existing – Expansion Potential	1. COS DPW Maintenance Dispatch 2. COS DPW Maintenance Vehicles 3. Spokane County DPW Maintenance Dispatch 4. Spokane County DPW Maintenance Vehicles 5. SRTMC 6. Weather Information Services 7. WSDOT ER Maintenance Dispatch 8. WSDOT Maintenance Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
MC05	Roadway Maintenance and Construction	This service package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.	Existing – Expansion Potential	1. COS DPW Maintenance Dispatch 2. COS DPW Maintenance Vehicles 3. COS ITS Field Devices 4. Spokane County DPW Maintenance Dispatch 5. Spokane County DPW Maintenance Vehicles 6. Spokane County ITS Field Devices 7. SRTMC 8. CoSV ITS Field Devices 9. WSDOT ER Maintenance Dispatch 10. WSDOT ITS Field Devices 11. WSDOT Maintenance Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – With Planned Expansion	1. COS ITS Field Devices 2. Private Utility Services 3. Spokane County ITS Field Devices 4. SRTMC 5. CoSV ITS Field Devices 6. STA Fixed Route Dispatch 7. STA Paratransit Dispatch 8. WSDOT ITS Field Devices 9. WSDOT Work Zone Database
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).	Planned	1. WSDOT ER Maintenance Dispatch 2. WSDOT ITS Field Devices 3. WSDOT Maintenance Vehicles 4. WSDOT Work Zone Database

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
MC08	Maintenance and Construction Activity Coordination	This service package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to Transportation Information Centers who can provide the information to travelers. Center to center coordination of work plans supports adjustments to reduce disruption to regional transportation operations.	Existing – Expansion Potential	1. COS DPW Maintenance Dispatch 2. Spokane County DPW Maintenance Dispatch 3. Spokane Regional Construction and Maintenance Event Clearinghouse 4. SRTMC 5. STA Fixed Route Dispatch 6. STA Paratransit Dispatch 7. WSDOT ER Maintenance Dispatch

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PS01	Emergency Call-Taking and Dispatch	This service package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Centers supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Center and an Emergency Vehicle supports dispatch and provision of information to responding personnel.	Existing – Expansion Potential	1. COS Emergency Management Dispatch Center 2. COS Public Safety Vehicles 3. Spokane County Dept. Emergency Management Dispatch 4. Spokane County Sheriff's Office Dispatch 5. Spokane County Sheriff's Office Vehicles 6. CoSV Emergency Management Dispatch Center 7. CoSV Public Safety Vehicles 8. WSP Dispatch 9. WSP Vehicles 10. WSDOT IRT Vehicle Operators 11. WSDOT IRT Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PS02	Routing Support for Emergency Responders	This service package provides information to support dynamic routing of emergency vehicles. Traffic information, road conditions, and weather advisories are provided to enhance emergency vehicle routing. The Emergency Management Center provides routing information based on real-time conditions and has the option to request an ingress/egress route from the Traffic Management Center.	Planned	1. COS Emergency Management Dispatch Center 2. COS Public Safety Vehicles 3. Spokane County Sheriff's Office Dispatch 4. Spokane County Sheriff's Office Vehicles 5. SRTMC 6. CoSV Emergency Management Dispatch Center 7. CoSV Public Safety Vehicles 8. WSP Dispatch 9. WSP Vehicles 10. WSDOT IRT Vehicle Operators 11. WSDOT IRT Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – Expansion Potential	1. COS ITS Field Devices 2. COS Public Safety Vehicles 3. Spokane County ITS Field Devices 4. Spokane County Sheriff's Office Vehicles 5. CoSV ITS Field Devices 6. CoSV Public Safety Vehicles 7. SRTMC Central Traffic Signal System 8. WSP Vehicles 9. WSDOT IRT Vehicles 10. WSDOT ITS Field Devices
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.	Existing – Expansion Potential	1. SRTMC 2. WSP Dispatch 3. WSP Vehicles 4. WSDOT IRT Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PS09	Transportation Infrastructure Protection	This service package includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to control access, preclude an incident, and mitigate the impact of an incident if it occurs. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.	Planned	1. SRTMC 2. WSDOT ITS Field Devices

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Planned	1. SRTMC 2. WSDOT ITS Field Devices 3. WSDOT Statewide Traveler Information System (511)
PS11	Early Warning System	This service package monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The service package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.	Planned	1. SRTMC 2. SRTMC Operators 3. Washington State Emergency Operations Center 4. Weather Information Services

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PS14	Disaster Traveler Information	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 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.	Planned	1. Personal Information Devices 2. SRTMC Multimodal Traveler Information System 3. Vehicles 4. Washington State Emergency Operations Center 5. Weather Information Services 6. WSDOT Statewide Traveler Information System (511)

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PT01	Transit Vehicle Tracking	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.	Existing – Expansion Potential	1. STA Fixed Route Dispatch 2. STA Fixed Route Vehicles 3. STA Paratransit Dispatch 4. STA Paratransit Vehicles
PT02	Transit Fixed-Route Operations	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.	Existing – Expansion Potential	1. SRTMC 2. SRTMC Central Traffic Signal System 3. STA Fixed Route Dispatch 4. STA Fixed Route Operators 5. STA Fixed Route Vehicles 6. STA Operations Personnel 7. STA Real-Time Customer Information Systems

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Planned	1. Regional Traveler Information Broker 2. SRTMC 3. STA Operations Personnel 4. STA Paratransit Dispatch 5. STA Paratransit Operators 6. STA Paratransit Vehicles 7. STA Real-Time Customer Information Systems
PT04	Transit Fare Collection Management	This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device such as a smart phone. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Center.	Existing – Expansion Potential	1. SRTMC Multimodal Traveler Information System 2. STA Fare Payment Smart Card 3. STA Fixed Route Dispatch 4. STA Fixed Route Vehicles 5. STA Operations Personnel 6. STA Paratransit Dispatch 7. STA Paratransit Vehicles 8. Travelers

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PT05	Transit Security	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. 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 and transit infrastructure. 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. 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.	Existing – Expansion Potential	1. Regional Traveler Information Broker 2. Spokane County Sheriff's Office Dispatch 3. STA Fixed Route Dispatch 4. STA Fixed Route Operators 5. STA Fixed Route Vehicles 6. STA Operations Personnel 7. STA Paratransit Dispatch 8. STA Paratransit Operators 9. STA Paratransit Vehicles 10. Travelers
PT06	Transit Fleet Management	This service package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Center. The Transit Management Center processes this data and schedules preventative and corrective maintenance. The service package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks and the assignment of transit vehicle operators to runs.	Planned	1. STA Fixed Route Dispatch 2. STA Fixed Route Vehicles 3. STA Operations Personnel 4. STA Paratransit Dispatch 5. STA Paratransit Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
PT07	Transit Passenger Counting	This service package counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.	Existing – Expansion Potential	1. STA Fixed Route Dispatch 2. STA Fixed Route Vehicles 3. STA Paratransit Dispatch 4. STA Paratransit Vehicles
PT08	Transit Traveler Information	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.	Planned	1. Personal Information Devices 2. SRTMC Multimodal Traveler Information System 3. STA Fixed Route Dispatch 4. STA Fixed Route Vehicles 5. STA Real-Time Customer Information Systems 6. Travelers

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Planned	1. COS ITS Field Devices 2. CoSV ITS Field Devices 3. STA Fixed Route Dispatch 4. STA Fixed Route Operators 5. STA Fixed Route Vehicles 6. STA Operations Personnel 7. WSDOT ITS Field Devices
PT11	Transit Pedestrian Indication	The Transit Pedestrian Indication service package provides vehicle to device communications to inform pedestrians at a station or stop about the presence of a transit vehicle. In addition, this service package would inform the transit vehicle operator about the presence of pedestrians nearby and those waiting for the bus. It would help prevent collisions between transit vehicles and pedestrians.	Planned	1. Personal Information Devices 2. STA Fixed Route Vehicles 3. Travelers

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – Expansion Potential	1. Archived Data Users 2. COS Arterial Operations Centers 3. COS Central Traffic Signal System 4. Media 5. Regional Traveler Information Broker 6. Spokane County Arterial Operations Center 7. CoSV Arterial Operations Center 8. SRTMC Multimodal Traveler Information System
TI01	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.	Existing – Expansion Potential	1. Media 2. Personal Information Devices 3. Spokane County DPW Maintenance Dispatch 4. SRTMC 5. STA Fixed Route Dispatch 6. Travelers

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – Expansion Potential	1. Media 2. Personal Information Devices 3. Regional Traveler Information Broker 4. Spokane Regional Construction and Maintenance Event Clearinghouse 5. SRTMC 6. SRTMC Multimodal Traveler Information System 7. STA Real-Time Customer Information Systems 8. Travelers 9. Weather Information Services 10. WSDOT Statewide Traveler Information System (511)

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM01	Infrastructure-Based Traffic Surveillance	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.	Existing – Expansion Potential	1. COS ITS Field Devices 2. ITD ITS Field Devices 3. CoSV Arterial Operations Center 4. Spokane County ITS Field Devices 5. SRTMC 6. CoSV ITS Field Devices 7. SRTMC Central Traffic Signal System 8. WSDOT ITS Field Devices
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).	Planned	1. SRTMC 2. Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM03	Traffic Signal Control	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.	Existing – Expansion Potential	1. COS ITS Field Devices 2. CoSV Arterial Operations Center 3. Spokane County ITS Field Devices 4. SRTMC 5. CoSV ITS Field Devices 6. SRTMC Central Traffic Signal System 7. SRTMC Operators 8. WSDOT ITS Field Devices
TM04	Connected Vehicle Traffic Signal System	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.	Planned	1. CoSV ITS Field Devices 2. WSDOT ITS Field Devices

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – Expansion Potential	1. SRTMC 2. SRTMC Central Traffic Signal System 3. SRTMC Operators 4. WSDOT ITS Field Devices
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.	Existing – Expansion Potential	1. COS ITS Field Devices 2. Media 3. Regional Traveler Information Broker 4. Spokane County ITS Field Devices 5. SRTMC 6. CoSV ITS Field Devices 7. STA Real-Time Customer Information Systems 8. WSDOT ITS Field Devices

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Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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.	Existing – Expansion Potential	1. CoSV Arterial Operations Center 2. SRTMC 3. SRTMC Central Traffic Signal System 4. SRTMC Operators

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM08	Traffic Incident Management System	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 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.	Existing – Expansion Potential	1. COS DPW Maintenance Dispatch 2. COS Emergency Management Dispatch Center 3. COS ITS Field Devices 4. COS Public Safety Vehicles 5. Federal Emergency Management Operations Centers 6. Spokane County Dept. Emergency Management Dispatch 7. Spokane County DPW Maintenance Dispatch 8. Spokane County ITS Field Devices 9. Spokane County Sheriff's Office Dispatch 10. Spokane County Sheriff's Office Vehicles 11. SRTMC

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM08	Traffic Incident Management System		Existing – Expansion Potential	12. CoSV Emergency Management Dispatch Center 13. CoSV ITS Field Devices 14. CoSV Public Safety Vehicles 15. SRTMC Central Traffic Signal System 16. SRTMC Multimodal Traveler Information System 17. SRTMC Operators 18. Washington State Emergency Operations Center 19. WSP Dispatch 20. WSP Vehicles 21. WSDOT IRT Vehicle Operators 22. WSDOT IRT Vehicles 23. WSDOT ITS Field Devices 24. WSDOT Statewide Traveler Information System (511)

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
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 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.	Planned	1. CoSV Arterial Operations Center 2. SRTMC 3. SRTMC Central Traffic Signal System 4. SRTMC Multimodal Traveler Information System 5. STA Fixed Route Dispatch 6. STA Paratransit Dispatch 7. STA Park and Ride Facilities 8. WSDOT Park and Ride Lots

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM12	Dynamic Roadway Warning	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).	Planned	1. COS ITS Field Devices 2. Spokane County ITS Field Devices 3. SRTMC 4. CoSV ITS Field Devices 5. WSDOT ITS Field Devices
TM13	Standard Railroad Grade Crossing	This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the ITS Roadway Equipment and the Driver in the physical view.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification of an approaching train by interfaced wayside equipment. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the Traffic Management Center.	Existing	1. SRTMC 2. WSDOT ITS Field Devices

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM17	Speed Warning and Enforcement	This service package monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles. This service focuses on monitoring of vehicle speeds and enforcement of the speed limit while the variable speed limits service (covered in TM20-Variable Speed Limits service package) focuses on varying the posted speed limits to create more uniform speeds along a roadway, to promote safer driving during adverse conditions (such as fog) and/or to reduce air pollution.	Existing	1. COS ITS Field Devices 2. Spokane County ITS Field Devices 3. SRTMC 4. CoSV ITS Field Devices 5. WSDOT ITS Field Devices
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).	Planned	1. SRTMC 2. WSDOT ITS Field Devices

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
TM22	Dynamic Lane Management and Shoulder Use	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).	Planned	1. WSDOT ITS Field Devices

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
WX01	Weather Data Collection	This service package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. It also collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions. It leverages vehicle on-board systems that measure temperature, sense current weather conditions (rain and sun sensors) and also can monitor aspects of the vehicle operational status (e.g., use of headlights, wipers, and traction control system) to gather information about local environmental conditions. In addition, environmental sensor systems located on Maintenance and Construction Vehicles are also potential data sources. The collected environmental data is used by the Weather Information Processing and Distribution service package to process the information and make decisions on operations. The collected environmental data may be aggregated, combined with data attributes and sent to meteorological systems for data qualification and further data consolidation. The service package may also request and receive qualified data sets from meteorological systems.	Existing – Expansion Potential	1. COS DPW Maintenance Vehicles 2. COS ITS Field Devices 3. Spokane County DPW Maintenance Vehicles 4. Spokane County ITS Field Devices 5. SRTMC 6. CoSV ITS Field Devices 7. Weather Information Services 8. WSDOT ITS Field Devices 9. WSDOT Maintenance Vehicles

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
WX02	Weather Information Processing and Distribution	This service package processes and distributes the environmental information collected from the Weather Data Collection service package. This service package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so operational centers and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination service package, and aid operators in scheduling work activity.	Existing – Expansion Potential	1. COS DPW Maintenance Dispatch 2. COS Emergency Management Dispatch Center 3. Federal Emergency Management Operations Centers 4. Media 5. Spokane County DPW Maintenance Dispatch 6. SRTMC 7. Washington State Emergency Operations Center 8. Weather Information Services 9. WSDOT ER Maintenance Dispatch 10. WSDOT Statewide Traveler Information System (511)

Service Package	Service Package Name	Service Package Description	Service Package Status	Included Elements
WX03	Spot Weather Impact Warning	This service package will alert drivers to unsafe conditions or road closure at specific points on the downstream roadway as a result of weather-related impacts, which include, but are not limited to high winds, flood conditions, ice, or fog. The service packages is designed to use standalone weather systems to warn drivers about inclement weather conditions that may impact travel conditions. Real time weather information is collected from fixed environmental sensor stations and vehicle based sensors. The information is processed to determine the nature of the alert or warning to be delivered and then communicated to connected vehicles. If the warning includes road closure then diversion information can be provided. For non-equipped vehicles the alerts or warnings will be provided via roadway signage. In addition, the roadway equipment may calculate the appropriate speed for current weather conditions and provide this information to the connected vehicle or on roadway signage.	Planned	1. WSDOT ITS Field Devices

7 Architecture Needs

The Stakeholders' Needs listed below describe what the systems need to do and what the users need from the system.

The needs are written from the perspective of a system user or stakeholder and are categorized by Service Packages that comprise the Spokane Region ITS Architecture 2019. Service Packages provide an accessible, service-oriented perspective to the overall system architecture used to describe the region or project. They identify the pieces of the physical view that are required to implement a particular ITS service. Each of these service packages has a set of Needs associated with it that can be used as the basis for stakeholder validation, setting proper expectations, and eliciting requirements for the systems and devices to be implemented.

Table 5 – DM01: ITS Data Warehouse Needs

Number	Need
01	System operators need to be able to store data for long term access by themselves and other operators.
02	System operators need to be able to query for and receive archive data products containing freeway data, tolling data, arterial data, parking data, transit and ridesharing data, incident management data, safety-related data, CVO data, environmental and weather data, vehicle and passenger data and intermodal operations data.
03	System operators need to be able to manage data processing with regard to data archive functions, including data aggregation, data tagging (processed, edited, raw, transformed, etc.), data storage timing and longevity, data quality analysis, data formatting and metadata assignments.

Table 6 – DM02: Performance Monitoring Needs

Number	Need
01	System operators need to be able to store vehicle data, transit data, weather data, freight data and other transportation-related data to support traffic data analysis, transportation network performance monitoring, transportation planning, safety analyses and research.
02	System operators need to be able to process vehicle data sourced by themselves and other system operators to support performance monitoring, infrastructure conditions reporting, and environmental monitoring. This supports system operator reporting needs and provides the source data and metrics for government reports.

Table 7 – MC01: Maintenance and Construction Vehicle and Equipment Tracking Needs

Number	Need
01	Maintenance and construction operations need to be able to track the location of maintenance and construction vehicles and other equipment in order to ascertain where their assets are.

Table 8 – MC02: Maintenance and Construction Vehicle Maintenance Needs

Number	Need
01	Maintenance and construction operations need to be able to manage vehicle maintenance scheduling for both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment.
02	Maintenance and construction operations need to be able to automatically collect diagnostics data from maintenance and construction vehicles in order to use it to schedule and manage vehicle and equipment maintenance.
03	Maintenance and construction vehicles need to be able to collect vehicle diagnostics and operating status data from the maintenance vehicle and send it to maintenance and construction operations.

Table 9 – MC03: Roadway Automated Treatment Needs

Number	Need
01	Maintenance and construction operations need to be able to automatically treat a roadway section based on environmental or atmospheric conditions.
02	Maintenance and construction operations need to be able to warn drivers when a roadway treatment system is activated.
03	Maintenance and construction operations need to be able to monitor operational status of the environmental sensors that detect adverse conditions.

Table 10 – MC04: Winter Maintenance Needs

Number	Need
01	Maintenance and construction operations need to be able to collect environmental situation data from centers, field devices and private, commercial, specialty and public fleet vehicles in order to schedule winter maintenance activities, determine the appropriate response to weather events/conditions, and track and manage response operations.
02	Maintenance and construction operations need to be able to process current and historical data from multiple sources in order to provide enhanced support for winter maintenance operations.
03	Maintenance and construction operations need to be able to create enhanced treatment plans for use by agency maintenance personnel.
04	Maintenance and construction operations need to be able to provide winter maintenance instructions including treatment route, treatment application rates, start and end times, and other treatment instructions for vehicle operators.

Number	Need
05	Maintenance and construction operations need to be able to provide winter road maintenance status to other centers.

Table 11 – MC05: Roadway Maintenance and Construction Needs

Number	Need
01	Maintenance and construction operations need to be able to schedule maintenance and construction on a roadway system or right-of-way.
02	Maintenance and construction operations need to be able to collect environmental conditions information from various weather sources in order to aid in scheduling maintenance and construction activities.
03	Maintenance and construction operations need to coordinate maintenance and construction activities with traffic and other management agencies.
04	Maintenance and construction operations need to be able to monitor the status of ITS field equipment and coordinate with Traffic Operations on the maintenance of the equipment.

Table 12 – MC06: Work Zone Management Needs

Number	Need
01	Maintenance and construction operations need to be able to manage work zones and control traffic in areas of the roadway where maintenance, construction, and utility work activities are underway.
02	Maintenance and construction operations need to be able to inform the driver of upcoming work zones, including reduced speeds, lanes affected, and delays.
03	Maintenance and construction operations need to be able to coordinate work zone information with other agencies (e.g., traveler information, traffic operations, and other maintenance and construction centers).
04	Maintenance and construction operations need to be able to provide control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

Table 13 – MC07: Work Zone Safety Monitoring Needs

Number	Need
01	Maintenance and Construction operations need to be able to provide warnings about hazards in the work zone to maintenance personnel, such as a vehicle moving in a manner that appears to create an unsafe condition.
02	Maintenance and Construction operations need to be able to monitor for hazards in the work zone.
03	Maintenance and Construction operations need to be able to monitor operational status of work zone safety devices.

Table 14 – MC08: Maintenance and Construction Activity Coordination Needs

Number	Need
01	Maintenance and construction operations need to be able to disseminate maintenance and construction activity to transportation agencies that can utilize it as part of their operations.

Table 15 – PS01: Emergency Call-Taking and Dispatch Needs

Number	Need
01	Emergency Management needs to provide basic public safety call-taking and dispatch of emergency vehicles in order to provide safe and rapid deployment of appropriate resources to an emergency.
02	Emergency Management needs to coordinate with other emergency management operations in order to support emergency notification between agencies.

Table 16 – PS02: Routing Support for Emergency Responders Needs

Number	Need
01	Emergency Management needs to process current and historical weather and road conditions data from multiple sources in order to generate warnings and route advisories for individual emergency responders or emergency response dispatchers.
02	Emergency Management needs to provide emergency responders with road weather warnings and advisories.
03	Emergency Management needs to provide routing information to the emergency responders.

Table 17 – PS03: Emergency Vehicle Preemption Needs

Number	Need
01	Emergency Management needs to be able to request signal preemption from Traffic Operations for a specific emergency vehicle.
02	Emergency Management needs to be able request signal preemption locally for one or more signals the vehicle is approaching so that it may quickly and safely cross the intersections.
03	Traffic Management needs to be able to adjust signal timing to provide signal preemption for an emergency vehicle based upon a request from Emergency Management.
04	Traffic Management needs to be able to support local adjustments to signal timing based upon a local preemption request and transition back to normal traffic signal operations after providing emergency vehicle preemption.

Table 18 – PS08: Roadway Service Patrols Needs

Number	Need
01	Roadway Service Patrol Operations need to be able to monitor service patrol vehicle locations and dispatch service patrol vehicles to identified incident locations.

Number	Need
02	Roadway Service Patrol Operations need to be able to monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) in order to minimize disruption to the traffic stream.
03	Roadway Service Patrol Operations need to be able to share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information systems.

Table 19 – PS10: Wide-Area Alert Needs

Number	Need
01	Emergency Management needs to be able to verify the reported emergency situation in order to activate the alert system.
02	Emergency Management needs to be able 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, 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.
03	Emergency Management needs to be able to broadcast emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems.

Table 20 – PS11: Early Warning System Needs

Number	Need
01	Emergency Management needs to be able to collect potential threats, alerts, and advisories from various ITS systems to identify emergencies.
02	Emergency Management needs to be able to alert all relevant agencies of detected emergencies.

Table 21 – PS14: Disaster Traveler Information Needs

Number	Need
01	Emergency Management and Traveler Information need to be able to provide general public real-time disaster and evacuation information using ITS traveler information systems.
02	Traveler Information needs to be able to collect disaster related information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations.
03	Emergency Management and Traveler Information need to be able to provide evacuees with information including a shelter that matches their needs, including location, availability, and routing.
04	Emergency Management and Traveler Information need to be able to provide information concerning roadside resources including information provided by other evacuees to help understand availability of resources.

Number	Need
05	Emergency Management and Traveler Information need to be able to provide evacuees with information regarding when they can return to their area, including routes and road conditions.

Table 22 – PT04: Transit Fare Collection Management Needs

Number	Need
01	Transit Operations needs to be able to collect transit fares on-board transit vehicles using electronic payment methods in order to improve transit operation.
02	Transit Operations needs to be able to collect transit fares at transit stations using electronic payment methods in or der to support bus rapid transit or train systems.
03	Transit Operations needs to be able to download transit fare collection information from transit vehicles or transit fare gates at stations in order to manage the fare collection operations.
04	Travelers need to be able to add value to payment instruments in order to use them as part of fare collection systems.
05	Transit operations needs to be able to share fare information with traveler information systems and other transit operations.

Table 23 – PT05: Transit Security Needs

Number	Need
01	Transit Operations needs to be able to monitor conditions on a transit vehicle in order to provide a secure environment for travelers.
02	Transit Operations needs to be able to monitor transit stops and transit stations in order to provide a secure environment for travelers.
03	Transit Operations needs to be able to monitor transit secure areas such as bus garages to provide security for transit assets.
04	Transit Operations needs to be able to authenticate operators of transit vehicles and perform remote disabling of vehicles if necessary in order to ensure secure operation of the vehicles.
05	Transit Operations needs to be able to alert emergency services to incidents on vehicles, at stations/stops, or other monitored assets.
06	Transit Operations needs to be able to inform traveler information systems or the media regarding transit related incidents in order to keep the traveling public informed of the impacts these incidents may have on their trips.

Table 24 – PT06: Transit Fleet Management Needs

Number	Need
01	Transit Operations needs to able to remotely monitor transit vehicle operating conditions in order to determine if maintenance of the vehicle is needed.
02	Transit Operations needs to be able to perform maintenance scheduling of transit vehicles including real time requests for actions by the vehicle operator.

Number	Need
03	Transit Operations needs to be able to assign specific vehicles to blocks in order to perform vehicle allocation.

Table 25 – PT07: Transit Passenger Counting Needs

Number	Need
01	Transit Operations needs to be able to count the passengers entering or exiting a transit vehicle in order to support efficient operations.

Table 26 – PT08: Transit Traveler Information Needs

Number	Need
01	Transit Operations needs to be able to provide static and real time transit information to traveler information systems and the media in order to increase travelers' ability to plan and manage their trips.
02	Transit Operations needs to be able to provide static and real time transit information directly to travelers either pretrip or enroute in order to support traveler trip decisions.
03	Transit Operations needs to be able to share static and real time transit information with other transit operations in order to facilitate multisystem trip planning.

Table 27 – PT09: Transit Signal Priority Needs

Number	Need
01	Transit Operations needs to provide approaching Transit Vehicle location and heading to the roadside signal controller so that the controller can modify signal timing in favor of the transit vehicle.
02	Transit Operations needs to provide approaching Transit Vehicle location and heading to traffic operations so that they can adjust the signal controller signal timing in favor of the transit vehicle.
03	Transit Operations needs to provide transit vehicle data to Traffic Operations including loading information and schedule performance in order to support decision making regarding whether to give the transit vehicle priority at the intersection.

Table 28 – PT11: Transit Pedestrian Indication Needs

Number	Need
01	Transit Vehicle Operators need to be aware of nearby pedestrians, including those who would like to board the transit vehicle in order to reduce the likelihood of pedestrian accidents with the transit vehicle.
02	Pedestrians need to know the proximity of a transit vehicle to a transit stop and whether the transit vehicle is the one they want to board (i.e., the correct route).

Table 29 – SU03: Data Distribution Needs

Number	Need
01	System Operators, Vehicle Operators, and PID Operators need to be able to request and receive information without establishing formal relationships with data providers.
02	System Operators need to be able to provide data to a geographically selected area.
03	Data Distribution Operators need to be able to exchange data with other data distribution systems.
04	Data Distribution Operators need to be able to establish and maintain data processing algorithms, rules and related metadata, including all those processes related to Validation, Integration, Sanitization, and Aggregation.

Table 30 – TI01: Broadcast Traveler Information Needs

Number	Need
01	Traveler Information needs to be able to collect timely, accurate, and reliable traffic, transit, and other road conditions data from multiple sources in order to inform travelers of the latest conditions affecting their travel.
02	Traveler Information needs to be able to inform as much of the traveling public as possible using any available means to increase mobility and safety through better information.
03	Travelers need access to timely, accurate, and reliable traffic, transit, and other travel conditions in order to make informed decisions about their travel.

Table 31 – TI02: Personalized Traveler Information Needs

Number	Need
01	Traveler Information needs to be able to collect timely, accurate, and reliable traffic, transit, and other road conditions data from multiple sources in order to inform travelers of the latest conditions affecting their travel.
02	Traveler Information needs to be able to inform as much of the traveling public as possible using any available means to increase mobility and safety through better information.
03	Travelers, including drivers or passengers, need access to timely, accurate, and reliable traffic, transit, and other travel conditions in order to make informed decisions about their travel.
04	Travelers, including drivers or passengers, need to be able to request specific and customized information concerning current and future travel conditions in order to make decisions about their own travel.

Table 32 – TM01: Infrastructure-Based Traffic Surveillance Needs

Number	Need
01	Traffic Operations need to be able to monitor the road network using infrastructure devices in order to detect and verify incidents and support implementation of traffic operational strategies.
02	Traffic Operations need to be able to monitor the infrastructure devices used for road network monitoring in order to detect faults in equipment or communications.

Number	Need
03	Traffic Operations need to be able to send network monitoring data to other centers in order to support traveler information.

Table 33 – TM02: Vehicle-Based Traffic Surveillance Needs

Number	Need
01	Traffic Operations and Traveler Information Providers need to be able to monitor the road network using information from connected vehicles in order to detect and verify incidents.
02	Traffic Operations need to be able to monitor the roadside equipment in order to detect faults in equipment or communications.
03	Traffic Operations need to be able to send network monitoring data to other centers in order to support traveler information.
04	Traffic Operations need to be able to monitor the road network using probe data from toll or transit systems.

Table 34 – TM03: Traffic Signal Control Needs

Number	Need
01	Traffic Operations need to be able to remotely control traffic signals at intersections under their jurisdiction
02	Traffic Operations need to be able to manage and implement control plans in order to coordinate signalized intersections.
03	Traffic Operations need to be able to monitor and control pedestrian crossing aspects of traffic signals in order to facilitate safe pedestrian crossings at the intersection.
04	Traffic Operations need to monitor the status of traffic signal control equipment.

Table 35 – TM04: Connected Vehicle Traffic Signal System Needs

Number	Need
01	Traffic Operations need to be able to use both information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems.
02	Traffic Operations need to be able to disseminate signal phase and timing data to connected vehicles to facilitate improved movement through intersections.
03	Traffic Operations need to be able to monitor and control pedestrian crossing aspects of traffic signals in order to facilitate safe pedestrian crossings at the intersection
04	Traffic Operations need to be able to manage and implement control plans in order to coordinate signalized intersections.
05	Traffic Operations need to monitor the status of traffic signal control equipment.

Table 36 – TM05: Traffic Metering Needs

Number	Need
01	Traffic Operations need to be able to monitor and control traffic metering equipment in order to regulate the flow of traffic on ramps, interchanges, and the mainline.
02	Traffic Operations need to monitor the status of traffic metering equipment.
03	Traffic Operations need to be able to implement control strategies utilizing the traffic metering equipment on ramps, interchanges, and on the mainline.

Table 37 – TM06: Traffic Information Dissemination Needs

Number	Need
01	Traffic Operations need to be able to provide traffic and incident information to drivers using roadside devices such as dynamic message signs and highway advisory radio.
02	Traffic Operations need to be able to monitor roadside devices used to provide traffic and traveler information to drivers.
03	Traffic Operations need to be able to provide traffic and incident information, including images to the media.
04	Traffic Operations need to be able to provide traffic and incident information, including images to traveler information, transit, maintenance and emergency centers.

Table 38 – TM07: Regional Traffic Management Needs

Number	Need
01	Traffic Operations need to exchange traffic and incident data with other Traffic Management Centers in order to support regional coordination spanning jurisdictional boundaries.
02	Traffic Operations need to exchange traffic control data with other traffic management centers to support inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor.

Table 39 – TM08: Traffic Incident Management System Needs

Number	Need
01	Traffic Operations need to detect and verify incidents on roadways using CCTV and field sensors.
02	Traffic Operations need to share incident information with other ITS centers in order to coordinate incident response.
03	Traffic Operations need to obtain incident information from other ITS centers in order to coordinate incident response
04	Emergency Operations need to be able to dispatch emergency assets to a traffic incident.
05	Traffic Operations need to coordinate requests for resources with emergency and maintenance centers in order to support cleanup after the incident.

Table 40 – TM09: Integrated Decision Support and Demand Management Needs

Number	Need
01	Traffic Operations need to be able to use current and forecast road and traffic conditions to develop traffic management plans.
02	Traffic Operations need to be able to develop operational decisions based upon analysis of current and forecast road and traffic conditions.
03	Traffic Operations need to be able to collect information describing multi-source, real-time data (both infrastructure and vehicle based) on arterials, freeways, and transit systems to develop operational decisions that can be applied to corridors or to the region as a whole.
04	Traffic Operations needs to be able to collect information from transit, parking, and toll operations in order to support development of demand management strategies.
05	Traffic Operations needs to be able to implement demand management strategies in order to correct network imbalances and effectively manage available capacity.
06	Traffic Operations needs to be able to collect emissions data to support development of demand management strategies.

Table 41 – TM12: Dynamic Roadway Warning Needs

Number	Need
01	Traffic Operations need to be able to dynamically warn drivers approaching hazards on a roadway in order to increase the safety of a roadway by reducing the occurrence of incidents.
02	Traffic Operations need to be able to receive and process data from multiple sources in order to generate warning for drivers based on the collected traffic and road conditions.

Table 42 – TM13: Standard Railroad Grade Crossing Needs

Number	Need
01	Traffic Operations need to be able to warn drivers of crossing closures or potential crash-imminent situations with a crossing or oncoming train in time for the driver to take appropriate action.
02	Traffic Operations need to be able to modify traffic signal timing in order to allow safe movement of vehicles away or towards a highway rail intersection when a train is approaching.

Table 43 – TM17: Speed Warning and Enforcement Needs

Number	Need
01	Traffic Operations need to be able to monitor vehicle speeds to determine when vehicle speed is excessive.
02	Traffic Operations need to be able to warn drivers when their speed is excessive.
03	Traffic Operations need to be able to notify an enforcement agency that vehicles are traveling at excessive speed and to be able to request that the enforcement agency respond to the excessive speed.

Number	Need
04	Enforcement agencies need to be able to monitor vehicle speeds as measured by field equipment to determine when vehicle speed is excessive.

Table 44 – TM20: Variable Speed Limits Needs

Number	Need
01	Traffic Operations need to be able to collect data from multiple sources to actively recommend variable speed limits which can be based on environmental conditions.
02	Traffic Operations need to be able to process current and historical data in order to provide recommended variable speed limits.
03	Traffic Operations need to be able to display variable speed limits to drivers.

Table 45 – TM22: Dynamic Lane Management and Shoulder Use Needs

Number	Need
01	Traffic operations needs to be able to change the lane configuration including lane destination and use of shoulder lanes on the roadway according to traffic demand in order to actively manage the traffic
02	Traffic Operations needs to be able to manage lane usage on highways and arterials including approaches to border crossings, multimodal crossings, or intermodal terminals.
03	Traffic Operations needs to be able to reconfigure intersections and interchanges and manage right-of-way dynamically including merges in order to increase roadway throughput during times of peak traffic or incidents.
04	Traffic operations needs to be able to prohibit or restrict of types of vehicles from using particular lanes in order to manage roadway throughput during times of peak traffic or incidents.
05	Traffic Operations need to be able to designate lanes for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc, in order to increase roadway throughput during times of peak traffic, incidents or special events.
06	Traffic Operations need to be able to disseminate the current lane configurations to drivers and other centers.

Table 46 – WX01: Weather Data Collection Needs

Number	Need
01	Traffic operations or maintenance and construction operations need be able to collect road conditions and weather data from environmental sensors on or in the vicinity of the roadway.
02	Traffic operations need to be able to collect road conditions and weather data from vehicle on-board sensors.
03	Traffic operations and maintenance and construction operations need to share collected environmental data with each other.
04	Traffic operations and Maintenance and construction need to be able to receive environmental data from Weather operations.

Number	Need
05	Maintenance and construction operations need to be able to collect road conditions and weather data from maintenance vehicle on-board sensors.
06	Weather Systems need be able to collect road conditions and weather data from environmental sensors on or in the vicinity of the roadway.

Table 47 – WX02: Weather Information Processing and Distribution Needs

Number	Need
01	Maintenance and construction operations need to be able to process collected environmental information to issue location specific road weather warnings derived from roadway environmental sensor data, vehicle on-board sensor data and weather service operations to make decisions regarding efficient deployment of road maintenance resources based on historical, current and forecasted environmental conditions.
02	Maintenance and construction operations needs to process collected environmental information to issue road weather alerts, warnings and advisories derived from roadway environmental sensor data, vehicle on-board sensor data and weather service operations to share the road weather information with emergency management operations, transit management operations, rail operations, weather service operations and other maintenance and construction operations.

Table 48 – WX03: Spot Weather Impact Warning Needs

Number	Need
01	Transportation information operations need to be able to disseminate road weather advisories and warnings at specific points on the downstream roadway to connected vehicles via in vehicle signage.
02	Traffic management operations need to be able to control environmental sensors and aggregate the environmental information.
03	Transportation information operations need to be able to disseminate road weather advisories and warnings at specific points on the downstream roadway to non-equipped vehicles via roadway signage.
04	Traffic management operations need to be able to monitor traffic and environmental information, calculate appropriate variable speed limits and provide this information to the connected vehicle or on roadway signage.

8 Operational Concept

The success of the operational objectives and strategies, identified in Chapter 3, Relationship to Planning, depend on cooperation of multiple agencies for effective implementation. The SRTMC, partner agencies, and other transportation and operational stakeholders have a long record of accomplishment of interagency cooperation in the Spokane region. This cooperation is necessary to maximize the return on investment to the public.

The Operational Concept lists the roles and responsibilities that each participating agency must take on to provide the ITS services included in the ITS Architecture. Defining the roles and responsibilities of the participating stakeholders in the region and the willingness of agencies to accept their roles and responsibilities is an important step in realizing the common goal of an interoperable ITS system throughout the region.

In this section, ITS Services are categorized into Roles and Responsibility Areas as follows:

1. Archived Operational Data Systems for Spokane Region

2. Operational Data Management for Spokane Region

3. Emergency Management for Spokane Region

4. Freeway Management for Spokane Region

5. Incident Management for Spokane Region

6. Maintenance and Construction for Spokane Region

7. Surface Street Management for Spokane Region

8. Transit Services for Spokane Region

9. Traveler Information for Spokane Region

10. Weather for Spokane Region

Table 49 – Operational Concept

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Archived Operational Data Systems for Spokane Region	A system for operational data from all transportation agency sources to be combined and archived for use by planning divisions, reporting resources, traveler information, emergency management information, and historical record for comparison and performance needs.	Archived Data Users	1. City of Spokane, City of Spokane Valley, STA and WSDOT Planning & Operations offices will provide their data to be included in a combined region data system to be used for planning, measuring and comparing performance 2. SRTC will use the data for long range planning and performance measurements and will determine appropriate reporting and data gathering use	Planned
		City of Spokane City of Spokane Valley	City of Spokane and City of Spokane Valley have field devices that collect data for archive, management, and dissemination	Existing
		Other Weather Service	1. National Weather Service sends weather information SRTMC to be used to provide traveler information 2. Weather Net is a DOT provided service for weather information for maintenance and travel	Existing
		Spokane County	Spokane County Traffic Signal Data will be collected, archived, managed, and disseminated	Planned

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Archived Operational Data Systems for Spokane Region	A system for operational data from all transportation agency sources to be combined and archived for use by planning divisions, reporting resources, traveler information, emergency management information, and historical record for comparison and performance needs.	Spokane Regional Transportation Management Center (SRTMC)	1. SRTMC will receive data from other agency sources and archive, manage, and disseminate the data to other systems and users 2. SRTMC will determine a data platform that can incorporate multiple sources of data, analyze the data and report the data as needed by transportation planning and operational agencies 3. SRTMC will manage the data through local servers or through cloud based data storage	Planned
		Spokane Transit Authority	STA Route, Passenger, and Fleet data will be collected, archived, managed, and disseminated	Existing
		Third-Party Transportation Data Sources	Third party data will provide additional information to be used with local agency data to fill gaps regarding travel data on local roadways within the region.	Planned
		Travelers	Travelers receive information from the data systems and will eventually provide additional information for data collection in a connected vehicle environment	Planned
		Washington State Department of Transportation (WSDOT)	WSDOT has field devices that collect data that needs to be archived, managed, and disseminated	Existing
		WSDOT Eastern Region Office	WSDOT ER Traffic Office will use the operational data to report on congestion related bottlenecks, delay, etc. for reporting through the gray notebook	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Operational Data Management for Spokane Region	Operational data from the region transportation agencies will be collected, stored, and disseminated. The data to be stored will require management to determine storage needs, access to stored data, data storage capacity, and connection to other systems.	Spokane Regional Transportation Management Center (SRTMC)	1. COS, COSV, SRTC, Spokane County, WSDOT, and STA will determine how many years of historical data will need to be archived. 2. COS, COSV, SRTC, Spokane County, WSDOT, and STA will determine what data analysis and reporting features will be needed from the data system. 3. COS, COSV, Spokane County, WSDOT, and STA will provide data from their existing systems to be managed, and archived through the regional data system. 4. SRTC will determine what regional reporting will be required to measure federal performance requirements	Planned
		Washington State Department of Transportation (WSDOT)	WSDOT Statewide Data Management resources will be utilized as necessary to support data management for transportation and operational planning and reporting	Planned
Emergency Management for Spokane Region	Emergency Management includes providing evacuation and reentry information to travelers during emergency situations including serious weather events.	City of Spokane	City of Spokane and City Police will provide emergency dispatch service that communicates with other emergency management centers	Existing
		Other Weather Service	1. National Weather Service sends weather information SRTMC to be used to provide traveler information 2. Weather Net is a WSDOT provided service for weather information for maintenance and travel	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Emergency Management for Spokane Region	Emergency Management includes providing evacuation and reentry information to travelers during emergency situations including serious weather events.	Spokane County Sheriffs Office	1. Partner in Emergency 911 Center 2. Spokane County Sheriff responds to incidents on county roadways and communicates with SRTMC as necessary. Radio communication is provided to SRTMC for their monitoring of incidents 3. County CAD integration into SRTMC systems	Existing Planned
		Spokane Regional Transportation Management Center (SRTMC)	1. SRTMC receives information from emergency service departments to share with travelers or initiate action plans in response to an emergency 2. SRTMC shares information with various emergency service centers during events 3. COS, COSV, Spokane County, STA, and WSDOT will coordinate efforts as necessary during emergency situations. 4. SRTMC partners will create action plans that can be implemented by an SRTMC operator when an event occurs	Existing Planned
		Travelers	1. Travelers receive information from the data systems and will eventually provide additional information for data collection in a connected vehicle environment. 2. Travelers are provided information on roadside signs, through the SRTMC and WSDOT websites and through Highway Advisory Radio to make appropriate choices concerning travel.	Planned Existing
		Washington State Emergency Operations Center	1. EOC receives CCTV feeds and is connected through the fiber communications infrastructure for the region 2. EOC coordinates with SRTMC and emergency response agencies during an emergency	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Emergency Management for Spokane Region	Emergency Management includes providing evacuation and reentry information to travelers during emergency situations including serious weather events.	Washington State Patrol (WSP)	WSP provides CAD interface with SRTMC and coordinates with IRT for aid during incidents or emergencies that impact the highway system	Existing
		WSDOT Incident Response Team	IRT responds to emergency events on the highway system	Existing
Freeway Management for Spokane Region	Freeway Management for the region consists of several traffic management strategies utilizing field ITS systems owned and operated by the SRTMC partner agencies and managed by the SRTMC, WSDOT operations, City of Spokane Operations, City of Spokane Valley Operations, Spokane County Operations, and STA Operations and coordinated by a unified effort.	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Monitors all Freeway devices and corresponds with WSDOT Maintenance and WSP to manage freeway operations	Existing
		Travelers	Travelers receive information and respond accordingly to maximize efficient use of the freeway capacity and maintain maximum operational use	Existing
		Washington State Patrol (WSP)	WSP enforces laws and regulations regarding freeway use by motorists and responds to violations to maintain safe operation of the freeway system	Existing
		WSDOT Eastern Region Office	1. The ER Traffic Office evaluates freeway operations and determines parameters for systems operations that influence freeway travel 2. ER IRT patrols provide support to travelers and to emergency services to keep safe and efficient freeway operations 3. ER Maintenance ensures proper use of freeway facilities by maintaining roadway features as well as operational systems.	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Incident Management for Spokane Region	Emergency responders from various agencies in the region will respond to incidents that impede the flow of traffic and create congestion to mitigate the potential for secondary crashes. Incidents are detected through ITS field devices located throughout the region. Operators monitor the roadways and respond to incidents that are detected. Incident Response Teams (ITS) patrol the region to provide support to motorists and emergency response crews.	Spokane County Sheriff's Office	1. Spokane County Sheriff responds to incidents on county roadways and communicates with SRTMC as necessary. Radio communication is provided to SRTMC for their monitoring of incidents 2. County CAD integration into SRTMC systems	Existing Planned
		Spokane Regional Transportation Management Center (SRTMC)	1. SRTMC monitors roadways, detects and verifies incidents and alerts responders and the public via field devices and alert messaging sent through TMC Log and the ATMS System 2. SRTMC Website shows incidents for public information.	Existing
		Washington State Patrol (WSP)	WSP provides CAD to SRTMC for communication about incidents and are in contact with SRTMC about any incidents detected by SRTMC. WSP dispatches IRT for incidents	Existing
		WSDOT Incident Response Team	WSDOT IRT Rovers respond to freeway incidents and provide service to emergency services and the public	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Maintenance and Construction for Spokane Region	Maintenance and Construction Management for the Spokane Region consists of providing travelers with real-time and planned construction activities that could impact travel. Maintenance and Construction activities are managed using ITS field devices that display information to travelers as well as information provided on websites. Coordination among all agencies who's construction or maintenance activities could impact travel is done through SRTMC.	City of Spokane City of Spokane Valley Private Utilities Spokane County	Share M &C information with SRTMC for dissemination on field devices and website for public information	Existing
Maintenance and Construction for Spokane Region	Maintenance and Construction Management for the Spokane Region consists of providing travelers with real-time and planned construction activities that could impact travel. Maintenance and Construction activities are managed using ITS field devices that display information to travelers as well as information provided on websites. Coordination among all agencies who's construction or maintenance activities could impact travel is done through SRTMC.	Spokane Regional Transportation Management Center (SRTMC)	1. SRTMC posts known construction and maintenance impacts on VMS and HAR and website 2. SRTMC website that shows all region maintenance and construction activities for all agencies	Existing
		Washington State Department of Transportation (WSDOT)	Share M &C information with SRTMC for dissemination on field devices and website for public information	Existing
Surface Street Management for Spokane Region	Surface Street Management includes several traffic management strategies for safe and efficient travel on the local street network including operation of traffic signals throughout the region.	City of Spokane City of Spokane Valley Spokane County	Share data and install devices to allow for SRTMC to provide support for managing surface streets	Planned

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Surface Street Management for Spokane Region	Surface Street Management includes several traffic management strategies for safe and efficient travel on the local street network including operation of traffic signals throughout the region.	Spokane Regional Transportation Management Center (SRTMC)	SRTMC is the support agency for COS, CoSV, Spokane County and STA	Existing
		Spokane Transit Authority	STA Route planning to support COS, CoSV, and Spokane County efforts to manage streets	Existing
		Washington State Department of Transportation (WSDOT)	Major Arterial Surface Streets that are highways are managed partly by WSDOT and also by agencies with jurisdiction	Existing
Transit Services for Spokane Region	Transit Services support public transportation efforts throughout the Spokane Region and include route operations planning, fleet management, transit security, and transit signal priority.	Spokane Regional Transportation Management Center (SRTMC)	SRTMC provides CCTV images to STA for bus route planning and surveillance	Existing
		Spokane Transit Authority	1. STA is the authority for transit in Spokane and a partner with SRTMC 2. WSDOT CCTV images provided to STA for monitoring bus routes	Existing
		Travelers	Transit passengers will request a pick up or use personal devices to determine bus arrival and departure times	Existing

Roles and Responsibilities Area Name	Roles and Responsibilities Area Description	Stakeholder	Roles and Responsibility Description	Status
Traveler Information for Spokane Region	Traveler Information in the Spokane Region provides travelers with information to make good travel choices. Information is displayed on roadside equipment and websites and sent via alerts on personal devices.	Spokane Regional Transportation Management Center (SRTMC)	1. SRTMC is the central hub for all agency devices and fiber optic communication infrastructure 2. SRTMC activates public information messaging on field devices and logs events that send alerts to the public via email, text and Twitter and puts information on the SRTMC Website	Existing
		Travelers	Travelers sign up to receive alerts on their personal devices	Existing
Weather for Spokane Region	Weather sensors and detectors are located throughout the Spokane Region and are used for maintenance operations and roadway operational decision making. Weather data is provided to the public for better travel decision making. Weather data will be collected and archived as necessary for historical use in planning and will be used in analytical processes that are necessary for other operational systems.	Other Weather Service	1. Weather data is provided to weather service partners 2. Weather service partners provide forecast information to be used for maintenance planning and roadway operations	Existing
		Spokane Regional Transportation Management Center (SRTMC)	SRTMC provides weather data through a link on the SRTMC website and receives weather data through the ATMS system	Existing
		Travelers	travelers can access weather data through the SRTMC website	Existing
		Washington State Department of Transportation (WSDOT)	1. WSDOT installs weather stations throughout the region that collects weather data 2. WSDOT is developing a program for implementation, maintenance and operation of state owned weather stations	Existing Planned

9 Functional Requirements

Each ITS system operated by the stakeholders must perform certain functions to effectively deliver the envisioned project capabilities. The primary functions that each system needs to perform are broadly defined in the Spokane Region ITS Architecture 2019 as a set of Functional Objects that make up the physical elements of the architecture.

The functional requirements are high-level descriptions of what the ITS elements will do, not detailed design requirements.

Table 50 – Functional Requirements

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Agency/Subsystem Data Archive (Archived Data System)	**Archive Data Repository**	1. The center shall collect data from centers. 2. The center shall store collected data in an information repository. 3. The center shall notify the system operator of errors related to data collection, analysis and archival. 4. The center shall include capabilities for archive to archive coordination. 5. The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive. 6. The center shall collect data from data distribution systems and other data sources. 7. The center shall respond to requests from the administrator interface function to manage center-sourced data collection. 8. The center shall respond to requests from the administrator interface function to manage the archive data. 9. The center shall respond to requests for archive data from archive data users (centers, field devices).
	Archive Government Reporting	1. The center shall provide archive data to federal, state, and local government reporting systems. 2. The center shall respond to requests for government report data. 3. The center shall provide the capability to format data suitable for input into government reports. 4. The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Agency/Subsystem Data Archive (Archived Data System)	**Archive On-Line Analysis and Mining**	1. The center shall respond to requests for archive data from center users. 2. The center shall provide the capability to perform activities such as data mining, data fusion, summarizations, aggregations, and recreation from archive data. This may include multidimensional analysis, selective summarization and expansion of data details, and many other advanced analysis services. 3. The center shall collect regional data from data distribution centers. 4. The center shall respond to users systems requests for a catalog of the archived data analysis products available. 5. The center shall be capable of processing vehicle probe data into transportation network performance measures. 6. The center shall be capable of processing vehicle probe data to support infrastructure conditions monitoring performed by Archived Data User Systems including maintenance and construction management centers. 7. The center shall be capable of processing vehicle probe data to determine roadway environmental conditions for non operational uses such as maintenance planning and research.
	Archive Situation Data Archival	1. The center shall collect data from roadside devices. 2. The center shall respond to requests from the administrator interface function to manage field-sourced data collection. 3. The center shall provide the capability to adjust the collection of field-sourced data based on the statistical measures. 4. The center shall collect vehicle traffic probe data for performance monitoring and analysis. 5. The center shall be capable of archiving vehicle traffic probe data. 6. The center shall provide the capability to execute methods on the incoming field data such as aggregation and statistical measures before the data is stored in the archive. 7. The center shall respond to requests from the administrator interface function to select and manage data stored in the archive.
Archived Data Users	**N/A**	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Arterial Operations Centers (Center)	Center Data Collection	1. The center shall collect transportation data such as traffic operational data, transit data, vehicle data, weather data, freight data, event logs, etc. and make it available for ITS Archives upon request. 2. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself. 4. The center shall be able to produce sample products of the data available. 5. The center shall collect operational data from other Centers.
	Center Field Equipment Management	1. The center shall collect the status and fault data from field equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, short range communications equipment, security sensors and surveillance equipment, etc.. 2. The center shall create a cohesive view of field equipment repair needs based upon the status and fault information collected. 3. The center shall be able to provide control commands, configuration updates, software installation, or software upgrades for field devices under management of the center. 4. The center shall be able to request maintenance actions of the center responsible for field equipment maintenance. 5. The center shall allow center personnel to manage the maintenance of field equipment.
City of Spokane Central Traffic Signal System (Traffic Management Center)	TMC Data Collection	1. The center shall collect traffic management data such as operational data, event logs, etc. 2. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself. 4. The center shall be able to produce sample products of the data available.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Central Traffic Signal System (Traffic Management Center)	**TMC Multi-Modal Coordination**	1. The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route. 2. The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes. 3. The center shall provide an integrated operations strategy for the parking facilities in the area. These strategies can include dynamic adjustments to parking fees and restrictions, and other active demand management strategies.
	TMC Regional Traffic Management	1. The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information. 2. The center shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
	TMC Roadway Equipment Monitoring	1. The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status. 2. The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status. 3. The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair. 4. The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair. 5. The center shall collect environmental sensor operational status. 6. The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair. 7. The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Central Traffic Signal System (Traffic Management Center)	**TMC Signal Control**	1. The center shall remotely control traffic signal controllers. 2. The center shall accept notifications of pedestrian calls. 3. The center shall collect traffic signal controller operational status and compare against the control information sent by the center. 4. The center shall collect traffic signal controller fault data from the field. 5. The center shall manage (define, store and modify) control plans to coordinate signalized intersections, to be engaged at the direction of center personnel or according to a daily schedule. 6. The center shall implement control plans to coordinate signalized intersections based on data from sensors. 7. The center shall manage boundaries of the control sections used within the signal system. 8. The center shall maintain traffic signal coordination including synchronizing clocks throughout the system. 9. The center shall implement control plans to coordinate signalized intersections based on data from sensors and connected vehicles. 10. The center shall adjust signal timing in respond to a signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other requests for right-of-way. 11. The center shall collect commercial vehicle data (e.g., characteristics, route, schedule) for intermodal freight events. 12. The center shall adjust signal timing in respond to traffic and environmental parameters at each intersection in real time and adapts so that the traffic network is optimized using available green time to serve the actual traffic demands while minimizing the environmental impact. 13. The center shall process collected traffic and environmental data from sensors and connected vehicles. 14. The center shall support requests from emergency management centers to provide responding emergency vehicles with signal preemption.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane DPW Maintenance Dispatch (Maintenance and Construction Management Center)	**MCM Roadway Maintenance**	1. The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
		2. The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
		3. The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
		4. The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, short range communications equipment, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
		5. The center shall collect the status and fault data from the centers that operate the equipment, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, short range communications equipment, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
		6. The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
		7. The center shall dispatch and route maintenance and construction vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
		8. The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.
		9. The center shall report the status of field equipment maintenance activities to the centers that operate the equipment.
		10. The Center shall provide the status of field maintenance actions to other centers.
		11. The Center shall track the status of field equipment maintenance actions.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane DPW Maintenance Dispatch (Maintenance and Construction Management Center)	**MCM Vehicle Tracking**	1. The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction. 2. The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.
	MCM Winter Maintenance Management	1. The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance. 2. The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media. 3. The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities. 4. The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities. 5. The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations. 6. The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information. 7. The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc. 8. The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane DPW Maintenance Dispatch (Maintenance and Construction Management Center)	**MCM Work Activity Coordination**	1. The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts. 2. The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media. 3. The Center shall provide road infrastructure restriction information to other Centers.
	MCM Work Zone Management	1. The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes. 2. The center shall control the collection of work zone status information including video images from cameras located in or near the work zone. 3. The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information centers, and the media. 4. The center shall control traffic in work zones by providing remote control of dynamic message signs, highway advisory radio systems, gates, and barriers located in or near the work zone. 5. The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration. 6. The center shall collect real-time information on the state of the road network including current traffic and road conditions to support work zone scheduling and management.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane DPW Maintenance Vehicles (Maintenance and Construction Vehicle OBE)	**MCV Roadway Maintenance and Construction**	1. The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle. 2. The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc. 3. The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle. 4. The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status. 5. The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.
	MCV Vehicle Location Tracking	1. The maintenance and construction vehicle shall track its current location. 2. The maintenance and construction vehicle shall send the time stamped vehicle location to the controlling center.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Emergency Management Dispatch Center (Emergency Management Center)	Emergency Call-Taking	1. The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. 2. The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. 3. The center shall receive emergency call information from vehicles and present the possible incident information to the emergency system operator. 4. The center shall receive emergency call information from other emergency management centers, e.g. mayday service providers, and present the possible incident information to the emergency system operator. 5. The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. 6. The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. 7. The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. 8. The center shall send a request for remote control of Closed-circuit Television (CCTV) systems from a traffic management center in order to verify the reported incident. 9. The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. 10. The center shall update the incident information log once the emergency system operator has verified the incident.
	Emergency Data Collection	1. The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data. 2. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself. 4. The center shall be able to produce sample products of the data available.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Emergency Management Dispatch Center (Emergency Management Center)	Emergency Dispatch	1. The center shall dispatch emergency vehicles to respond to verified emergencies under center personnel control. 2. The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. 3. The center shall relay location and incident details to the responding vehicles. 4. The center shall track the location and status of emergency vehicles responding to an emergency based on information from the emergency vehicle. 5. The center shall store and maintain the emergency service responses in an action log. 6. The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized. 7. The center shall receive traffic images to support dispatch of emergency vehicles. 8. The center shall provide the capability to request remote control of traffic surveillance devices. 9. The center shall process road and weather conditions to provide updates to responding personnel.
	Emergency Incident Command	1. The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers. 2. The center shall track and maintain resource information and action plans pertaining to the incident command. 3. The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions. 4. The center shall provide other agencies real-time information on the current conditions at the incident scene. 5. The center shall collect on-scene reports to support emergency dispatch and staging of personnel and equipment. 6. The center shall provide situational awareness information to emergency responders about an incident, both en-route and while they are on-scene. 7. The center shall provide status of the current conditions at the incident scene to arriving responders.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Emergency Management Dispatch Center (Emergency Management Center)	**Emergency Response Management**	1. The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. 2. The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and response status with allied agencies. 3. The center shall develop, coordinate with other agencies, and store emergency response plans. 4. The center shall track the availability of resources and coordinate resource sharing with allied agency centers including traffic, maintenance, or other emergency centers. 5. The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. 6. The center shall receive event scheduling information from Event Promoters. 7. The center shall support remote control of field equipment normally under control of the traffic management center including traffic signals, dynamic message signs, gates, and barriers. 8. The center shall provide the capability to remotely control and monitor CCTV systems normally operated by a traffic management center.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Emergency Management Dispatch Center (Emergency Management Center)	**Emergency Routing**	1. The center shall collect current traffic and road condition information for emergency vehicle route calculation.
		2. The center shall receive information on the location and status of traffic control equipment and work zones along potential emergency routes.
		3. The center shall receive status information from care facilities to determine the appropriate facility and its location.
		4. The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.
		5. The center shall track current emergency vehicle location and status along with other emergency vehicle characteristics.
		6. The center shall calculate emergency vehicle routes, under center personnel control, based on the collected traffic and road conditions information.
		7. The center shall request and receive ingress and egress routes or other specialized emergency access routes from the traffic management center.
		8. The center shall provide the capability to request special traffic control measures, such as signal preemption, from the traffic management center to facilitate emergency vehicle progress along the suggested route.
		9. The center shall provide the calculated route for emergency vehicles to the dispatch function.
		10. The center shall collect weather and maintenance activity data, e.g., which roads have been plowed to support emergency dispatch and staging of personnel and equipment.
		11. The center shall collect road and traffic conditions information, including current traffic conditions en route, current traffic conditions on-scene, and road weather conditions (e.g. wet, icy, snow-covered).
		12. The center shall collect road and traffic conditions information from multiple sources including: traffic management centers, probe vehicle data, including traffic data and environmental conditions, and other private traffic data sources, e.g. private distributors that integrate connected (probe) vehicle data with cellular or surveillance device inputs.
		13. The center shall provide routing instructions for a dispatched emergency vehicle that may reflect current network conditions and the additional routing options available to en route emergency that are not available to the general public.
		14. The center shall collect location and situational information about the emergency vehicles responding to or on the scene of an incident.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	Roadway Basic Surveillance	1. The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control. 2. The field element shall collect, process, and send traffic images to the center for further analysis and distribution. 3. The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV), and high occupancy toll (HOT) lane sensor data to the center for further analysis and storage. 4. The field element shall return sensor and CCTV system operational status to the controlling center. 5. The field element shall return sensor and CCTV system fault data to the controlling center for repair.
	Roadway Data Collection	1. The field element shall collect traffic, road, and environmental conditions information. 2. The field element shall include the sensors and supporting roadside devices that sense, collect, and send traffic, road, and environmental conditions information to a center for archival. 3. The field element shall collect sensor status and sensor faults from roadside equipment and send it along with the recorded data to a center for archival.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	Roadway Environmental Monitoring	1. The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures. 2. The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility. 3. The field element's environmental sensors shall be remotely controlled by a maintenance center. 4. The field element's environmental sensors shall be remotely controlled by a traffic management center. 5. The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services. 6. The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle. 7. The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle. 8. The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle. 9. The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles. 10. The field element shall provide weather and road surface condition data to centers. 11. The field element shall provide weather and road surface condition data to maintenance and construction vehicles. 12. The field equipment shall provide environmental sensor data to the Connected Vehicle Roadside Equipment.
	Roadway Field Device Support	1. The field element shall monitor the operational status of field devices and detects and reports fault conditions. 2. The field element shall detect and report any fault conditions with the equipment being monitored back to its controlling center. 3. The field element shall provide the capability for field personnel to locally control and configure this equipment. 4. The field element shall support an interface with field support equipment to accept installation of updates or configuration of field operations.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	Roadway Field Management Station Operation	1. The field element shall accept configuration information from the center. 2. The field element shall pass data provided by the center to local field devices and report data from the field devices back to the center.
	Roadway Incident Detection	1. The field element shall collect, process, and send traffic images to the center for further analysis and distribution. 2. The field element shall remotely process video data and provide an indication of potential incidents to the traffic management center. 3. The field element's video devices shall be remotely controlled by a traffic management center. 4. The field element shall provide operational status and fault data for the incident detection devices to the traffic management center.
	Roadway Mixed Use Crossing Safety	1. The field element shall collect images or sensor data for pedestrians or bicyclists and respond to pedestrian or bicyclist crossing requests via display, audio signal, or other manner. 2. The field element shall respond to pedestrian or bicyclist crossing requests via display, audio signal, or other manner. 3. The field element shall be able to inform pedestrians and bicyclists of the status of the intersection including the amount of time left for crossing the intersection.
	Roadway Passive Monitoring	1. The field element shall collect, process, and send data to the center to uniquely identify passing vehicles in order to support travel time measurement

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	Roadway Signal Control	1. The field element shall control traffic signals under center control. 2. The field element shall respond to pedestrian crossing requests by accommodating the pedestrian crossing. 3. The field element shall provide the capability to notify the traffic management center of pedestrian calls and pedestrian accommodations. 4. The field element shall report the current signal control information to the center. 5. The field element shall report current preemption status to the center. 6. The field element shall return traffic signal controller operational status to the center. 7. The field element shall return traffic signal controller fault data to the center. 8. The field element shall report current transit priority status to the center. 9. The field element shall report current intersection signal timing information to roadside equipment for transmission to connected vehicles. 10. The field element shall receive request for transit vehicle signal priority. 11. The field element shall receive request for commercial vehicle signal priority. 12. The field element shall provide to roadside equipment the intersection geometry and signal phase movement information including phase and timing information, alarm status, and priority/preempt status. 13. The field element shall provide data to the Connected Vehicle Roadside Equipment. 14. The field element shall receive requests for emergency vehicle signal preemption.
	Roadway Signal Preemption	1. The field element shall respond to signal preemption requests from emergency vehicles. 2. The field element shall inform the controlling center when preemption requests have been received. 3. The field element shall send the preemption request to the signal controller to immediately preempt the signal for the requested direction.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	**Roadway Speed Monitoring and Warning**	1. The field element shall include sensors to detect vehicle speeds, under traffic or maintenance center control. 2. The field element shall include sensors to detect vehicle speeds, under enforcement agency control. 3. If the speed detected by vehicle speed sensors is determined to be excessive, the field element shall provide a safe speed advisory to passing drivers via a driver information system (such as portable messages signs, field to vehicle communications to in-vehicle signing systems, etc.). 4. The field element shall base speed advisories to passing drivers on environmental conditions. 5. The field element shall monitor notify an enforcement agency when a speed violation is detected. 6. The field element shall return operational status for the vehicle speed sensors to the controlling traffic or maintenance center; including measured speeds, warning messages displayed, and violation records. 7. The field element shall return operational status for the vehicle speed sensors to the enforcement agency. 8. The field element shall return fault data for the vehicle speed sensors to the controlling center for repair.
	Roadway Traffic Information Dissemination	1. The field element shall include dynamic message signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close). 2. The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control. 3. The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center. 4. The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair. 5. The field element shall provide dynamic message sign information to roadside equipment for transmission to connected vehicles to support in-vehicle signing. 6. The field element shall include devices that provide data and status information to other field element devices without center control. 7. The field element shall include devices that receive configuration data from other field element devices, without center control.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (ITS Roadway Equipment)	Roadway Warning	1. The field element shall monitor for hazardous traffic conditions, including queues. 2. The field element shall monitor for hazardous road surface and local weather conditions. 3. The field element shall monitor for debris, animals, or other objects in the travel lanes. 4. The field element shall provide collected sensor data to the controlling center. 5. The field element shall autonomously identify potentially hazardous conditions and activate warning signs to approaching motorists. 6. The field element shall receive commands from the controlling center that activate warning signs to approaching motorists. 7. The field element shall collect operational status of the warning system field equipment and report the operational status to the controlling center. 8. The field element shall monitor and report faults to the controlling center.
	Roadway Work Zone Traffic Control	1. The field element shall collect, process, and send work zone images to the center for further analysis and distribution, under center control. 2. Under traffic and maintenance center control, the field element shall include driver information systems (such as dynamic messages signs and highway advisory radios) that advise drivers of activity around the work zone through which they are currently passing. 3. Under the control of field personnel within maintenance vehicles, the field element shall include driver information systems (such as dynamic messages signs and highway advisory radios) that advise drivers of activity around a work zone through which they are currently passing. 4. The field element shall control access to the work zone using automated gate or barrier systems. This includes automated flagger assistance devices that include automated gate arms and other automated gate/barrier systems. 5. The field element shall provide operational status for the surveillance (e.g. CCTV), driver information systems, and gates/barriers in work zones to the maintenance center. 6. The field element shall provide fault data for the surveillance (e.g. CCTV), driver information systems, and gates/barriers in work zones to the maintenance center for repair.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane ITS Field Devices (Security Monitoring Equipment)	**Field Secure Area Surveillance**	1. The field element shall include video and/or audio surveillance of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). 2. The field element shall be remotely controlled by a center. 3. The field element shall provide equipment status and fault indication of surveillance equipment to a center. 4. The field element shall provide raw video or audio data. 5. The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.
City of Spokane Public Information Website (Transportation Information Center)	**TIC Traveler Information Broadcast**	1. The center shall disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes. 2. The center shall disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities. 3. The center shall disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers. 4. The center shall disseminate parking information to travelers, including location, availability, and fees. 5. The center shall disseminate weather information to travelers. 6. The center shall disseminate event information to travelers. 7. The center shall provide traffic and incident data to the media. 8. The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Public Safety Vehicles (Emergency Vehicle OBE)	EV On-Board En Route Support	1. The emergency vehicle, including roadway service patrols, shall track its current location. 2. The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch. 3. The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene. 4. The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates. 5. The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal. 6. The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene. 7. The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers. 8. The emergency vehicle shall send the vehicle's location, speed and direction to other vehicles in the area. 9. The roadway service patrols vehicle shall monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas). 10. The emergency vehicle shall receive the crash data from connected vehicles involved in a crash. 11. The emergency vehicle shall receive the HAZMAT information from commercial vehicles involved in a crash.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City of Spokane Public Safety Vehicles (Emergency Vehicle OBE)	**EV On-Board Incident Management Communication**	1. The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident. 2. The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc. 3. The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status. 4. The emergency vehicle shall provide traffic incident information to other emergency vehicles using short range communications. 5. The emergency vehicle shall receive container manifest and status of the electronic seal on a container. 6. The emergency vehicle shall inspect the electronic seal on a container to verify the container has not been opened or tampered with. 7. The emergency vehicle shall exchange information with other emergency vehicles to support the decision making and overall incident response.
	EV Service Patrol Vehicle Operations	1. The service patrol vehicle shall track its current location. 2. The service patrol vehicle shall send the vehicle's location and operational data to the center for dispatch. 3. The service patrol vehicle shall receive incident details and a suggested route when dispatched to a scene. 4. The service patrol vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates. 5. The service patrol vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene. 6. The service patrol vehicle shall update the center with status of an incident response including the nature of the incident, e.g. flat tire, gas, minor accident.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Federal Emergency Management Operations Centers (Emergency Management Center)	**Emergency Incident Command**	Defined Above
	Emergency Response Management	Defined Above
Idaho State Communications Center (Center)	**Center Data Collection**	Defined Above
ITD ITS Field Devices (ITS Roadway Equipment)	**Roadway Warning**	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
ITD Statewide Traveler Information System-511 (Transportation Information Center)	**TIC Traveler Telephone Information**	1. The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. 2. The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. 3. The center shall provide the capability to process traveler information requests from a traveler telephone information system. 4. The center shall provide information on traffic conditions in the requested voice format and for the requested location. 5. The center shall provide work zone and roadway maintenance information in the requested voice format and for the requested location. 6. The center shall provide roadway environment conditions information in the requested voice format and for the requested location. 7. The center shall provide weather and event information in the requested voice format and for the requested location. 8. The center shall provide transit service information in the requested voice format and for the requested location. 9. The center shall provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. 10. The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
Media	**N/A**	N/A
Personal Information Devices (Personal Information Device)	**Personal Traveler Information Reception**	1. The personal traveler interface shall receive traffic information from a center and present it to the traveler. 2. The personal traveler interface shall receive transit information from a center and present it to the traveler. 3. The personal traveler interface shall receive event information from a center and present it to the traveler. 4. The personal traveler interface shall receive evacuation information from a center and present it to the traveler. 5. The personal traveler interface shall receive wide-area alerts and present it to the traveler. 6. The personal traveler interface shall support traveler input in audio or manual form.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Private Utility Services	**N/A**	N/A
Regional Traveler Information Broker (Data Distribution System)	**DDS Data Access Management**	1. The Center shall distribute to personal devices data which has been validated, aggregated, integrated, and sanitized. 2. The Center shall distribute to Vehicles data which has been validated, aggregated, integrated, and sanitized. 3. The Center shall distribute to other Centers data which has been validated, aggregated, integrated, and sanitized. 4. The Center shall distribute to Vehicles broadcast data which has been validated, aggregated, integrated, and sanitized. 5. The Center shall distribute to Connected Vehicle Roadside Equipment data which has been validated, aggregated, integrated, and sanitized. 6. The Center shall provide metadata parameters (geographic area, data content type, time) as filters for subscription. 7. The Center shall provide data consumers with a mechanism for throttling (or reducing) the data they receive as part of subscriptions. 8. The Center shall provide data consumers with a mechanism for subscribing to data received by the Center. 9. The Center shall provide a mechanism for the operator to modify data subscriptions.
	DDS Data Collection and Aggregation	1. The Center shall collect data from Vehicles. 2. The Center shall provide data collection parameters to Vehicles. 3. The Center shall collect data from Connected Vehicle Roadside Equipment. 4. The Center shall provide data collection parameters to Connected Vehicle Roadside Equipment. 5. The Center shall collect data from other Centers. 6. The Center shall collect data from other Personal Devices. 7. The Center shall perform 'VISA' functions on incoming data (VISA = Validation, Integration, Sanitization, Aggregation). 8. The Center shall provide a mechanism for the operator to control data collection parameters. 9. The Center shall provide a mechanism for the operator to modify VISA functions.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Regional Traveler Information Broker (Transportation Information Center)	**TIC Data Collection**	1. The center shall collect, process, and store traffic and highway condition information, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes. 2. The center shall select real-time information on the state of the regional transportation system including current traffic and road conditions, weather conditions, transit information, parking information, special event and incident information. 3. The center shall collect, process, and store maintenance and construction information, including scheduled maintenance and construction work activities and work zone activities. 4. The center shall collect, process, and store transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information. 5. The center shall collect, process, and store parking information, including location, availability, and fees. 6. The center shall collect, process, and store current and forecast road conditions and surface weather conditions. 7. The center shall collect, process, and store event information. 8. The center shall collect information on transit schedule and service changes that adapt the service to better meet needs of responders and the general public in an emergency situation, including special service schedules supporting evacuation. 9. The center shall collect alert information and status from emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. 10. The center shall collect road condition information for freeways, arterials, and secondary roads that are used as freight routes.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Regional Traveler Information Broker (Transportation Information Center)	TIC Emergency Traveler Information	1. The center shall disseminate emergency evacuation information to the traveler interface systems, including evacuation zones, shelter information, available transportation modes, road closures and detours, changes to transit services, and traffic and road conditions at the origin, destination, and along the evacuation routes. 2. The center shall disseminate wide-area alert information to the traveler interface systems, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. 3. The center shall provide the capability for a system operator to control the type and update frequency of emergency and wide-area alert information distributed to travelers. 4. The center shall provide evacuation information to personal information devices. 5. The center shall provide evacuation information to connected vehicles. 6. The center shall maintain a set of evacuation routes based on various incident scenarios, e.g., storm, industrial accident, etc. 7. The center shall maintain a set of evacuation plans in the event that an evacuation is necessary, including: evacuation routes, call-plan, special needs evacuations, and shelter locations. 8. The center shall provide information concerning available resources along an evacuation route including information provided by other evacuees. 9. The center needs to provide evacuees with information regarding when they can return to their area, including evacuation return routes, evacuation return schedule, and evacuation return road conditions.
	TIC Traveler Information Broadcast	Defined Above
	TIC Traveler Telephone Information	Defined Above
Spokane County Arterial Operations Center (Center)	Center Field Equipment Management	Defined Above

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County Commute Trip Reduction Website	**TIC Data Collection**	Defined Above
Spokane County Dept. Emergency Management Dispatch (Emergency Management Center)	**Emergency Call-Taking**	Defined Above
	Emergency Data Collection	Defined Above
	Emergency Dispatch	Defined Above
	Emergency Incident Command	Defined Above
	Emergency Response Management	Defined Above
	Emergency Routing	Defined Above
Spokane County DPW Maintenance Dispatch (Maintenance and Construction Management Center)	**MCM Roadway Maintenance**	Defined Above
	MCM Vehicle Tracking	Defined Above
	MCM Winter Maintenance Management	Defined Above
	MCM Work Activity Coordination	Defined Above
	MCM Work Zone Management	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County DPW Maintenance Vehicles (Maintenance and Construction Vehicle On Board Equipment)	**MCV Roadway Maintenance and Construction**	Defined Above
	MCV Vehicle Location Tracking	Defined Above
Spokane County ITS Field Devices (ITS Roadway Equipment)	**Roadway Data Collection**	Defined Above
	Roadway Field Device Support	Defined Above
	Roadway Field Management Station Operation	Defined Above
	Roadway Incident Detection	Defined Above
	Roadway Mixed Use Crossing Safety	Defined Above
	Roadway Passive Monitoring	Defined Above
	Roadway Signal Control	Defined Above
	Roadway Signal Preemption	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County ITS Field Devices (ITS Roadway Equipment)	**Roadway Speed Monitoring and Warning**	Defined Above
Spokane County Public Information Website	**TIC Traveler Information Broadcast**	Defined Above
Spokane County Sheriff's Office Dispatch (Emergency Management Center)	**Emergency Call-Taking**	Defined Above
	Emergency Data Collection	Defined Above
	Emergency Dispatch	Defined Above
	Emergency Incident Command	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County Sheriff's Office Dispatch

(Emergency Management Center) | Emergency Notification Support | 1. The center shall be able to determine that a crash or emergency situation has taken place, based on on-board sensor data collected from the vehicle.
2. The center shall monitor subscribed vehicle data, including changes in velocity, attitude/orientation, position, and air bag status to determine when an emergency situation (crash) has happened.
3. The center shall collect mayday messages from travelers via personal handheld devices.
4. The center shall collect mayday messages from drivers via onboard devices.
5. The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
6. The center shall communicate with the mayday emergency message sender (driver) to determine the nature and severity of their situation.
7. After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
8. The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
9. The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
10. The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
11. The center shall maintain a log of all mayday signals received from vehicles.
12. The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.
13. The center shall determine that a collision has occurred based on changes in vehicle sensor data.
14. The center shall determine the location of the sender when it receives a collision notification broadcast.
15. The center shall determine the nature of the emergency from the contents of the received collision notification message. |
| | Emergency Response Management | Defined Above |

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County Sheriff's Office Dispatch (Emergency Management Center)	**Emergency Routing**	Defined Above
	Emergency Secure Area Alarm Support	1. The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities). 2. The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator. 3. After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender. 4. After the alarm message becomes a verified incident, the center shall determine the appropriate response. 5. The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary. 6. The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane County Sheriff's Office Dispatch (Emergency Management Center)	**Emergency Secure Area Surveillance**	1. The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit guideways). The data may be raw or pre-processed in the field. 2. The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field. 3. The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field. 4. The center shall exchange surveillance data with other emergency centers. 5. The center shall identify potential security threats based on collected security surveillance data. 6. The center shall verify potential security threats by correlating security surveillance data from multiple sources. 7. The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit guideways). 8. The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). 9. The center shall remotely control security surveillance devices on-board transit vehicles. 10. The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching. 11. The center shall monitor maintenance status of the security sensor field equipment.
Spokane County Sheriff's Office Vehicles (Emergency Vehicle OBE)	**EV On-Board En Route Support**	Defined Above
	EV On-Board Incident Management Communication	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
	EV Service Patrol Vehicle Operations	Defined Above
Spokane Region Archived Data Warehouse (Archived Data System)	Archive Data Repository	Defined Above
	Archive Government Reporting	Defined Above
	Archive On-Line Analysis and Mining	Defined Above
	Archive Situation Data Archival	Defined Above
Spokane Regional Construction and Maintenance Event Clearinghouse	TIC Data Collection	Defined Above
	TIC Emergency Traveler Information	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Construction and Maintenance Event Clearinghouse (Transportation Information Center)	TIC Interactive Traveler Information	1. The center shall disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request. 2. The center shall disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request. 3. The center shall disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request. 4. The center shall disseminate customized parking information to travelers, including location, availability, and fees upon request. 5. The center shall disseminate customized weather information to travelers upon request. 6. The center shall disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. 7. The center shall disseminate customized event information to travelers upon request. 8. The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. 9. The center shall accept requests for parking space information from travelers. 10. The center shall provide park and ride space information to travelers. 11. The center shall provide the capability to support requests from the media for traffic and incident data. 12. The center shall provide the capability for a system operator to control the type and update frequency of traveler information. 13. The center shall disseminate customized freight information to travelers, including truck routes, permit information, truck stops, inspection stations, steep grades, high-profile vehicle advisories. Information provided includes freight-related road and weather conditions, parking information, and route plans.
	TIC Traveler Information Broadcast	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Construction and Maintenance Event Clearinghouse	TIC Traveler Telephone Information	Defined Above
Spokane Regional Transportation Management Center (Center)	Center Data Subscription Management	1. The center shall support a data subscription service that manages the necessary user information and rules that govern the data subscriptions. 2. The center shall support peer-to-peer communications with other regional centers to support operational data sharing. 3. The center shall allow users to sign up for a data subscription service to access data held by the center. 4. The center shall be able to send data to users based upon a set of rules governing the data subscription service. 5. The center shall allow center personnel to manage the subscription service. 6. The center shall be capable of collecting data from other centers to be used as part of the data subscription service. 7. The center shall maintain a catalog of available data that can be accessed by users of the data subscription service. 8. The center shall support peer-to-peer communications with other regional centers to support operational data sharing.
Spokane Regional Transportation Management Center	TMC Basic Surveillance	Defined Above
	TMC Data Collection	Defined Above

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	TMC Demand Management Coordination	1. The center shall collect and store toll pricing data from payment administration centers, including the price for each road segment to which a toll applies, with the time and date for when it applies. 2. The center shall collect and store parking information from parking management providers including lot locations, features (e.g. ability to handle oversized vehicles), capacity, type, hours of operation and rates. 3. The center shall collect and store transit fare and schedule information from transit management centers. 4. The center shall collect and store current transit, parking, and toll fee schedule information provided by regional traveler information centers. 5. The center shall send requests to payment administration centers to change pricing, modify restrictions, or modify operations of a toll road facility. 6. The center shall send requests to parking management providers to change the current parking lot charging structure. 7. The center shall send requests to transit management centers to change the current transit services - schedules or fares of the transit services including park-and-ride lots.
	TMC Environmental Monitoring	1. The center shall remotely control environmental sensors that measure road surface conditions including temperature, moisture, icing, salinity, and other measures. 2. The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility. 3. The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway. 4. The center shall be able to receive road condition information from weather service providers. 5. The center shall receive aggregated and processed vehicle environmental data collected from vehicle safety and convenience systems through the connected vehicle roadside equipment. 6. The center shall be able to share the collected environmental data with Maintenance and construction operations. 7. The center shall provide drivers road weather advisories at warnings.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Incident Detection**	1. The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System. 2. The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents. 3. The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters and traveler information service providers. 4. The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident. 5. The center shall support requests from emergency management centers and border inspection systems to remotely control sensor and surveillance equipment located in the field. 6. The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents. 7. The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Incident Dispatch Coordination**	1. The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public. 2. The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations. 3. The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption. 4. The center shall exchange incident information with emergency management centers, maintenance and construction centers, transit centers, information service providers, and the media including description, location, traffic impact, status, expected duration, and response information. 5. The center shall share resources with allied agency centers to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers. 6. The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, border crossings, and rail operations centers. 7. The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers. 8. The center shall monitor incident response performance and calculate incident response and clearance times. 9. The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery. 10. The center shall coordinate information and controls with other traffic management centers. 11. The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	TMC Multi-Modal Coordination	Defined Above
	TMC Passive Surveillance	1. The center shall collect time stamped vehicle identities from field equipment. 2. The center shall correlate the time stamped vehicle identities in order to calculate link travel times and derive other traffic measures.
	TMC Regional Traffic Management	Defined Above
	TMC Roadway Equipment Monitoring	Defined Above
	TMC Roadway Warning	1. The center shall monitor data on traffic, environmental conditions, and other hazards collected from sensors along the roadway. 2. The center shall identify hazardous road weather and surface conditions. 3. The center shall identify hazardous traffic conditions including queues. 4. The center shall identify debris, animals, or other encroachment on the roadway dangerous to approaching motorists. 5. The center shall issue control commands to field equipment warning drivers approaching the identified hazardous conditions. 6. The center shall monitor the operational status of the dynamic warning equipment, including fault reports. 7. The center shall have the capability to receive real-time traffic (including location and speed), road conditions (e.g. ice, wet, etc.), and weather data (clear, rainy and snowy) from connected vehicles. 8. The center shall generate appropriate queue response strategies that include speed reduction, lane change, or diversion recommendations based on local traffic, weather, and roadway conditions. 9. 9. The center shall use collected data to detect the location, duration, and length of queue propagation, as a result of significant downstream speed reductions or stopped traffic.
	TMC Signal Control	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Speed Warning**	1. The center shall provide the capability to notify an enforcement agency when vehicle speeds in the work zone are in excess of the posted speed limit or are creating an unsafe condition based upon the current environmental or traffic conditions. 2. The center shall province the capability to control automated speed monitoring and speed warning systems. 3. The center shall monitor reduced speed zone warning field equipment. 4. The center shall control reduced speed zone warning roadside equipment, providing the location and extent of the reduced speed zone, the posted speed limit(s) with information about the applicability of the speed limit(s) (e.g., time of day, day of week, seasonality, relevant vehicle types) and information about associated road configuration changes including lane merges and shifts.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Traffic Information Dissemination**	1. The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers. 2. The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers. 3. The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.). 4. The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair. 5. The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), and the definition of the road network itself. 6. The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, parking facilities, and traveler information providers. 7. The center shall distribute traffic data to the media. 8. The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media. 9. The center shall collect current lane configurations status for the driver information systems equipment (DMS, HAR, etc.). 10. The center shall provide traffic information in both data stream and graphical display. 11. The center shall receive alert notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public from emergency management.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Traffic Management Decision Support**	1. The center shall provide center personnel with an integrated regional view of current and forecast road and traffic conditions including traffic incidents, special events, maintenance activities and other events or conditions that impact capacity or demand. 2. The center shall identify network imbalances and potential courses of action. 3. The center shall compare the impact of potential courses of action and make recommendations to the operator. 4. The recommended actions shall include predefined incident response plans, signal timing plan changes, DMS/HAR messages, lane control strategies and freeway control strategies including ramp metering, interchange metering, and mainline metering. 5. The recommended actions shall include multimodal strategies that include suggested transit strategies and suggested route and mode choices for travelers. 6. The center shall provide an interface to center personnel to input control parameters for the decision support process and receive recommended actions and supporting information presentation. 7. The center shall provide transportation operational strategies to other centers.
	TMC Traffic Metering	1. The center shall remotely control systems to manage use of the freeways, including ramp, interchange, and mainline metering. 2. The center shall collect operational status from ramp meters, interchange meters, and mainline meters and compare against the control information sent by the center. 3. The center shall collect fault data from ramp meters, interchange meters, and mainline meters. 4. The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, interchange meters, and mainline meters), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the approaches to the meters. 5. The center shall be able to, under control of center personnel, use collected environmental and vehicle emissions data to regulate the flow of traffic on ramps, interchanges, and the mainline.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	**TMC Traffic Network Performance Evaluation**	1. The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center to support overall network performance evaluations. 2. The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance. 3. The center shall provide an interface to the archive data repository to enable the operator to retrieve historical operating data for use in planning to predict future traffic patterns and conditions. 4. This center shall use the collected information to measure overall current and forecast network performance and predict travel demand patterns.
	TMC Variable Speed Limits	1. The center shall monitor data on traffic and environmental conditions collected from sensors along the roadway. 2. Based on the measured data, the center shall calculate and set suitable speed limits by lane. 3. The center shall control field equipment that posts the current speed limits and displays additional information such as basic safety rules and current traffic information to drivers. 4. The center shall monitor the operational status of the variable speed limit equipment, including fault reports. 5. The center shall provide center personnel current system status and respond to control data from center personnel regarding variable speed limits. 6. The center shall provide the current speed limits and additional information such as basic safety rules and current traffic information to drivers.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Regional Transportation Management Center (Traffic Management Center)	TMC Work Zone Traffic Management	1. The center shall receive work zone images from a maintenance center. 2. The center shall analyze work zone images for indications of a possible incident. 3. The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone. 4. The center shall collect operational status for the driver information systems equipment in work zones. 5. The center shall collect fault data for the driver information systems equipment in work zones for repair. 6. The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center. 7. The center shall receive temporary facility restrictions that are imposed during maintenance and construction.
Spokane Valley Arterial Operations Center (Traffic Management Center)	TMC Basic Surveillance	1. The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center. 2. The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center. 3. The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers. 4. The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution. 5. The center shall maintain a database of surveillance equipment and sensors and associated data (including the roadway on which they are located, the type of data collected, and the ownership of each).
	TMC Signal Control	Defined Above
	Emergency Dispatch	Defined Above
Spokane Valley ITS Field Devices (ITS Roadway Equipment)	Roadway Basic Surveillance	Defined Above
	Roadway Data Collection	Defined Above

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Valley ITS Field Devices (ITS Roadway Equipment)	**Roadway Field Device Support**	Defined Above
	Roadway Field Management Station Operation	Defined Above
	Roadway Incident Detection	Defined Above
	Roadway Mixed Use Crossing Safety	Defined Above
	Roadway Passive Monitoring	Defined Above
	Roadway Signal Control	Defined Above
	Roadway Signal Preemption	Defined Above
	Roadway Traffic Information Dissemination	Defined Above
	Roadway Warning	Defined Above
Spokane Valley Public Information Website	**TIC Traveler Information Broadcast**	Defined Above
Spokane Valley Public Safety Vehicles	**EV On-Board En Route Support**	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Spokane Valley Public Safety Vehicles

(Emergency Vehicle OBE) | **EV On-Board Incident Management Communication** | Defined Above |
| | **EV Service Patrol Vehicle Operations** | Defined Above |
| SRTMC Central Traffic Signal System

(Traffic Management Center) | **TMC Data Collection** | Defined Above |
| | **TMC Regional Traffic Management** | Defined Above |
| | **TMC Signal Control** | Defined Above |
| SRTMC Multimodal Traveler Information System

(Transportation Information Center) | **TIC Interactive Traveler Information** | Defined Above |
| | **TIC Travel Services Information and Reservation** | 1. The center shall disseminate yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) to travelers upon request.
2. The center shall be able to provide electric charging station information identifying the location, operating hours, current availability, charging capacity and standards supported, access restrictions, and rates/fee structure for each station to travelers.
3. The center shall correlate electric vehicle needs to charging station capacities.
4. The center shall provide charging station information to electric vehicles in order to balance the supply and demand of charging facilities. |
| | **TIC Traveler Information Broadcast** | Defined Above |
| | **TIC Traveler Telephone Information** | Defined Above |

Element Name/ (Physical Object)	Functional Object	Functional Requirements
SRTMC Multimodal Traveler Information System (Transportation Information Center)	**TIC Trip Planning**	1. The center shall provide the capability to provide specific pre-trip and en route directions to travelers (and drivers), including costs, arrival times, and transfer points. 2. The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and en route directions it provides to travelers. 3. The center shall support on-line route guidance for travelers using personal devices (such as PDAs). 4. The center shall support on-line route guidance for drivers in vehicles. 5. The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles. 6. The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities. 7. The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs. 8. The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges. 9. The center shall generate trips based on the use of more than one mode of transport. 10. The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. 11. The center shall provide the capability for the traveler to confirm the proposed trip plan. 12. The center shall provide the capability for center personnel to control route calculation parameters.
SRTMC Operators	**N/A**	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Facilities Surveillance Cameras (Security Monitoring Equipment)	**Field Secure Area Sensor Monitoring**	1. The field element shall include security sensors that monitor conditions of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). 2. The field element shall be remotely controlled by a center. 3. The field element shall provide equipment status and fault indication of security sensor equipment to a center. 4. The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological). 5. The field element shall include infrastructure condition and integrity monitoring sensors. 6. The field element shall include motion and intrusion detection sensors. 7. The field element shall include object detection sensors (such as metal detectors). 8. The field element shall provide raw security sensor data. 9. The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.
	Field Secure Area Surveillance	Defined Above
STA Fare Payment Smart Card	**(To be used with Fare Box and on STA Website**	1. Smart Cards configured to be accepted at on-board fare box for fare payment 2. Smart Cards configured to allow for fare payment reloading on STA Website
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Data Collection**	1. The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc. 2. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself. 4. The center shall be able to produce sample products of the data available.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Fare Management**	1. The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations. 2. The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information. 3. The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution. 4. The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments. 5. The center shall process requests for transit fares to be paid in advance. 6. The center shall maintain a list of invalid traveler credit identities or bad tag lists that can be forwarded to transit vehicles and transit stops or stations. 7. The center shall collect fare statistics data to implement variable and flexible fare structures. 8. The center shall provide transit fare information to traveler information providers upon request.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Fixed-Route Operations**	1. The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, incident information, operational data on current routes and schedules, and digitized map data. 2. The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes 3. The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency. 4. The center shall dispatch fixed route or flexible route transit vehicles. 5. The center shall collect transit operational data for use in the generation of routes and schedules. 6. The center shall provide instructions or corrective actions to the transit vehicle operators based upon operational needs. 7. The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. 8. The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc. 9. The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. 10. The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services. 11. The center shall provide an interface to the archive data repository to enable the operator to retrieve historical operating data for use in planning transit routes and schedules. 12. The center shall receive information from Traffic Operations concerning road network conditions, incidents, and other impacts to the road network. 13. The center shall monitor transit vehicle schedule adherence in order to manage transit vehicle operations.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Information Services**	1. The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. 2. The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems. 3. The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation. 4. The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters. 5. The center shall provide transit vehicle transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters. 6. The center shall receive transit stop requests from travelers and provide them to the appropriate transit vehicles. 7. The center shall receive trip requests from travelers, including those who are visually impaired which include the current location of the traveler. 8. The center shall provide route and stop information to travelers, including those who are visually impaired, based on their trip requests.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Multi-Modal Coordination**	1. The center shall coordinate schedules and services with traffic management, parking management, and event planning systems. 2. The center shall share transfer cluster and transfer point information with other transit centers. A transfer cluster is a collection of stop points, stations, or terminals where transfers can be made conveniently. 3. The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies. 4. The center shall coordinate schedules and services with other surface or air transportation modes. 5. The center shall provide transit operations personnel with the capability to control and monitor transit service coordination activities. 6. The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center. 7. The center shall receive temporary facility restrictions that are imposed during maintenance and construction. 8. The center shall collect asset restriction information from maintenance operations.
	Transit Center Passenger Counting	1. The center shall collect passenger count information from each transit vehicle. 2. The center shall calculate transit ridership data by route, route segment, transit stop, time of day, and day of week based on the collected passenger count information. 3. The center shall make the compiled ridership data available to the system operator.
	Transit Center Priority Management	1. The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections. 2. The center shall send requests for priority along routes or at intersections to traffic management. 3. The center shall define business rules that govern use of transit vehicle signal priority, communicate these rules to the transit vehicle, and monitor transit vehicle requests for priority at signalized intersections. 4. The center shall provide transit operations personnel with the capability to control and monitor transit signal priority operations. 5. The center shall identify if the request for specific lane can be met, and the specific lane, start, end location, and time period where priority or exclusive access is to be granted.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Dispatch (Transit Management Center)	**Transit Center Vehicle Assignment**	1. The center shall assign individual transit vehicles to transit blocks. 2. The center shall download vehicle assignments to the transit vehicle prior to the start of the day's operations. 3. The center shall provide an exception handling process for the vehicle assignment function. This process shall generate new supplemental vehicle assignments as required due to change events which occur during the operating day. 4. The center shall provide an inventory management function for the transit facility that stores functional attributes about each vehicle owned by the transit operator. The functional attributes permit the planning and assignment functions to match vehicles with routes based on suitability for the types of service required by the particular routes. 5. The center shall generate transit vehicle availability listings, current and forecast, to support transit vehicle assignment planning. 6. The center shall provide transit operations personnel with the capability to update transit vehicle assignments and receive reports on transit vehicle inventory status.
	Transit Center Vehicle Tracking	1. The center shall monitor the locations of all transit vehicles within its network. 2. The center shall determine adherence of transit vehicles to their assigned schedule. 3. The center shall provide transit operational data to traveler information service providers. 4. The center shall provide collected transit probe data to traffic management centers and traveler information service providers for use in measuring current traffic conditions.
STA Fixed Route Operators	**N/A**	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Vehicles (Transit Vehicle OBE)	**Transit Vehicle On-Board Fare Management**	1. The transit vehicle shall read data from the traveler card / payment instrument presented by boarding passengers. 2. The transit vehicle shall have access to the complete range of transit services (routes and schedules) that are available to the traveler. 3. The transit vehicle shall provide a transit fare payment interface that is suitable for travelers with physical disabilities. 4. The transit vehicle shall include a database on-board the transit vehicle for use in fare processing from which the fares for all possible trips within the transit operational network can be determined. 5. The transit vehicle shall support the support advanced payments for tolls, and/or parking lot charges, and/or transit fares via the traveler card / payment instrument. 6. The transit vehicle shall provide fare statistics data to the center.
	Transit Vehicle On-Board Information Services	1. The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. 2. The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system. 3. The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities. 4. The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters. 5. The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle. 6. The transit vehicle shall provide to the transit vehicle operator transit stop requests received from travelers or from the transit center.
	Transit Vehicle On-Board Maintenance	1. The transit vehicle shall collect and process vehicle mileage data available to sensors on-board. 2. The transit vehicle shall collect and process the transit vehicle's operating conditions such as engine temperature, oil pressure, brake wear, internal lighting, environmental controls, etc. 3. The transit vehicle shall transmit vehicle maintenance data to the center to be used for scheduling future vehicle maintenance.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Vehicles (Transit Vehicle OBE)	**Transit Vehicle On-Board Trip Monitoring**	1. The transit vehicle shall track the current location of the transit vehicle. 2. The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length. 3. The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage. 4. The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, running times, etc. 5. The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions. 6. The transit vehicle shall receive transit stop requests from travelers. 7. The transit vehicle shall receive transit stop requests from Transit Operations
	Transit Vehicle Passenger Counting	1. The transit vehicle shall count passengers boarding and alighting. 2. The passenger counts shall be related to location to support association of passenger counts with routes, route segments, or bus stops. 3. The passenger counts shall be timestamped so that ridership can be measured by time of day and day of week. 4. The transit vehicle shall send the collected passenger count information to the transit center.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Vehicles (Transit Vehicle OBE)	**Transit Vehicle Schedule Management**	1. The transit vehicle shall receive a vehicle assignment including transit route information, transit service instructions, traffic information, road conditions, and other information for the operator. 2. The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule. 3. The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops. 4. The transit vehicle shall determine scenarios to correct the schedule deviation. 5. The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area. 6. The transit vehicle shall send the schedule deviation and estimated arrival time information to the center. 7. The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions. 8. The transit vehicle shall notify the transit center of vehicle location and operational status as the vehicle exits and returns to the transit facility to support future vehicle assignments.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Fixed Route Vehicles (Transit Vehicle OBE)	Transit Vehicle Security	1. The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for local monitoring or remote monitoring. 2. The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters. 3. The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location. 4. The transit vehicle shall accept sensor control data to allow remote control of the sensors. 5. The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications. 6. The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc. 7. The transit vehicle shall output reported emergencies to the center. 8. The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers. 9. The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator. 10. The transit vehicle shall perform authentication of the transit vehicle operator.
	Transit Vehicle Signal Priority	1. The transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops. 2. The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected. 3. The transit vehicle shall send the schedule deviation data and status of priority requests to the transit vehicle operator and provide the capability for the transit vehicle operator to control the priority system. 4. The transit vehicle shall prevent a priority request from being sent when the transit vehicle cannot use the priority (e.g., when the transit vehicle makes a passenger stop on the approach to an intersection).
STA Operations Personnel	N/A	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Paratransit Dispatch (Transit Management Center)	**Transit Center Fare Management**	Defined Above
	Transit Center Multi-Modal Coordination	Defined Above
	Transit Center Paratransit Operations	1. The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers. 2. The center shall monitor the operational status of the demand response vehicles including status of passenger pick-up and drop-off. 3. The center shall generate demand response transit (including paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, road network information, and incident information. 4. The center shall dispatch demand response (paratransit) transit vehicles. 5. The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. 6. The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit). 7. The center shall collect the log of passenger boardings and alightings from the paratransit vehicles. 8. The center shall monitor real time location of demand response vehicles. 9. The center shall receive information from Traffic Operations concerning road network conditions, incidents, and other impacts to the road network.
	Transit Center Vehicle Assignment	Defined Above
	Transit Center Vehicle Tracking	Defined Above
STA Paratransit Operators	**N/A**	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Paratransit Vehicles (Transit Vehicle OBE)	**Transit Vehicle On-Board Fare Management**	Defined Above
	Transit Vehicle On-Board Maintenance	Defined Above
	Transit Vehicle On-Board Paratransit Operations	1. The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity. 2. The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator. 3. The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center. 4. The transit vehicle shall provide the capability to log passenger boardings and alightings and make passenger use data available to the transit center.
	Transit Vehicle On-Board Trip Monitoring	Defined Above
	Transit Vehicle Schedule Management	Defined Above
	Transit Vehicle Security	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City & County Parking Facilities (Parking Management System)	**Parking Coordination**	1. The parking element shall exchange parking management data with other parking facilities including location, hours, availability, status, lot usage, operating strategies, and charging information. 2. The parking element shall provide parking management data to traffic management centers upon request as part of the implementation of demand management programs in the region. This could include changes to hours of operation or pricing. 3. The parking element shall distribute parking lot information to traffic management centers upon request to support integrated regional traffic control and parking management. This could include information on facility hours of operation and current parking availability. 4. The parking element shall distribute parking lot information upon request to transit management centers for park and ride facilities, parking shuttle services, and other applications that integrate transit and parking services. 5. The parking element shall distribute parking lot information upon request to traveler information providers to support travel planning. 6. The parking element shall support requests for parking reservations. 7. The parking facility shall determine availability of parking spaces.
	Parking Data Collection	1. The parking element shall collect parking management data including lot usage and charging information. 2. The parking element shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The parking element shall receive and respond to requests from ITS Archives for either a catalog of the parking management data or for the data itself. 4. The parking element shall be able to produce sample products of the data available.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
City & County Parking Facilities (Parking Management System)	**Parking Electronic Payment**	1. The parking element shall detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.). 2. The parking element shall read data from the payment device on-board the vehicle or by the traveler. 3. The parking element shall provide an interface to the driver informing them of the success or failure of the financial transaction. This may involve a request for the driver to pull aside so the operator can resolve an issue. 4. The parking element shall collect data on payment violations and send the data, including images of the violator and the vehicle registration data obtained from the Department of Motor Vehicles (DMV) office, to the appropriate enforcement agency. 5. The parking element shall manage the parking lot charges, considering such factors as location, vehicle types, and times of day. 6. The parking element shall process the financial requests and manage an interface to a Financial Institution. 7. The parking element shall support the payment of parking lot transactions using data provided by the traveler cards / payment instruments. 8. The parking element shall process requests for parking lot charges to be paid in advance. 9. The parking element shall process requests for the advanced payment of tolls and transit fares as well as other non-transportation services, e.g. yellow-pages services. 10. The parking element shall maintain a list of invalid traveler credit identities.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Park and Ride Facilities (Parking Management System)	Parking Management	1. The parking element shall maintain static parking lot information including hours of operation, rates, location, entrance locations, capacity, type, and constraints. 2. The parking element shall maintain dynamic parking lot information including current state of the lot, occupancy, arrival rates, and departure rates. 3. The parking element shall determine and maintain the number and availability of parking spaces. 4. The parking element shall share information with a traffic management center to identify queues at entrances, exits that should be used, and other information that supports coordinated local traffic control in and around the parking facility. 5. The parking element shall manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges. 6. The parking element shall provide the capability to detect, count, and classify vehicles at entrances, exits, and designated locations within a parking facility. 7. The parking element shall provide precise parking egress/ingress location information to Centers. 8. The parking element shall provide precise parking space location information to Centers.
	Parking Park and Ride Operations	1. The parking element shall provide parking arrival information for transit operations. 2. The parking element shall receive the transit arrivals and departures from transit operations. 3. The parking element shall provide general parking information to drivers including lot status, parking availability, and directions to available spaces, entrances, and exits. 4. The parking element shall provide parking status to traveler information providers including current parking availability. 5. The parking element shall accept requests for parking space information from transit systems. 6. The parking facility shall provide park and ride space information to transit systems operating in the same area as the park and ride lots.
STA Real-Time Customer Information Systems (Data Distribution System)	DDS Data Access Management	Defined Above
	DDS Data Collection and Aggregation	Defined Above

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
STA Real-Time Customer Information Systems (Transportation Information Center)	**TIC Data Collection**	Defined Above
	TIC Interactive Traveler Information	Defined Above
	TIC Operations Data Collection	1. The center shall collect traveler information data, such as parking lot data, rideshare data, road network use data, vehicle probe data, and other data from traveler information system operations. 2. The center shall collect traveler requests, confirmations, and payment transaction data for traveler services provided. 3. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 4. The center shall receive and respond to requests from ITS Archives for either a catalog of the traveler information data or for the data itself. 5. The center shall be able to produce sample products of the data available.
	TIC Traveler Information Broadcast	Defined Above
	TIC Traveler Telephone Information	Defined Above
	TIC Trip Planning	Defined Above
Third-Party Transportation Data Sources (Traffic Management Center)	**TMC Data Collection**	Defined Above
	TMC Environmental Monitoring	Defined Above
	TMC Multi-Modal Coordination	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Third-Party Traveler Information Service Provider (Transportation Information Center)	**TIC Data Collection**	Defined Above
	TIC Emergency Traveler Information	Defined Above
	TIC Interactive Traveler Information	Defined Above
	TIC Situation Data Management	1. The center shall collect traffic probe data (speeds, travel times, etc.) from appropriately equipped vehicles and short range communications equipment. 2. The center shall collect environmental probe data (air temperature, exterior light status, wiper status, traction control status, etc.) from appropriately equipped vehicles and short range communications equipment. 3. The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center. 4. The center shall collect probe data from toll administrative centers containing travel times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center. 5. The center shall aggregate collected traffic probe data, calculate route segment travel times, route segment speeds, route usage, and road weather information for dissemination to other centers.
	TIC Travel Services Information and Reservation	Defined Above
	TIC Traveler Information Broadcast	Defined Above
	TIC Traveler Telephone Information	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Third-Party Traveler Information Service Provider (Transportation Information Center)	**TIC Trip Planning**	Defined Above
Travelers	**N/A**	N/A
Vehicles (Vehicle OBE)	**Vehicle Basic Toll/Parking Payment**	1. The vehicle shall respond to request from parking field equipment for credit identity, stored value card cash, etc. 2. The vehicle shall provide an interface to the driver to make requests for advance payments of tolls, parking, and transit fares and present the status of electronic payment transactions. 3. The vehicle shall provide an interface with the traveler card / payment instrument carried on-board the vehicle - to exchange identity information and payment transactions.
	Vehicle Emergency Notification	1. The vehicle shall provide the capability for a driver to report an emergency and summon assistance. 2. The vehicle shall provide the capability to accept input from a driver via a panic button or some other functionally similar form of input device provided as part of the in-vehicle equipment. 3. The vehicle shall acknowledge the driver's request for emergency assistance. 4. The vehicle shall collect vehicle characteristics describing the vehicles typical and real time configuration, including damage to vehicle components. 5. The vehicle shall notify emergency responders of the characteristics and damage identified to the vehicle involved in a collision. 6. The vehicle shall provide the capability to automatically identify that a collision has occurred using equipment such as collision detection sensors with an interface to mayday type equipment that would automatically detect vehicle problems and send appropriate distress signals to the arriving public safety vehicles. 7. The vehicle shall collect vehicle operational state information from the host vehicle. 8. The vehicle shall analyze vehicle operational state information to determine if the host vehicle has been involved in a collision.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Vehicles (Vehicle OBE)	**Vehicle Interactive Traveler Information**	1. The vehicle shall receive formatted traffic and travel advisories from a center and present them to the driver upon request. 2. The vehicle shall receive travel alerts from a center and present them to the driver. Relevant alerts are provided based on pre-supplied trip characteristics and preferences. 3. The vehicle shall receive event information from a center and present it to the driver upon request. 4. The vehicle shall provide the capability of translating signage for presentation to the driver, including fixed signage, situational messages, or work zone intrusion messages. 5. The vehicle shall prioritize safety and warning messages to supersede advisory and broadcast messages. 6. The vehicle shall base requests from the driver on the vehicle's current location, and filter the provided information accordingly. 7. The vehicle shall accept personal preferences, recurring trip characteristics, and traveler alert subscription information from the driver and send this information to a center to support customized traveler information services. 8. The vehicle shall receive information on evacuation resources including self-evacuation options, anticipated pickup time and location if a transportation asset is to be deployed, destination shelter, and supporting information on what to bring, estimated reentry date/time, from a center and present it to the traveler. 9. The vehicle shall receive wide-area alerts from the center and present it to the traveler. 10. The vehicle shall receive information on available parking including available spaces with associated information about parking restrictions and location for each available space.
	Vehicle Location Determination	1. The vehicle shall provide the vehicle's current location to other in-vehicle functions. 2. The vehicle shall calculate the location from one or more data sources including positioning systems such as GPS, sensors that track vehicle movement, and maps used to determine the likely vehicle route. 3. The Vehicle shall obtain position correction data from the Connected Vehicle Roadside Equipment. 4. The Vehicle shall apply position correction data to its base positional data. 5. The Vehicle shall provide its location with lane-level accuracy to on-board applications. 6. The Vehicle shall provide its location with road-level accuracy to on-board applications.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Vehicles (Vehicle OBE)	**Vehicle Secure Area Access System**	1. This vehicle shall accept inputs from the vehicle driver that include the necessary identity and access information. 2. The vehicle shall generate the request to activate the access control system to gain access to the secure area. 3. The vehicle shall receive status from access control system and provide status to the driver.
	Vehicle Situation Data Monitoring	1. The Vehicle shall obtain data collection parameters from Connected Vehicle Roadside Equipment. 2. The Vehicle shall collect data collection parameters from Centers. 3. The vehicle shall provide traffic-related data including snapshots of measured speed and heading and events including starts and stops, speed changes, and other vehicle control from vehicle. 4. The Vehicle shall provide data to Centers in accordance with data collection parameters provided by Centers/Connected Vehicle Roadside Equipment. 5. The Vehicle shall provide data to Connected Vehicle Roadside Equipment. in accordance with data collection parameters provided by Centers/Connected Vehicle Roadside Equipment.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Vehicles (Vehicle OBE)	**Vehicle Traveler Information Reception**	1. The vehicle shall receive formatted traffic information from a center and present it to the driver. 2. The vehicle shall receive transit information from a center and present it to the driver. 3. The vehicle shall receive event information from a center and present it to the driver. 4. The vehicle shall receive evacuation information from a center and present it to the driver. 5. The vehicle shall receive wide-area alerts and present it to the driver. 6. The vehicle shall provide data from the vehicle itself to the driver. This vehicle data may include vehicle conditions, environmental conditions, safety or position warnings. 7. The vehicle shall prioritize safety and warning messages to supersede advisory and broadcast messages. 8. The vehicle shall support driver input in audio or manual form. 9. The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner. 10. The vehicle shall receive border clearance information and present it to driver. 11. The vehicle shall provide eco-driving recommendations to the driver. 12. The Vehicle shall receive traveler information from Connected Vehicle Roadside Equipment. 13. The vehicle shall receive traffic regulation information from the center and validate that the information originated with the traffic regulatory entity with authority over the region the regulation applies. 14. The vehicle shall present traffic regulation information to the driver when the driver is in a condition where the regulation is relevant.
	Vehicle Trip Planning and Route Guidance	1. The vehicle shall provide the capability for a driver to request and confirm multi-modal route guidance from a specified source to a destination. 2. The vehicle shall forward the request for route guidance to a traveler information center for route calculation. 3. The vehicle shall forward user preferences, background information, constraints, and payment information to the supplying traveler information center. 4. The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Washington State Emergency Operations Center (Emergency Management Center)	Emergency Evacuation Support	1. The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. 2. The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. 3. The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. 4. The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. 5. The center shall request resources from transit agencies as needed to support the evacuation. 6. The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. 7. The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. 8. The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. 9. The center shall monitor the progress of the reentry process.
	Emergency Incident Command	Defined Above
	Emergency Notification Support	Defined Above
	Emergency Response Management	Defined Above
Washington State Patrol Dispatch	Emergency Call-Taking	Defined Above
	Emergency Data Collection	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
Washington State Patrol Dispatch (Emergency Management Center)	**Emergency Dispatch**	Defined Above
	Emergency Incident Command	Defined Above
	Emergency Response Management	Defined Above
	Emergency Routing	Defined Above
Washington State Patrol Dispatch (Traffic Management Center)	**TMC Service Patrol Management**	1. The center shall dispatch roadway service patrol vehicles to identified incident locations. 2. The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched. 3. The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup. 4. The center shall track the location and status of service patrol vehicles.
Washington State Patrol Vehicles (Emergency Vehicle OBE)	**EV On-Board En Route Support**	Defined Above
	EV On-Board Incident Management Communication	Defined Above
	EV Service Patrol Vehicle Operations	Defined Above
Weather Information Services	**N/A**	N/A

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Eastern Region Maintenance Dispatch (Maintenance and Construction Management Center)	**MCM Environmental Information Collection**	1. The center shall collect environmental probe data (air temperature, exterior light status, wiper status, traction control status, etc.) from short range communications equipment that communicates with appropriately equipped probe vehicles. 2. The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic and traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles and the broader population of vehicle probes. 3. The center shall provide weather and road condition information to weather service providers and center personnel. 4. The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing. 5. The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment. 6. The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair. 7. The center shall collect environmental data from sensors that measure road surface temperature, moisture, icing, salinity, and other measures. 8. The center shall provide weather and road condition information to traffic management operations.

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Eastern Region Maintenance Dispatch (Maintenance and Construction Management Center)	MCM Environmental Information Processing	1. The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing. 2. The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data. 3. The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions. 4. The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers. 5. The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.
	MCM Maintenance Decision Support	1. The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information. 2. The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision). 3. The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation. 4. The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.
	MCM Roadway Maintenance	Defined Above
	MCM Vehicle Tracking	Defined Above
	MCM Winter Maintenance Management	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Eastern Region Maintenance Dispatch (Traffic Management Center)	MCM Work Activity Coordination	Defined Above
	MCM Work Zone Management	Defined Above
	TMC Roadway Equipment Monitoring	Defined Above
WSDOT Incident Response Team Vehicle Operators	N/A	N/A
WSDOT Incident Response Team Vehicles (Emergency Vehicle OBE)	EV On-Board En Route Support	Defined Above
	EV On-Board Incident Management Communication	Defined Above
	EV Service Patrol Vehicle Operations	Defined Above
WSDOT ITS Field Devices (ITS Roadway Equipment)	Roadway Basic Surveillance	Defined Above
	Roadway Data Collection	Defined Above
	Roadway Environmental Monitoring	Defined Above
	Roadway Field Device Support	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT ITS Field Devices (ITS Roadway Equipment)	**Roadway Field Management Station Operation**	Defined Above
	Roadway Incident Detection	Defined Above
	Roadway Mixed Use Crossing Safety	Defined Above
	Roadway Passive Monitoring	Defined Above
	Roadway Signal Control	Defined Above
	Roadway Signal Preemption	Defined Above
	Roadway Speed Monitoring and Warning	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT ITS Field Devices (ITS Roadway Equipment)	**Roadway Standard Rail Crossing**	1. The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI). 2. The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center. 3. The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment. 4. The field element shall receive track status from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and whether a train is approaching. 5. The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals. 6. The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection. 7. The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center. 8. The field element shall warn drivers of crossing closures or potential crash-imminent situations.
	Roadway Traffic Information Dissemination	Defined Above
	Roadway Traffic Metering	1. The field element shall regulate the flow of traffic on ramps, interchanges, and the mainline, under center control. 2. The field element shall monitor operation of ramp, interchange, and mainline meters and report to the center any conflicts between received control plans and current system operation. 3. The field element shall return ramp, interchange, and mainline meter operational status to the controlling center. 4. The field element shall provide indications to the driver that the metering system is active and provide safe transitions between active and inactive status. 5. The field element shall return ramp, interchange, and mainline meter fault data to the maintenance center for repair.

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT ITS Field Devices (ITS Roadway Equipment)	**Roadway Warning**	Defined Above
	Roadway Work Zone Traffic Control	Defined Above
WSDOT Maintenance Vehicles (Maintenance and Construction Vehicle OBE)	**MCV Environmental Monitoring**	1. The maintenance and construction vehicle shall collect environmental data from on-board sensors, including air temperature, wind speed, surface temperature, traction conditions, etc. 2. The maintenance and construction vehicle shall transmit environmental sensor data to the center. The sensor data includes location and timestamp information. 3. The maintenance and construction vehicle shall provide environmental sensor equipment operational status to the center. 4. The maintenance and construction vehicle shall provide environmental sensor equipment fault indication to the center for repair. 5. The maintenance and construction vehicle shall collect environmental data from sensors located at the roadway but are monitored on-board a maintenance and construction vehicle. 6. The maintenance and construction vehicle shall be capable of accepting sensor control data from the center. 7. The maintenance and construction vehicle shall provide control signals to environmental sensors located at the roadway. 8. The maintenance and construction vehicle shall transmit environmental sensor data to roadside equipment. The sensor data includes location and timestamp information.
	MCV Roadway Maintenance and Construction	Defined Above
	MCV Vehicle Location Tracking	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Maintenance Vehicles (Maintenance and Construction Vehicle OBE)	**MCV Winter Maintenance**	1. The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle. 2. The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing. 3. The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle. 4. The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status. 5. The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed. 6. The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.
	MCV Work Zone Support	1. The maintenance and construction vehicle shall monitor, operate, and control work zone devices located at or alongside the roadway. The devices operated on board the vehicle include driver information devices (e.g. dynamic message signs) and work zone intrusion detection and alert devices. 2. The maintenance and construction vehicle shall provide an interface for field personnel to input status of their work zone activities. 3. The maintenance and construction vehicle shall collect inputs from field personnel and from work zone devices on-board the maintenance and construction vehicle and send them to the controlling center. 4. The maintenance and construction vehicle shall provide work zone information, including lane closures and reduced speed to oncoming traffic via direct warning signals or in-vehicle signage functions.
WSDOT Park and Ride Lots	**Parking Coordination**	Defined Above

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Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Park and Ride Lots (Parking Management System)	**Parking Data Collection**	Defined Above
	Parking Electronic Payment	Defined Above
	Parking Management	Defined Above
	Parking Park and Ride Operations	Defined Above
WSDOT Statewide Traveler Information System-511 (Transportation Information Center)	**TIC Emergency Traveler Information**	Defined Above
	TIC Traveler Information Broadcast	Defined Above
	TIC Traveler Telephone Information	Defined Above
WSDOT TMC Log (Traffic Management Center)	**TMC Data Collection**	Defined Above

Element Name/ (Physical Object)	Functional Object	Functional Requirements
WSDOT Work Zone Database (Maintenance and Construction Management Center)	**MCM Data Collection**	1. The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources. 2. The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. 3. The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself. 4. The center shall be able to produce sample products of the data available

Table 51 – Functional Object Descriptions

Functional Object	Functional Object Description
Archive Data Repository	'Archive Data Repository' collects data and data catalogs from one or more data sources and stores the data in a focused repository that is suited to a particular set of ITS data users. It includes capabilities for performing quality checks on the incoming data, error notification, and archive to archive coordination. It supports a broad range of implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region. Repositories may be established to support operations planning, performance monitoring and management, and policy and investment decisions.
Archive Government Reporting	'Archive Government Reporting' selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements. It provides transportation system statistics and performance measures in required formats to support investment and policy decisions.
Archive On-Line Analysis and Mining	'Archive On-Line Analysis and Mining' provides advanced data analysis, summarization, and mining features that facilitate discovery of information, patterns, and correlations in large data sets. Multidimensional analysis, selective summarization and expansion of data details, and many other advanced analysis services may be offered. Complex performance measures that are derived from multiple data sources may also be produced.

Functional Object	Functional Object Description
Archive Situation Data Archival	'Archive Situation Data Archival' collects and archives traffic, roadway, and environmental information for use in off-line planning, research, and analysis. It controls and collects information directly from equipment at the roadside, reflecting the deployment of traffic detectors that are used primarily for traffic monitoring and planning purposes, rather than for traffic management. It also collects situation data from connected vehicles. The data collected, quality checks performed, and aggregation strategies are defined to support transportation system performance monitoring and management.
Center Data Collection	'Center Data Collection' collects and stores information that is created in the course of center operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
Center Data Subscription Management	'Center Data Subscription Management' manages data subscriptions for an end user. It provides access to a catalog of available data, manages the necessary user information and rules that govern the data subscriptions, supports communications with data providers to collect data per the subscription rules, and makes the data available to the end user. It provides the local user interface through which a user can specify and manage subscriptions. It supports different mechanisms for collecting subscribed data for the end-user including one-time query-response as well as publish-subscribe services.
Center Field Equipment Management	'Center Field Equipment Management' is the back office application that supports monitoring and maintenance of field equipment. It monitors the performance and configuration of the field equipment. This includes management of the infrastructure configuration as well as detection, isolation, and correction of field equipment problems. The application also includes monitoring of performance of the field equipment, including communications links.
DDS Data Access Management	'DDS Data Access Management' defines the access mechanisms, structures and restrictions for inbound (from providers) and outbound (to consumers) data.
DDS Data Collection and Aggregation	'DDS Data Collection and Aggregation' collects data 'deposits' from producers including meta data such as the generation location and time. It authenticates and validates the data deposits and logs all associated meta data. Authenticated, valid data is bundled based on information type and location and made available as data products to consumers who are interested in the data. It establishes delivery parameters for data consumers that subscribe based on parameters including content type and geographic region of interest and delivers data to consumers based on these parameters.
Emergency Call-Taking	'Emergency Call-Taking' supports the emergency call-taker, collecting available information about the caller and the reported emergency, and forwarding this information to other objects that formulate and manage the emergency response. It receives 9-1-1, 7-digit local access, and motorist call-box calls and interfaces to other agencies to assist in the verification and assessment of the emergency and to forward the emergency information to the appropriate response agency.

Functional Object	Functional Object Description
Emergency Data Collection	'Emergency Data Collection' collects and stores emergency information that is collected in the course of operations by the Emergency Management Center. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
Emergency Dispatch	'Emergency Dispatch' tracks the location and status of emergency vehicles and dispatches these vehicles to incidents. Pertinent incident information is gathered from the public and other public safety agencies and relayed to the responding units. Incident status and the status of the responding units is tracked so that additional units can be dispatched and/or unit status can be returned to available when the incident is cleared and closed.
Emergency Evacuation Support	'Emergency Evacuation Support' coordinates evacuation plans among allied agencies and manages evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety. Where appropriate, the affected population is evacuated in shifts, using more than one evacuation route, and including several evacuation destinations to spread demand and thereby expedite the evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. The public is provided with real-time evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times. The evacuation and reentry status are monitored and used to refine the plan and resource allocations during the evacuation and subsequent reentry. It communicates with public health systems to develop evacuation plans and recommended strategies for disasters and evacuation scenarios involving biological or other medical hazards.
Emergency Incident Command	'Emergency Incident Command' provides tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders at or near the incident scene to support local management of an incident. It supports communications with public safety, emergency management, transportation, and other allied response agency centers, tracks and maintains resource information, action plans, and the incident command organization itself. Information is shared with agency centers including resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response. It supports the functions and interfaces commonly supported by a mobile command center.
Emergency Notification Support	'Emergency Notification Support' receives emergency notification messages from vehicles or personal handheld devices, determines an appropriate response, and either uses internal resources or contacts a local agency to provide that response. The nature of the emergency is determined based on the information in the received message as well as other inputs. This object effectively serves as an interface between automated collision notification systems and the local public safety answering point for messages that require a public safety response. This capability depends on an up-to-date registry of public safety answering points/response agencies by coverage area, the type of emergency, and hours of service.

Functional Object	Functional Object Description
Emergency Response Management	'Emergency Response Management' provides the strategic emergency response capabilities and broad inter-agency interfaces that are implemented for extraordinary incidents and disasters that require response from outside the local community. It provides the functional capabilities and interfaces commonly associated with Emergency Operations Centers. It develops and stores emergency response plans and manages overall coordinated response to emergencies. It monitors real-time information on the state of the regional transportation system including current traffic and road conditions, weather conditions, special event and incident information. It tracks the availability of resources and assists in the appropriate allocation of these resources for a particular emergency response. It also provides coordination between multiple allied agencies before and during emergencies to implement emergency response plans and track progress through the incident. It also coordinates with the public through the Emergency Telecommunication Systems (e.g., Reverse 911). It coordinates with public health systems to provide the most appropriate response for emergencies involving biological or other medical hazards.
Emergency Routing	'Emergency Routing' supports routing of emergency vehicles and enlists support from the Traffic Management Center to facilitate travel along these routes. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by the Traffic Management Center on request. Vehicles are tracked and routes are based on current vehicle location. It may coordinate with the Traffic Management Center to provide preemption or otherwise adapt the traffic control strategy along the selected route.
Emergency Secure Area Alarm Support	'Emergency Secure Area Alarm Support' receives traveler or transit vehicle operator alarm messages, notifies the system operator, and provides acknowledgement of alarm receipt back to the originator of the alarm. The alarms received can be generated by silent or audible alarm systems and may originate from public areas (e.g. transit stops, park and ride lots, transit stations, rest areas) or transit vehicles. The nature of the emergency may be determined based on the information in the alarm message as well as other inputs.
Emergency Secure Area Surveillance	'Emergency Secure Area Surveillance' monitors surveillance inputs from secure areas in the transportation system. The surveillance may be of secure areas frequented by travelers (i.e., transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.) or around transportation infrastructure such as bridges, tunnels and transit railways or guideways. It provides both video and audio surveillance information to emergency personnel and automatically alerts emergency personnel of potential incidents.
EV On-Board En Route Support	'EV On-Board En Route Support' provides communications functions to responding emergency vehicles that reduce response times and improve safety of responding public safety personnel and the general public. It supports traffic signal preemption via short range communication directly with signal control equipment and sends alert messages to surrounding vehicles.

Functional Object	Functional Object Description
EV On-Board Incident Management Communication	'EV On-board Incident Management Communication' provides communications support to first responders. Information about the incident, information on dispatched resources, and ancillary information such as road and weather conditions are provided to emergency personnel. Emergency personnel transmit information about the incident such as identification of vehicles and people involved, the extent of injuries, hazardous material, resources on site, site management strategies in effect, and current clearance status. Emergency personnel may also send in-vehicle signing messages to approaching traffic using short range communications.
EV Service Patrol Vehicle Operations	'EV Service Patrol Vehicle Operations' provides on-board processing and communications to service patrol vehicles that reduce response times and improve safety of responding personnel. It supports service patrol vehicle dispatch and provides incident information back to the dispatching center.
Field Secure Area Sensor Monitoring	'Field Secure Area Sensor Monitoring' includes sensors that monitor conditions of secure areas including facilities (e.g. transit yards), transportation infrastructure (e.g. Bridges, tunnels, interchanges, and transit railways or guideways), and public areas (e.g., transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities). A range of acoustic, environmental threat (e.g. Chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity and motion and object sensors are included.
Field Secure Area Surveillance	'Field Secure Area Surveillance' includes video and audio surveillance equipment that monitors conditions of secure areas including facilities (e.g. transit yards), transportation infrastructure (e.g. as bridges, tunnels, interchanges, and transit railways or guideways), and public areas (e.g., transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities). It provides the surveillance information to the Emergency Management Center for possible threat detection. It also provides local processing of the video or audio information, providing processed or analyzed results to the Emergency Management Center.
MCM Data Collection	'MCM Data Collection' collects and stores maintenance and construction information that is collected in the course of operations by the Maintenance and Construction Management Center. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
MCM Environmental Information Collection	'MCM Environmental Information Collection' collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. In addition to fixed sensor stations at the roadside, this functional object also collects environmental information from sensor systems located on Maintenance and Construction Vehicles. It also collects current and forecast environmental conditions information that is made available by other systems. The functional object aggregates the sensor system data and provides it, along with data attributes to other applications.
MCM Environmental Information Processing	'MCM Environmental Information Processing' processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. The processed environmental information products are presented to center personnel and disseminated to other centers.

Functional Object	Functional Object Description
MCM Maintenance Decision Support	'MCM Maintenance Decision Support' recommends maintenance courses of action based on current and forecast environmental and road conditions and additional application specific information. Decisions are supported through understandable presentation of filtered and fused environmental and road condition information for specific time horizons as well as specific maintenance recommendations that are generated by the system based on this integrated information. The recommended courses of action are supported by information on the anticipated consequences of action or inaction, when available.
MCM Roadway Maintenance	'MCM Roadway Maintenance' provides overall management and support for routine maintenance on a roadway system or right-of-way. Services managed include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of non-ITS equipment on the roadway (e.g., signs, gantries, cabinets, guard rails, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling routine maintenance activities. See also MCM Field Equipment Maintenance for maintenance of ITS field equipment.
MCM Vehicle Tracking	'MCM Vehicle Tracking' tracks the location of maintenance and construction vehicles and other equipment. Vehicle/equipment location and associated information is presented to the operator.
MCM Winter Maintenance Management	'MCM Winter Maintenance Management' manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications), and other snow and ice control operations. It 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.
MCM Work Activity Coordination	'MCM Work Activity Coordination' disseminates work activity schedules and current asset restrictions to other agencies. Work schedules are coordinated with operating agencies, factoring in the needs and activities of other agencies and adjacent jurisdictions. Work schedules are also distributed to Transportation Information Centers for dissemination to the traveling public.
MCM Work Zone Management	'MCM Work Zone Management' remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers, and informing other groups of activity (e.g., traveler information, traffic management, other maintenance and construction centers) for better coordination management. Work zone speeds, and delays, and closures are provided to the motorist prior to the work zones. This application provides control of field equipment in all maintenance areas, including fixed and portable field equipment supporting both stationary and mobile work zones.
MCV Environmental Monitoring	'MCV Environmental Monitoring' collects current road and surface weather conditions from sensors on-board the maintenance and construction vehicle or by querying fixed sensors on or near the roadway. Environmental information including road surface temperature, air temperature, and wind speed is measured and spatially located and time stamped, and reported back to a center.

Functional Object	Functional Object Description
MCV Roadway Maintenance and Construction	'MCV Roadway Maintenance and Construction' includes the on-board systems that support routine non-winter maintenance on a roadway system or right-of-way. Routine maintenance includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, etc.).
MCV Vehicle Location Tracking	'MCV Vehicle Location Tracking' monitors vehicle location and reports the position and timestamp information to the dispatch center.
MCV Winter Maintenance	'MCV Winter Maintenance' supports snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). It supports communications with the center to receive information and instructions that are provided to the vehicle operator and also supports remote control of on-board systems. It tracks operational status of snow and ice control operations and provides this information back to the center.
MCV Work Zone Support	'MCV Work Zone Support' provides communications and support for local management of a work zone. It supports communications between field personnel and the managing center to keep the center appraised of current work zone status. It controls vehicle-mounted driver information systems (e.g., dynamic message signs) and uses short range communications to monitor and control other fixed or portable driver information systems in the work zone.
Parking Coordination	'Parking Coordination' supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic management systems. Coordination with traffic management supports local traffic control coordination in and around the parking facility and broader regional coordination. It also shares information with transit management systems and information providers to support multimodal travel planning, including parking reservations capabilities. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.
Parking Data Collection	'Parking Data Collection' collects and stores parking information that is collected in the course of parking system operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
Parking Electronic Payment	'Parking Electronic Payment' supports electronic payment of parking fees using in-vehicle equipment (e.g., tags) or contact or proximity cards. It includes the field elements that provide the interface to the in-vehicle or card payment device and the back-office functionality that performs the transaction.
Parking Management	'Parking Management' detects and classifies vehicles at parking facility entrances, exits, and other designated locations within the facility. Current parking availability is monitored and used to inform drivers through dynamic message signs/displays so that vehicles are efficiently routed to available spaces. Parking facility information, including current parking rates and directions to entrances and available exits, is also provided to drivers.

Functional Object	Functional Object Description
Parking Park and Ride Operations	'Parking Park and Ride Operations' manages parking lots specifically to support park and ride operations, providing additional coordination with transit operations on parking arrivals and transit arrivals and departures, smoothing the transition between parking and riding for park and ride customers.
Personal Traveler Information Reception	'Personal Traveler Information Reception' receives formatted traffic advisories, road conditions, traffic regulations, transit information, broadcast alerts, and other general traveler information broadcasts and presents the information to the traveler. The traveler information broadcasts are received by personal devices including personal computers and personal portable devices such as smart phones.
Roadway Basic Surveillance	'Roadway Basic Surveillance' monitors traffic conditions using fixed equipment such as loop detectors and CCTV cameras.
Roadway Data Collection	'Roadway Data Collection' collects traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications where data quality and completeness take precedence over real-time performance. It includes the sensors, supporting roadside infrastructure, and communications equipment that collects and transfers information to a center for archival.
Roadway Environmental Monitoring	'Roadway Environmental Monitoring' measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed or to other field devices to support communications to vehicles. A broad array of general weather and road surface information may be collected. Weather conditions that may be measured include temperature, wind, humidity, precipitation, and visibility. Surface and sub-surface sensors can measure road surface temperature, moisture, icing, salinity, and other measures.
Roadway Field Device Support	'Roadway Field Device Support' monitors the operational status of field devices and detects and reports fault conditions. Consolidated operational status (device status, configuration, and fault information) are reported for resolution and repair. A local interface is provided to field personnel for local monitoring and diagnostics, supporting field maintenance, upgrade, repair, and replacement of field devices.
Roadway Field Management Station Operation	'Roadway Field Management Station Operation' supports direct communications between field management stations and the local field equipment under their control.
Roadway Incident Detection	'Roadway Incident Detection' provides incident detection using traffic detectors and surveillance equipment. It monitors for unusual traffic conditions that may indicate an incident or processes surveillance images, watching for potential incidents. It provides potential incident information as well as traffic flow and images to the center for processing and presentation to traffic operations personnel.
Roadway Mixed Use Crossing Safety	'Roadway Mixed Use Crossing Safety' is an advanced infrastructure application that detects pedestrians, cyclists, and other non-motorized users and provides active safety warnings to drivers when cross walks or other intersecting mixed use paths are occupied.

Functional Object	Functional Object Description
Roadway Passive Monitoring	'Roadway Passive Monitoring' monitors passing vehicles for a signature that can be used to recognize the same vehicle at different points in the network and measure travel times. Depending on the implementation and the penetration rate of the technology that is monitored, other point traffic measures may also be inferred by monitoring the number of vehicles within range over time. Today this approach is implemented most commonly using a Bluetooth receiver that passively monitors Bluetooth devices on-board passing vehicles and license plate readers that record the vehicle license plate number, but any widely deployed vehicle communications technology or feature that can be passively monitored to uniquely identify a vehicle could be used.
Roadway Signal Control	'Roadway Signal Control' includes the field elements that monitor and control signalized intersections. It includes the traffic signal controllers, detectors, conflict monitors, signal heads, and other ancillary equipment that supports traffic signal control. It also includes field masters, and equipment that supports communications with a central monitoring and/or control system, as applicable. The communications link supports upload and download of signal timings and other parameters and reporting of current intersection status. It represents the field equipment used in all levels of traffic signal control from basic actuated systems that operate on fixed timing plans through adaptive systems. It also supports all signalized intersection configurations, including those that accommodate pedestrians. In advanced, future implementations, environmental data may be monitored and used to support dilemma zone processing and other aspects of signal control that are sensitive to local environmental conditions.
Roadway Signal Preemption	'Roadway Signal Preemption' includes the field elements that receive signal preemption requests from emergency vehicles approaching a signalized intersection and overrides the current operation of the traffic signals to stop conflicting traffic and grant right-of-way to the approaching vehicle.
Roadway Speed Monitoring and Warning	'Roadway Speed Monitoring and Warning' includes the field elements that monitor vehicle speeds. If the speed is determined to be excessive, an advisory or warning is displayed. Current environmental conditions and other factors that may reduce safe operating speeds may also be taken into account. The operational status (state of the device, configuration, and fault data) is provided to the center. This application can also provide an enforcement function, reporting speed violations to an enforcement agency.
Roadway Standard Rail Crossing	'Roadway Standard Rail Crossing' manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates) are supported depending on the specific requirements for each intersection. These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification of an approaching train by interfaced wayside equipment. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported through interfaces to the wayside interface equipment and the Traffic Management Center.

Functional Object	Functional Object Description
Roadway Traffic Information Dissemination	'Roadway Traffic Information Dissemination' includes field elements that provide information to drivers, including dynamic message signs and highway advisory radios.
Roadway Traffic Metering	'Roadway Traffic Metering' includes the field equipment used to meter traffic on ramps, through interchanges, and on the mainline roadway. The equipment includes dynamic messages signs to provide guidance and information to drivers at and approaching a meter, including information for any special bypass lanes.
Roadway Warning	'Roadway Warning' includes the field equipment used to warn drivers approaching hazards on a roadway. Warnings may be generated in response to roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway, and any other transient events that can be sensed. The equipment monitors traffic and roadway conditions and may send data to a Traffic Management Center for processing or may process it to determine when a warning should be issued. When it is determined that a warning should be issued, the equipment is used to alert approaching drivers via dynamic warning signs, flashing lights, in-vehicle messages, etc.
Roadway Work Zone Traffic Control	'Roadway Work Zone Traffic Control' controls traffic in areas of the roadway where maintenance and construction activities are underway, monitoring and controlling traffic using field equipment such as CCTV cameras, dynamic messages signs, and gates/barriers. Work zone speeds and delays are provided to the motorist prior to the work zones.
TIC Data Collection	'TIC Data Collection' collects transportation-related data from other centers, performs data quality checks on the collected data and then consolidates, verifies, and refines the data and makes it available in a consistent format to applications that support operational data sharing between centers and deliver traveler information to end-users. A broad range of data is collected including traffic and road conditions, transit data, emergency information and advisories, weather data, special event information, traveler services, parking, multimodal data, and toll/pricing data. It also shares data with other transportation information centers.
TIC Emergency Traveler Information	'TIC Emergency Traveler Information' provides emergency information to the public, including wide-area alerts and evacuation information. It provides emergency alerts, information on evacuation zones and evacuation requirements, evacuation destinations and shelter information, available transportation modes, and traffic and road conditions at the origin, destination, and along the evacuation routes. In addition to general evacuation information, personalized information including tailored evacuation routes, service information, and estimated travel times is also provided based on traveler specified origin, destination, and route parameters. Updated information is provided throughout the evacuation and subsequent reentry as status changes and plans are adapted.
TIC Interactive Traveler Information	'TIC Interactive Traveler Information' disseminates personalized traveler information including traffic and road conditions, transit information, parking information, maintenance and construction information, multimodal information, event information, and weather information. Tailored information is provided based on the traveler's request in this interactive service.

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Functional Object	Functional Object Description
TIC Operations Data Collection	'TIC Operations Data Collection' collects and stores information that is collected about the transportation information service including data on the number of clients serviced and the services that were provided. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
TIC Situation Data Management	'TIC Situation Data Management' manages connected vehicle situation data collection, quality controls, filtering, aggregation, and storage. Through this process, raw data reported by connected vehicles are transformed into information products that can be accessed and used to support transportation operations and traveler information. The distribution of the connected vehicle-derived information products is handled by other functional objects.
TIC Traveler Information Broadcast	'TIC Traveler Information Broadcast' disseminates traveler information including traffic and road conditions, incident information, maintenance and construction information, event information, transit information, parking information, and weather information. The same information is broadcast to all equipped traveler interface systems and vehicles.
TIC Traveler Telephone Information	'TIC Traveler Telephone Information' services voice-based traveler requests for information that supports traveler telephone information systems like 511. It takes requests for traveler information, which could be voice-formatted traveler requests, dual-tone multi-frequency (DTMF)-based requests, or a simple traveler information request, and returns the requested traveler information in the proper format. In addition to servicing requests for traveler information, it also collects and forwards alerts and advisories to traveler telephone information systems.
TIC Travel Services Information and Reservation	'TIC Travel Services Information' disseminates information about traveler services such as lodging, restaurants, and service stations. Tailored traveler service information is provided on request that meets the constraints and preferences specified by the traveler. This application also supports reservations and advanced payment for traveler services including parking and loading zone use.
TIC Trip Planning	'TIC Trip Planning' provides pre-trip and en-route trip planning services for travelers. It receives origin, destination, constraints, and preferences and returns trip plan(s) that meet the supplied criteria. Trip plans may be based on current traffic and road conditions, transit schedule information, and other real-time traveler information. Candidate trip plans are multimodal and may include vehicle, transit, and alternate mode segments (e.g., rail, ferry, bicycle routes, and walkways) based on traveler preferences. It also confirms the trip plan for the traveler and supports reservations and advanced payment for portions of the trip. The trip plan includes specific routing information and instructions for each segment of the trip and may also include information and reservations for additional services (e.g., parking) along the route.
TMC Basic Surveillance	'TMC Basic Surveillance' remotely monitors and controls traffic sensor systems and surveillance (e.g., CCTV) equipment, and collects, processes and stores the collected traffic data. Current traffic information and other real-time transportation information is also collected from other centers. The collected information is provided to traffic operations personnel and made available to other centers.

Functional Object	Functional Object Description
TMC Data Collection	'TMC Data Collection' collects and stores information that is created in the course of traffic operations performed by the Traffic Management Center. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.
TMC Demand Management Coordination	'TMC Demand Management Coordination' provides the capability to gather information on regional toll, parking, and transit usage and request changes to pricing and other mechanisms to manage overall transportation demand.
TMC Environmental Monitoring	'TMC Environmental Monitoring' assimilates current and forecast road conditions and surface weather information using a combination of weather service provider information, information collected by other centers such as the Maintenance and Construction Management Center, data collected from environmental sensors deployed on and about the roadway, and information collected from connected vehicles. The collected environmental information is monitored and presented to the operator. This information can be used to issue general traveler advisories and support location specific warnings to drivers.
TMC Incident Detection	'TMC Incident Detection' identifies and reports incidents to Traffic Operations Personnel. It remotely monitors and controls traffic sensor and surveillance systems that support incident detection and verification. It analyzes and reduces the collected sensor and surveillance data, external alerting and advisory and incident reporting systems, anticipated demand information from intermodal freight depots, border crossings, special event information, and identifies and reports incidents and hazardous conditions
TMC Incident Dispatch Coordination	'TMC Incident Dispatch Coordination' formulates and manages an incident response that takes into account the incident potential, incident impacts, and resources required for incident management. It provides information to support dispatch and routing of emergency response and service vehicles as well as coordination with other cooperating agencies. It provides access to traffic management resources that provide surveillance of the incident, traffic control in the surrounding area, and support for the incident response. It monitors the incident response and collects performance measures such as incident response and clearance times.
TMC Multi-Modal Coordination	'TMC Multi-Modal Coordination' supports center-to-center coordination between the Traffic Management and Transit Management Centers. It monitors transit operations and provides traffic signal priority for transit vehicles on request from the Transit Management Center.
TMC Passive Surveillance	'TMC Passive Surveillance' collects time stamped vehicle identities from different detection zones, correlates the identities, and calculates link travel times and derives other traffic measures.
TMC Regional Traffic Management	'TMC Regional Traffic Management' supports coordination between Traffic Management Centers in order to share traffic information between centers as well as control of traffic management field equipment. This coordination supports wide area optimization and regional coordination that spans jurisdictional boundaries; for example, coordinated signal control in a metropolitan area or coordination between freeway operations and arterial signal control within a corridor.

Functional Object	Functional Object Description
TMC Roadway Equipment Monitoring	'TMC Roadway Equipment Monitoring' monitors the operational status of field equipment and detects failures. It presents field equipment status to Traffic Operations Personnel and reports failures to the Maintenance and Construction Management Center. It tracks the repair or replacement of the failed equipment. The entire range of ITS field equipment may be monitored including sensors (traffic, infrastructure, environmental, security, speed, etc.) and devices (highway advisory radio, dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security surveillance equipment, etc.).
TMC Roadway Warning	'TMC Roadway Warning' remotely monitors and controls the systems used to warn drivers approaching hazards on a roadway. It monitors data on roadway conditions from sensors in the field and generates warnings in response to roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway, and any other transient events that can be sensed.
TMC Service Patrol Management	'TMC Service Patrol Management' supports dispatch and communication with service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.
TMC Signal Control	'TMC Signal Control' provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single Traffic Management Center and are responsive to traffic conditions and adapt to support incidents, preemption and priority requests, pedestrian crossing calls, etc.
TMC Speed Warning	'TMC Speed Warning' supports remote control and monitoring of reduced speed zone warning roadside equipment. It provides the location and extent of the reduced speed zone, the posted speed limit(s) with information about the applicability of the speed limit(s) (e.g., time of day, day of week, seasonality, relevant vehicle types) and information about associated road configuration changes including lane merges and shifts. It monitors field equipment operation and reports current status to the operator.
TMC Traffic Information Dissemination	'TMC Traffic Information Dissemination' disseminates traffic and road conditions, closure and detour information, incident information, driver advisories, and other traffic-related data to other centers, the media, and driver information systems. It monitors and controls driver information system field equipment including dynamic message signs and highway advisory radio, managing dissemination of driver information through these systems.

Functional Object	Functional Object Description
TMC Traffic Management Decision Support	'TMC Traffic Management Decision Support' recommends courses of action to the traffic operator based on current and forecast road and traffic conditions. Traffic incidents, special events, maintenance activities and other events or conditions that impact capacity or demand are monitored. Historical data and models are used to compare the impact of potential courses of action and make recommendations to the operator. Decisions are supported through presentation of filtered and fused network-wide road and traffic conditions that identify network imbalances and recommended courses of action. The recommended actions may include predefined incident response plans, signal timing plan changes, DMS/HAR messages, truck restrictions, lane control strategies, metering strategies, and adjustment of variable speed limits. Multimodal strategies may also be recommended that include suggested transit strategies and suggested route and mode choices for travelers. Once a course of action is selected, traffic operations personnel implement these actions within the Traffic Management Center and coordinate the response with other centers in the region.
TMC Traffic Metering	'TMC Traffic Metering' provides center monitoring and control of traffic metering systems including on ramps, through interchanges, and on the mainline roadway. All types of metering are covered including pre-timed/fixed time, time-based, dynamic and adaptive metering strategies and special bypasses. Metering rates can be calculated based upon historical data or current conditions including traffic, air quality, etc.
TMC Traffic Network Performance Evaluation	'TMC Traffic Network Performance Evaluation' measures traffic network performance and predicts travel demand patterns to support traffic flow optimization, demand management, and incident management. It collects traffic data from sensors and surveillance equipment as well as input from other Traffic Management Centers, emissions management, transit operations, and event promoters and uses this information to measure traffic network performance. It collects route planning information from transportation information centers and integrates and uses this information to predict future traffic conditions. The planned control strategies can be passed back to the transportation information center so that the intended strategies can be reflected in future route planning.
TMC Variable Speed Limits	'TMC Variable Speed Limits' provides center monitoring and control of variable speed limits systems. It monitors data on traffic and environmental conditions collected from sensors along the roadway. Based on the measured data, it calculates and sets suitable speed limits usually by lane. It controls equipment that posts the current speed limits and displays additional information such as basic safety rules and current traffic information to drivers.
TMC Work Zone Traffic Management	'TMC Work Zone Traffic Management' coordinates work plans with maintenance systems so that work zones are established that have minimum traffic impact. Traffic control strategies are implemented to further mitigate traffic impacts associated with work zones that are established, providing work zone information to driver information systems such as dynamic message signs.
Transit Center Data Collection	'Transit Center Data Collection' collects and stores transit information that is collected in the course of transit operations performed by the Transit Management Center. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Functional Object	Functional Object Description
Transit Center Fare Management	'Transit Center Fare Management' manages fare collection and passenger load management at the transit center. It provides the back office functions that support transit fare collection, supporting payment reconciliation with links to financial institutions and enforcement agencies for fare violations. It collects data required to determine accurate ridership levels, establish fares, and distribute fare information. It loads fare data into the vehicle prior to the beginning of normal operations and unloads fare collection data from the vehicle at the close out of normal operations.
Transit Center Fixed-Route Operations	'Transit Center Fixed-Route Operations' manages fixed route transit operations. It supports creation of schedules, blocks and runs for fixed and flexible route transit services. It allows fixed-route and flexible-route transit services to disseminate schedules and automatically updates customer service operator systems with the most current schedule information. It also supports automated dispatch of transit vehicles. Current vehicle schedule adherence and optimum scenarios for schedule adjustment are also provided. It also receives and processes transit vehicle loading data.
Transit Center Information Services	'Transit Center Information Services' collects the latest available information for a transit service and makes it available to transit customers and to Transportation Information Centers for further distribution. Customers are provided information at transit stops and other public transportation areas before they embark and on-board the transit vehicle once they are enroute. Information provided can include the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events. In addition to general service information, tailored information (e.g., itineraries) are provided to individual transit users.
Transit Center Multi-Modal Coordination	'Transit Center Multi-Modal Coordination' supports transit service coordination between transit properties and coordinates with other surface and air transportation modes. As part of service coordination, it shares schedule and trip information, as well as transit transfer cluster (a collection of stop points, stations, or terminals where transfers can be made conveniently) and transfer point information between Multimodal Transportation Service Providers, Transit Agencies, and ISPs. An interface to Traffic Management also supports demand management strategies.
Transit Center Paratransit Operations	'Transit Center Paratransit Operations' manages demand responsive transit services, including paratransit services. It supports planning and scheduling of these services, allowing paratransit and other demand response transit services to plan efficient routes and better estimate arrival times. It also supports automated dispatch of paratransit vehicles and tracks passenger pick-ups and drop-offs. Customer service operator systems are updated with the most current schedule information.
Transit Center Passenger Counting	'Transit Center Passenger Counting' receives and processes transit vehicle loading data using two-way communications from equipped transit vehicles.
Transit Center Priority Management	'Transit Center Priority Management' monitors transit schedule performance and generates requests for transit priority on routes and at certain intersections. It may coordinate with the Traffic Management Center to provide transit priority along the selected route, including allocation of dynamic lanes and granting signal priority. It also coordinates with the Transit Vehicle OBE to monitor and manage local transit signal priority requests at individual intersections.

Functional Object	Functional Object Description
Transit Center Vehicle Assignment	'Transit Center Vehicle Assignment' assigns individual transit vehicles to vehicle blocks and downloads this information to the transit vehicle. It also provides an exception handling process for the vehicle assignment function to generate new, supplemental vehicle assignments when required by changes during the operating day. It provides an inventory management function for the transit facility which stores functional attributes about each of the vehicles owned by the transit operator. These attributes permit the planning and assignment functions to match vehicles with routes based on suitability for the types of service required by the particular routes.
Transit Center Vehicle Tracking	'Transit Center Vehicle Tracking' monitors transit vehicle location. The location information is collected via a data communication link between the transit vehicles and the transit center. The location information is presented to the transit operator on a digitized map of the transit service area. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time. The real-time schedule information is disseminated to other information providers, which furnish the information to travelers.
Transit Vehicle On-Board Fare Management	'Transit Vehicle On-board Fare Management' supports fare collection using a standard fare card or other non-monetary fare medium and detects payment violations. Collected fare data are made available to the center.
Transit Vehicle On-Board Information Services	'Transit Vehicle On-board Information Services' furnishes en-route transit users with real-time travel-related information on-board a transit vehicle. Current information that can be provided to transit users includes transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events are provided. In addition to tailored information for individual transit users, it also supports general annunciation and/or display of general schedule information, imminent arrival information, and other information of general interest to transit users.
Transit Vehicle On-Board Maintenance	'Transit Vehicle On-Board Maintenance' collects and processes transit vehicle maintenance data on-board the vehicle, including mileage and vehicle operating conditions. This maintenance information is provided to the management center and used to schedule future vehicle maintenance and repair.
Transit Vehicle On-Board Paratransit Operations	'Transit Vehicle On-board Paratransit Operations' forwards paratransit and flexible-route dispatch requests to the operator and forwards acknowledgements to the center. It coordinates with, and assists the operator in managing multi-stop runs associated with demand responsive transit services including paratransit. It collects transit vehicle passenger data and makes it available to the center.
Transit Vehicle On-Board Trip Monitoring	'Transit Vehicle On-Board Trip Monitoring' tracks vehicle location, monitors fuel usage, collects operational status (doors opened/closed, running times, etc.) and sends the collected, time stamped data to the Transit Management Center.
Transit Vehicle Passenger Counting	'Transit Vehicle Passenger Counting' collects transit vehicle loading data and makes it available to the center.

Functional Object	Functional Object Description
Transit Vehicle Schedule Management	'Transit Vehicle Schedule Management' monitors schedule performance and identifies corrective actions when a deviation is detected. It provides two-way communication between the transit vehicle and center, enabling the center to communicate with the vehicle operator and monitor on-board systems.
Transit Vehicle Security	'Transit Vehicle Security' provides security and safety functions on-board the transit vehicle. It includes surveillance and sensor systems that monitor the on-board environment, silent alarms that can be activated by transit user or vehicle operator, operator authentication. The surveillance equipment includes video (e.g. CCTV cameras), audio systems and/or event recorder systems.
Transit Vehicle Signal Priority	'Transit Vehicle Signal Priority' provides the capability for transit vehicles to determine eligibility for priority and request signal priority at signalized intersections, ramps, and interchanges through short range communication with traffic control equipment at the roadside.
Vehicle Basic Toll/Parking Payment	'Vehicle Basic Toll/Parking Payment' includes the traditional on-board systems that pay for tolls and parking electronically. It includes the 'tag' in-vehicle equipment that communicates with the toll/parking plaza and an optional interface to a carry-in payment device. See also 'Vehicle Payment Services', which provides a broader range of payment services.
Vehicle Emergency Notification	'Vehicle Emergency Notification' provides the capability for drivers or collision detection sensors to report an emergency and summon assistance. It gathers data from on-board collision detection sensors, provides a mechanism for the driver to summon assistance, and includes a communications capability to report the collision including indicators of collision severity, the number of passengers involved, and information about the vehicle that may affect the response.
Vehicle Interactive Traveler Information	'Vehicle Interactive Traveler Information' provides drivers with personalized traveler information including traffic and road conditions, transit information, maintenance and construction information, multimodal information, event information, and weather information. The provided information is tailored based on driver requests. Both one-time requests for information and on-going information streams based on a submitted traveler profile and preferences are supported.
Vehicle Location Determination	'Vehicle Location Determination' receives current location of the vehicle and provides this information to vehicle applications that use the location information to provide ITS services.
Vehicle Secure Area Access System	'Vehicle Secure Area Access System' provides access to secure areas such as shipping yards, warehouses, airports, transit-only ramps, parking gates and other areas. It accepts inputs from the vehicle driver that include the necessary identity information and uses this information to generate the request to activate a barrier to gain access to the area.
Vehicle Situation Data Monitoring	'Vehicle Situation Data Monitoring' is the highest-level representation of the functionality required to collect traffic and environmental situation data by monitoring and storing the experience of the vehicle as it travels through the road network. Collected data is aggregated into snapshots that are reported when communications is available and with flow control based on parameters provided by the infrastructure. Note that this functional object supports collection of data for areas remote from RSEs or other communications infrastructure.

Functional Object	Functional Object Description
Vehicle Traveler Information Reception	'Vehicle Traveler Information Reception' provides the capability for drivers to receive general transportation information including traffic and road conditions, traffic regulations, incident information, maintenance and construction information, event information, transit information, parking information, weather information, and broadcast alerts.
Vehicle Trip Planning and Route Guidance	'Vehicle Trip Planning and Route Guidance' includes the in-vehicle system that coordinates with a traveler information center to provide a personalized trip plan to the driver. The trip plan is calculated by the Transportation Information Center (TIC) based on preferences and constraints supplied by the driver and provided to the driver for confirmation. Reservations and advanced payment may also be processed to confirm the trip plan. Coordination with the TIC may continue during the trip so that the route plan can be modified to account for new information. Many equipment configurations are possible including in-vehicle systems that provide a basic trip plan to the driver as well as more sophisticated systems that can provide turn by turn guidance to the driver along the route.

10 Interfaces Between Systems

The interfaces of the transportation systems in Spokane Region ITS Architecture 2019 are based on ARC-IT and tailored to reflect the plan for the region. Architecture diagrams are viewable in ARC-IT and the tailored diagrams for the Spokane region can be produced out of RAD-IT. The diagrams display the transportation systems in the Spokane Region ITS Architecture 2019 and show how these systems connect with one another so information can be exchanged and transportation services can be coordinated. These diagrams can be used to identify integration opportunities. Each system in the region is represented with two types of diagrams, a context diagram and an interface diagram.
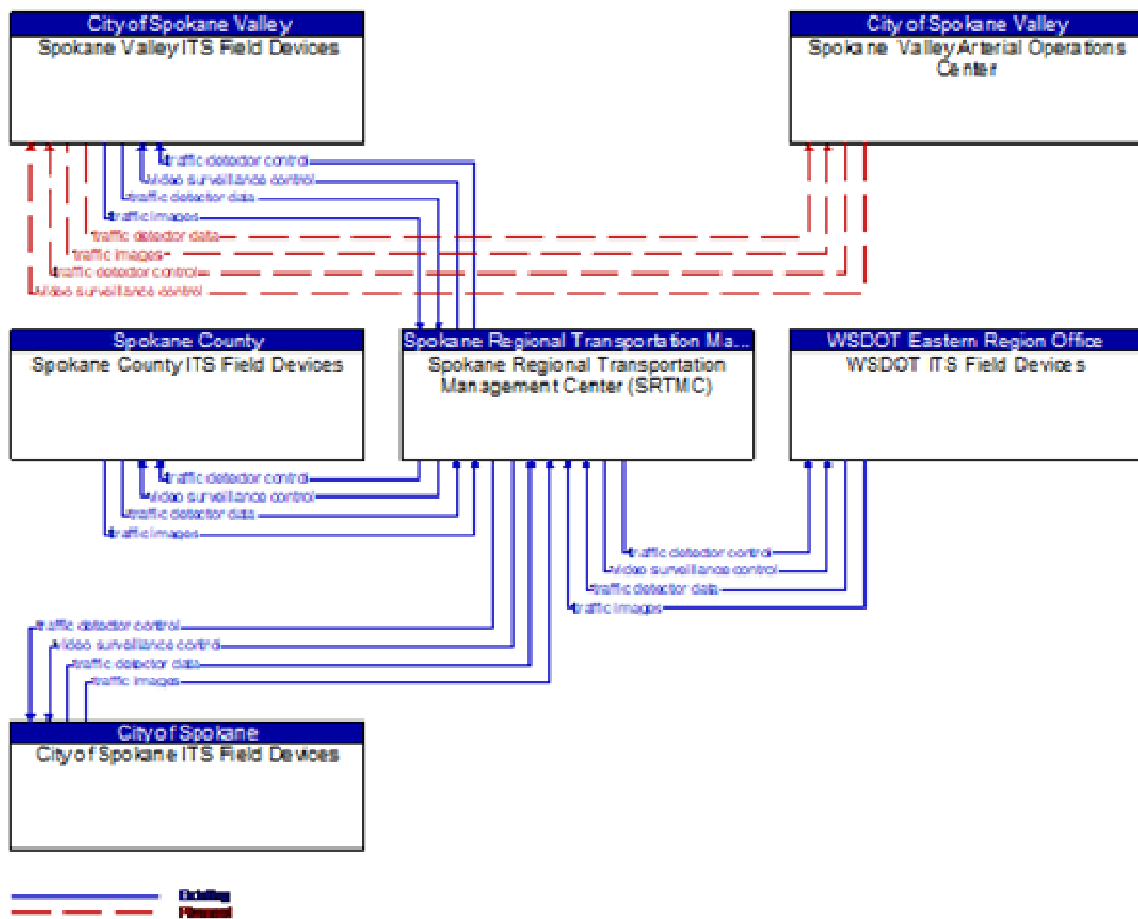
TMO1 Service Package Diagram

A context diagram shows a particular system and all other systems with which it shares information. Interconnects are represented as single lines and indicate information sharing without specifying the type of information being shared or the direction of the information movement.

Information about the interfaces of the systems in the region is contained in the RAD-IT database. RAD-IT can be used to create tailored interconnect and information flow diagrams for any system in the database.
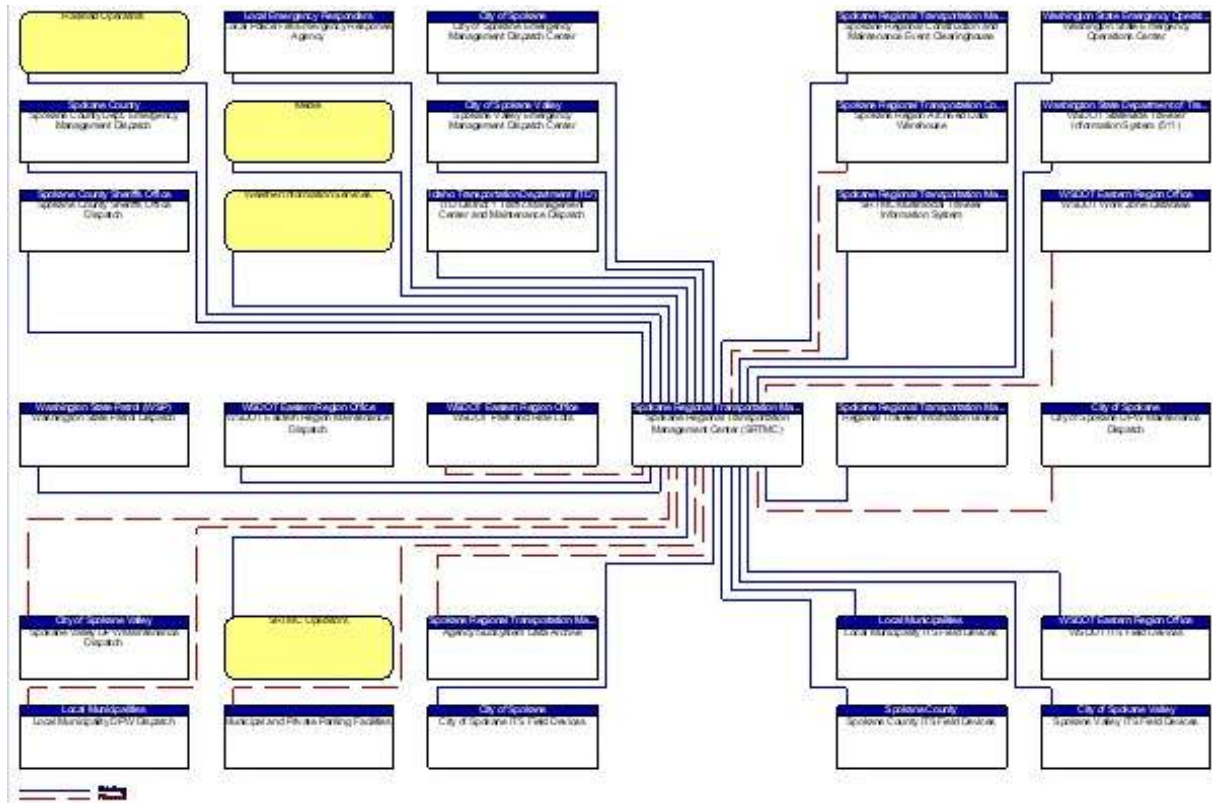
SRTMC Context Diagram

Following is a table of all the connected elements contained in the RAD-IT database specific to the Spokane Region ITS Architecture 2019.

Table 52: Interconnects

Element 1	Element 2	Communications	Status
Agency/Subsystem Data Archive	Archived Data Users	Public Website	Planned
Agency/Subsystem Data Archive	City of Spokane Arterial Operations Centers	COS Communications Network	Existing
Agency/Subsystem Data Archive	City of Spokane Central Traffic Signal System	COS Communications Network	Existing
Agency/Subsystem Data Archive	City of Spokane ITS Field Devices	COS Communications Network	Existing
Agency/Subsystem Data Archive	Regional Traveler Information Broker	SRTMC Communications Network	Planned

Element 1	Element 2	Communications	Status
Agency/Subsystem Data Archive	Spokane County Arterial Operations Center	Spokane County Communications Network	Existing
Agency/Subsystem Data Archive	Spokane Valley Arterial Operations Center	CoSV Communications Network	Existing
Agency/Subsystem Data Archive	Spokane County ITS Field Devices	Spokane County Communications Network	Existing
Agency/Subsystem Data Archive	Spokane County Sheriff's Office Dispatch	CAD	Planned
Agency/Subsystem Data Archive	Spokane Region Archived Data Warehouse	SRTMC Communications Network	Existing
Agency/Subsystem Data Archive	Spokane Regional Construction and Maintenance Event Clearinghouse	SRTMC Communications Network	Planned
Agency/Subsystem Data Archive	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Planned
Agency/Subsystem Data Archive	Spokane Valley ITS Field Devices	CoSV Communications Network	Existing
Agency/Subsystem Data Archive	SRTMC Central Traffic Signal System	SRTMC Communications Network	Planned
Agency/Subsystem Data Archive	STA Real-Time Customer Information Systems	STA Communications Network	Existing
Agency/Subsystem Data Archive	Third-Party Transportation Data Sources	Web Interface	Existing
Agency/Subsystem Data Archive	Washington State Patrol Dispatch	CAD	Existing
Agency/Subsystem Data Archive	Weather Information Services	Not identified	Planned
Agency/Subsystem Data Archive	WSDOT ITS Field Devices	SRTMC Communications Network	Existing
Agency/Subsystem Data Archive	WSDOT Statewide Traveler Information System (511)	Not identified	Planned
Agency/Subsystem Data Archive	WSDOT TMC Log	WSDOT Communications Network	Existing
Agency/Subsystem Data Archive	WSDOT Work Zone Database	WSDOT Communications Network	Existing

Element 1	Element 2	Communications	Status
Archived Data Users	Spokane Region Archived Data Warehouse	SRTMC Communications Network	Planned
City of Spokane Central Traffic Signal System	Spokane Region Archived Data Warehouse	SRTMC Communications Network	Planned
City of Spokane DPW Maintenance Dispatch	Spokane Regional Transportation Management Center (SRTMC)	Phone/Radio	Planned
City of Spokane DPW Maintenance Dispatch	WSDOT Eastern Region Maintenance Dispatch	Phone/Radio	Existing
City of Spokane Emergency Management Dispatch Center	City of Spokane Public Safety Vehicles	Phone/Radio	Existing
City of Spokane Emergency Management Dispatch Center	Spokane Regional Transportation Management Center (SRTMC)	Phone/Radio	Existing
City of Spokane Emergency Management Dispatch Center	Spokane Valley Emergency Management Dispatch Center	Phone/Radio	Existing
City of Spokane Emergency Management Dispatch Center	Washington State Emergency Operations Center	Phone/Radio	Existing
City of Spokane Emergency Management Dispatch Center	Washington State Patrol Dispatch	Phone/Radio	Planned
City of Spokane Emergency Management Dispatch Center	Weather Information Services	Not identified	Existing
City of Spokane ITS Field Devices	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Existing
City of Spokane ITS Field Devices	SRTMC Central Traffic Signal System	SRTMC Communications Network	Planned
Federal Emergency Management Operations Centers	Spokane County Dept. Emergency Management Dispatch	Not identified	Unknown
Federal Emergency Management Operations Centers	Washington State Emergency Operations Center	Not identified	Unknown
Federal Emergency Management Operations Centers	WSDOT Statewide Traveler Information System (511)	Not identified	Unknown
Media	Spokane Regional Construction and Maintenance Event Clearinghouse	SRTMC Communications Network	Planned

Element 1	Element 2	Communications	Status
Media	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Existing
Media	SRTMC Multimodal Traveler Information System	SRTMC Communications Network	Planned
Media	WSDOT Statewide Traveler Information System (511)	Not identified	Unknown
Personal Information Devices	Regional Traveler Information Broker	Public Website	Planned
Personal Information Devices	Spokane Regional Construction and Maintenance Event Clearinghouse	Public Website	Planned
Personal Information Devices	SRTMC Multimodal Traveler Information System	Public Website	Planned
Personal Information Devices	STA Fare Payment Smart Card	Public Website	Planned
Personal Information Devices	STA Fixed Route Dispatch	Public Website	Existing
Personal Information Devices	STA Real-Time Customer Information Systems	Public Website	Planned
Personal Information Devices	Travelers	Public Website	Existing
Personal Information Devices	WSDOT Statewide Traveler Information System (511)	Phone/Website	Planned
Private Utility Services	WSDOT Eastern Region Maintenance Dispatch	Not identified	Existing
Regional Traveler Information Broker	Spokane Region Archived Data Warehouse	SRTMC Communications Network	Planned
Regional Traveler Information Broker	Spokane Regional Construction and Maintenance Event Clearinghouse	SRTMC Communications Network	Planned
Regional Traveler Information Broker	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Existing
Regional Traveler Information Broker	SRTMC Multimodal Traveler Information System	SRTMC Communications Network	Existing
Regional Traveler Information Broker	STA Real-Time Customer Information Systems	SRTMC Communications Network	Existing
Regional Traveler Information Broker	Weather Information Services	SRTMC Communications Network	Planned

Element 1	Element 2	Communications	Status
Regional Traveler Information Broker	WSDOT Statewide Traveler Information System (511)	Not identified	Planned
Spokane County Arterial Operations Center	Spokane Region Archived Data Warehouse	SRTMC Communications Network	Planned
Spokane Valley Arterial Operations Center	Spokane Valley ITS Field Devices	CoSV Communications Network	Planned
Spokane County Dept. Emergency Management Dispatch	Spokane County Sheriff's Office Vehicles	CAD	Existing
Spokane County Dept. Emergency Management Dispatch	Spokane Regional Transportation Management Center (SRTMC)	Not identified	Existing
Spokane County Dept. Emergency Management Dispatch	Spokane Valley Emergency Management Dispatch Center	Not identified	Existing
Spokane County Dept. Emergency Management Dispatch	Washington State Emergency Operations Center	Not identified	Existing
Spokane County DPW Maintenance Dispatch	Spokane County DPW Maintenance Vehicles	Phone/Radio	Existing
Spokane County DPW Maintenance Dispatch	Spokane Regional Construction and Maintenance Event Clearinghouse	Not identified	Planned
Spokane County DPW Maintenance Dispatch	Spokane Regional Transportation Management Center (SRTMC)	Not identified	Planned
Spokane County ITS Field Devices	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Existing
Spokane County ITS Field Devices	SRTMC Central Traffic Signal System	SRTMC Communications Network	Existing
Spokane County Sheriff's Office Dispatch	Spokane County Sheriff's Office Vehicles	CAD	Existing
Spokane County Sheriff's Office Dispatch	Spokane Regional Transportation Management Center (SRTMC)	Radio	Existing
Spokane County Sheriff's Office Dispatch	Washington State Emergency Operations Center	Not identified	Planned
Spokane Region Archived Data Warehouse	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Planned

Element 1	Element 2	Communications	Status
Spokane Region Archived Data Warehouse	SRTMC Central Traffic Signal System	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	STA Real-Time Customer Information Systems	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	Third-Party Transportation Data Sources	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	Weather Information Services	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	WSDOT ITS Field Devices	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	WSDOT TMC Log	SRTMC Communications Network	Planned
Spokane Region Archived Data Warehouse	WSDOT Work Zone Database	SRTMC Communications Network	Planned
Spokane Regional Construction and Maintenance Event Clearinghouse	Spokane Regional Transportation Management Center (SRTMC)	SRTMC Communications Network	Existing
Spokane Regional Construction and Maintenance Event Clearinghouse	STA Fixed Route Dispatch	SRTMC Communications Network	Planned
Spokane Regional Construction and Maintenance Event Clearinghouse	Washington State Patrol Dispatch	SRTMC Communications Network	Planned
Spokane Regional Construction and Maintenance Event Clearinghouse	Weather Information Services	SRTMC Communications Network	Planned
Spokane Regional Construction and Maintenance Event Clearinghouse	WSDOT Eastern Region Maintenance Dispatch	WSDOT Communications Network	Existing
Spokane Regional Construction and Maintenance Event Clearinghouse	WSDOT Statewide Traveler Information System (511)	Not identified	Planned
Spokane Regional Transportation Management Center (SRTMC)	Spokane Valley Emergency Management Dispatch Center	SRTMC Communications Network	Existing
Spokane Regional Transportation Management Center (SRTMC)	Spokane Valley ITS Field Devices	SRTMC Communications Network	Existing

Element 1	Element 2	Communications	Status
Spokane Regional Transportation Management Center (SRTMC)	SRTMC Multimodal Traveler Information System	SRTMC Communications Network	Planned
Spokane Regional Transportation Management Center (SRTMC)	SRTMC Operators	SRTMC Communications Network	Existing
Spokane Regional Transportation Management Center (SRTMC)	Washington State Emergency Operations Center	SRTMC Communications Network	Existing
Spokane Regional Transportation Management Center (SRTMC)	Washington State Patrol Dispatch	SRTMC Communications Network	Existing
Spokane Regional Transportation Management Center (SRTMC)	Weather Information Services	SRTMC Communications Network	Existing
Spokane Regional Transportation Management Center (SRTMC)	WSDOT Eastern Region Maintenance Dispatch	SRTMC Communications Networks	Existing
Spokane Regional Transportation Management Center (SRTMC)	WSDOT ITS Field Devices	SRTMC Communications Networks	Existing
Spokane Regional Transportation Management Center (SRTMC)	WSDOT Park and Ride Lots	SRTMC Communications Networks	Planned
Spokane Regional Transportation Management Center (SRTMC)	WSDOT Statewide Traveler Information System (511)	SRTMC Communications Networks	Existing
Spokane Regional Transportation Management Center (SRTMC)	WSDOT Work Zone Database	WSDOT Communication Network	Planned
Spokane Valley Emergency Management Dispatch Center	Spokane Valley Public Safety Vehicles	CoSV Communication Network	Existing
Spokane Valley Emergency Management Dispatch Center	Washington State Patrol Dispatch	CoSV Communication Network	Planned
Spokane Valley Emergency Management Dispatch Center	Weather Information Services	SRTMC Communications Networks	Existing
Spokane Valley Emergency Management Dispatch Center	WSDOT Eastern Region Maintenance Dispatch	Not identified	Existing
Spokane Valley ITS Field Devices	SRTMC Central Traffic Signal System	SRTMC Communications Networks	Existing
SRTMC Central Traffic Signal System	SRTMC Multimodal Traveler Information System	SRTMC Communications Networks	Planned

Element 1	Element 2	Communications	Status
SRTMC Central Traffic Signal System	SRTMC Operators	SRTMC Communications Networks	Planned
SRTMC Central Traffic Signal System	WSDOT ITS Field Devices	SRTMC Communications Networks	Existing
SRTMC Multimodal Traveler Information System	STA Fixed Route Dispatch	SRTMC Communications Networks	Planned
SRTMC Multimodal Traveler Information System	STA Real-Time Customer Information Systems	SRTMC Communications Networks	Planned
SRTMC Multimodal Traveler Information System	Weather Information Services	SRTMC Communications Networks	Planned
SRTMC Multimodal Traveler Information System	WSDOT Statewide Traveler Information System (511)	Not identified	Planned
STA Fare Payment Smart Card	STA Fixed Route Vehicles	STA Communications Network	Existing
STA Fare Payment Smart Card	STA Paratransit Vehicles	STA Communications Network	Existing
STA Fare Payment Smart Card	STA Park and Ride Facilities	STA Communications Network	Planned
STA Fixed Route Dispatch	STA Fixed Route Operators	STA Communications Network	Existing
STA Fixed Route Dispatch	STA Fixed Route Vehicles	STA Communications Network	Existing
STA Fixed Route Dispatch	STA Operations Personnel	STA Communications Network	Existing
STA Fixed Route Dispatch	STA Paratransit Dispatch	STA Communications Network	Existing
STA Fixed Route Dispatch	STA Park and Ride Facilities	STA Communications Network	Planned
STA Fixed Route Dispatch	STA Real-Time Customer Information Systems	STA Communications Network	Existing
STA Fixed Route Dispatch	Weather Information Services	STA Communications Network	Existing
STA Fixed Route Operators	STA Fixed Route Vehicles	STA Communications Network	Existing
STA Operations Personnel	STA Paratransit Dispatch	STA Communications Network	Existing
STA Paratransit Dispatch	STA Paratransit Operators	STA Communications Network	Existing

Element 1	Element 2	Communications	Status
STA Paratransit Dispatch	STA Paratransit Vehicles	STA Communications Network	Existing
STA Paratransit Dispatch	STA Real-Time Customer Information Systems	STA Communications Network	Existing
STA Paratransit Dispatch	Washington State Patrol Dispatch	STA Communications Network	Existing
STA Paratransit Operators	STA Paratransit Vehicles	STA Communications Network	Existing
Washington State Emergency Operations Center	Washington State Patrol Dispatch	Not identified	Existing
Washington State Emergency Operations Center	WSDOT Statewide Traveler Information System (511)	Not identified	Existing
Washington State Patrol Dispatch	Washington State Patrol Vehicles	CAD	Existing
Washington State Patrol Dispatch	Weather Information Services	Not identified	Existing
Washington State Patrol Dispatch	WSDOT Incident Response Team Vehicles	Radio	Existing
Washington State Patrol Dispatch	WSDOT Statewide Traveler Information System (511)	Not identified	Existing
Weather Information Services	WSDOT Eastern Region Maintenance Dispatch	WSDOT Communications Network	Existing
Weather Information Services	WSDOT Statewide Traveler Information System (511)	Not identified	Existing
WSDOT Eastern Region Maintenance Dispatch	WSDOT Maintenance Vehicles	Phone/Radio WSDOT Communications Network	Existing
WSDOT Eastern Region Maintenance Dispatch	WSDOT Statewide Traveler Information System (511)	Not identified	Existing
WSDOT Eastern Region Maintenance Dispatch	WSDOT Work Zone Database	WSDOT Communications Network	Existing
WSDOT Incident Response Team Vehicle Operators	WSDOT Incident Response Team Vehicles	Not identified	Existing

11 ITS Standards

Standardizing the flow of information between the systems is essential to cost-effectively integrating ITS throughout the region. ITS standards are fundamental to the establishment of an open ITS environment that achieves the goal of interoperability for ITS. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve.

Establishing standards for exchanging information among ITS systems is important not only from an interoperability point of view; it also provides interchangeability and expandability thereby reducing risk and cost. Since an agency using standardized interfaces can select among multiple vendors for products and applications, competition is maintained and prices are lower in the long term.

Standards Development Organizations (SDO) are developing ITS standards that support interoperability and interchangeability. Several of the communication standards overlap in applicability. This provides flexibility in the design of ITS systems allowing agencies to choose the most applicable standard for their needs. Before systems are designed, all stakeholders involved in the applicable ITS service(s) should decide upon the standards and their specifics that will be used. Once a decision is made, all future systems should use the agreed upon standards.

Table 52 – ITS Standards

Standards Development Organizations	Document ID	Standard Title	Standard Type
American Public Transportation Association	APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles	Message/Data
American Society for Testing and Materials	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	Message/Data
American Society for Testing and Materials	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1201	Global Object Definitions	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	Message/Data

Standards Development Organizations	Document ID	Standard Title	Standard Type
Consortium of AASHTO, ITE, and NEMA	NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1213	Object Definitions for Electrical and Lighting Management Systems (ELMS)	Message/Data
European Committee for Standardization	TS 15531	Service Interface for Real-Time Information (SIRI)	Message/Data
General Transit Feed Specification Discussion Group	GTFS	General Transit Feed Specification (GTFS) Static	Message/Data
General Transit Feed Specification Discussion Group	GTSF-Realtime	General Transit Feed Specification (GTFS) Realtime	Message/Data
Institute of Electrical and Electronic Engineers	IEEE 1512 -2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Message/Data
Institute of Electrical and Electronic Engineers	IEEE 1609.11	Standard for Wireless Access in Vehicular Environments (WAVE) - Over- the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS)	Message/Data

Standards Development Organizations	Document ID	Standard Title	Standard Type
Institute of Transportation Engineers	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/Data
Profile	Contact-Proximity-Interface	Proximity Communication Interface	Standard Profile
Profile	NTCIP-DATEX	NTCIP using DATEX	Standard Profile
Profile	NTCIP-SMTP	NTCIP using SMTP	Standard Profile
Profile	NTCIP-SNMP	NTCIP using SNMP	Standard Profile
Profile	RSEGateway-VehicleDestination	Vehicle Communications via RSEs, Vehicle Destination	Standard Profile
Profile	RSEGateway-VehicleSource	Vehicle Communications via RSEs, Vehicle Source	Standard Profile
Profile	SRC-Legacy	Legacy Short Range Comm Using IEEE 1455	Standard Profile
Profile	WAB-Via-WAID	Wide-Area-Broadcast-Via-WAID	Standard Profile
Profile	WAW-ASN1	Wide Area Wireless using ASN.1 as encoding method	Standard Profile
Profile	WAW-WWWBrowser-JSON	Wide Area Wireless using JSON as encoding method	Standard Profile
Profile	WAW-XML	Wide Area Wireless using XML as encoding method	Standard Profile
Profile	XML	eXtensible Markup Language	Standard Profile
Society of Automotive Engineers	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)	Message/Data
Society of Automotive Engineers	SAE J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary	Message/Data
Society of Automotive Engineers	SAE J3067	Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods	Message/Data

12 Agreements

This section identifies the list of existing and future agreements between each of the stakeholder organizations whose ITS systems will be exchanging information. This list identifies the agreements that should be established but does not define the agreements themselves.

Table 53 – Agreements

Agreement Number	Agreement Title	Agreement Type	Agreement Status	Description	Lead Stakeholder	Associated Stakeholders
GCB2457	Interlocal Agreement Regarding the Creation, Operations, and Management of the SRTMC	Interagency Agreement (General)	Existing	Formalizes the creation, operations and management of the Spokane Regional Transportation Management Center between all partner agencies	Washington State Department of Transportation (WSDOT)	City of Spokane (COS)
						City of Spokane Valley (CoSV)
						Spokane County
						Spokane Regional Transportation Council (SRTC)
						Spokane Transit Authority (STA)
						WSDOT
GCB3005	Fiber Cable Strand Sharing	Interagency Agreement (General)	Existing	City of Spokane shared 12 fibers with WSDOT between Fire Station 1 and the US Bank Building	City of Spokane	City of Spokane
						WSDOT
GMB1084	Fiber Communication Infrastructure Maintenance and Operation	Interagency Agreement (General)	Existing	City of Spokane and WSDOT Agreement for Maintenance and Operation responsibility of a shared Fiber Communication Infrastructure located throughout the City of Spokane	WSDOT	City of Spokane
						WSDOT
JOPS 2018	Joint Operations Policy Statement	Shared Operations Agreement (General)	Existing	Policy agreement between WSP, WSDOT, and Washington Fire Chiefs (WFC) to delineate responsibilities and state policy as guidance for collaboration and performance measures necessary		WSDOT
						Washington State Patrol (WSP)

Agreement Number	Agreement Title	Agreement Type	Agreement Status	Description	Lead Stakeholder	Associated Stakeholders
				for enhancing the safety and security of our transportation systems.		WSDOT Incident Response Team
K10551	Interagency Between WSDOT and County for Fiber Use	Interagency Agreement (General)	Existing	County use of fiber that is owned by WSDOT	WSDOT	Spokane County
						WSDOT

13 ITS Projects

The Spokane Region ITS Architecture provides strategies for implementation of ITS projects. This chapter lists the projects that have been identified as part of the regional ITS architecture definition. Table 55 lists the ITS Project Categories that have been identified for the Region and have been summarized in the RAD-IT database. Table 56 includes a more specific and detailed list of projects, which includes locations, benefits, priority, and timeframes.

ITS project implementation began in the Spokane Region in 1997 with the first Regional Transportation Communication System project. This was the first project, of many ITS projects in the region, that installed fiber optic communication trunk line, CCTV cameras, Variable Message Signs (VMS), Highway Advisory Radio (HAR), and Remote Weather Information Systems (RWIS) to provide for traffic monitoring and management, construction and maintenance management, incident management, and traveler information that is provided across the region today. Our fiber optic communication as well as other communication systems and devices also support regional emergency services, transit service, public information and the media.

The priority implementation for regional ITS Projects started with establishment of the Spokane Regional Transportation Management Center, which was opened in 2002. Implementation of ITS on Interstate 90 (I-90), through Spokane County, within the limits of City of Spokane and City of Spokane Valley, and ending at the Idaho State Line, was also a first priority focus. The I-90 fiber infrastructure and initial ITS implementation was completed in 2012. ITS and fiber communication projects were constructed on major North/South and East/West arterials in the City of Spokane and City of Spokane Valley as well as on US 2, US 195 and US 395, within the Spokane region.

Primary funding sources for these projects consist of Federal, State, and Local sources with the majority consisting of competitively awarded Federal funds.

Table 54 – ITS Project Categories

Category Name	Description	Status	Timeframe	Geographic Scope	Service Scope
Arterial Data Collection	Deploy Arterial Data Gathering Devices and a data management platform for collecting, analyzing, storing, and disseminating data on primary arterials throughout Spokane County.	Planned	2019	Major Arterials and highways including CPM Corridors within Spokane County	Data Warehousing, Data Distribution, Traffic Management, Performance Management, Traveler Information
CCTV Upgrade and Expansion	Upgrade all CCTV to IP based communication and standard communication protocols capable of interfacing with SRTMC. Expand CCTV coverage throughout the region to cover all major arterials and remote highways	Planned	1-5 years	Region wide	This project supports Traffic Management, Traveler Information, Public Safety, Maintenance and Construction, and Data Management service areas
Corridor Traffic Signal Performance Enhancements	Upgrade traffic signals to include better detection and analytics devices for information collection and analysis to determine performance needs to increase efficiency and reliability. Additional equipment enhancements would allow for data collection, signal to signal communications, center to center communications, center to field communications, connected vehicle capabilities, and automation.	Planned	1-7 years	Region wide to include City of Spokane, City of Spokane Valley, Spokane County and WSDOT Traffic Signals.	This project supports Traffic Management in the area of Traffic Signal Control with an emphasis on Arterial Management, Special Event Management, System Efficiency, System Reliability, Transit Operations and Management, and Travel Weather Management
DSRC Radio for SPAT Messaging Test Project	DSRC Radios have been installed in 3 traffic signal cabinets on SR 27 to test the ability for traffic signal information (SPAT messaging) to broadcast to equipped connected vehicles.	Existing	1-3 years	Spokane Valley and WSDOT located in east Spokane	This project supports the Vehicle Safety and Traffic Management service areas of ARC-IT.

Category Name	Description	Status	Timeframe	Geographic Scope	Service Scope
I-90 Ramp Meter Project	Install Ramp Meters on I-90 in the downtown core to provide improved flow during congested hours and improve safety	Planned	2019-2020	I-90, in City of Spokane and City of Spokane Valley, in Spokane County, from US 195 to Broadway	This project supports the Traffic Management service area and utilizes the Traffic Metering service package.
I-90 Variable Speed Limits	Provide Variable Speed Limit traveler information on I-90. This would include weather detection systems, volume and speed detection systems, and dynamic messaging systems and structures in the field as well as enhanced communication and surveillance equipment interface with SRTMC.	Planned	5-10 years	I-90 from Geiger to Idaho State Line	This project supports Traffic Management, Traveler Information, Vehicle Safety, and Weather service areas
I-90 Wrong Way Detection Systems	Install Wrong Way Detection Systems on I-90 ramps to detect, alert, and initiate action for vehicles entering I-90 the wrong way.	Planned	2-6 years	I-90 between Maple/Walnut and the Idaho State Line	This project supports Traffic Management, Traveler Information, and Vehicle Safety service areas.
Region Communications Expansion	Plan to determine region communication needs for all agencies. Reliable communication between all agencies and including center to center, center to field, and field to field communications. To increase the ability to collect and disseminate information efficiently and reliably.	Planned	1-5 years	Region wide	Supports all service areas of ARC-IT
Region IRT Expansion	Expand IRT patrols to include major arterials throughout the region.	Planned	3-8 years	Region wide	This project supports Public Safety service area and the Roadway Service Patrols service package

Category Name	Description	Status	Timeframe	Geographic Scope	Service Scope
Region Maintenance and Construction Monitoring and Information Systems	Install systems that will provide for the monitoring of maintenance vehicles, monitoring and management of work zones, automated treatment of roadways, and infrastructure monitoring. This would include enhancements to the SRTMC website to provide public information regarding maintenance and construction activities.	Planned	3-7 years	Region wide	This project supports the Maintenance and Construction service area.
Region Traffic Management and Traveler Information Systems	Expansion of the Traffic Management and Traveler Information Systems throughout the region. These systems consist of coordinated traffic signal systems, surveillance systems, variable message signs, HAR radios, Connected Vehicle technologies, detection systems, and communication systems.	Planned	1-7 years	Region wide within Spokane County	This project supports the Traffic Management and Traveler Information service areas.
SRTMC Upgrade and Expansion	Upgrade all SRTMC equipment and communication to IP based protocols. Expand the SRTMC to include partner agency operations staff including WSDOT staff to oversee I-90 operational strategies for ramp metering, wrong way detection, variable speed limits, and queue detection and warning. This could include relocation of the SRTMC.	Planned	1-7 years	SRTMC	This project supports all service areas defined by the National Reference ITS Architecture (ARC-IT)
STA Communication Expansion & Traveler Information	Expand Communication infrastructure to connect to all STA facilities. Install systems for monitoring and providing travel information to the public for better mode choices.	Planned	1-7 years	Region wide	This project supports the Public Transportation and Traveler Information service areas.

Table 55 – Detailed ITS Projects

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
SC-1: County Wide Traffic Signal Connectivity & Communications	Corridor Traffic Signal Performance Enhancements	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
SC-2: Remote Snow Level Monitoring Stations	Region Maintenance & Construction Monitoring and Information Systems	Weather	Medium	5.3
SC-3: Bigelow Gulch Rd Communication Infrastructure & ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traveler Information Support	Medium	1.1, 3.3, 4.1
SP-1: Spokane Traveler Information & Communication Expansion – City Wide	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traveler Information Support	Medium	1.1, 3.3, 4.1
SP-2: 29th Ave - ITS Devices & Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3
SP-3: Francis Ave, Division St to West City Limits – ITS Devices and Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1
SP-4: Sprague Ave – ITS Devices & Communication Infrastructure (Phase 2)	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
SP-5: West Plains - ITS Devices & Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
SP-6: Freya St, 5th Ave to Frederick Ave – ITS Devices & Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
SP-7: Indian Trail Road – ITS Devices & Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
SP-8: City of Spokane – Arterial Data Collection	Arterial Data Collection	Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
SP-9: Spokane Central Business District – Traffic Signal System Enhancement & Coordination	Corridor Traffic Signal Performance Enhancements	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
SP-10: Hamilton St – ITS and Signal System Replacements	CCTV Upgrade and Expansion Corridor Traffic Signal Performance Enhancements	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
SP-11: City Wide Controller Upgrades & Automated Traffic Signal Performance Measures	Corridor Traffic Signal Performance Enhancements	Traffic Management Support	High	1.1, 2.1, 3.1, 4.1, 4.2.1
SP-12: Regal Corridor – ITS & Communication	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
SP-13: Freya St, Frederick to Francis – ITS & Communication Infrastructure	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
SP-14: Freya St & Palouse Hwy – Signal & Communication	Corridor Traffic Signal Performance Enhancements Region Communications Expansion	Traffic Management	Medium	4.2.1
SR-2019-1: Region Wide Network & Communication Technology Enhancements	Region Communications Expansion	Support	Medium	1.1, 4.1, 4.2.1
SR-2019-2: Region Wide ITS Device Technology Enhancements	CCTV Upgrade and Expansion Corridor Traffic Signal Performance Enhancements Arterial Data Collection	Support	Medium	1.1, 3.1, 3.3, 4.1
SR-2019-3: Region Wide Traffic Signal Performance & Detection Enhancement	Corridor Traffic Signal Performance Enhancements	Traffic Management	Medium	4.2.1
SR-2019-4: SRTMC Relocation & Expansion	SRTMC Upgrade and Expansion	Support	High	1.1, 3.1
SR-2019-5: SRTMC Equipment Maintenance and Infrastructure Upgrades	SRTMC Upgrade and Expansion	Support	High	1.1, 3.1

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
SR-2019-6: Advanced Transportation Management System (ATMS) Phase 2 Enhancements	SRTMC Upgrade and Expansion Region Traffic Management and Traveler Information Systems	Support	High	1.1
SR-2019-7: Region Wide Communications Expansion	Region Communications Expansion	Support	High	1.1
SR-2019-8: Region Wide STA Communication Connectivity to STA facilities and park and rides	STA Communication Expansion & Traveler information	Traffic Management Traveler Information Support	High	5.1, 5.2
SR-2019-9: Region Wide Arterial Data Collection, Data Management, & Data Dissemination System	Arterial Data Collection Region Communications Expansion	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1, 4.2.1
STA-17: Fare System Upgrade	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1, 5.2
STA-18: Moran Prairie Park and Ride	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1.1
STA-19: Liberty Lake Park and Ride	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1.1
STA-20: Mirabeau Transit Center Improvements	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1.1
STA-22: SCC Transit Center	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.3
STA-24: Mobile Data Computer (MDC) System Units	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.2.1, 5.3
STA-25: Park and Ride Cameras	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1.1

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
STA-26: On-Board Camera Upgrade	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.1.1
STA-27: Central City Line and ITS	STA Communication Expansion & Traveler information	Public Transportation	High	5.3
STA-28: Cheney High Performance Transit and ITS	STA Communication Expansion & Traveler information	Public Transportation Traveler Information Support	High	5.3
STA-29: Division High Performance Transit and ITS	STA Communication Expansion & Traveler information	Public Transportation Traffic Management Support	High	5.3
STA-30: I-90 High Performance Transit	STA Communication Expansion & Traveler information	Public Transportation Traffic Management Support	High	5.3
STA-31: West Plains Transit Center Connections	STA Communication Expansion & Traveler information	Public Transportation	Medium	5.3
STA-32: Fiber Communication Connectivity to STA Plaza and Park and Ride Locations	STA Communication Expansion & Traveler information	Public Transportation Traveler Information Support	High	5.3

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
SV-1: South Sullivan Road, Sprague to 24th - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Low	1.1, 2.1, 3.1, 3.3, 4.1
SV-2: Argonne Road/Mullan Road/Dishman-Mica Road Corridor - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
SV-3: North Sullivan Road Corridor - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	High	1.1, 2.1, 3.1, 3.3, 4.1
SV-4: Sprague Avenue/Appleway Avenue/Barker Road Corridor - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
SV-5: 32nd Avenue/University Road Corridor - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Low	1.1, 2.1, 3.1, 3.3, 4.1
WSDOT-C: US 2/Fairchild to Deer Heights Rd - ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
WSDOT-D: US 2/Hawthorne to Farwell Rd ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Traveler Information Support	Medium	1.1, 2.1, 3.1, 3.3, 4.1
WSDOT-K: SR 27 Palouse Hwy Safety Applications	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Weather	Low	4.1, 5.4
WSDOT-M: Region Weather Data	Region Traffic Management and Traveler Information Systems Region Maintenance & Construction Monitoring and Information Systems	Weather	Medium	4.1, 5.4
WSDOT-Q: I-90 Freeway Integrated Corridor Management	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Weather	Medium	3.2.1, 4.3, 5.4
WSDOT-R: SR 206 / US 2 to Mt. Spokane St. Park Traveler Information	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Weather	Low	4.1, 5.4
WSDOT-S: US 2/ Deer Heights Road to Airport Interchange ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Transit Management Traveler Information Support Weather	High	1.1, 2.1, 3.1, 3.3, 4.1, 5.4

Project Name	Project Category	ARC-IT Service Area	Priority	Planning Strategy
WSDOT-T : NSC/I-90 to Francis/Freya ITS	Region Traffic Management and Traveler Information Systems Region Communications Expansion	Traffic Management Transit Management Traveler Information Support Weather	High	1.1, 2.1, 3.1, 3.3, 4.1, 5.4
WSDOT-U : I-90/Wrong Way Detection Systems	I-90 Wrong Way Detection Systems	Traffic Management Traveler Information Support	Medium	3.3, 3.3.2
WSDOT-V: I-90/Queue Detection and Warning Systems	Region Traffic Management and Traveler Information Systems I-90 Variable Speed Limits	Traffic Management Traveler Information	Low	3.2.1, 3.3, 4.3, 4.3.2, 4.3.3
WSDOT-W : I-90 Ramp Meters – US 195 to Hamilton	I-90 Ramp Meter Project	Traffic Management Traveler Information Support	High	4.3, 4.3.1, 4.3.3
WSDOT-X : DSRC Radio for SPAT Messaging Test Project – SR 27	DSRC Radio for SPAT Messaging Test Project	Traffic Management Traveler Information Support	Low	1.1

Project Benefit Criteria for Prioritization

The project benefit criteria used to determine prioritization for the proposed ITS Projects were established through the Horizon 2040 outreach process as reflected in the Horizon 2040 Plan as the Horizon 2040 Guiding Principles. The same principles, with the addition of one, were used to determine objectives for the Congestion Management Process plan for the region. These same guiding principles determined the ITS project benefit criteria and are defined in the following table.

Table 57 – Project Benefit Criteria

Benefit Criteria	Description - Objective
1. Economic Vitality	Promote economic vitality and prioritize transportation investment – manage congestion through operational strategies and technology to improve travel efficiency and reliability
2. Cooperation & Leadership	Provide a regional forum for transportation planning and funding – Coordinate transportation relevant data for shared use among regional stakeholders
3. Stewardship	Protect the environment and minimize the impacts form transportation – Maximize the use of existing facilities across all transportation modes. Share resources between transportation agencies. Use performance measures to evaluate how investments support objectives
4. System Operations, Maintenance, and Preservation	Maximize the operations and physical condition of the transportation network with strategic investments – Implement low cost/high benefit solutions that help maintain and preserve reliable transportation facilities. Improve operations through ITS technologies, demand management, and TSMO
5. Quality of Life	Make quality of life a hallmark of our community and to foster neighborhoods and protect cultural resources through context sensitive design – Enhance the human environment and limit impacts to the natural environment
6. Choice & Mobility	Improve choice and Mobility – Fill in gaps between modes, improve access to transit, support high performance transit, expand pedestrian and bicycle facilities, and support demand management strategies.
7. Safety & Security	Provide for maximum transportation safety and support security in the region – Improve safety and reduce non-recurring congestion by reducing collisions.

Appendix A.   Interfaces Details

The interfaces of the transportation systems in the Spokane Region ITS Architecture 2019 ITS Architecture are based on ARC-IT and tailored to reflect the plan for the region. Architecture diagrams display the transportation systems in the Spokane Region ITS Architecture 2019 ITS Architecture, and more importantly, how these systems are and will be connected with one another so information can be exchanged and transportation services can be coordinated. Stakeholders may use these diagrams to identify integration opportunities. Each system in the region is represented with two types of diagrams, a context diagram and an interface diagram.

A context diagram shows a particular system and all other systems with which it shares information. Interconnects are represented as single lines and indicate information sharing without specifying the type of information being shared or the direction of the information movement.

Following each interconnect context diagram are a series of information flow diagrams showing the information (i.e. information flows) movement between the various systems. Descriptions of the information flows are included at the end of the chapter.

Information about the interfaces of the systems in the region is contained in the RAD-IT database. RAD-IT can be used to create tailored interconnect and information flow diagrams for any system in the database.

Spokane Region ITS Architecture 2019 Interface Diagrams
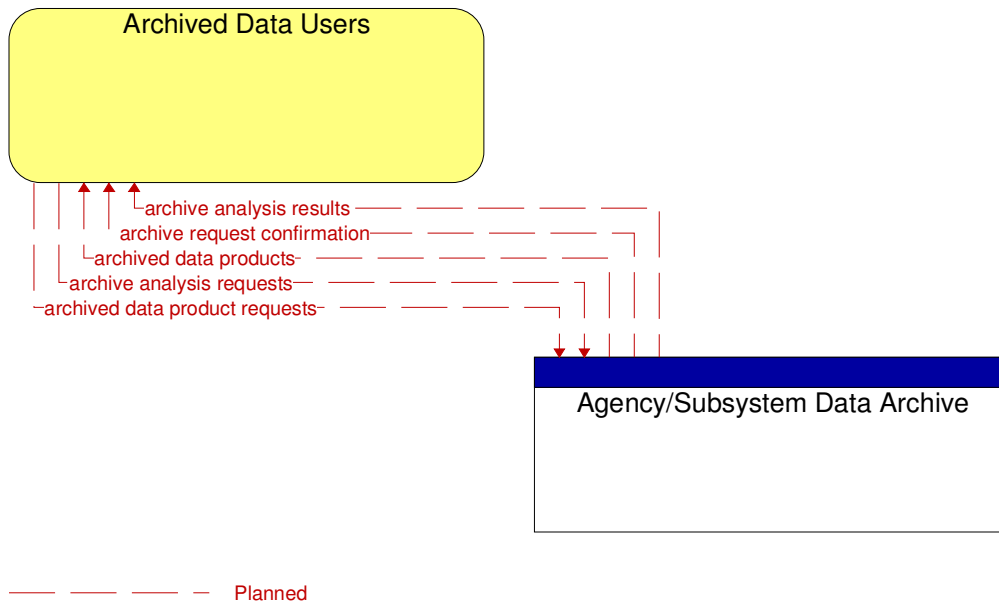
Figure 1: Agency/Subsystem Data Archive - Archived Data Users Interface
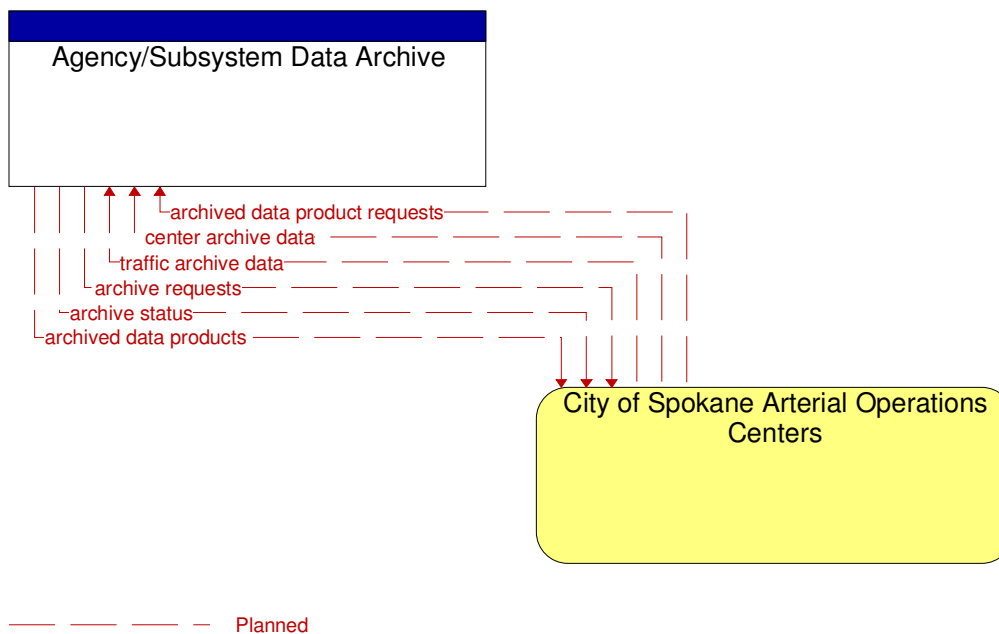
Figure 2: Agency/Subsystem Data Archive - City of Spokane Arterial Operations Centers Interface

City of Spokane

City of Spokane Central Traffic Signal System

archive requests
archive status
archived data products
archived data product requests
center archive data
traffic archive data

Agency/Subsystem Data Archive

Existing
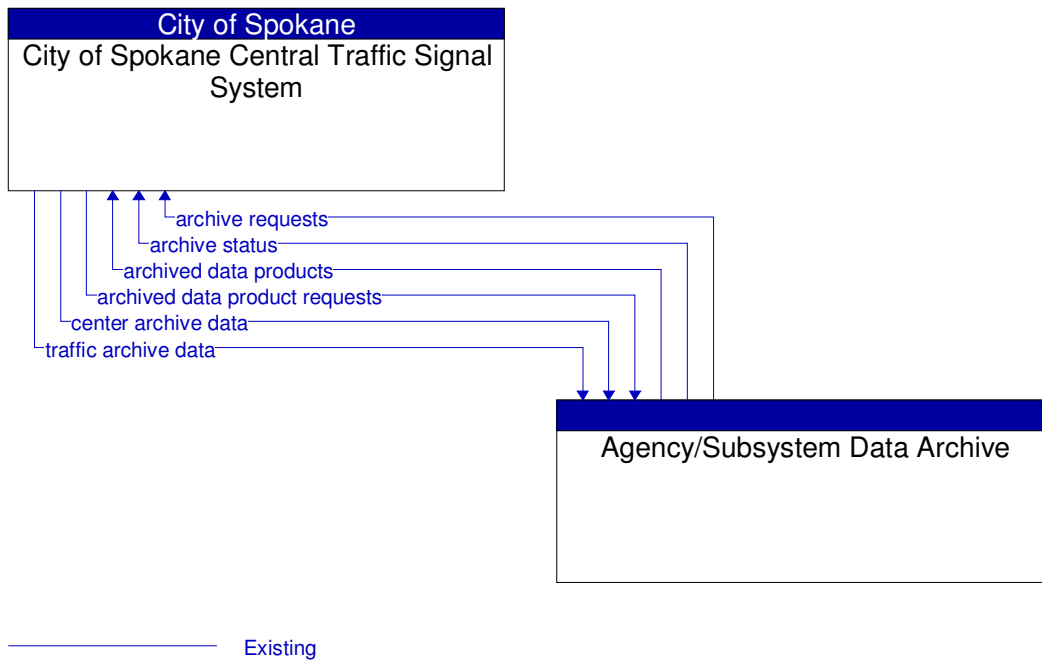
Figure 3: Agency/Subsystem Data Archive - City of Spokane Central Traffic Signal System Interface
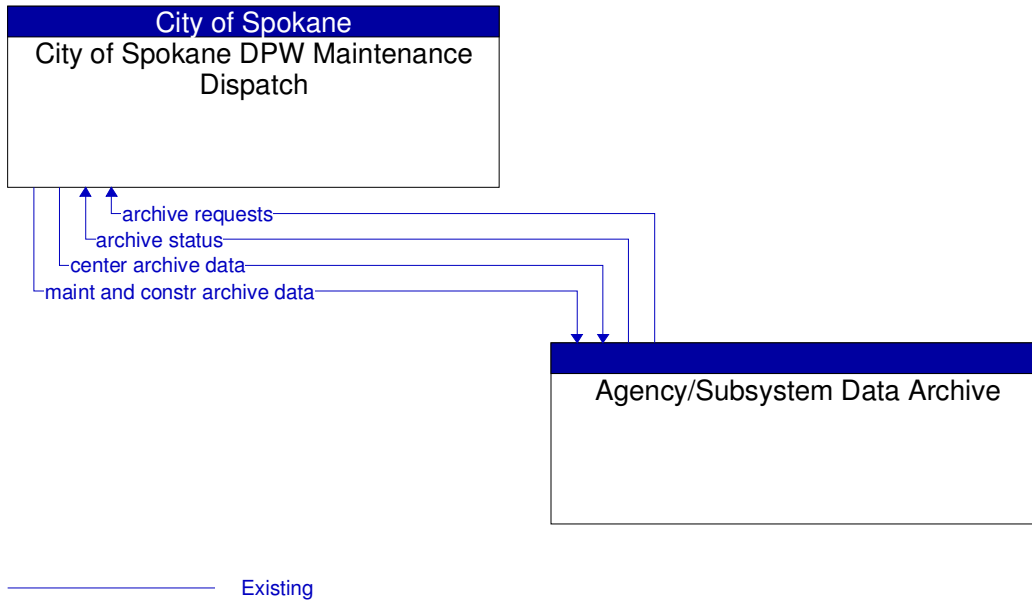
Figure 4: Agency/Subsystem Data Archive - City of Spokane DPW Maintenance Dispatch Interface
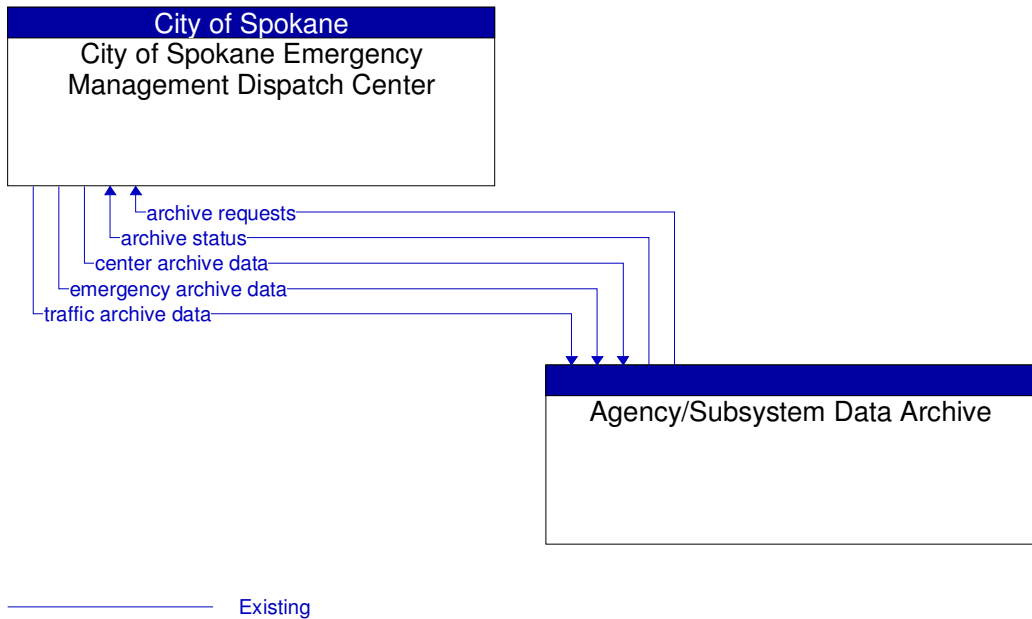
Figure 5: Agency/Subsystem Data Archive - City of Spokane Emergency Management Dispatch Center Interface
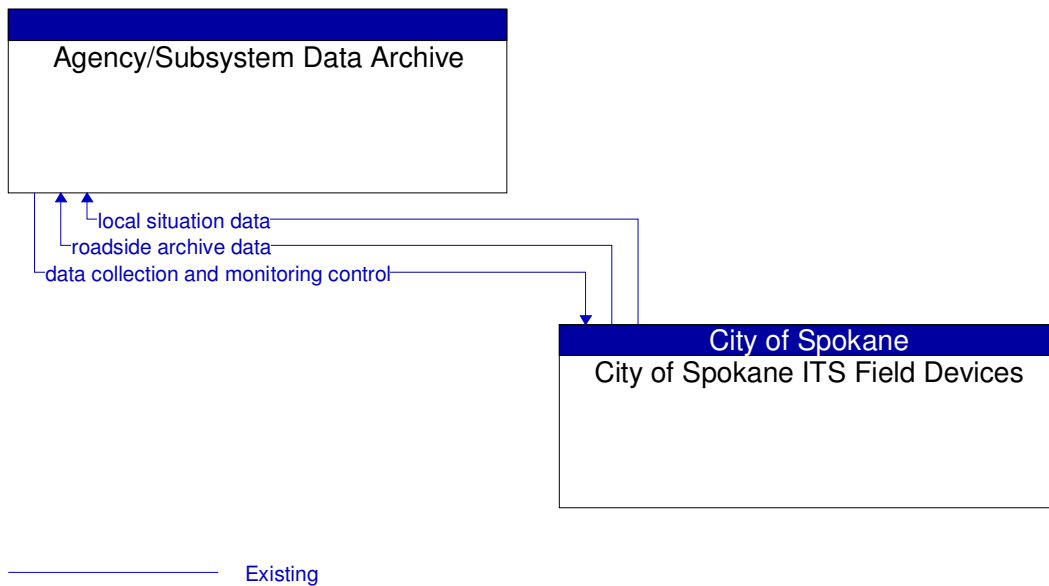
Figure 6: Agency/Subsystem Data Archive - City of Spokane ITS Field Devices Interface
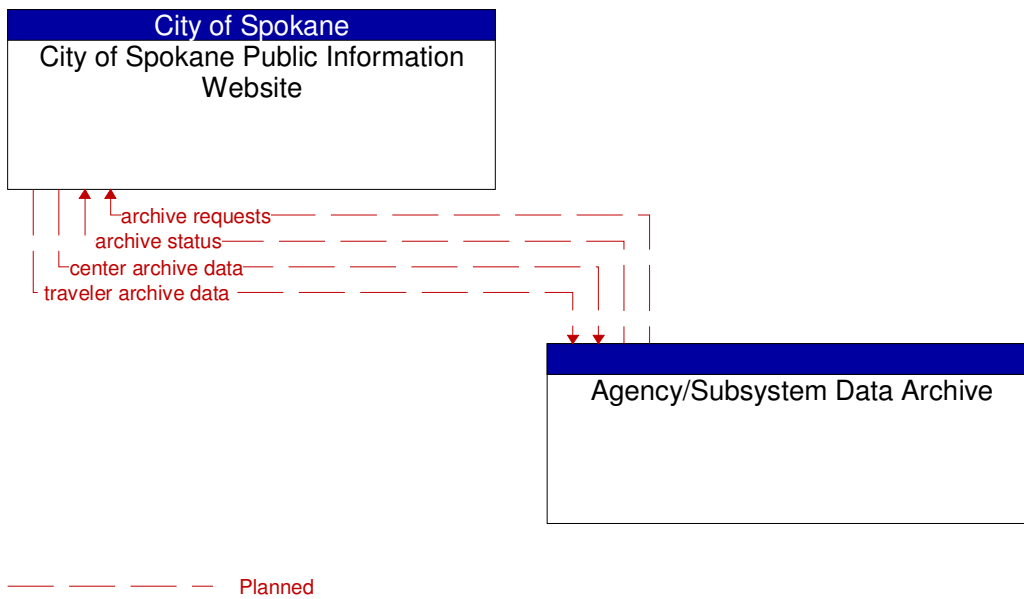
Figure 7: Agency/Subsystem Data Archive - City of Spokane Public Information Website Interface
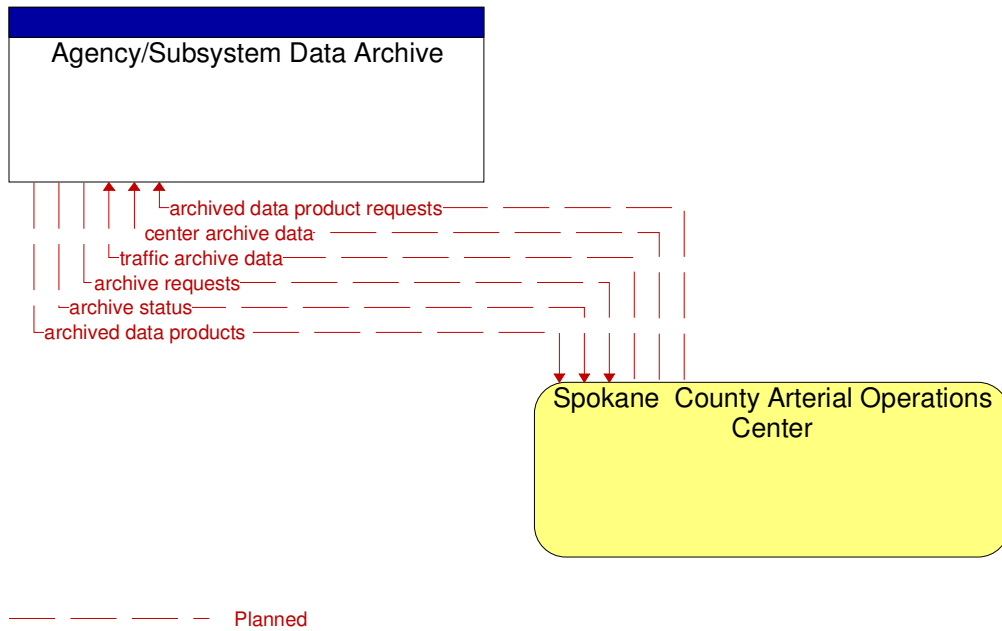
Figure 8: Agency/Subsystem Data Archive - Spokane County Arterial Operations Center Interface
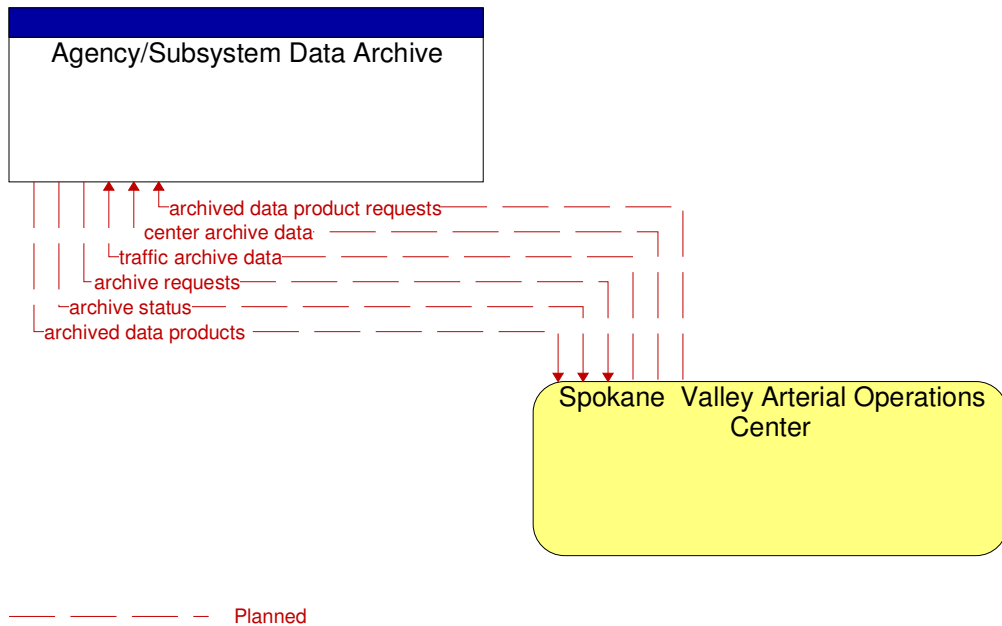
Figure 9: Agency/Subsystem Data Archive - Spokane Valley Arterial Operations Center Interface
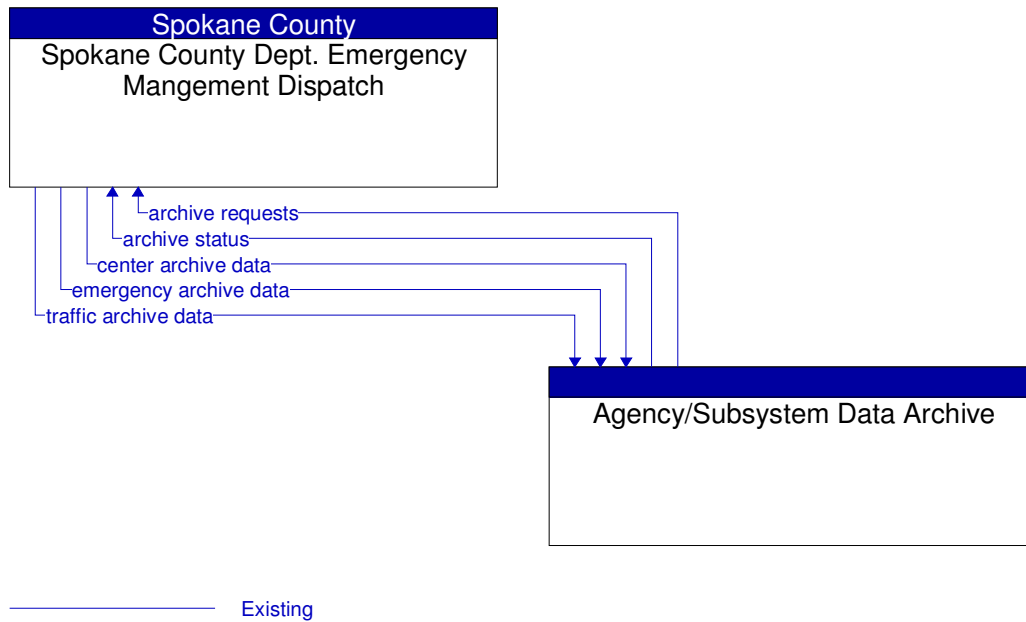
Figure 10: Agency/Subsystem Data Archive - Spokane County Dept. Emergency Mangement Dispatch Interface
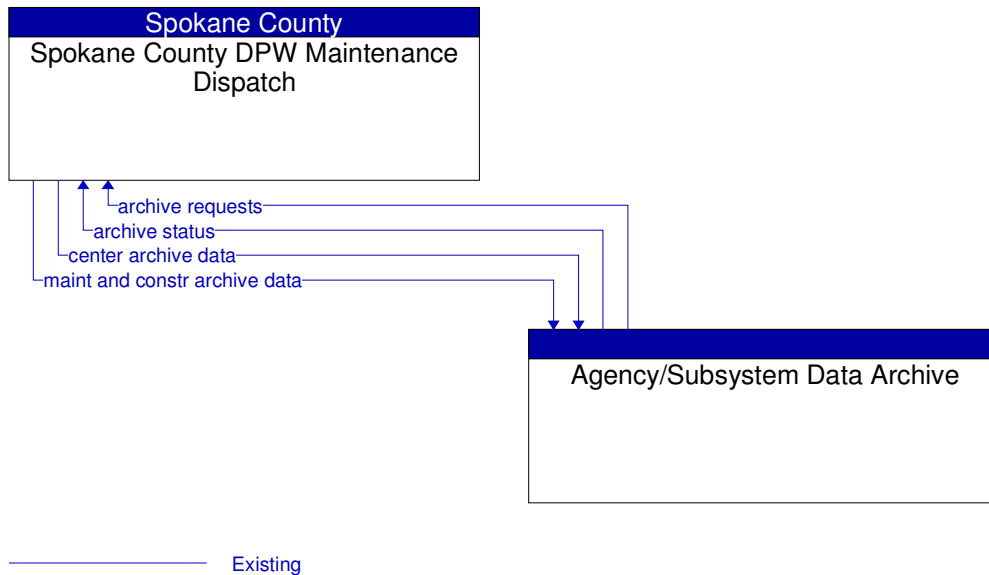
Figure 11: Agency/Subsystem Data Archive - Spokane County DPW Maintenance Dispatch Interface
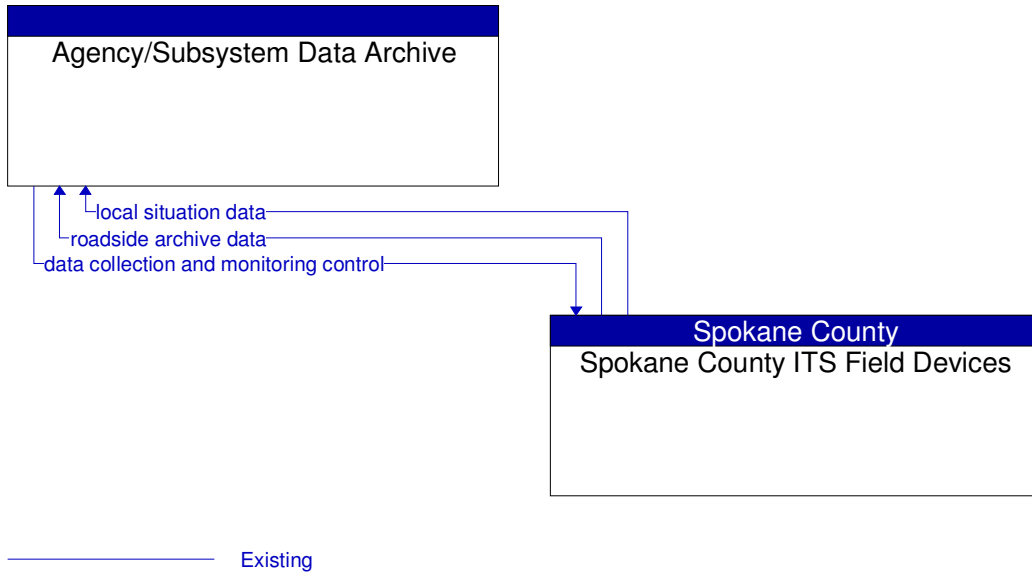
Figure 12: Agency/Subsystem Data Archive - Spokane County ITS Field Devices Interface
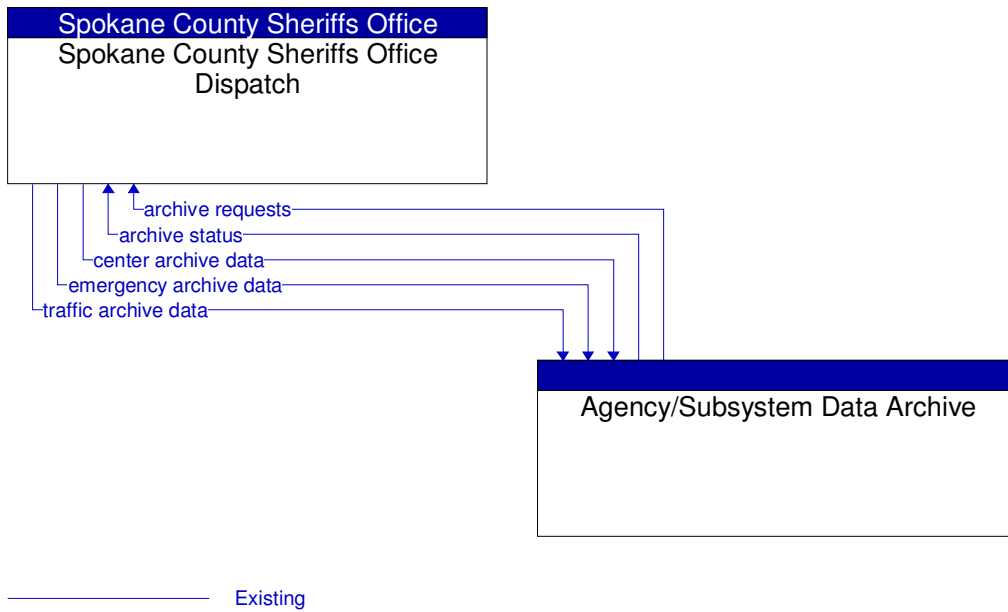
Figure 13: Agency/Subsystem Data Archive - Spokane County Sheriffs Office Dispatch Interface
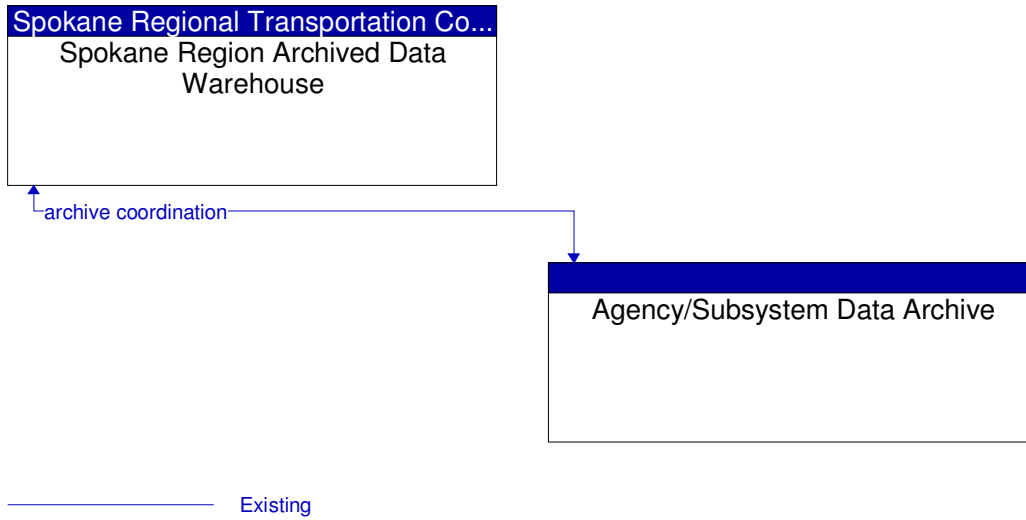
Figure 14: Agency/Subsystem Data Archive - Spokane Region Archived Data Warehouse Interface
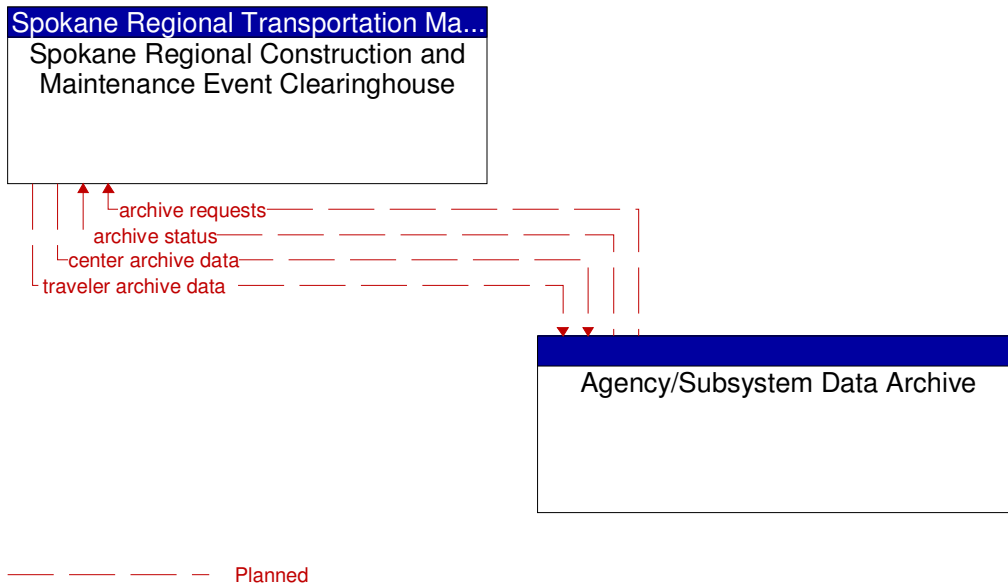
Figure 15: Agency/Subsystem Data Archive - Spokane Regional Construction and Maintenance Event Clearinghouse Interface

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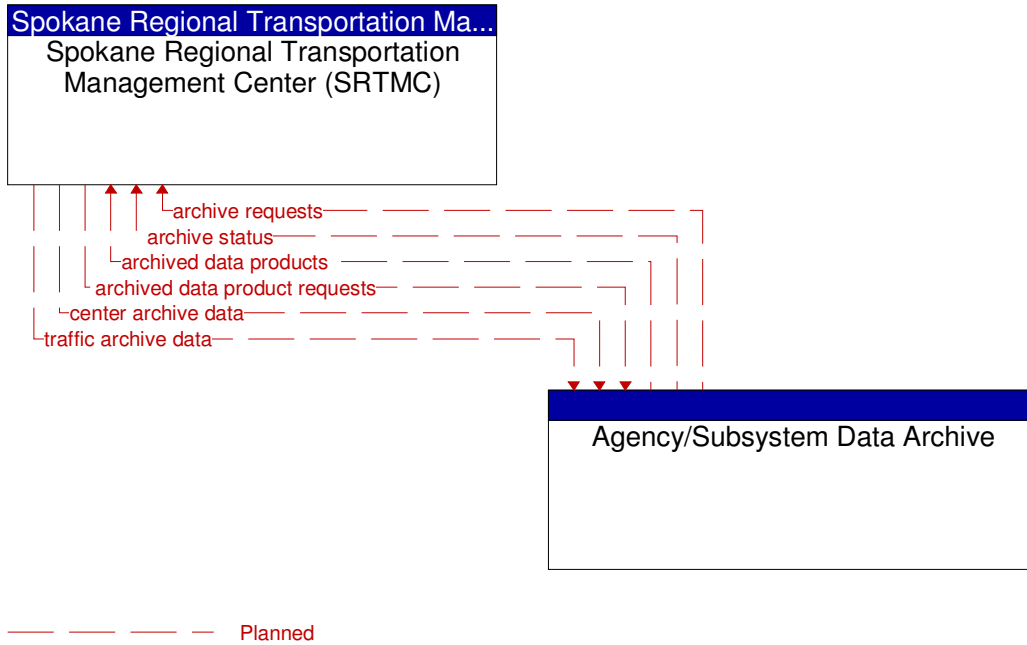
Figure 16: Agency/Subsystem Data Archive - Spokane Regional Transportation Management Center (SRTMC) Interface
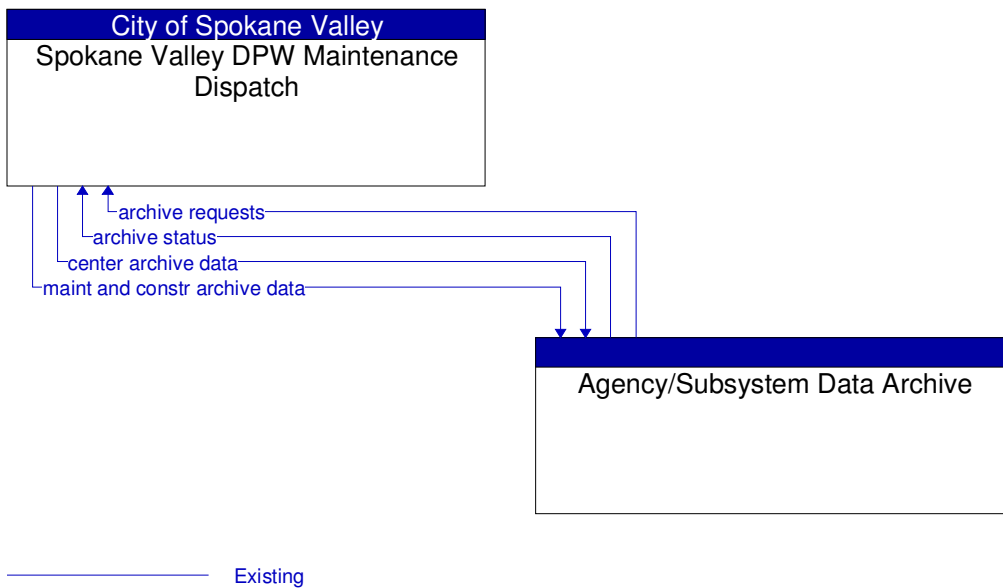
Figure 17: Agency/Subsystem Data Archive - Spokane Valley DPW Maintenance Dispatch Interface
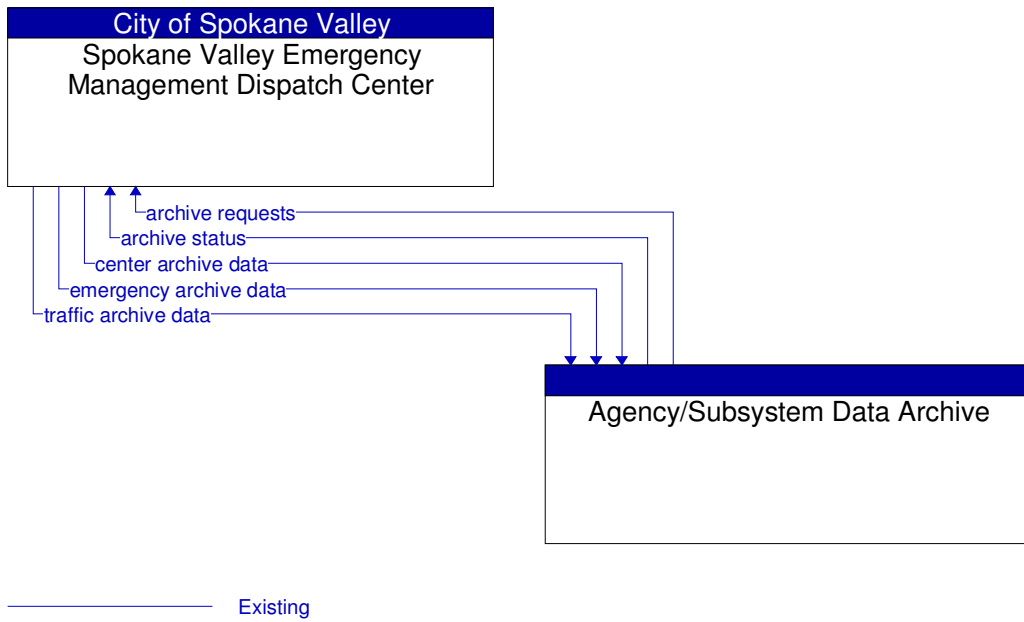
Figure 18: Agency/Subsystem Data Archive - Spokane Valley Emergency Management Dispatch Center Interface
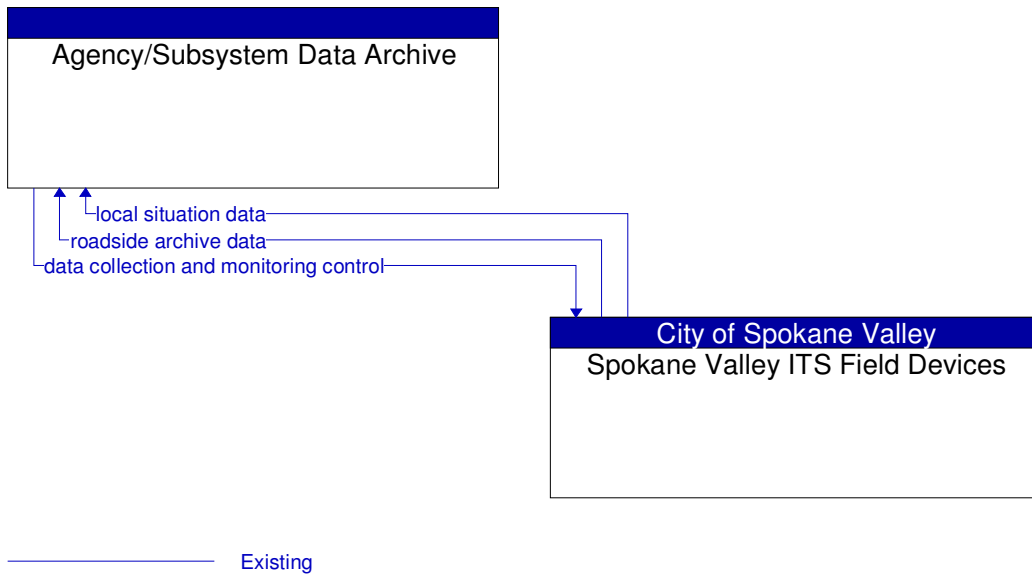
Figure 19: Agency/Subsystem Data Archive - Spokane Valley ITS Field Devices Interface

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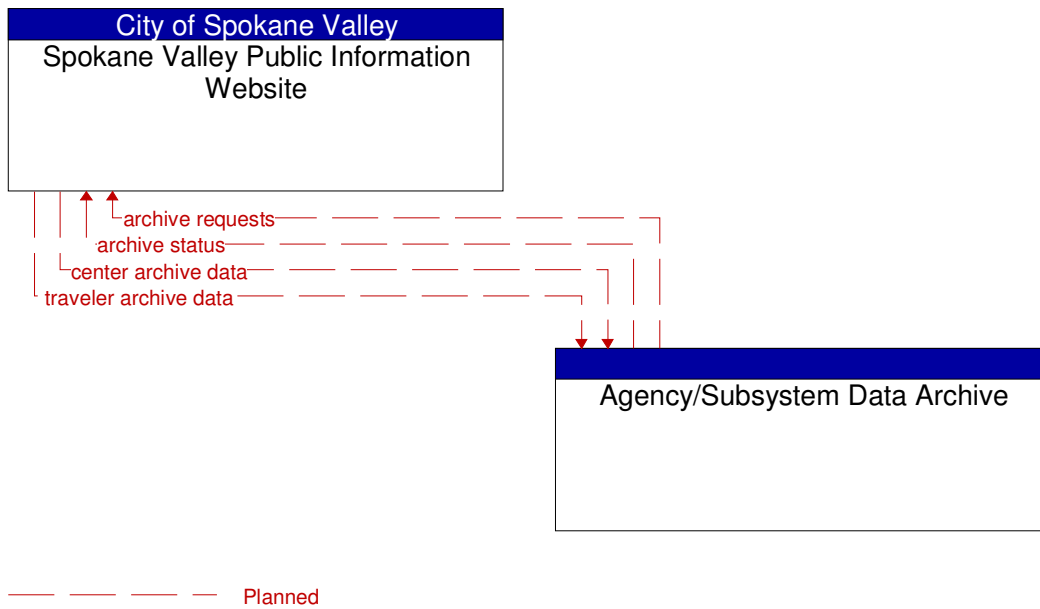
Figure 20: Agency/Subsystem Data Archive - Spokane Valley Public Information Website Interface
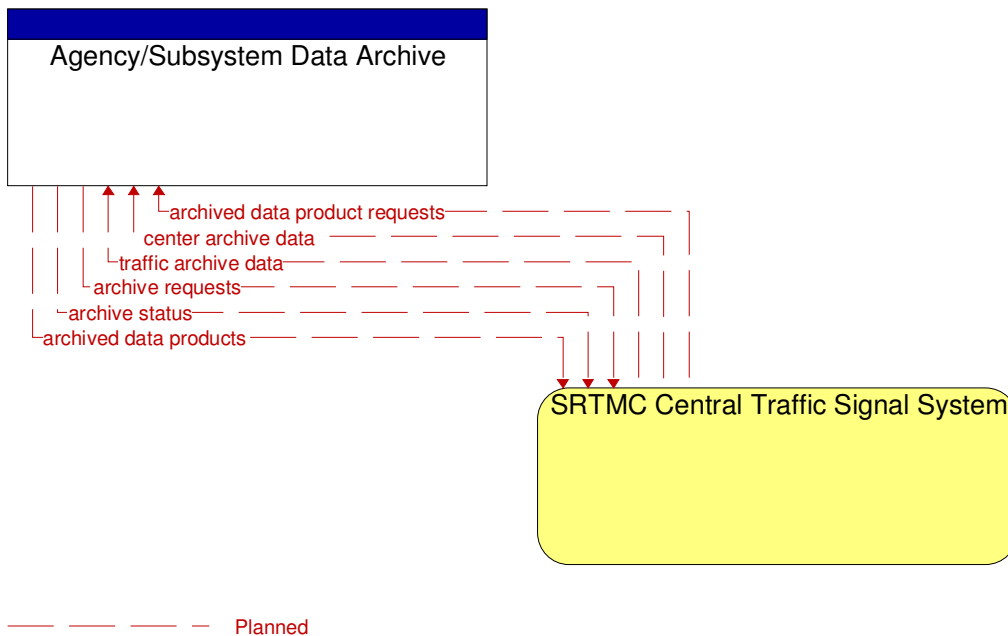
Figure 21: Agency/Subsystem Data Archive - SRTMC Central Traffic Signal System Interface
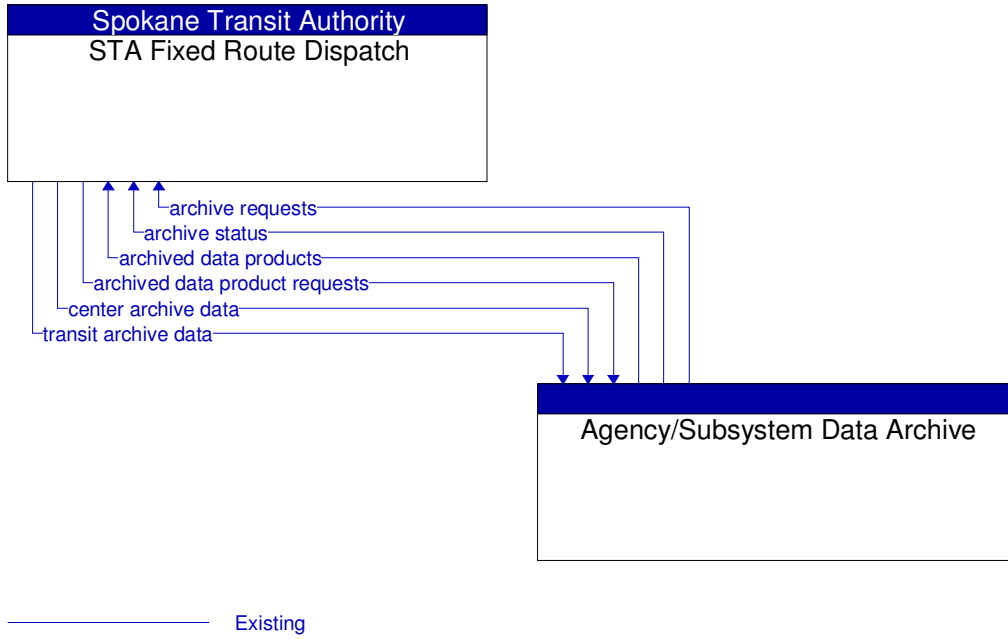
Figure 22: Agency/Subsystem Data Archive - STA Fixed Route Dispatch Interface
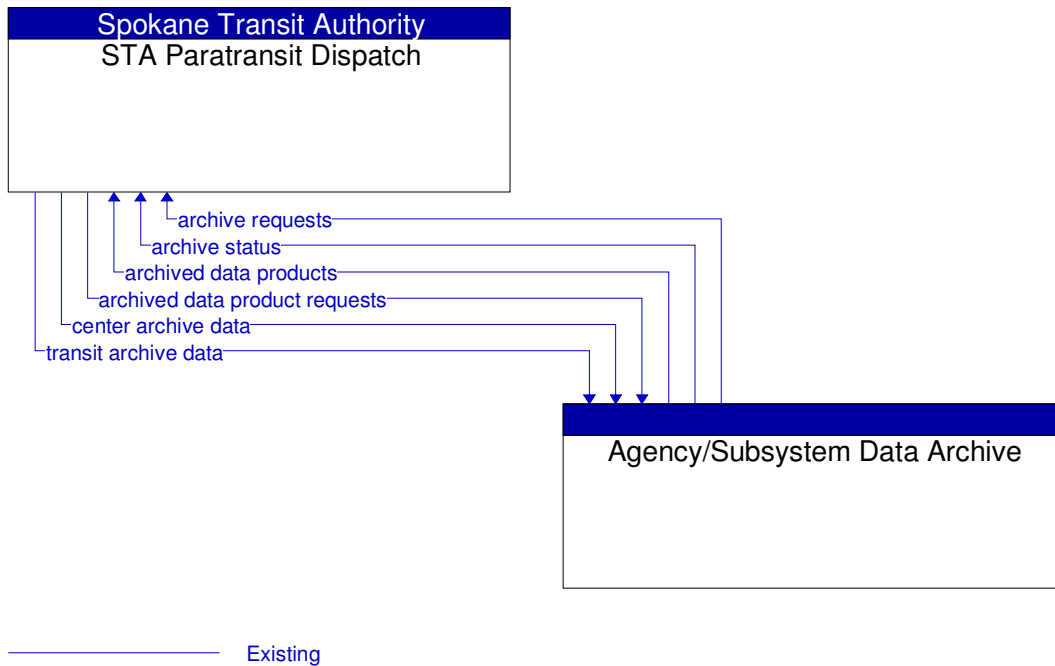
Figure 23: Agency/Subsystem Data Archive - STA Paratransit Dispatch Interface
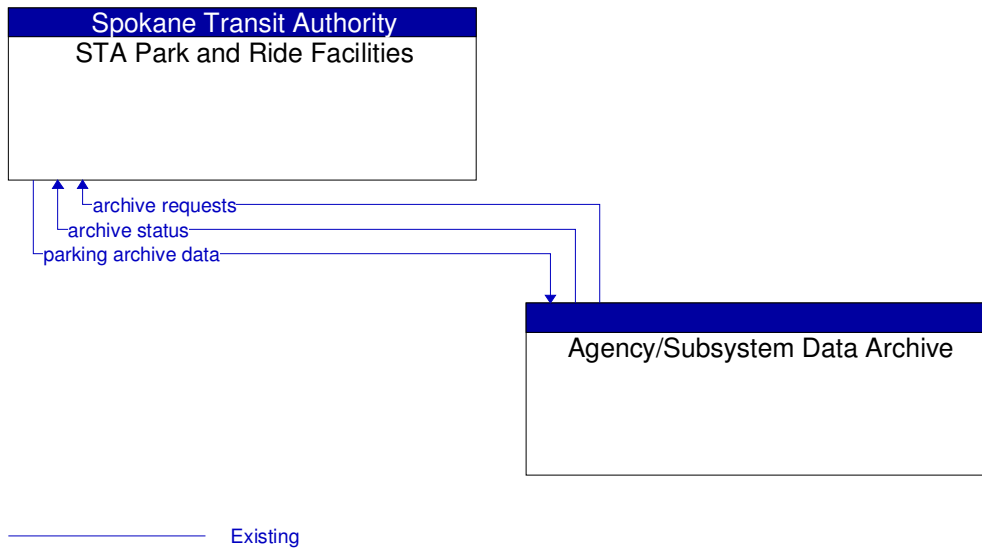
Figure 24: Agency/Subsystem Data Archive - STA Park and Ride Facilities Interface
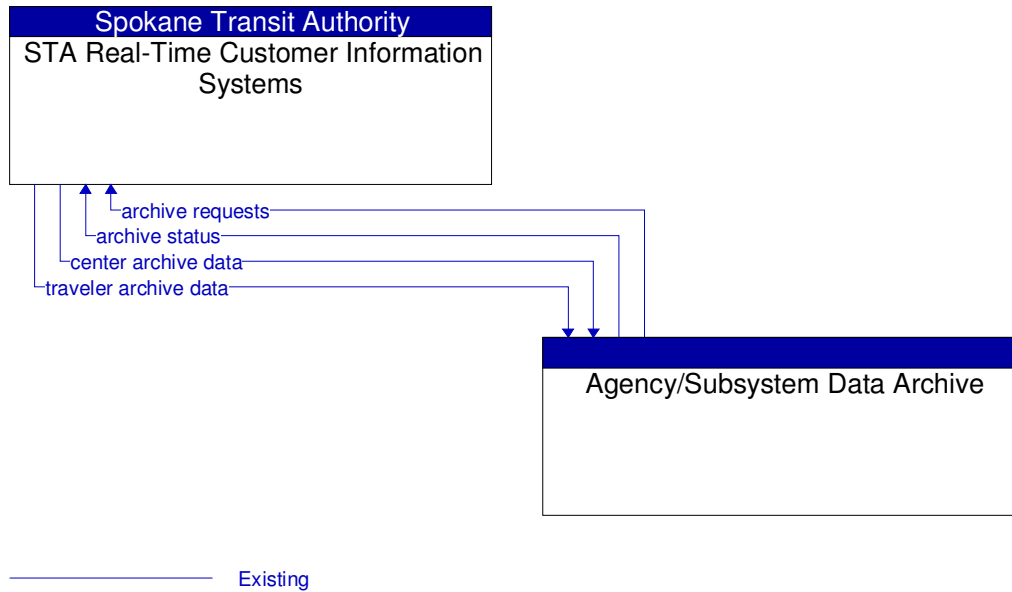
Figure 25: Agency/Subsystem Data Archive - STA Real-Time Customer Information Systems Interface
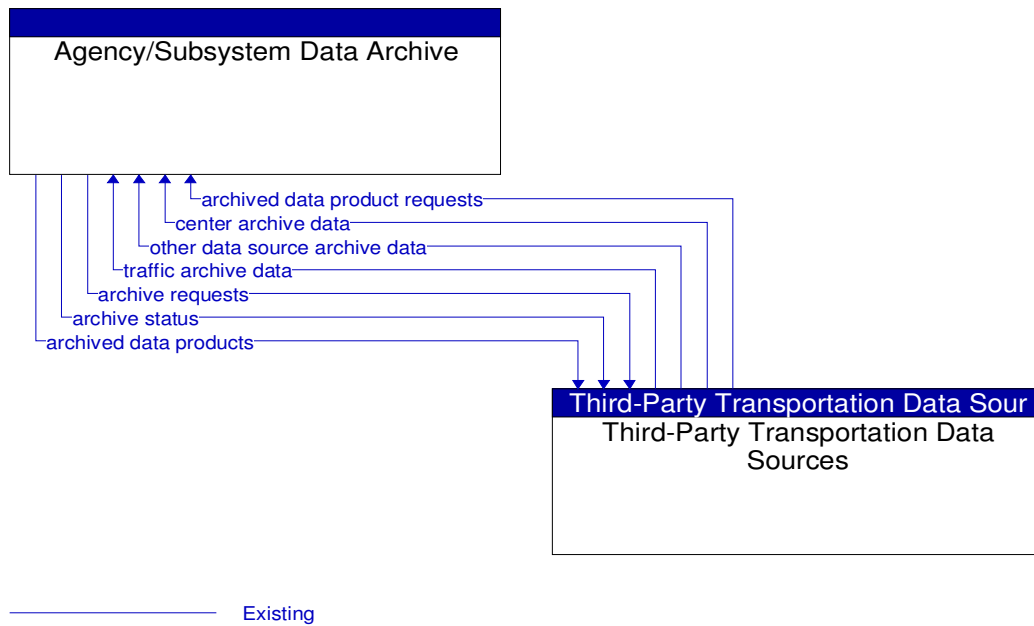
Figure 26: Agency/Subsystem Data Archive - Third-Party Transportation Data Sources Interface
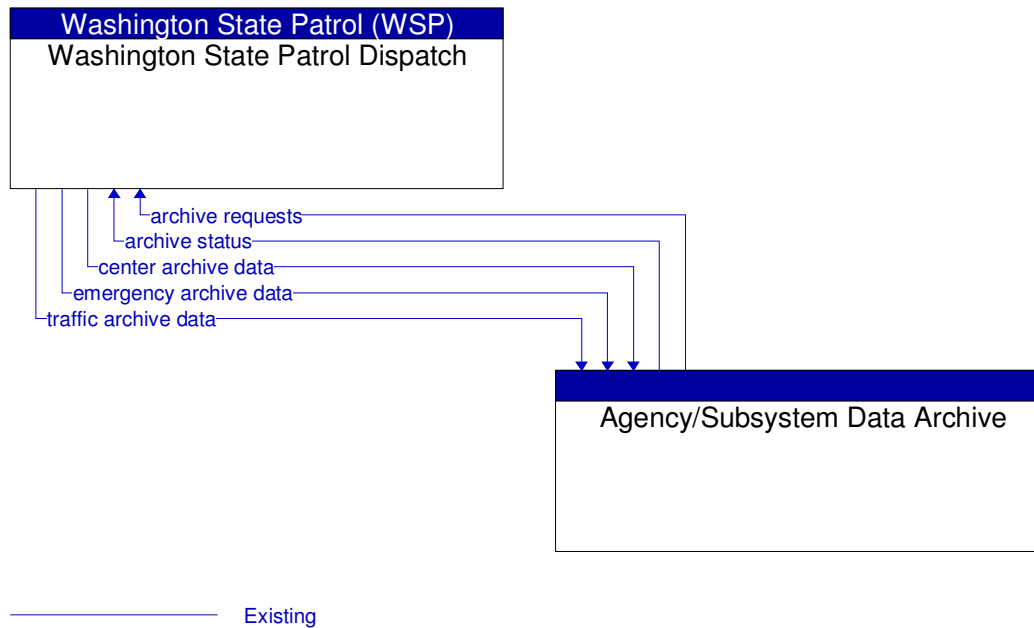
Figure 27: Agency/Subsystem Data Archive - Washington State Patrol Dispatch Interface
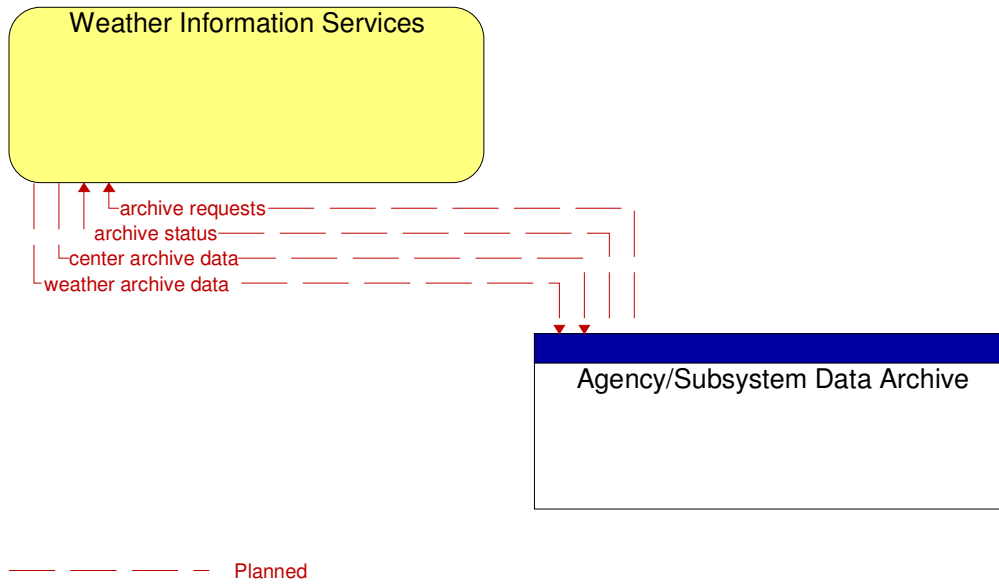
Figure 28: Agency/Subsystem Data Archive - Weather Information Services Interface
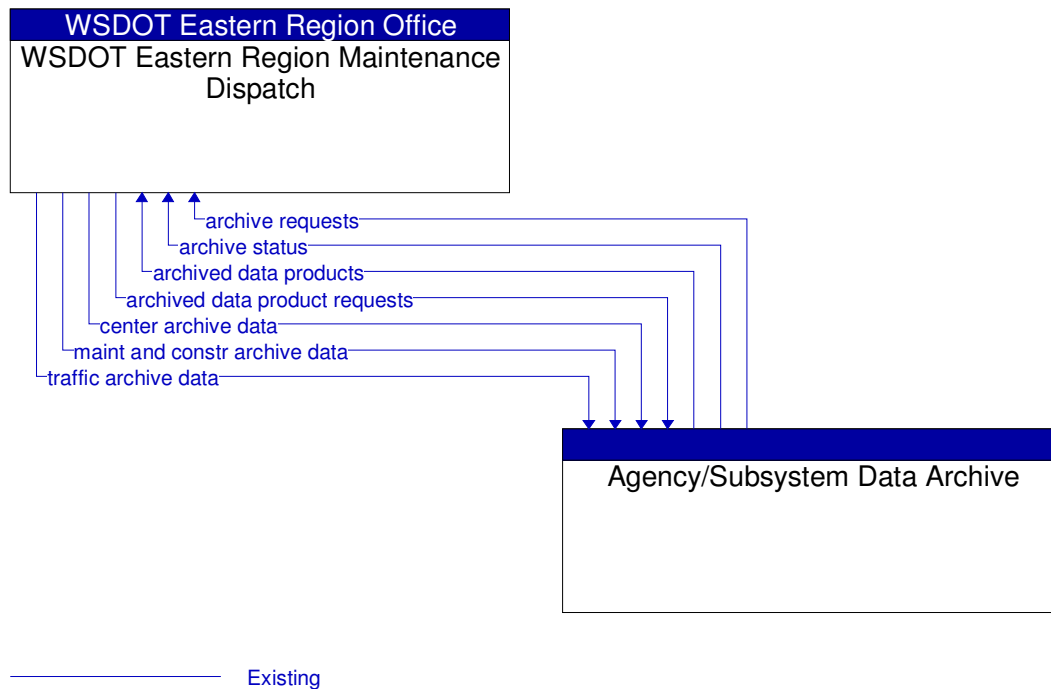
Figure 29: Agency/Subsystem Data Archive - WSDOT Eastern Region Maintenance Dispatch Interface
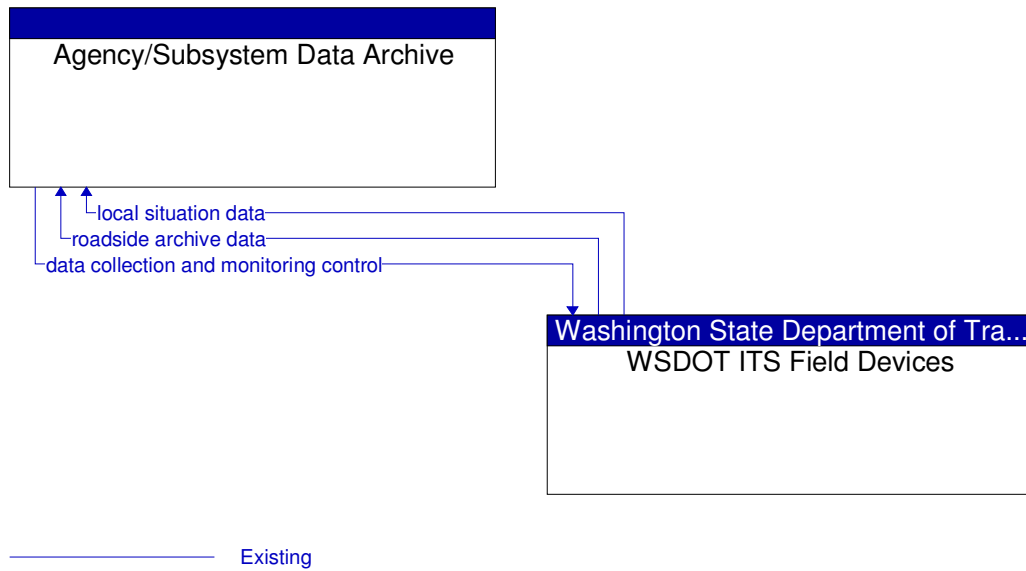
Figure 30: Agency/Subsystem Data Archive - WSDOT ITS Field Devices Interface
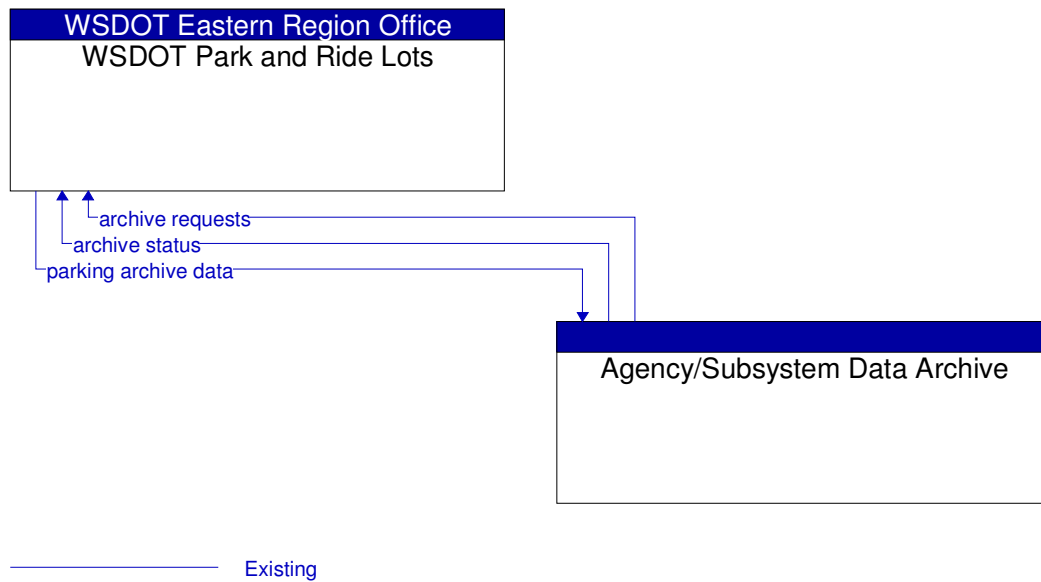
Figure 31: Agency/Subsystem Data Archive - WSDOT Park and Ride Lots Interface
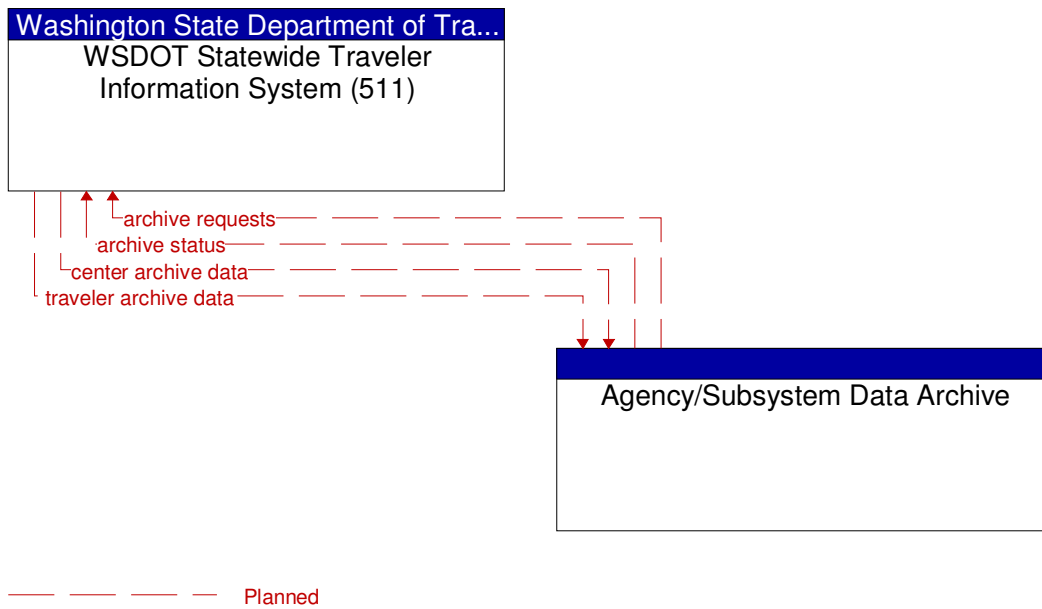
Figure 32: Agency/Subsystem Data Archive - WSDOT Statewide Traveler Information System (511) Interface
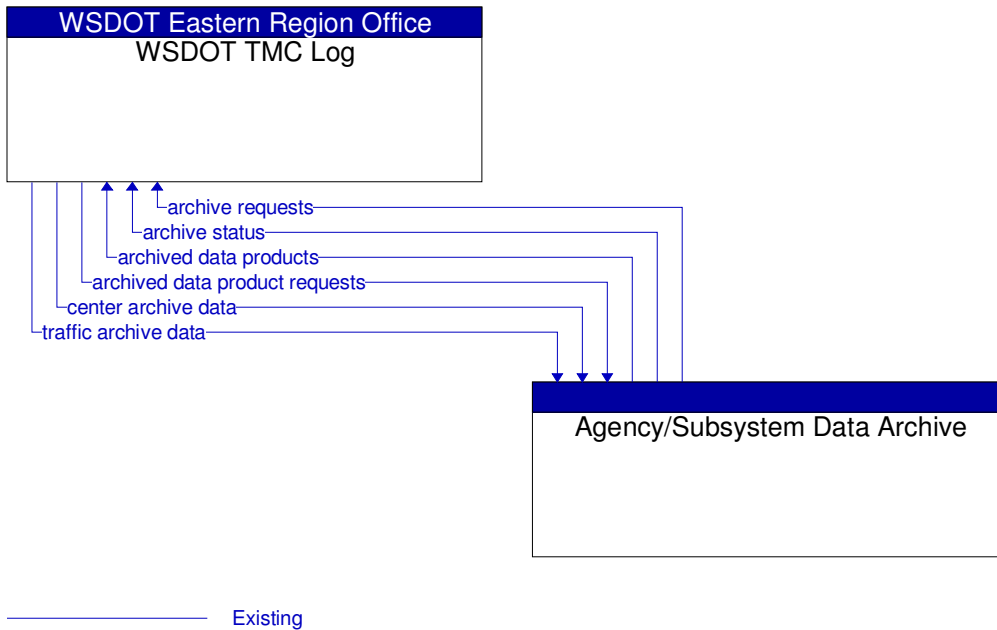
Figure 33: Agency/Subsystem Data Archive - WSDOT TMC Log Interface
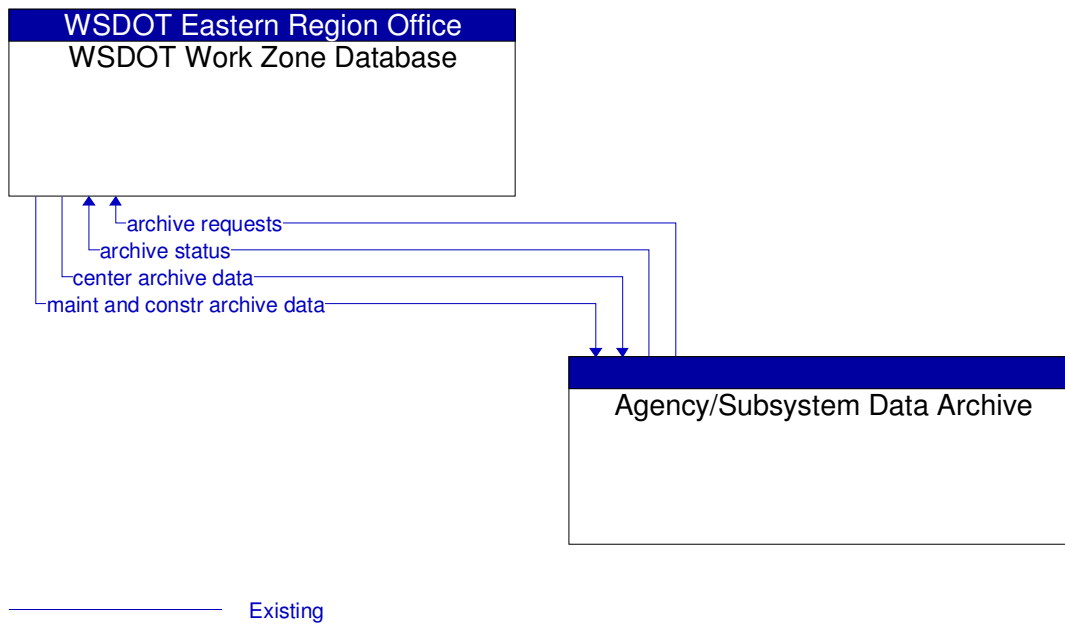
Figure 34: Agency/Subsystem Data Archive - WSDOT Work Zone Database Interface
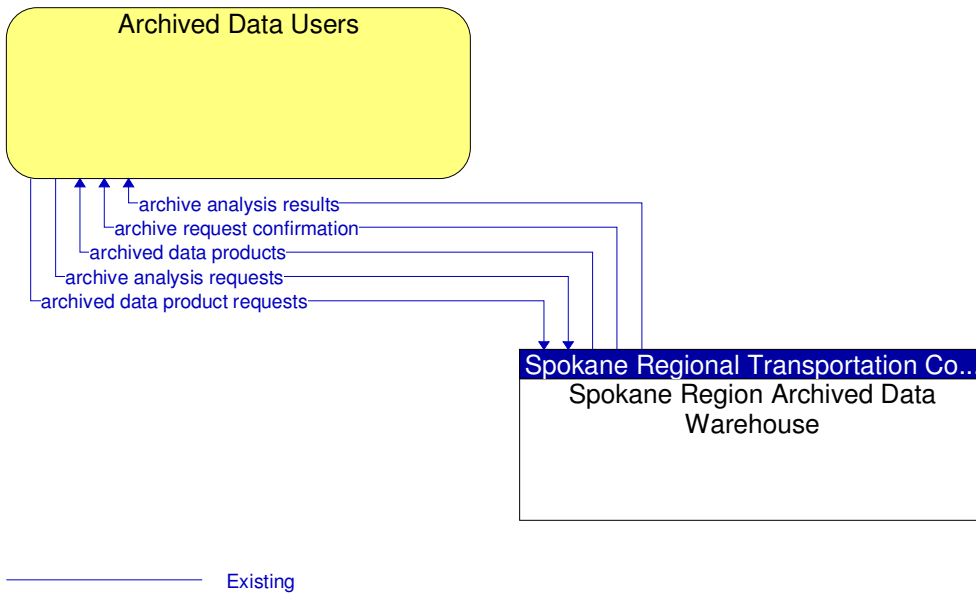
Figure 35: Archived Data Users - Spokane Region Archived Data Warehouse Interface
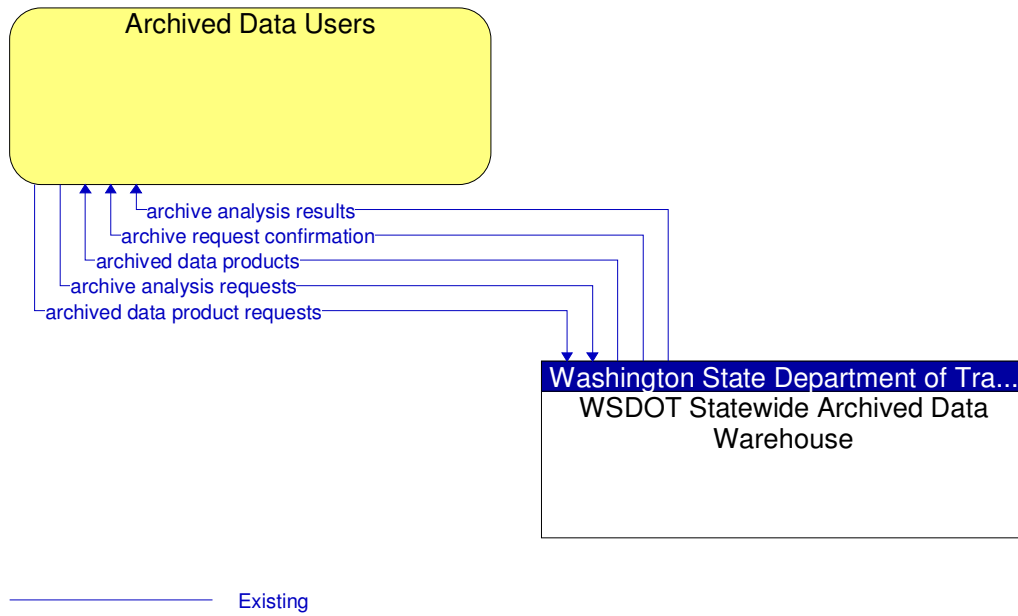
Figure 36: Archived Data Users - WSDOT Statewide Archived Data Warehouse Interface
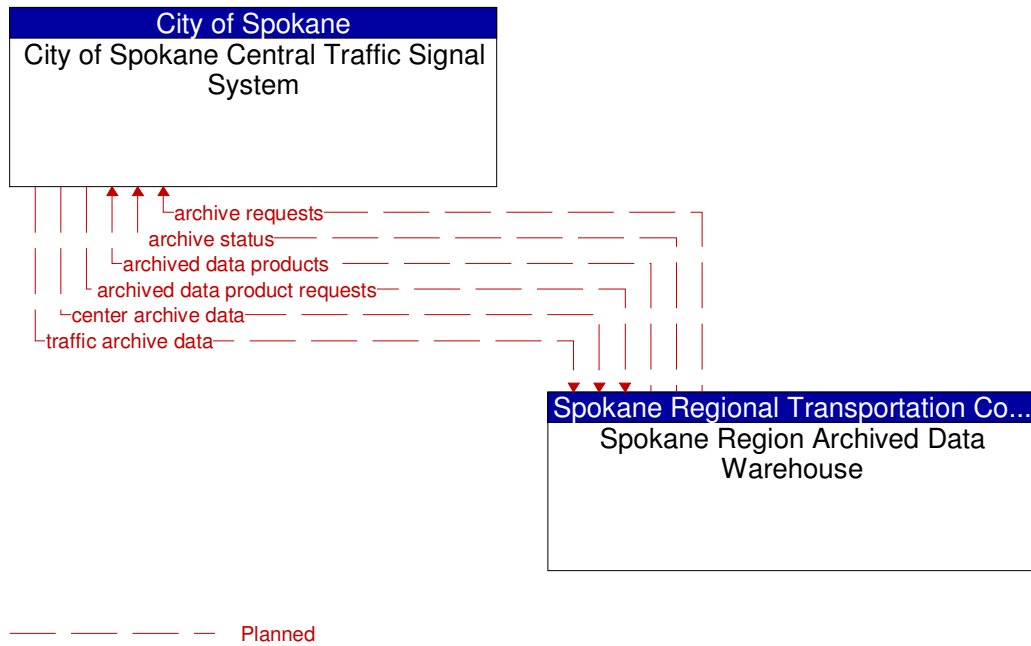
Figure 37: City of Spokane Central Traffic Signal System - Spokane Region Archived Data Warehouse Interface

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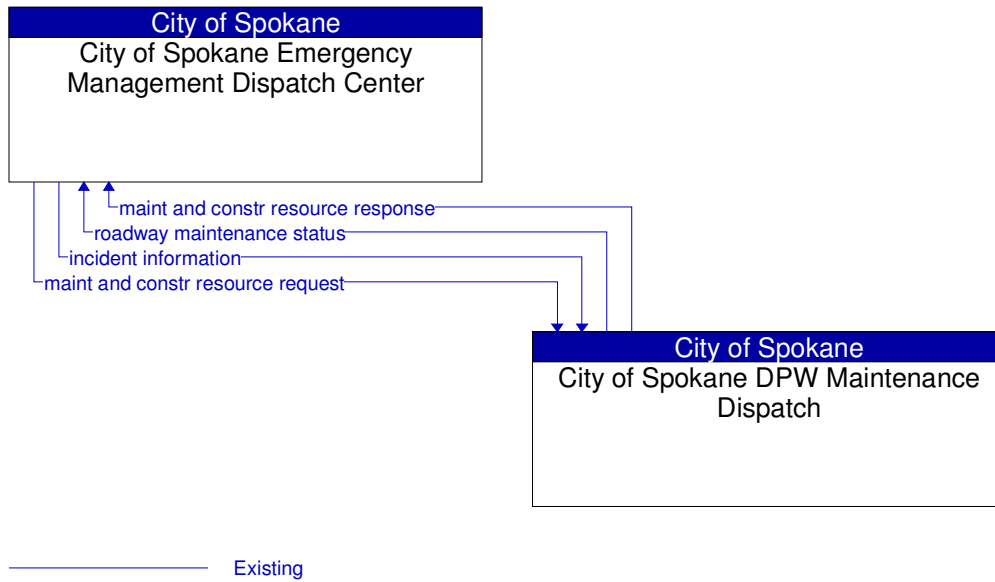
Figure 38: City of Spokane DPW Maintenance Dispatch - City of Spokane Emergency Management Dispatch Center Interface
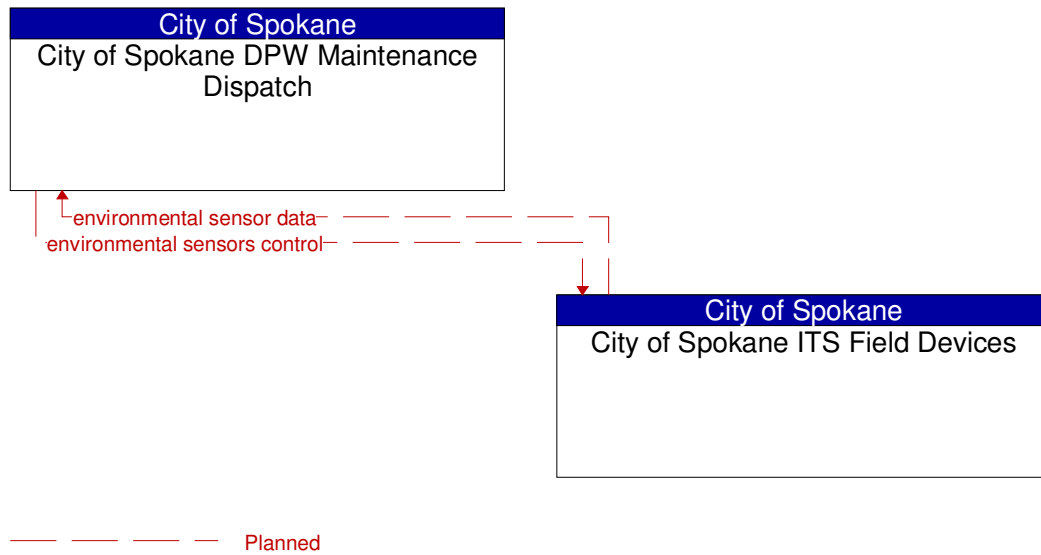
Figure 39: City of Spokane DPW Maintenance Dispatch - City of Spokane ITS Field Devices Interface
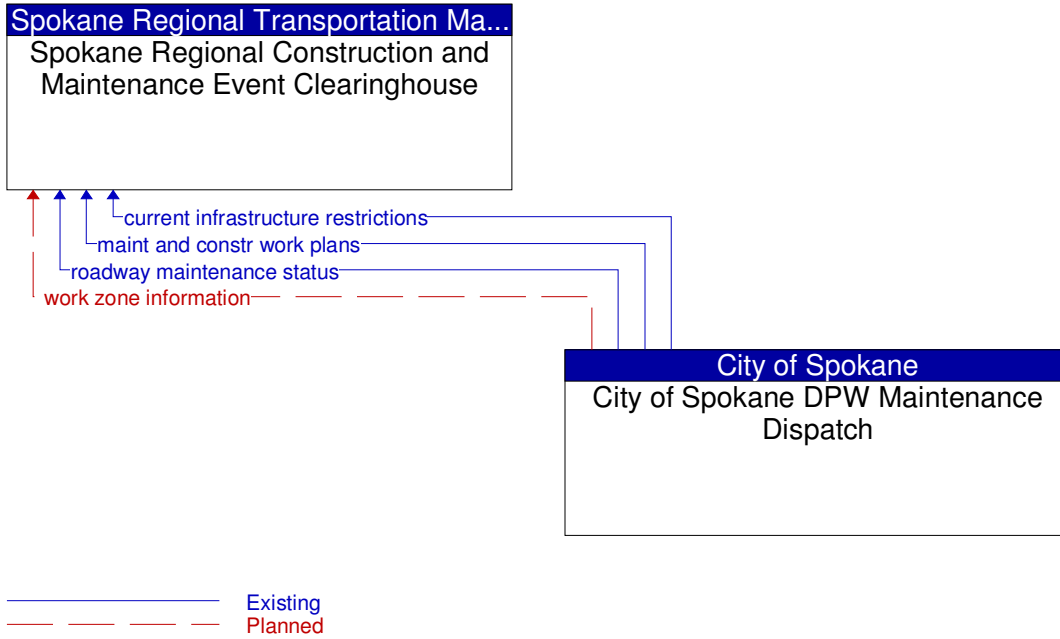
Figure 40: City of Spokane DPW Maintenance Dispatch - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
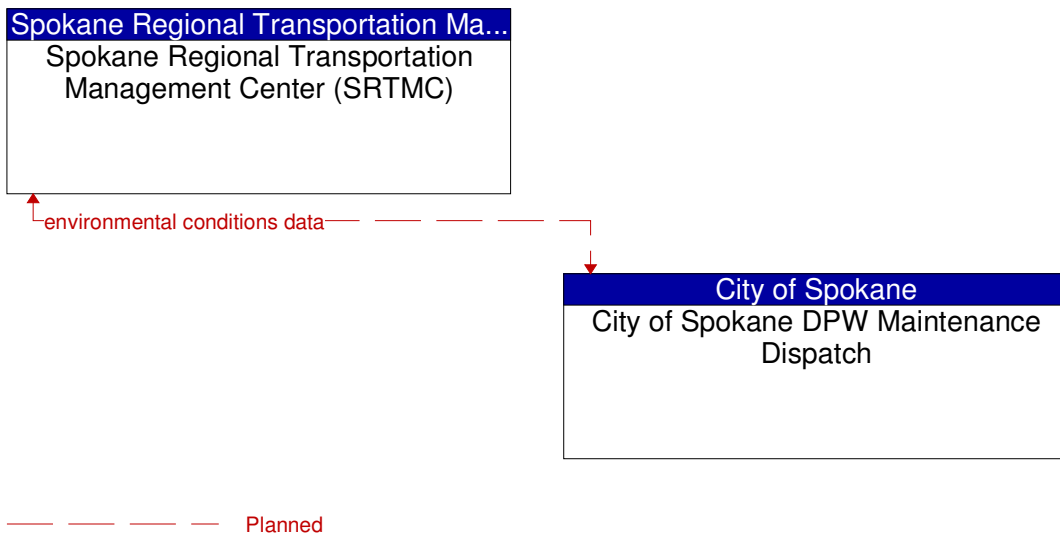
Figure 41: City of Spokane DPW Maintenance Dispatch - Spokane Regional Transportation Management Center (SRTMC) Interface
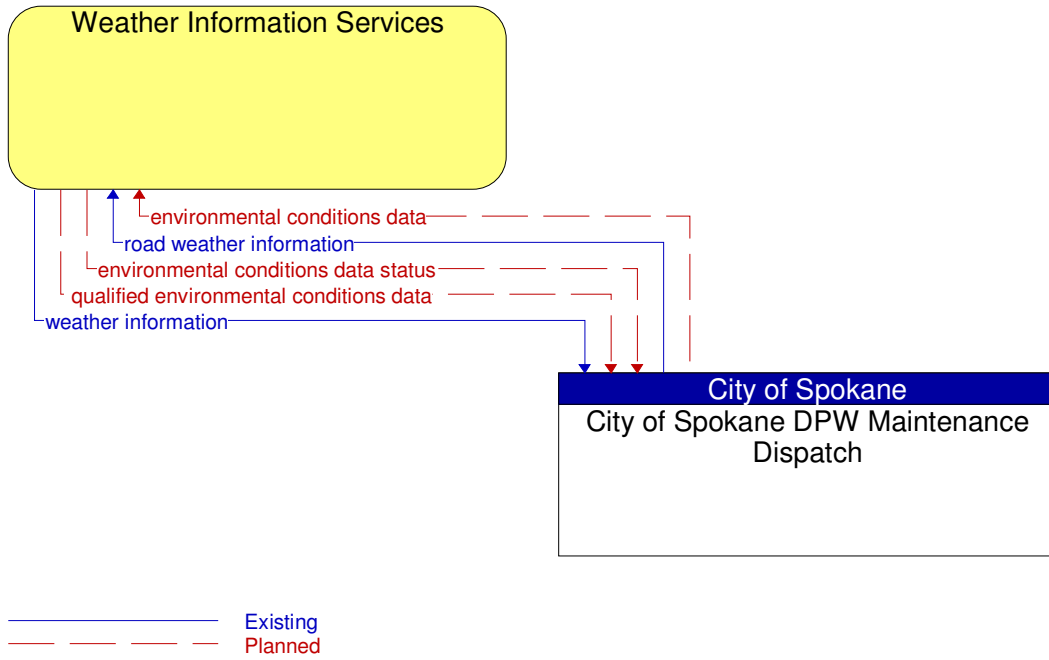
Figure 42: City of Spokane DPW Maintenance Dispatch - Weather Information Services Interface
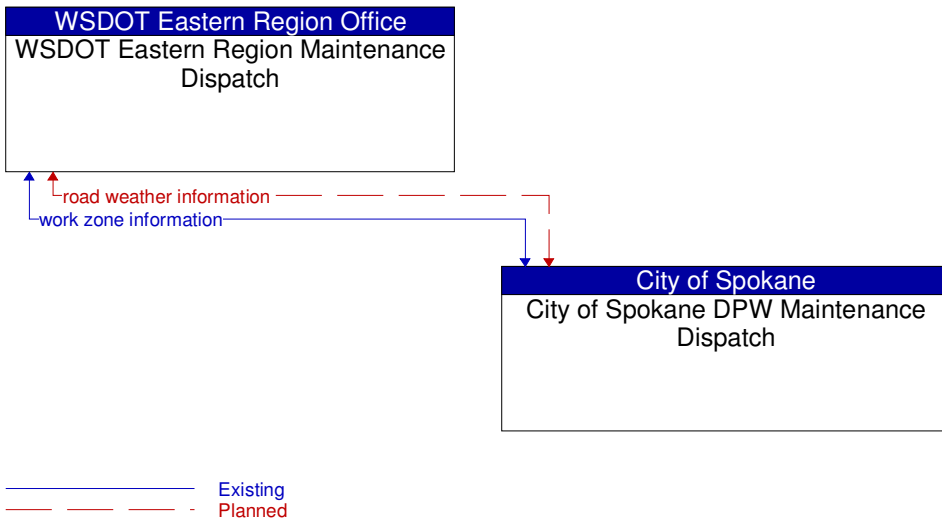
Figure 43: City of Spokane DPW Maintenance Dispatch - WSDOT Eastern Region Maintenance Dispatch Interface
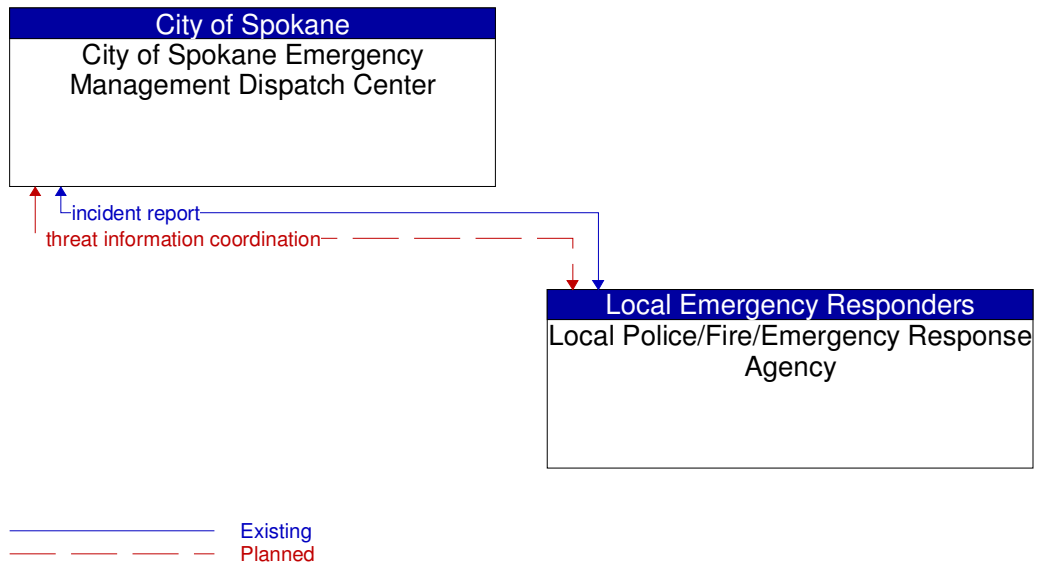
Figure 44: City of Spokane Emergency Management Dispatch Center - Local Police/Fire/Emergency Response Agency Interface
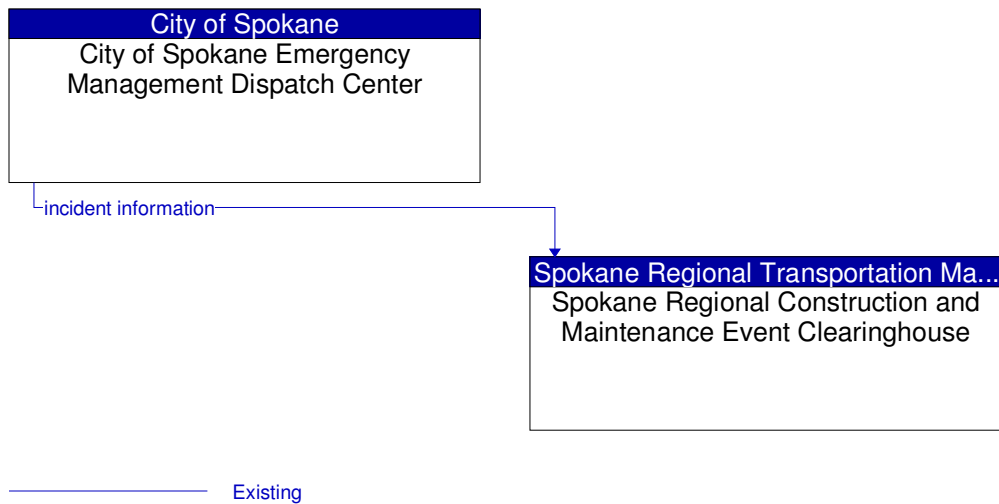
Figure 45: City of Spokane Emergency Management Dispatch Center - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
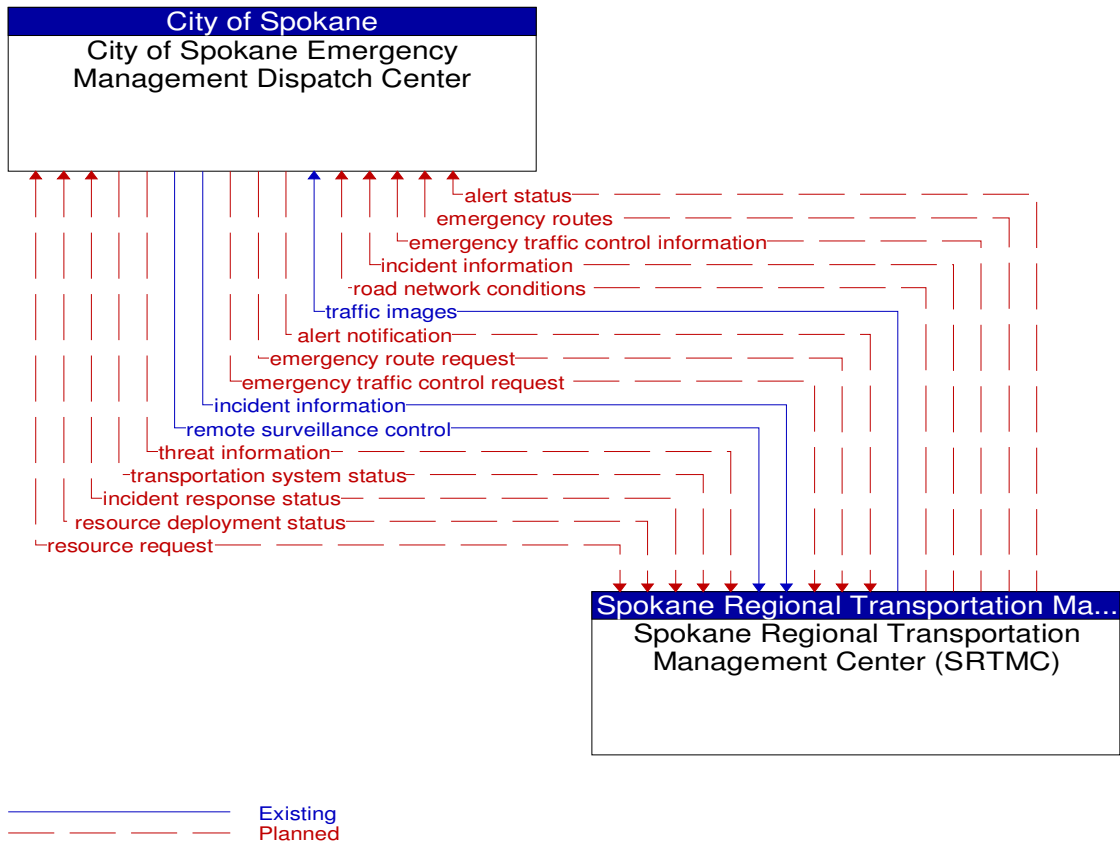
Figure 46: City of Spokane Emergency Management Dispatch Center - Spokane Regional Transportation Management Center (SRTMC) Interface
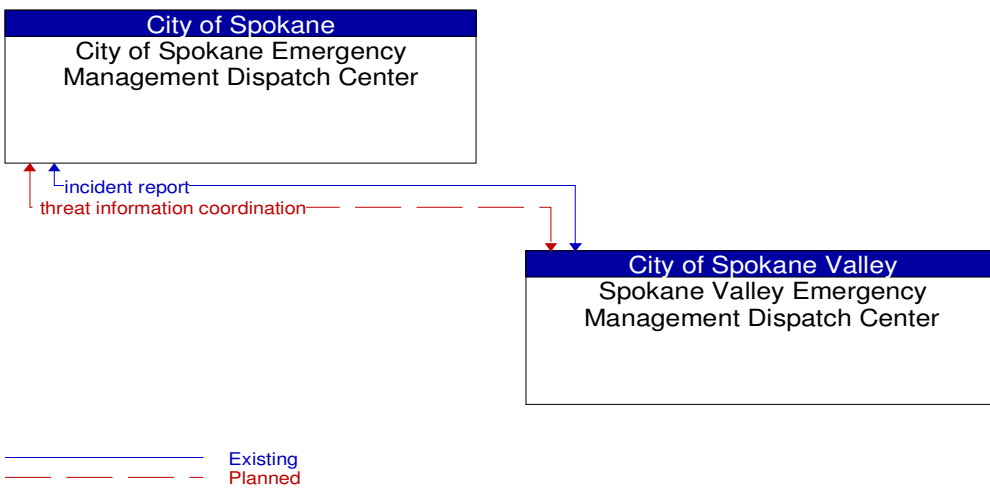
Figure 47: City of Spokane Emergency Management Dispatch Center - Spokane Valley Emergency Management Dispatch Center Interface
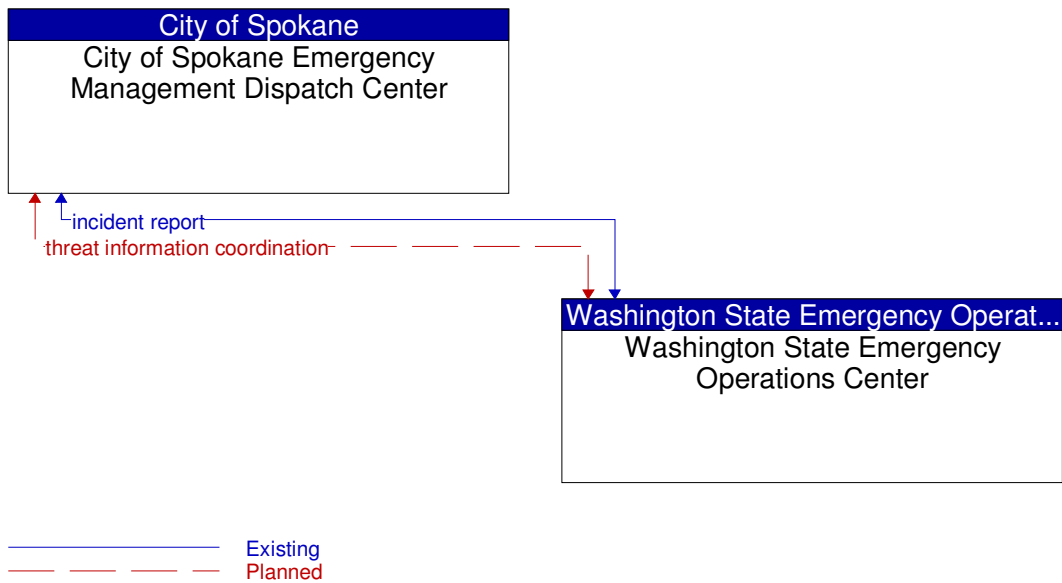
Figure 48: City of Spokane Emergency Management Dispatch Center - Washington State Emergency Operations Center Interface
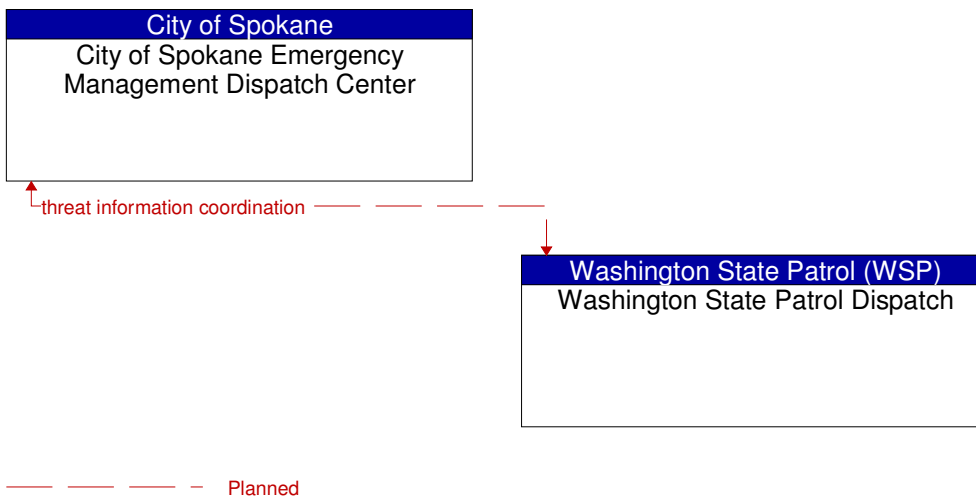
Figure 49: City of Spokane Emergency Management Dispatch Center - Washington State Patrol Dispatch Interface
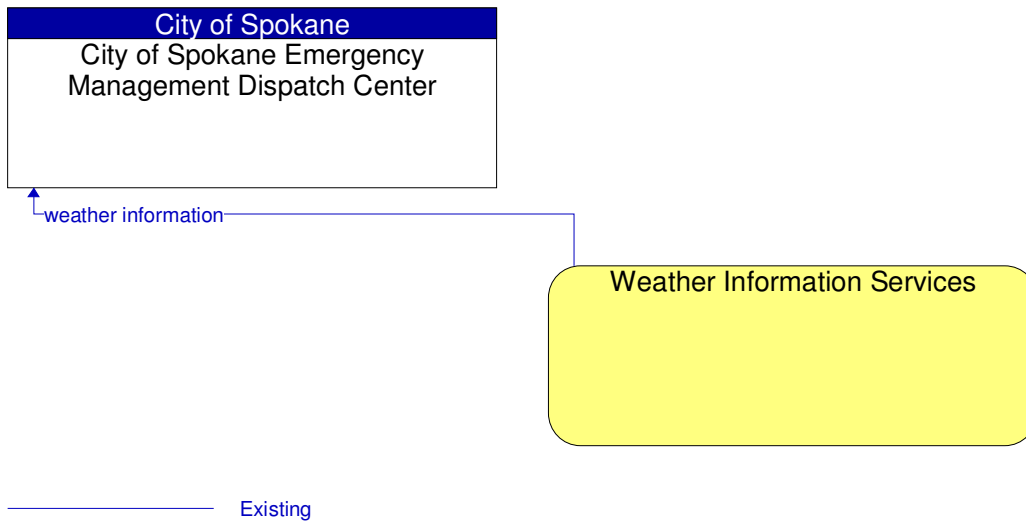
Figure 50: City of Spokane Emergency Management Dispatch Center - Weather Information Services Interface
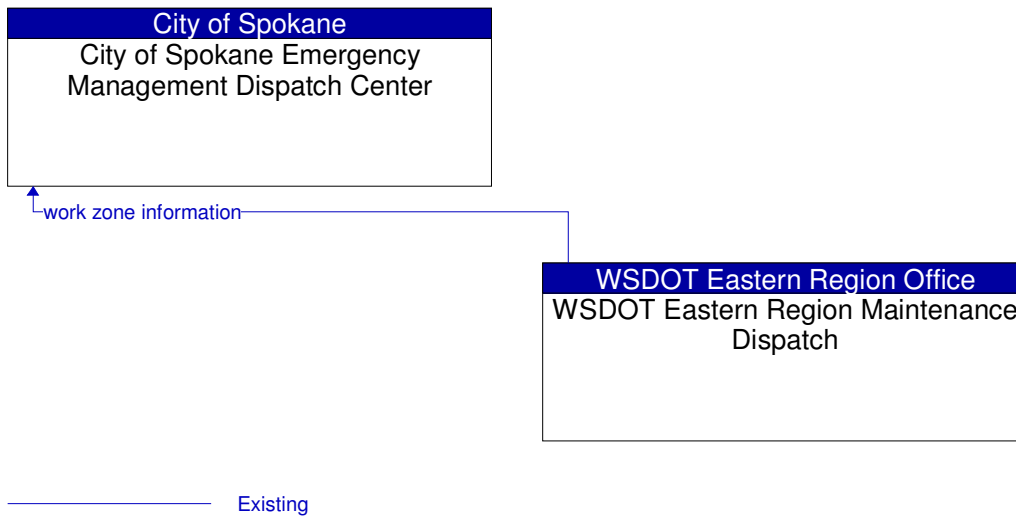
Figure 51: City of Spokane Emergency Management Dispatch Center - WSDOT Eastern Region Maintenance Dispatch Interface
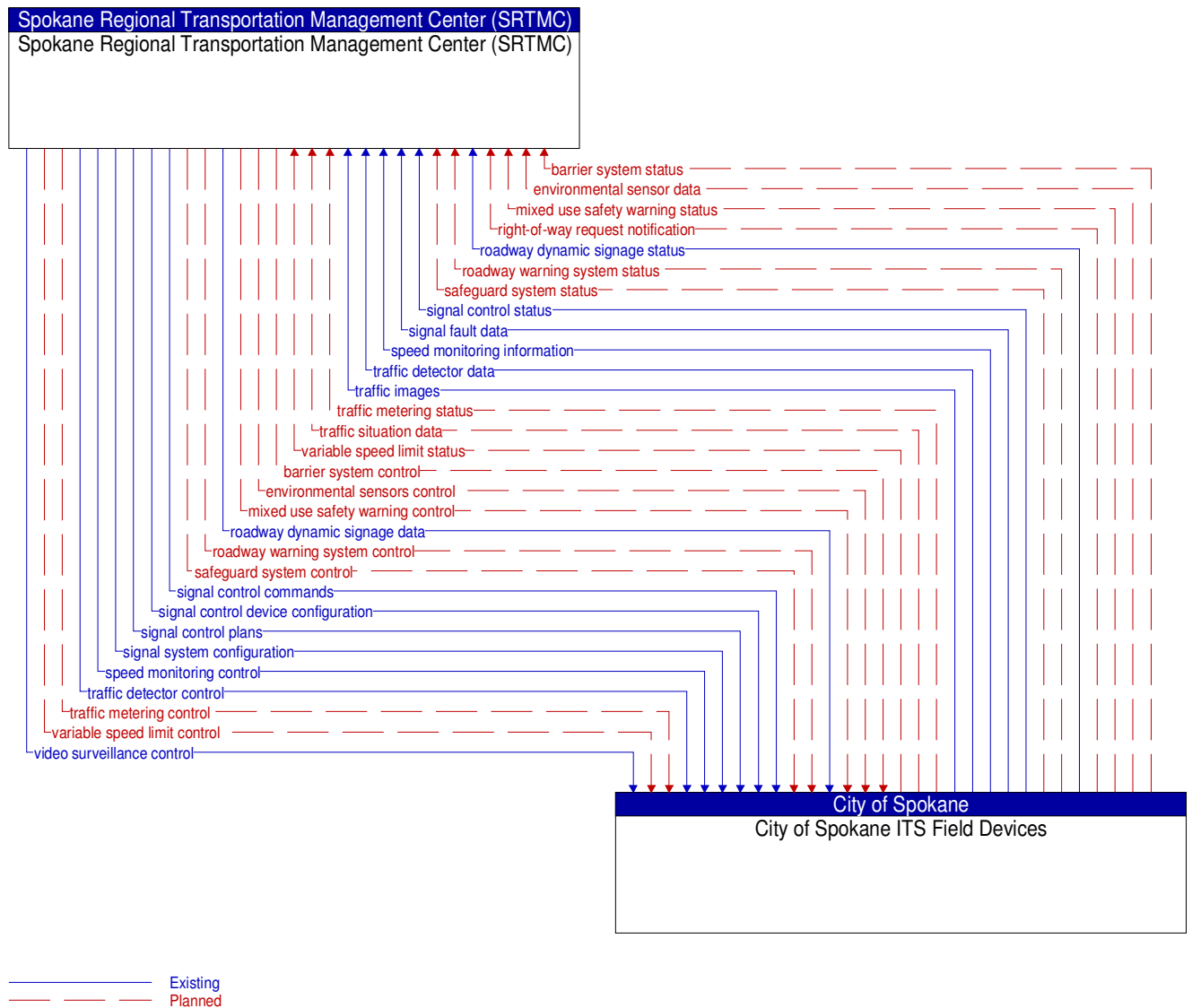
Figure 52: City of Spokane ITS Field Devices - Spokane Regional Transportation Management Center (SRTMC) Interface
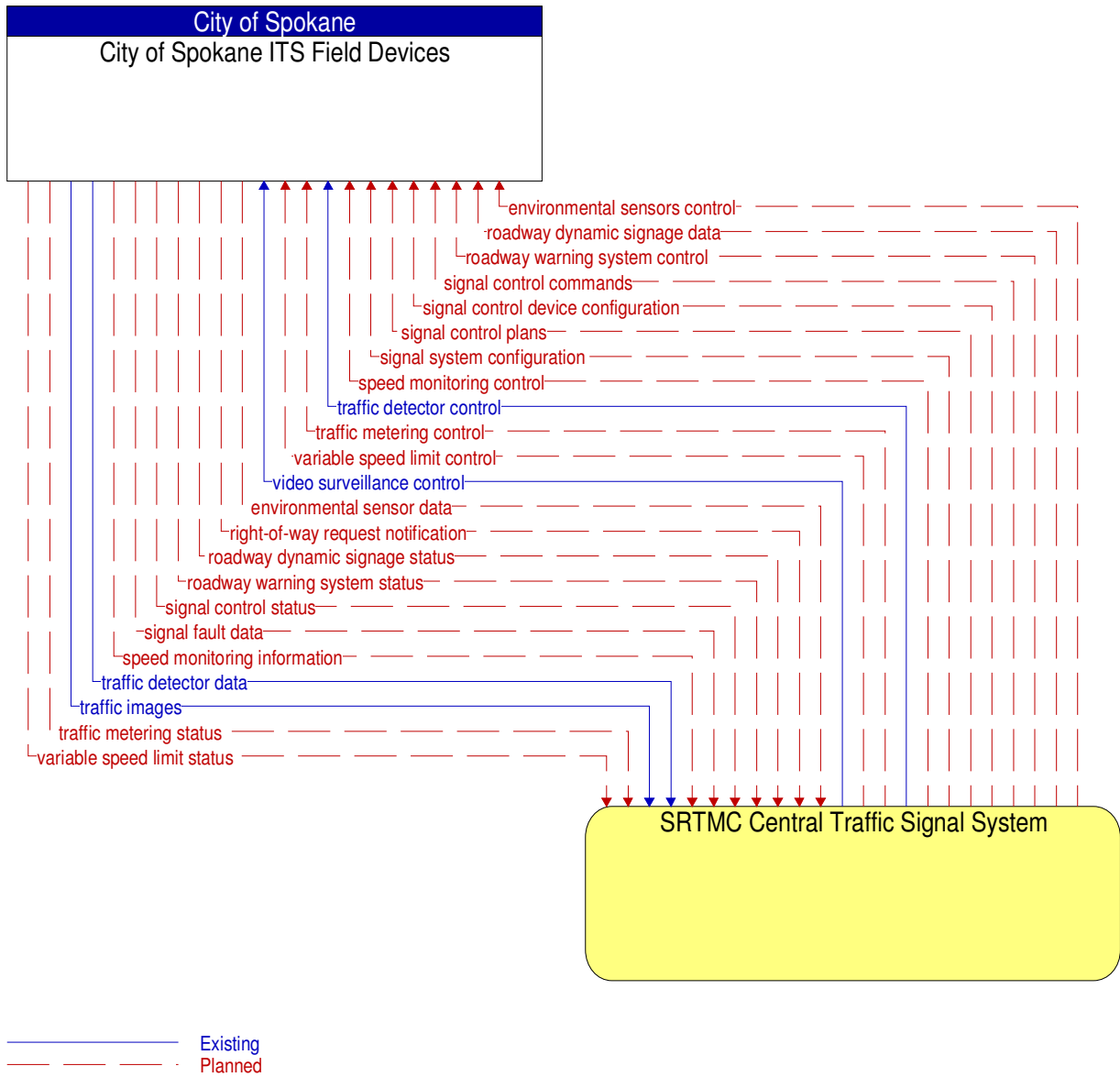
Figure 53: City of Spokane ITS Field Devices - SRTMC Central Traffic Signal System Interface
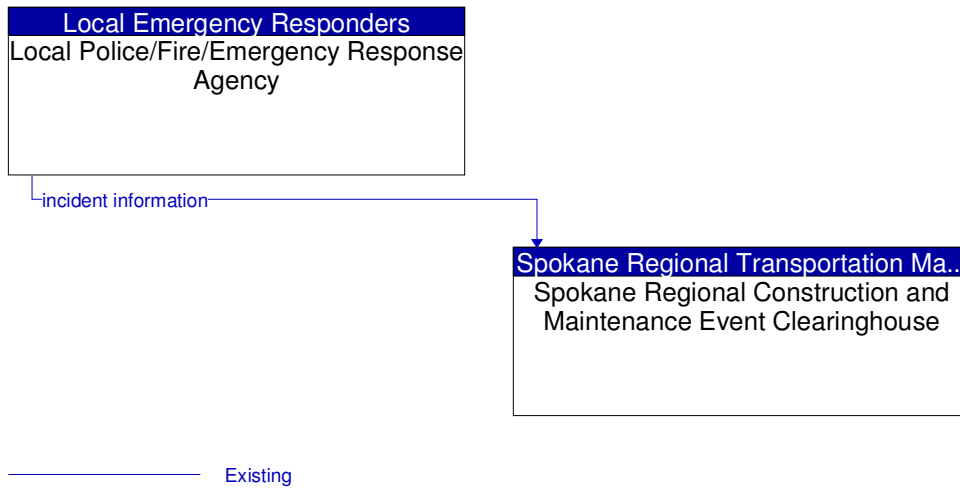
Figure 54: Local Police/Fire/Emergency Response Agency - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
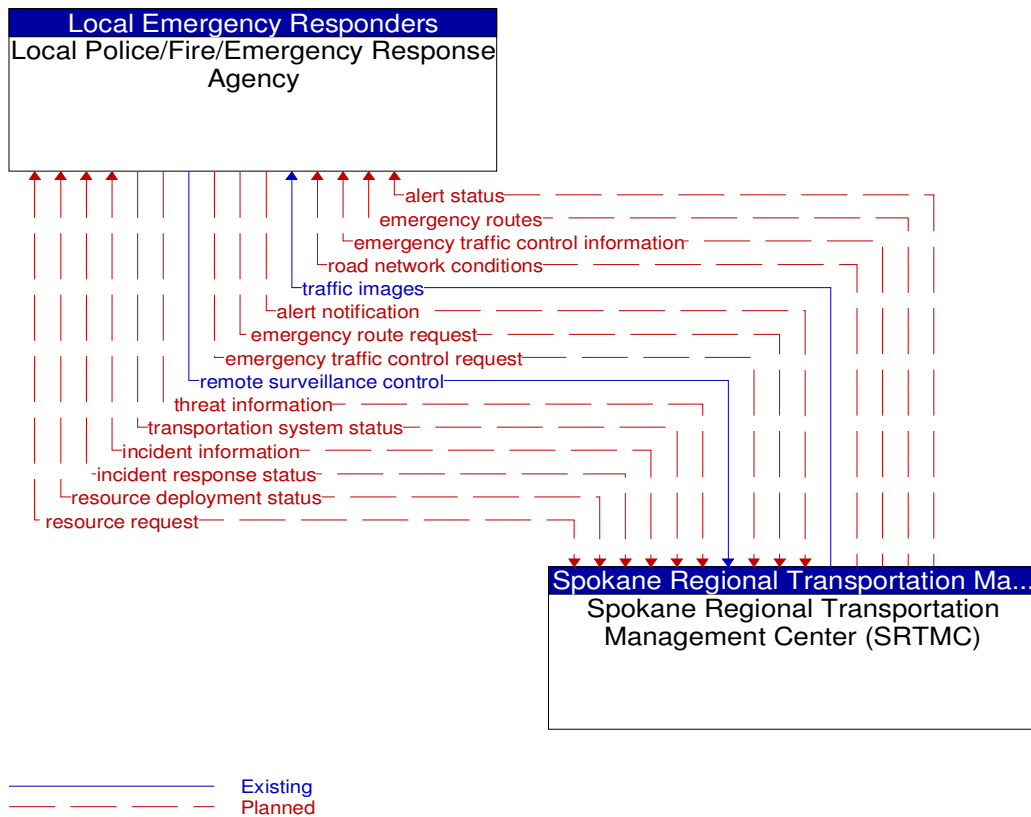
Figure 55: Local Police/Fire/Emergency Response Agency - Spokane Regional Transportation Management Center (SRTMC) Interface
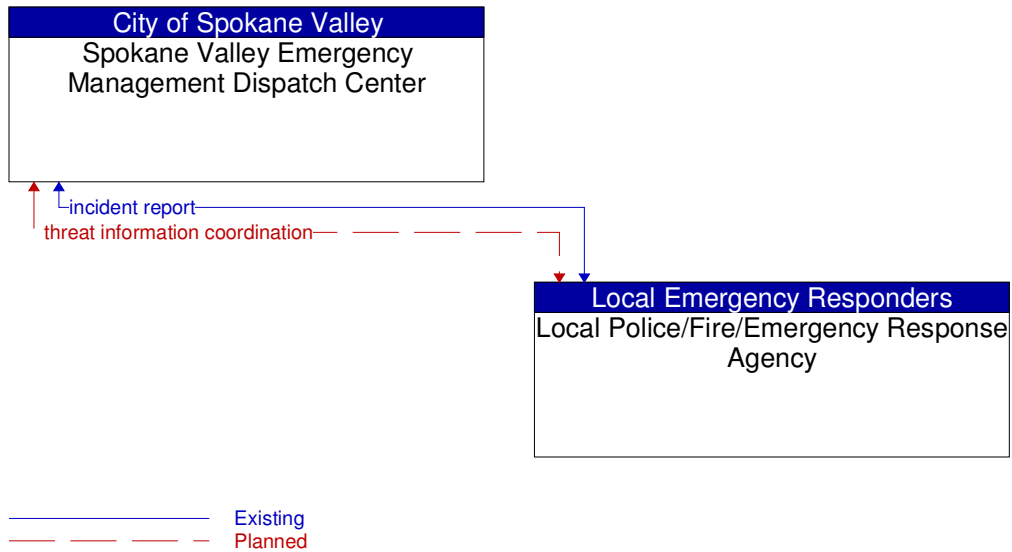
Figure 56: Local Police/Fire/Emergency Response Agency - Spokane Valley Emergency Management Dispatch Center Interface
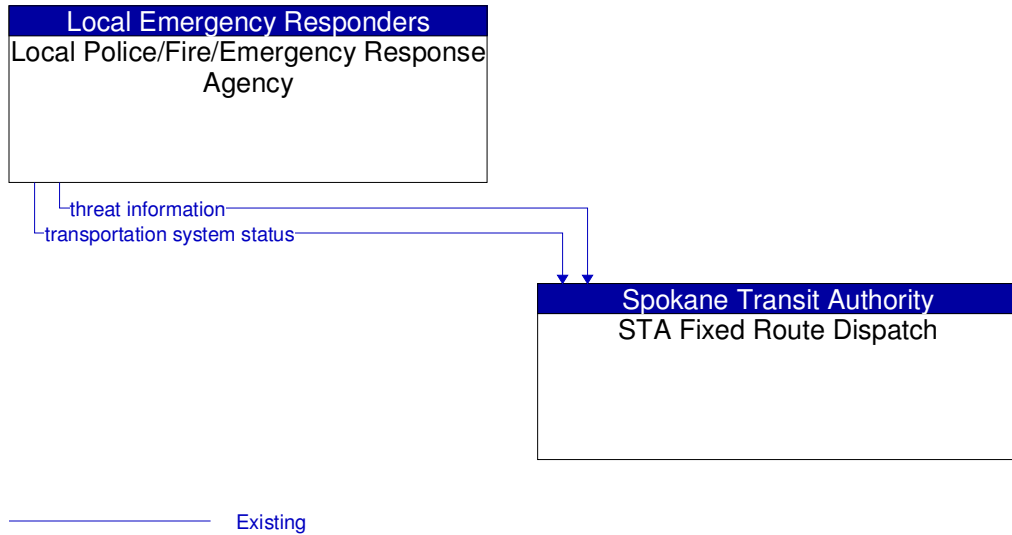
Figure 57: Local Police/Fire/Emergency Response Agency - STA Fixed Route Dispatch Interface
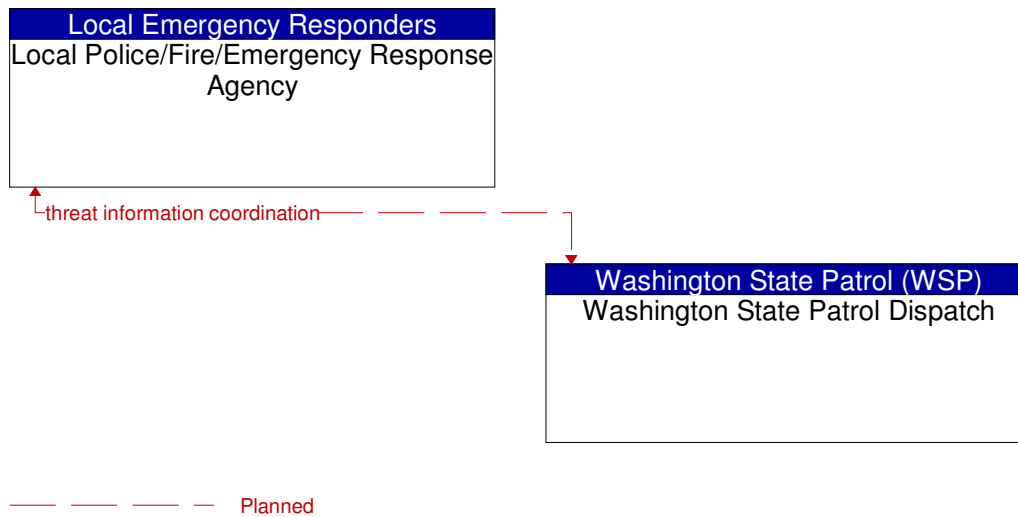
Figure 58: Local Police/Fire/Emergency Response Agency - Washington State Patrol Dispatch Interface
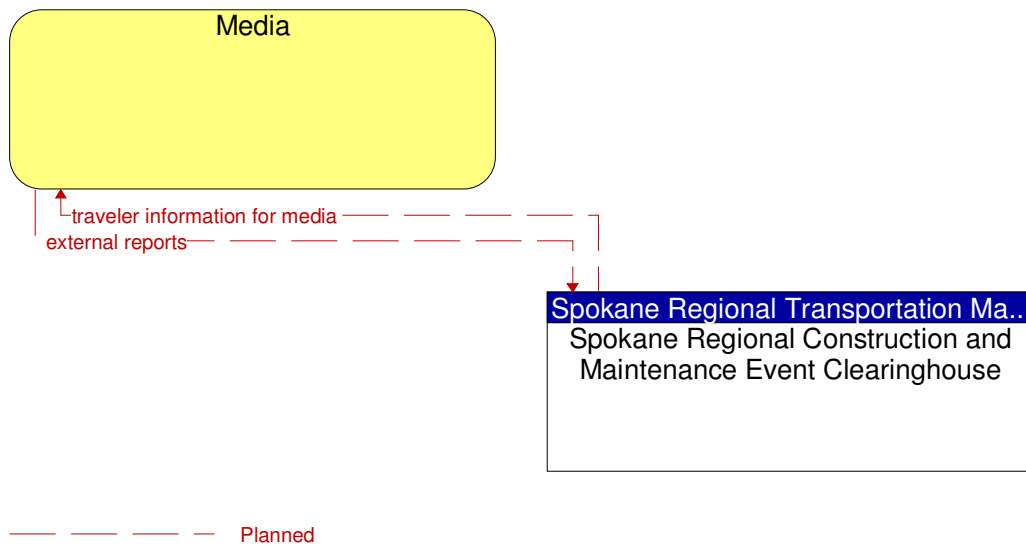
Figure 59: Media - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
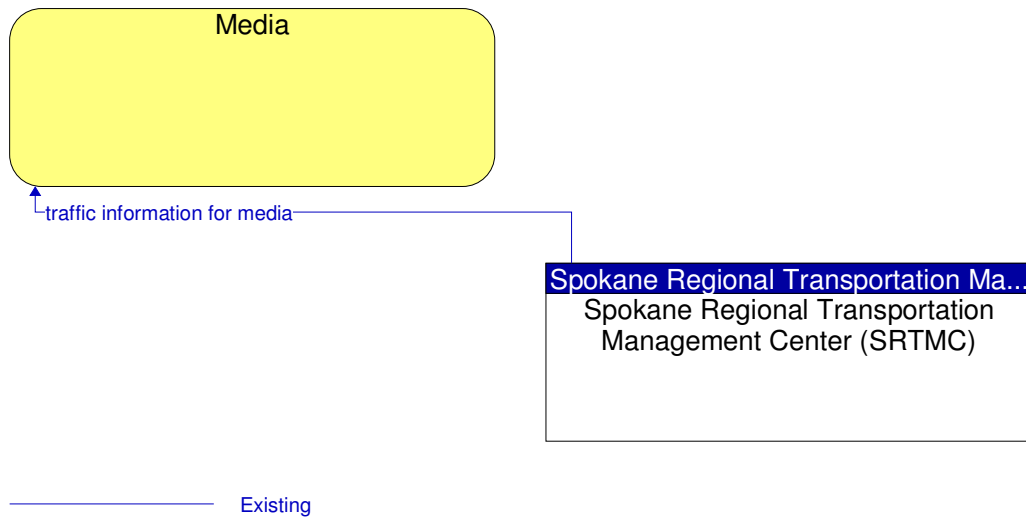
Figure 60: Media - Spokane Regional Transportation Management Center (SRTMC) Interface
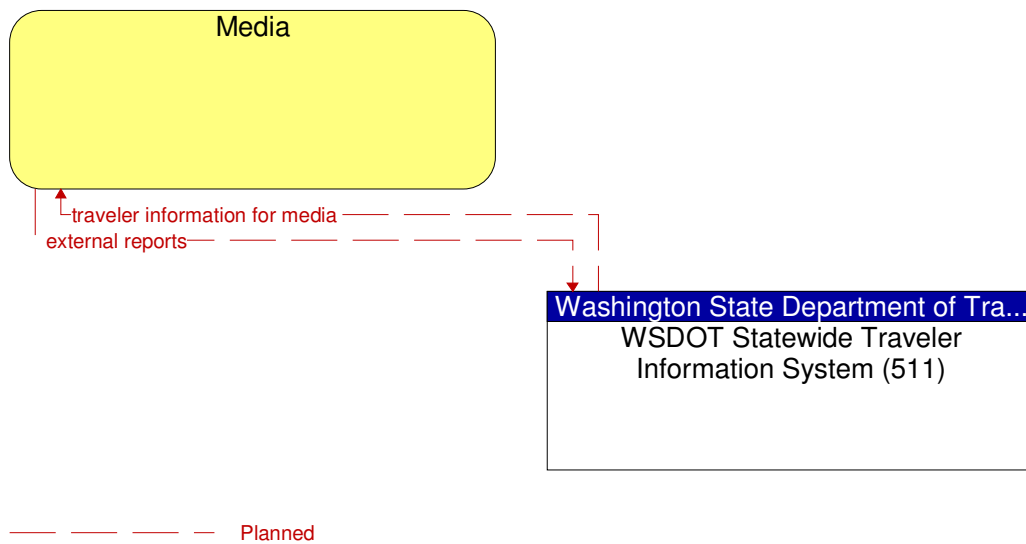
Figure 61: Media - WSDOT Statewide Traveler Information System (511) Interface
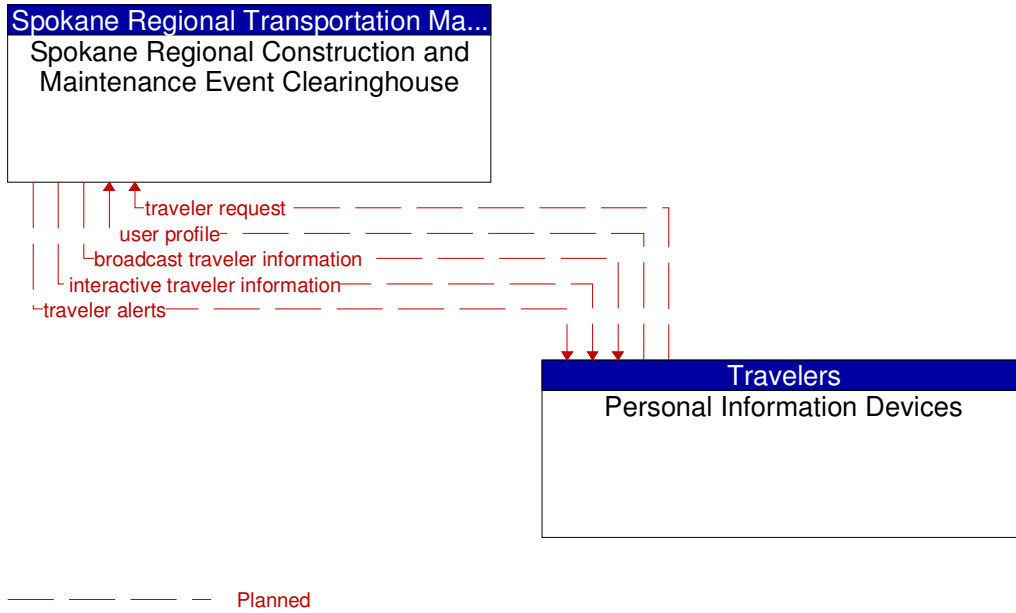
Figure 62: Personal Information Devices - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
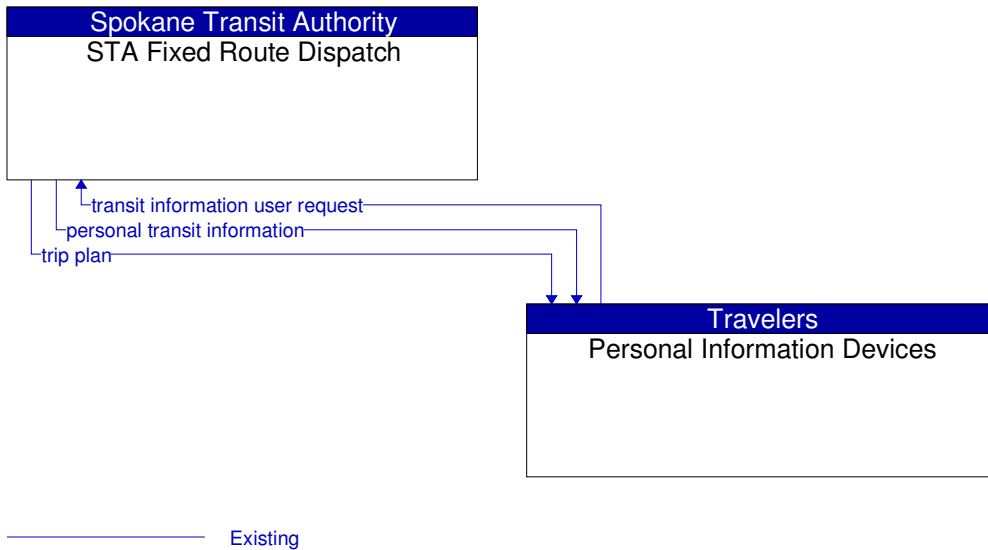
Figure 63: Personal Information Devices - STA Fixed Route Dispatch Interface
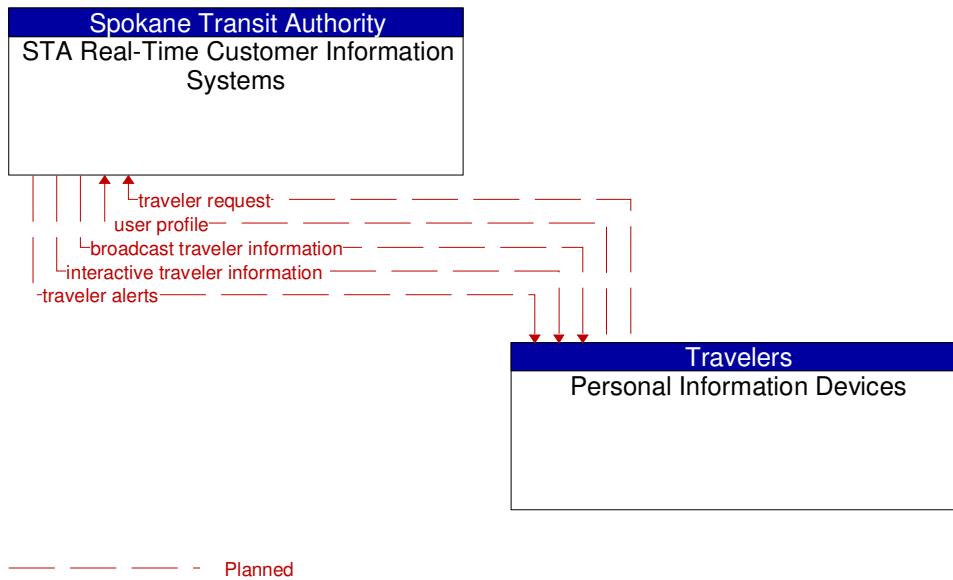
Figure 64: Personal Information Devices - STA Real-Time Customer Information Systems Interface
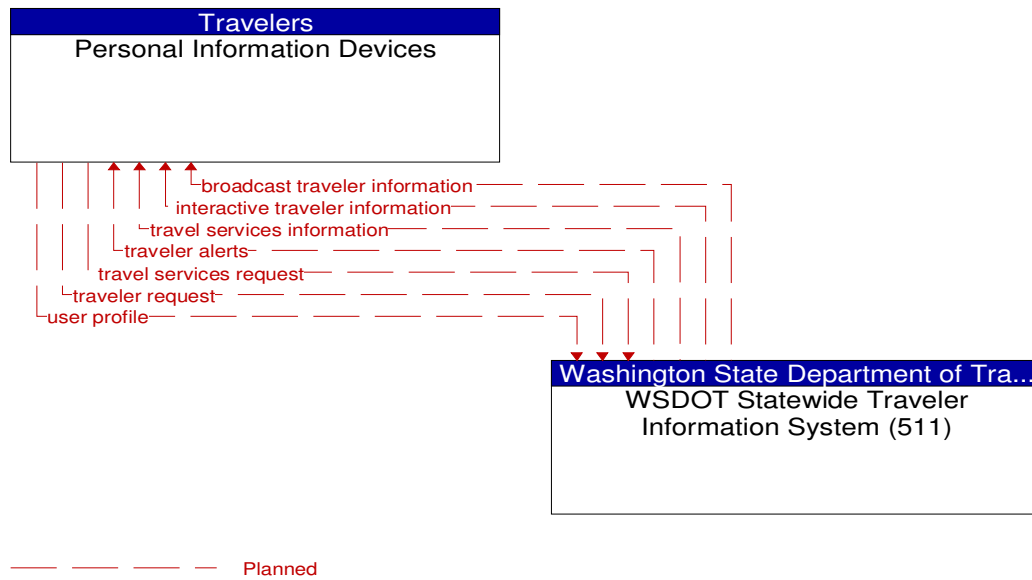
Figure 65: Personal Information Devices - WSDOT Statewide Traveler Information System (511) Interface
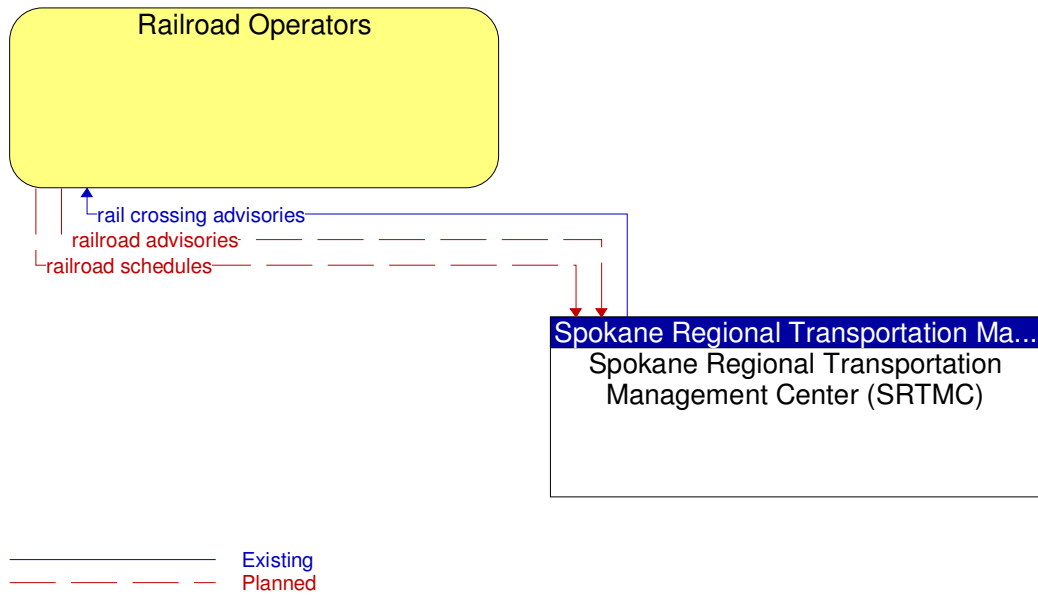
Figure 66: Railroad Operators - Spokane Regional Transportation Management Center (SRTMC) Interface
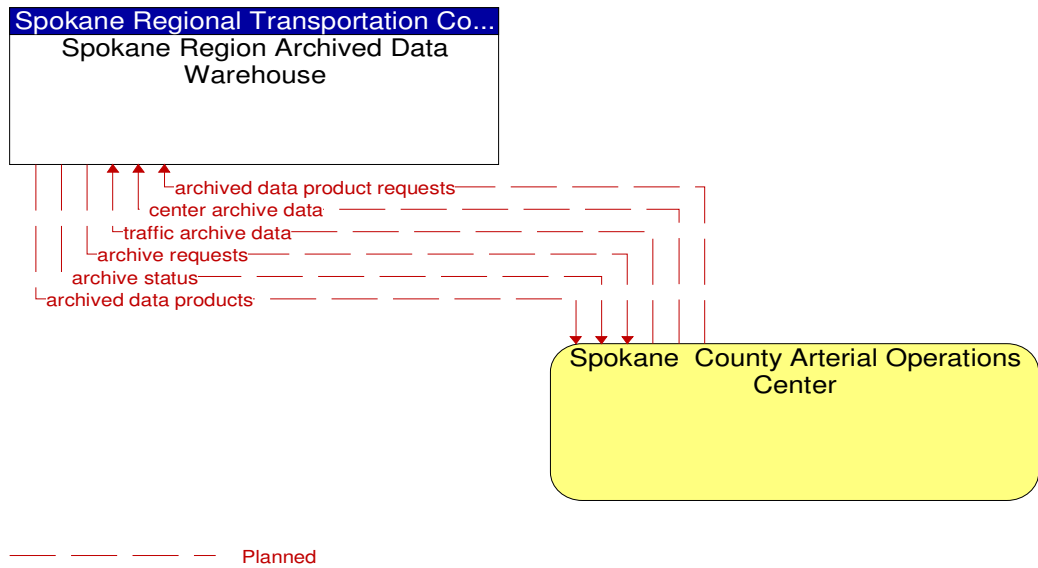
Figure 67: Spokane County Arterial Operations Center - Spokane Region Archived Data Warehouse Interface
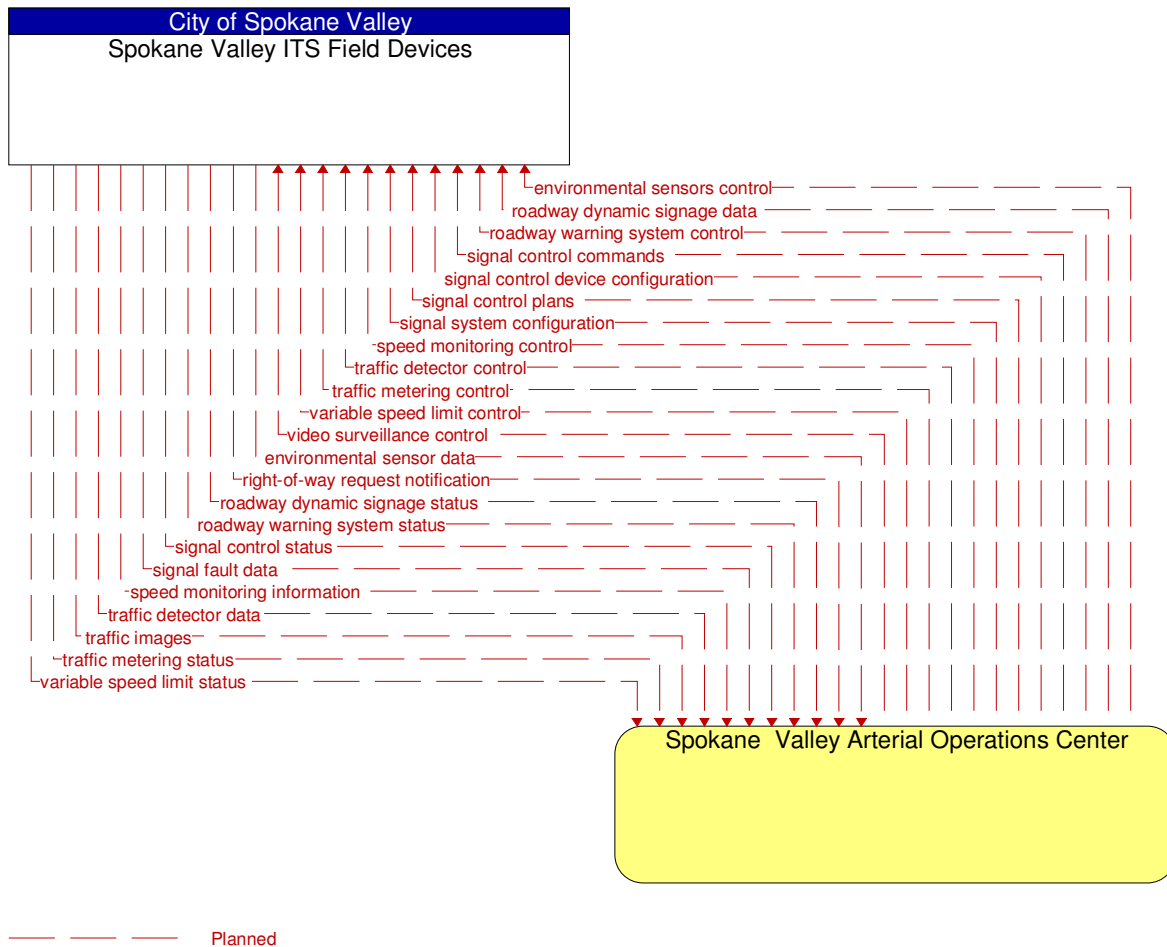
Figure 68: Spokane Valley Arterial Operations Center - Spokane Valley ITS Field Devices Interface
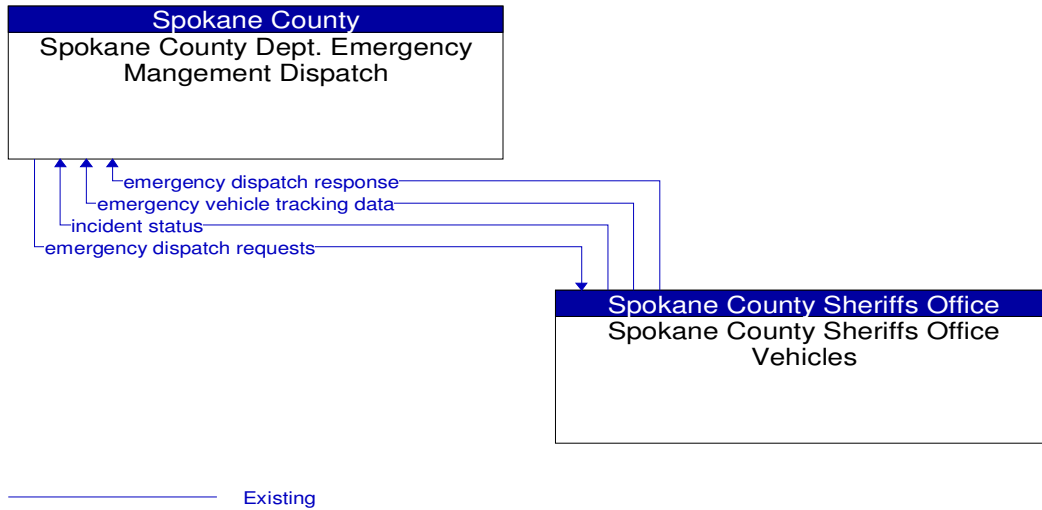
Figure 69: Spokane County Dept. Emergency Mangement Dispatch - Spokane County Sheriffs Office Vehicles Interface
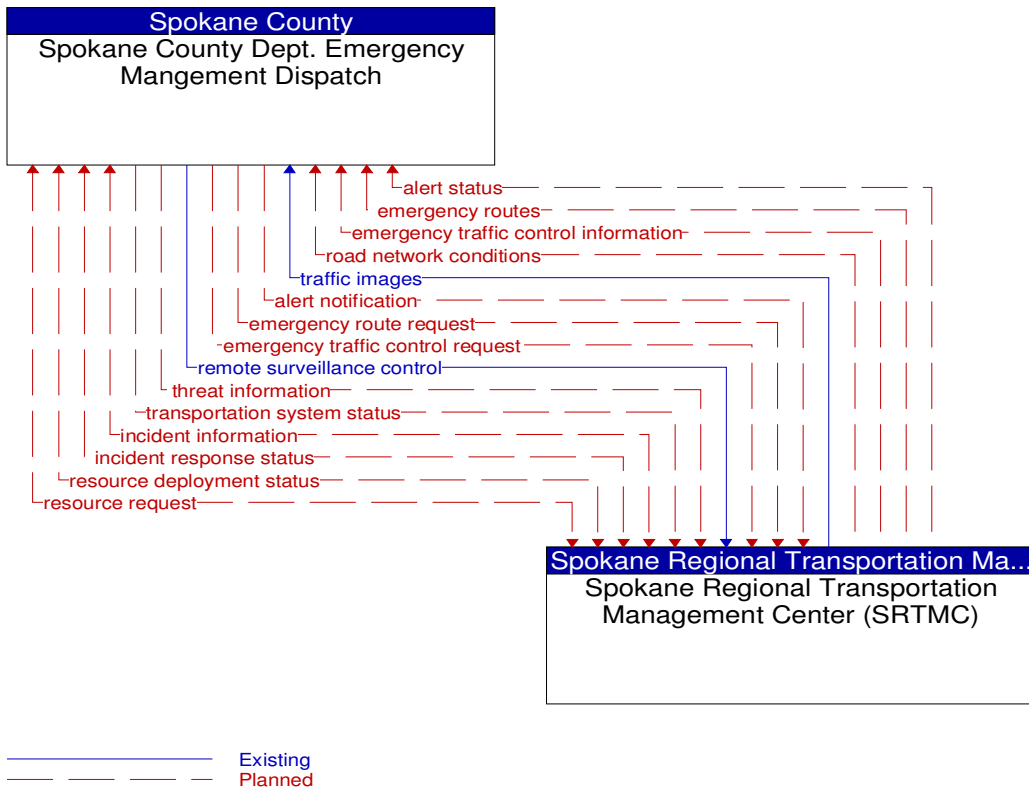
Figure 70: Spokane County Dept. Emergency Mangement Dispatch - Spokane Regional Transportation Management Center (SRTMC) Interface
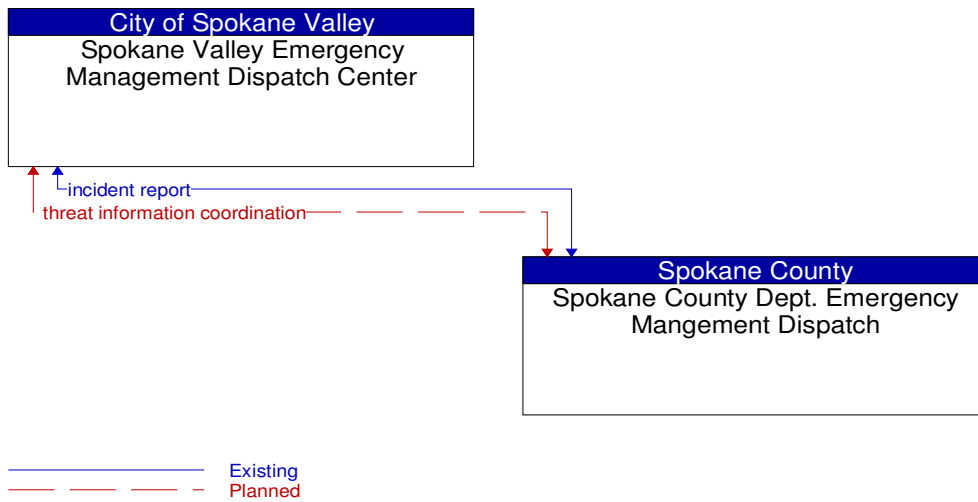
Figure 71: Spokane County Dept. Emergency Mangement Dispatch - Spokane Valley Emergency Management Dispatch Center Interface
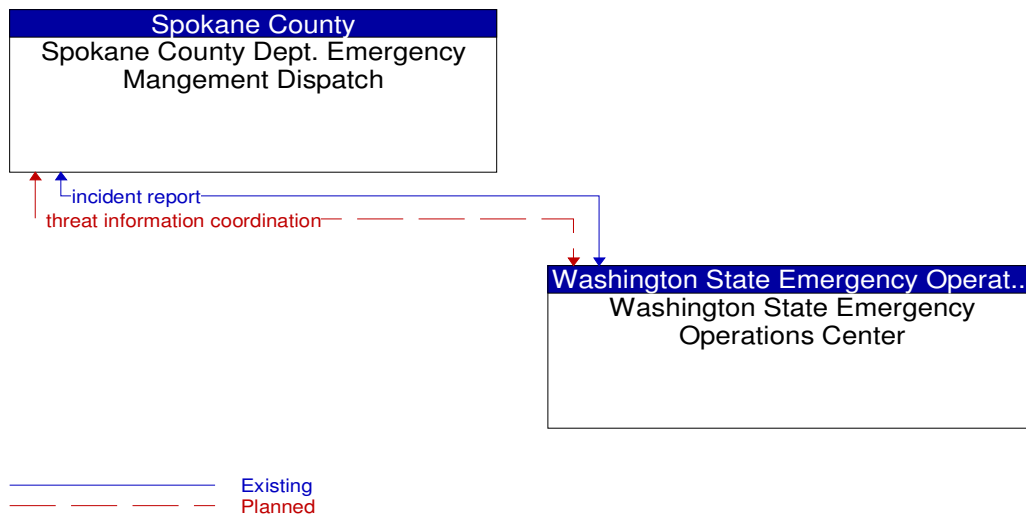
Figure 72: Spokane County Dept. Emergency Management Dispatch - Washington State Emergency Operations Center Interface
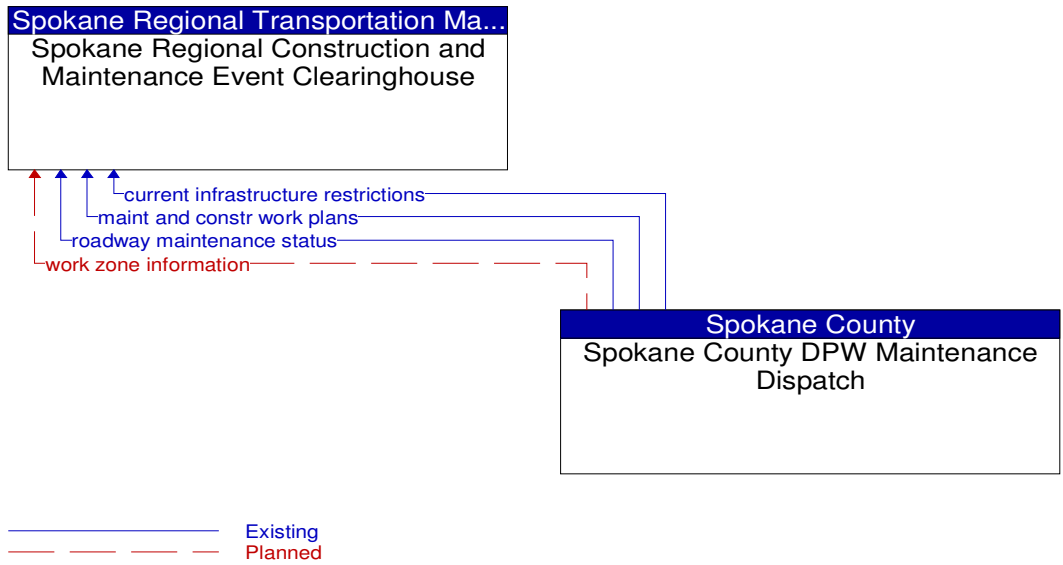
Figure 73: Spokane County DPW Maintenance Dispatch - Spokane Regional Construction and Maintenance Event Clearinghouse Interface
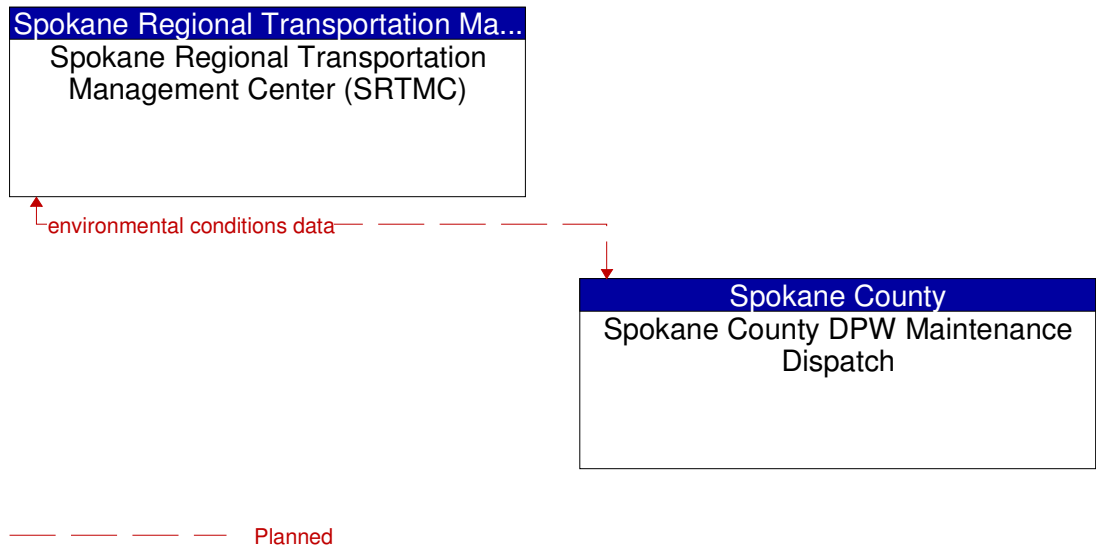
Figure 74: Spokane County DPW Maintenance Dispatch - Spokane Regional Transportation Management Center (SRTMC) Interface
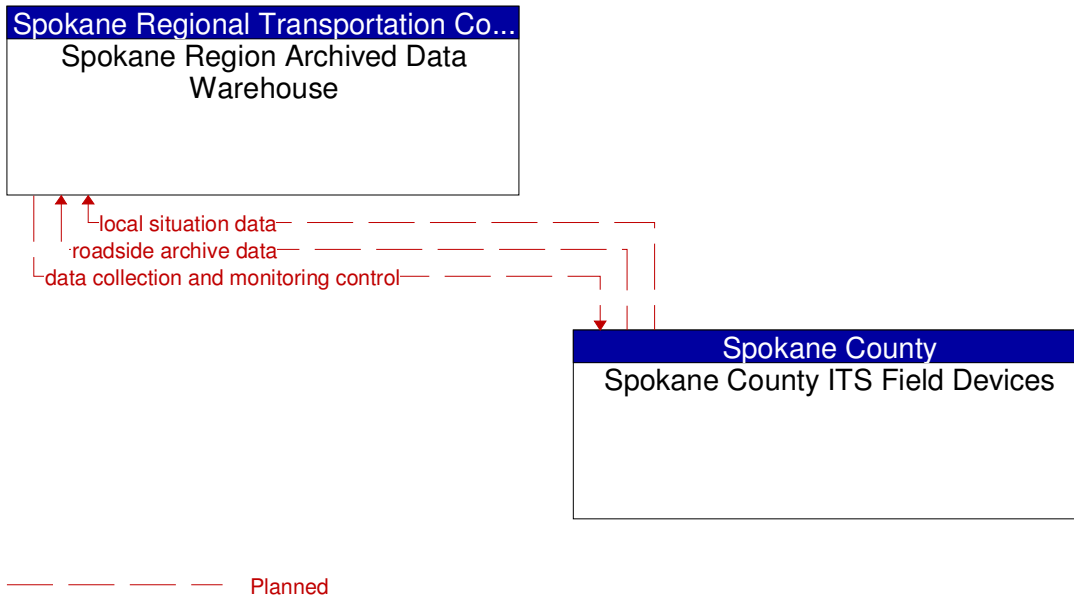
Figure 75: Spokane County ITS Field Devices - Spokane Region Archived Data Warehouse Interface
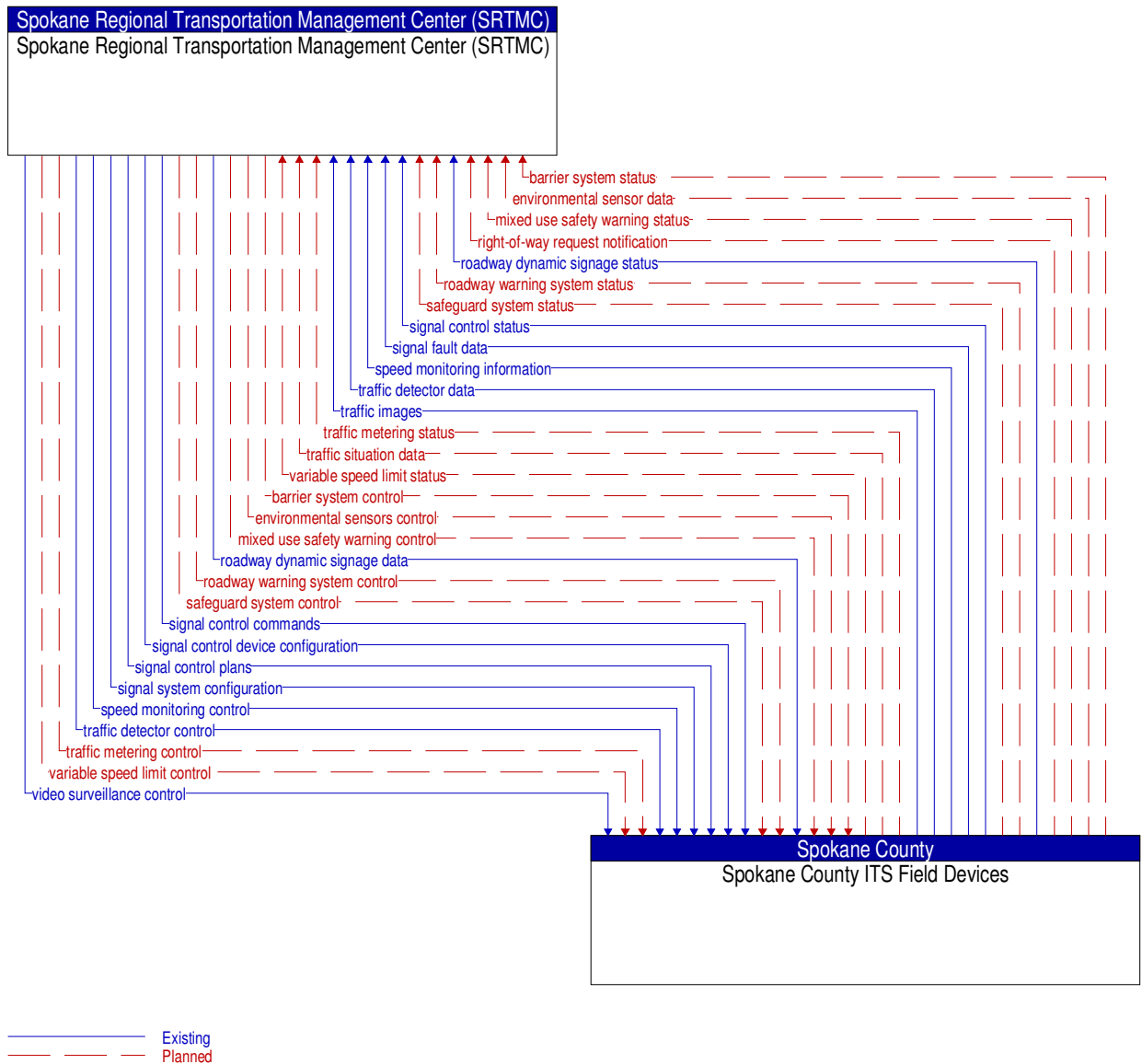
Figure 76: Spokane County ITS Field Devices - Spokane Regional Transportation Management Center (SRTMC) Interface
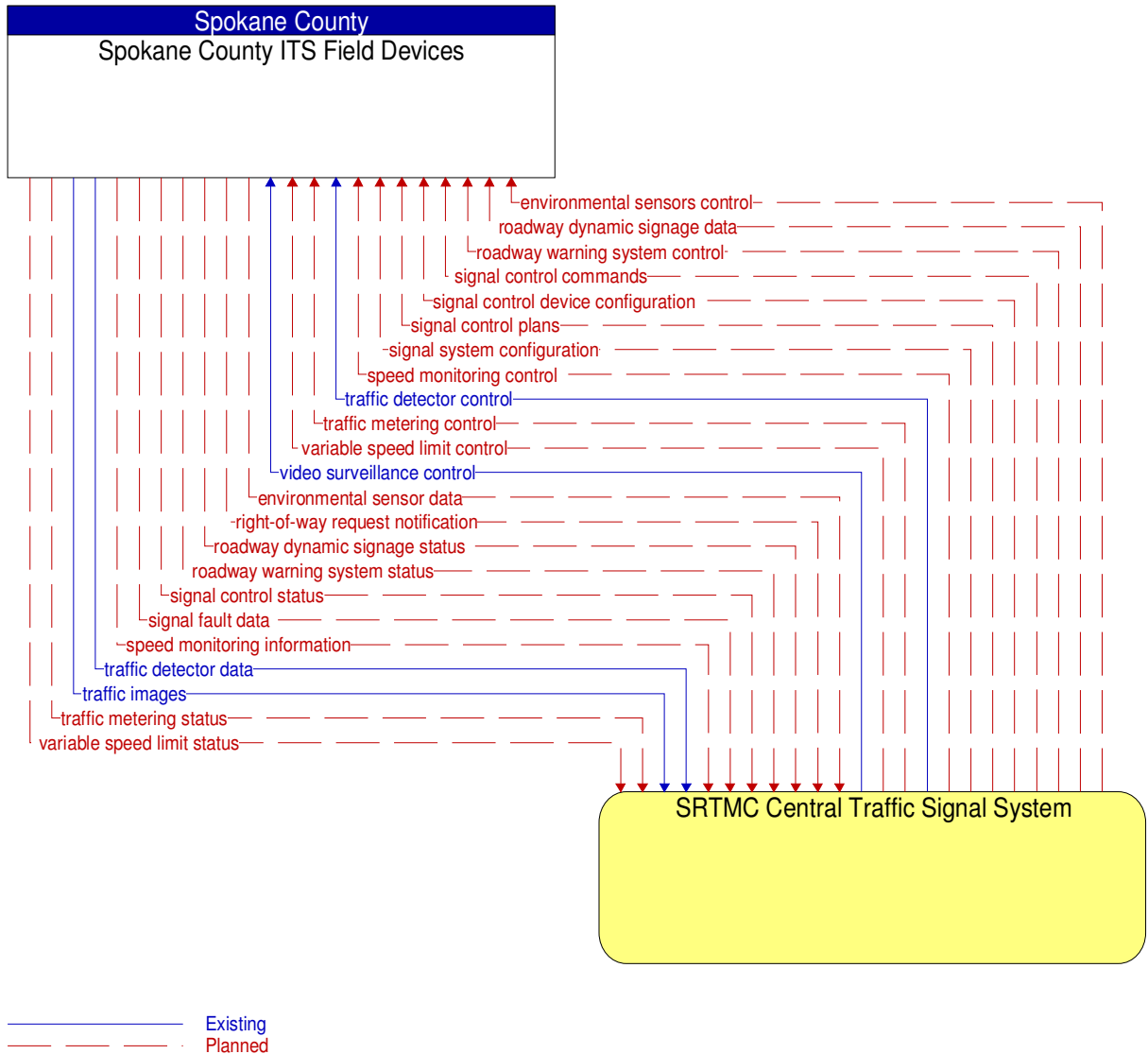
Figure 77: Spokane County ITS Field Devices - SRTMC Central Traffic Signal System Interface
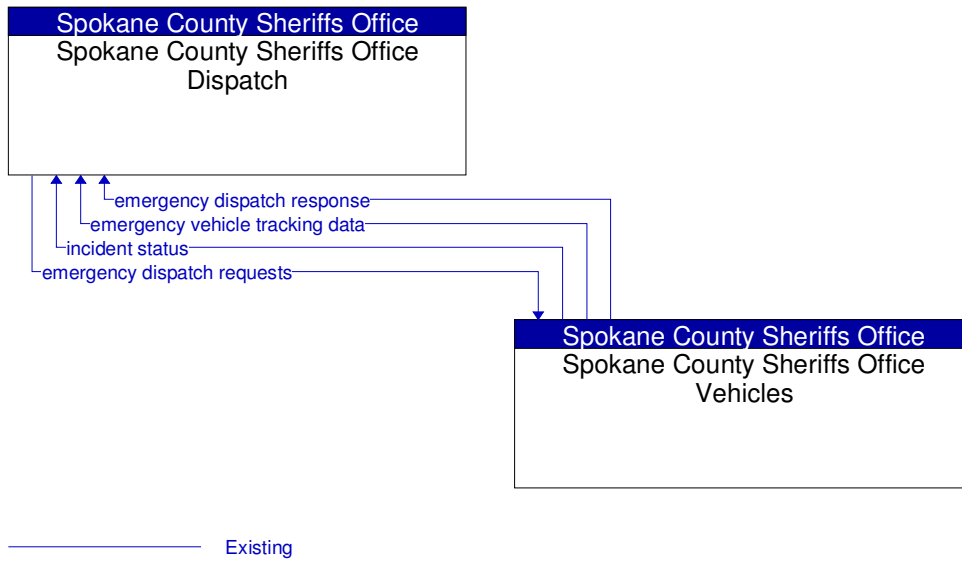
Figure 78: Spokane County Sheriffs Office Dispatch - Spokane County Sheriffs Office Vehicles Interface
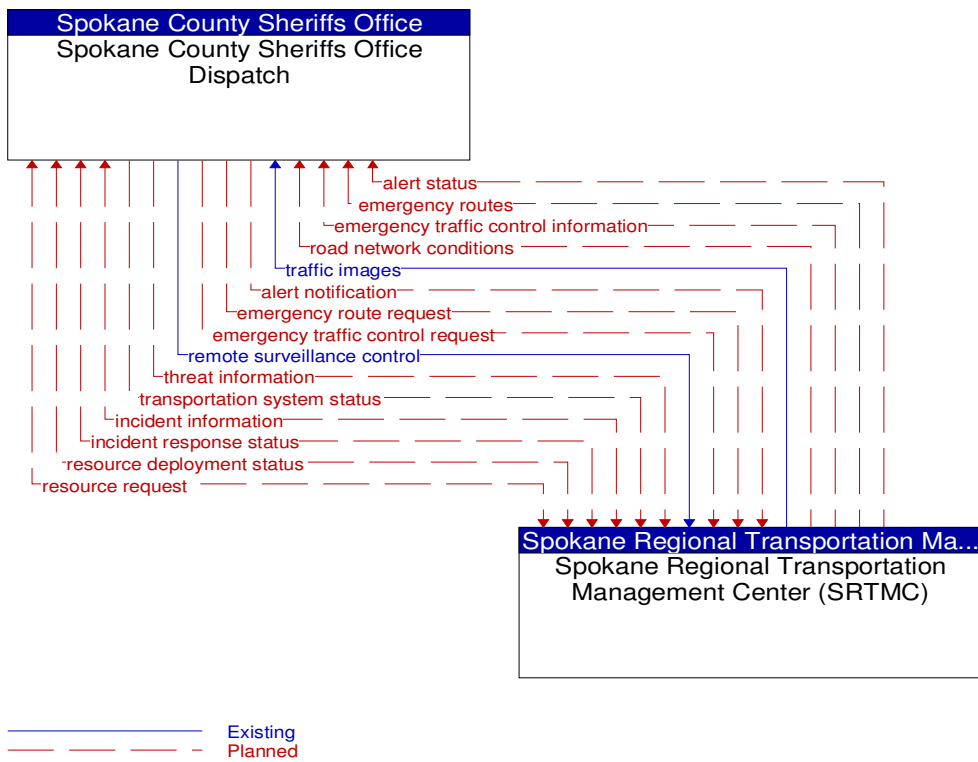
Figure 79: Spokane County Sheriffs Office Dispatch - Spokane Regional Transportation Management Center (SRTMC) Interface
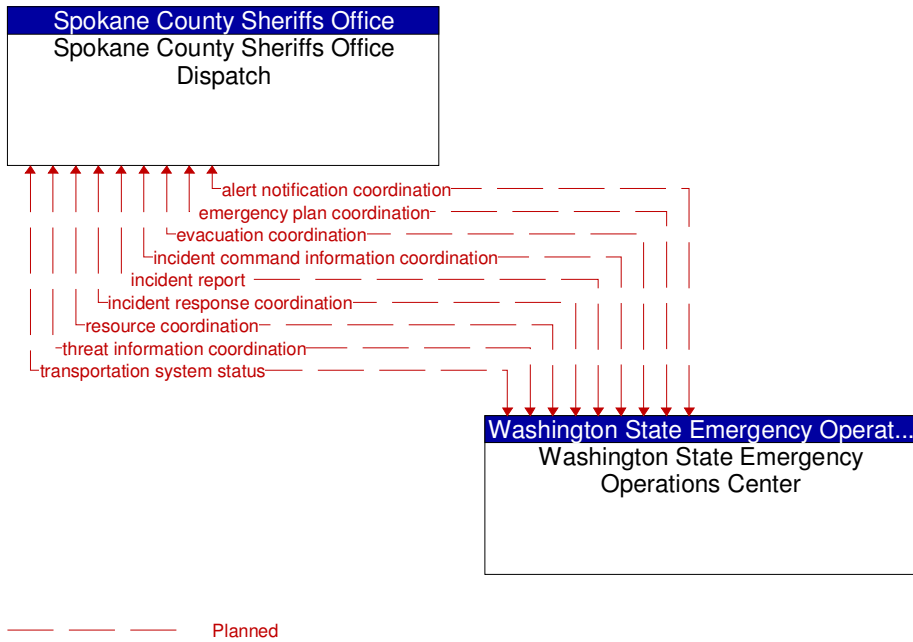
Figure 80: Spokane County Sheriffs Office Dispatch - Washington State Emergency Operations Center Interface
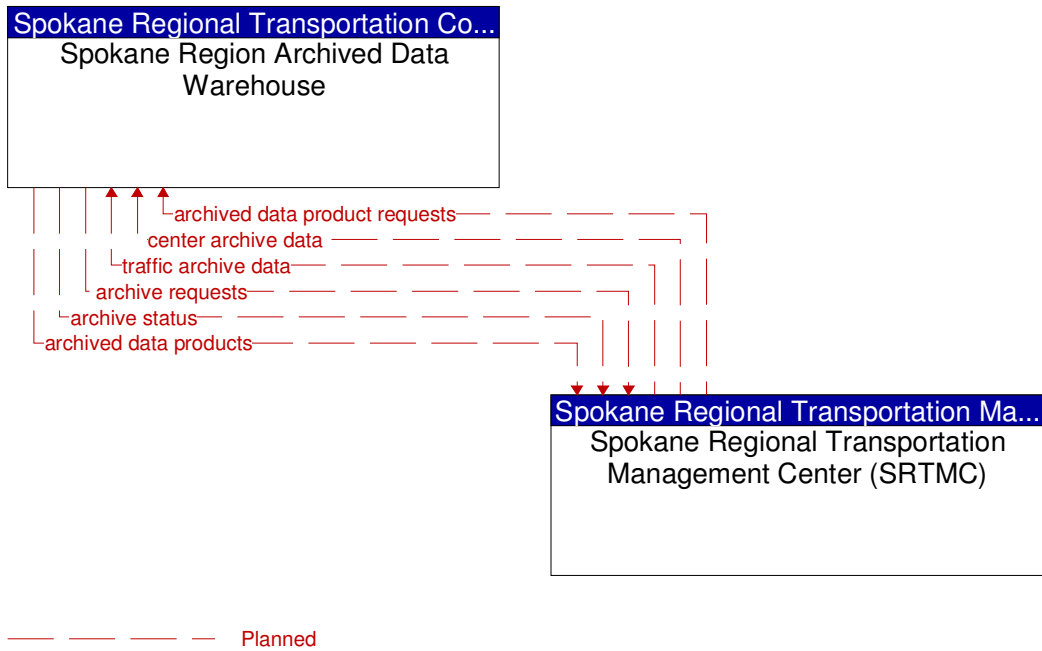
Figure 81: Spokane Region Archived Data Warehouse - Spokane Regional Transportation Management Center (SRTMC) Interface
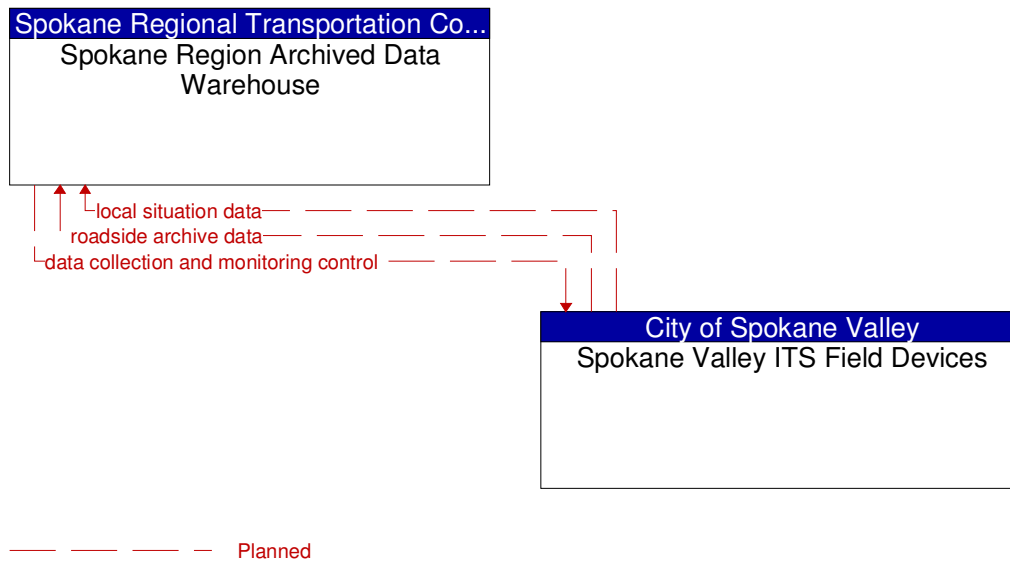
Figure 82: Spokane Region Archived Data Warehouse - Spokane Valley ITS Field Devices Interface
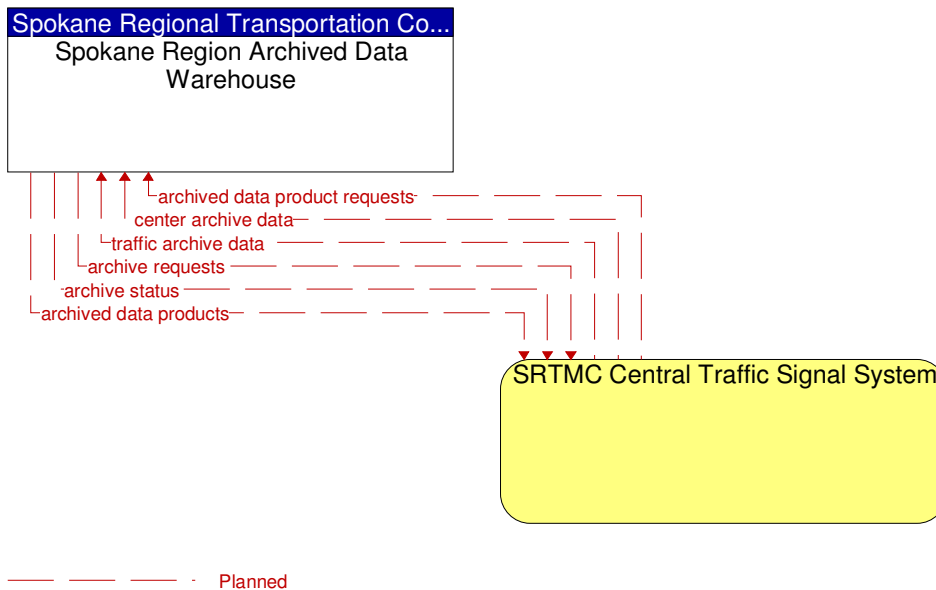
Figure 83: Spokane Region Archived Data Warehouse - SRTMC Central Traffic Signal System Interface
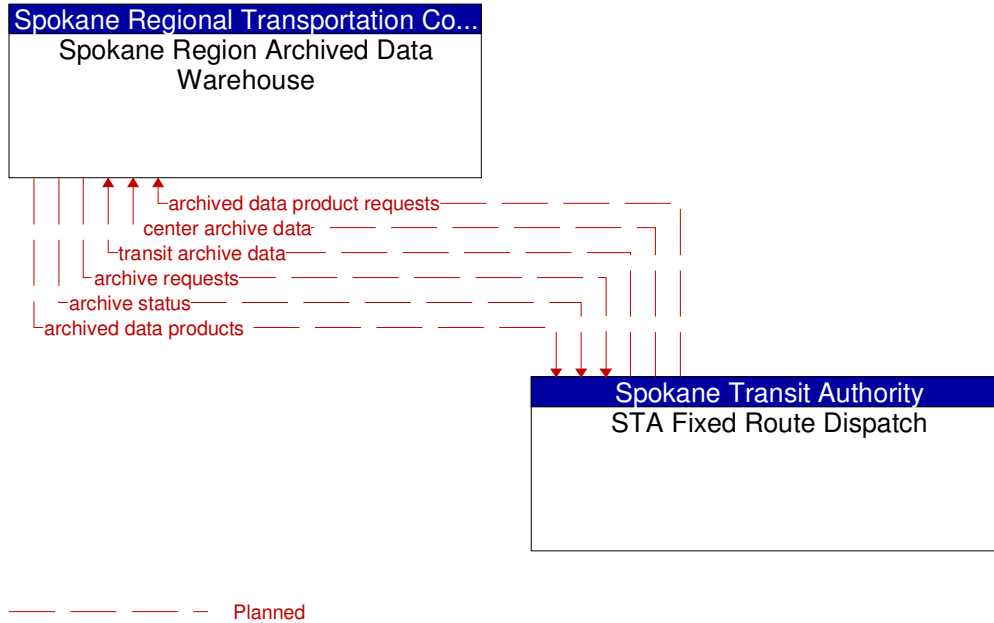
Figure 84: Spokane Region Archived Data Warehouse - STA Fixed Route Dispatch Interface
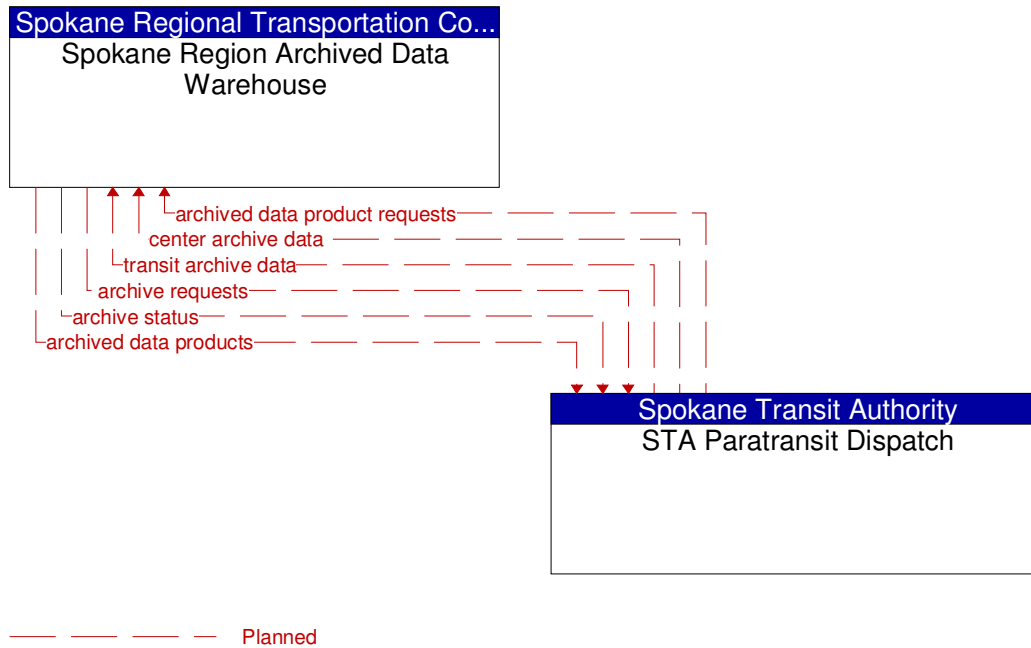
Figure 85: Spokane Region Archived Data Warehouse - STA Paratransit Dispatch Interface
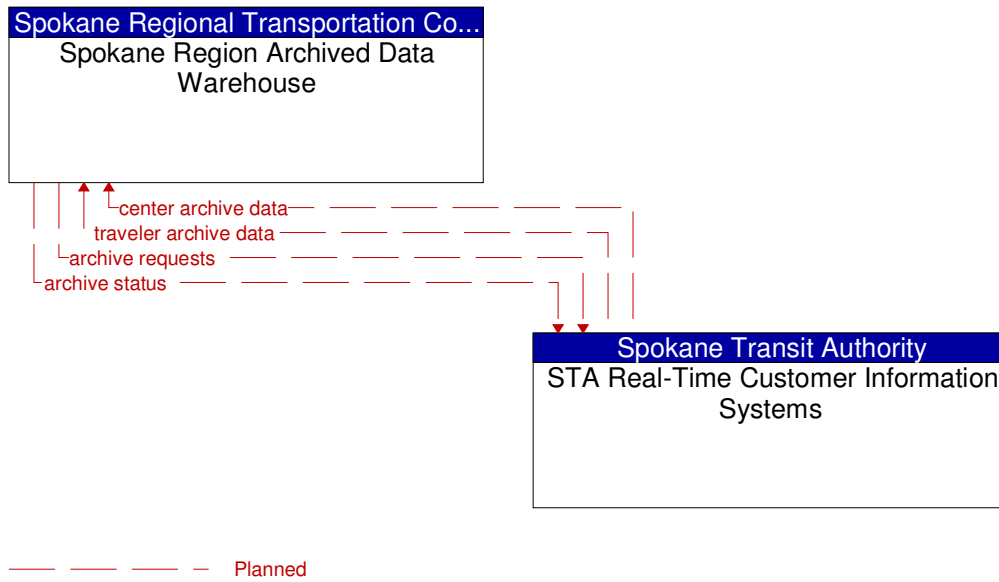
Figure 86: Spokane Region Archived Data Warehouse - STA Real-Time Customer Information Systems Interface
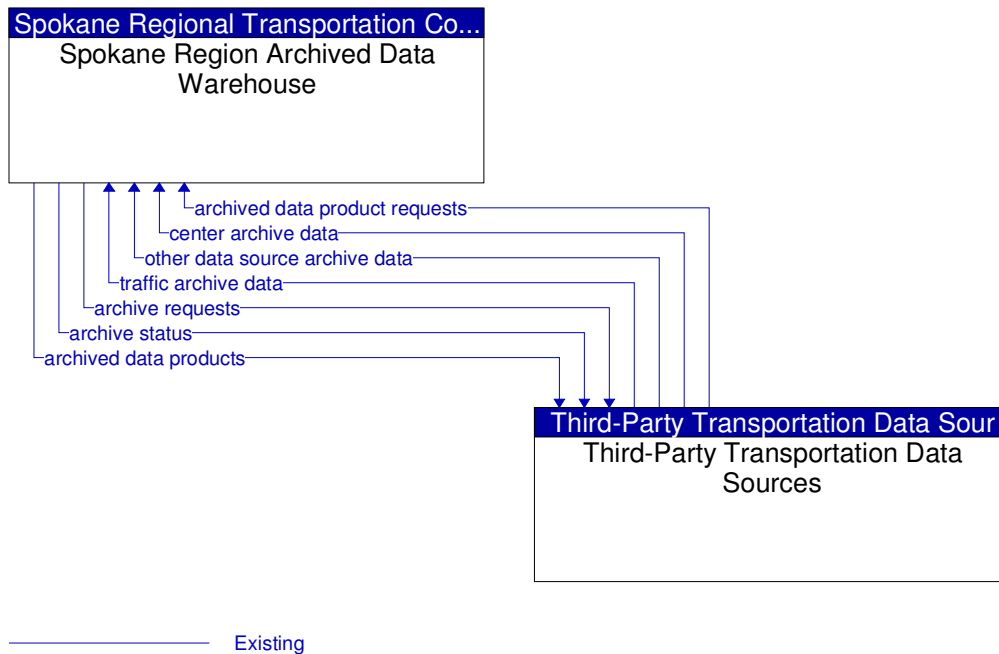
Figure 87: Spokane Region Archived Data Warehouse - Third-Party Transportation Data Sources Interface
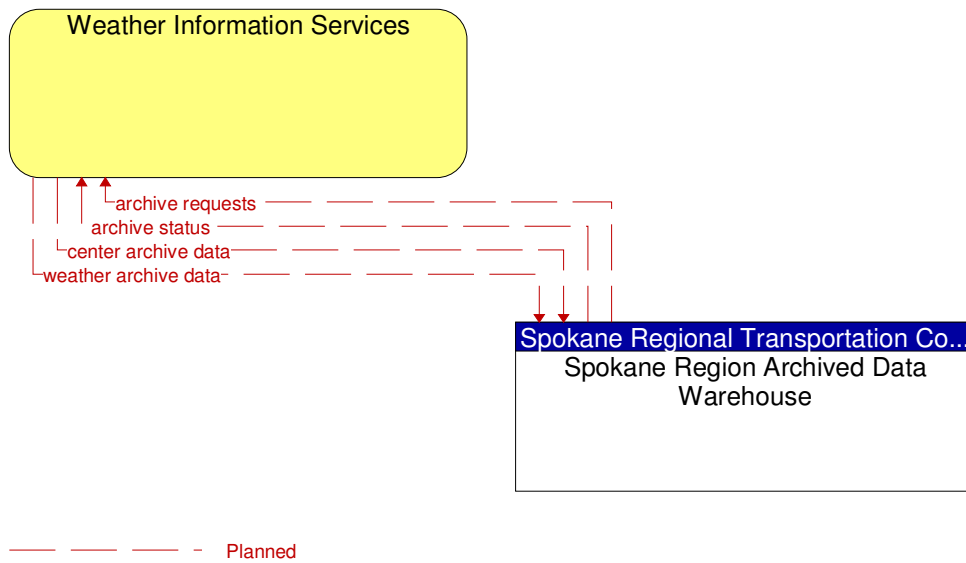
Figure 88: Spokane Region Archived Data Warehouse - Weather Information Services Interface
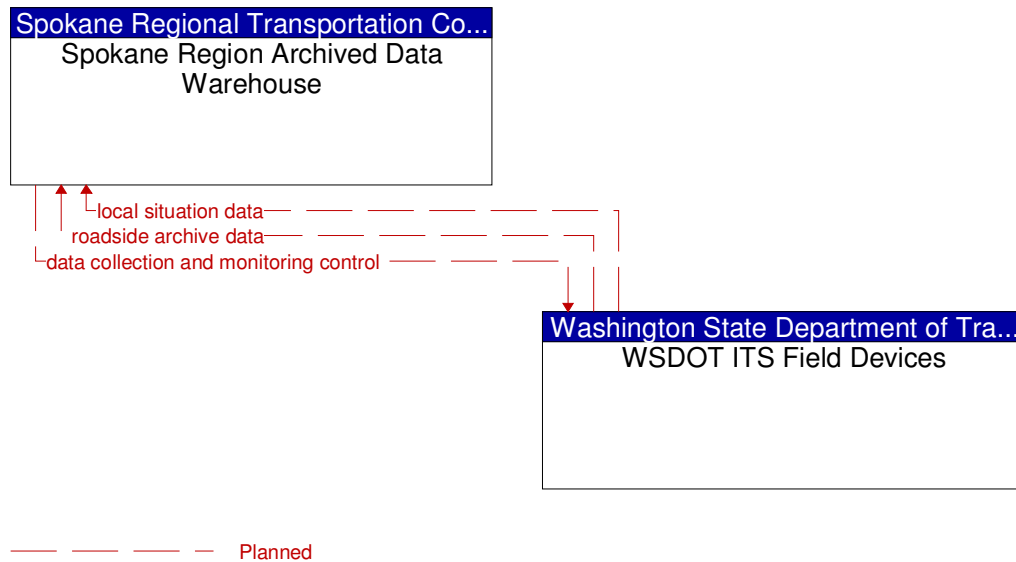
Figure 89: Spokane Region Archived Data Warehouse - WSDOT ITS Field Devices Interface
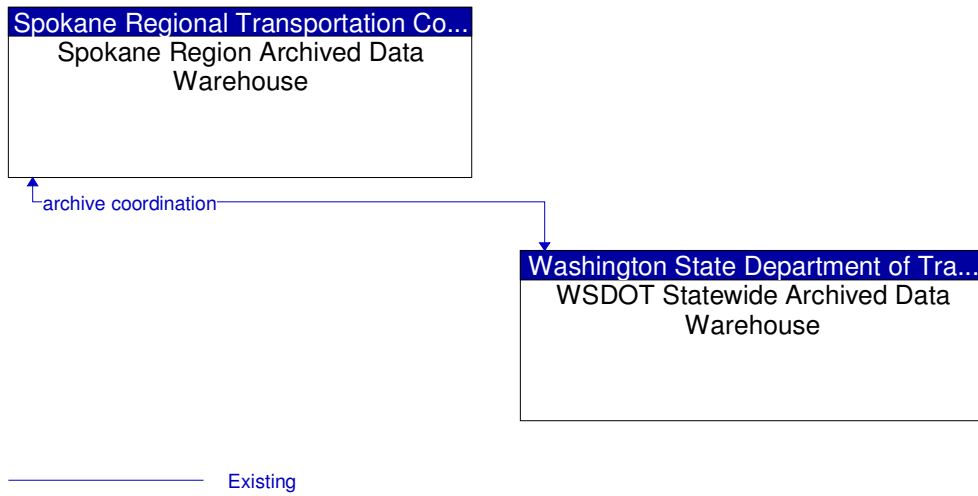
Figure 90: Spokane Region Archived Data Warehouse - WSDOT Statewide Archived Data Warehouse Interface
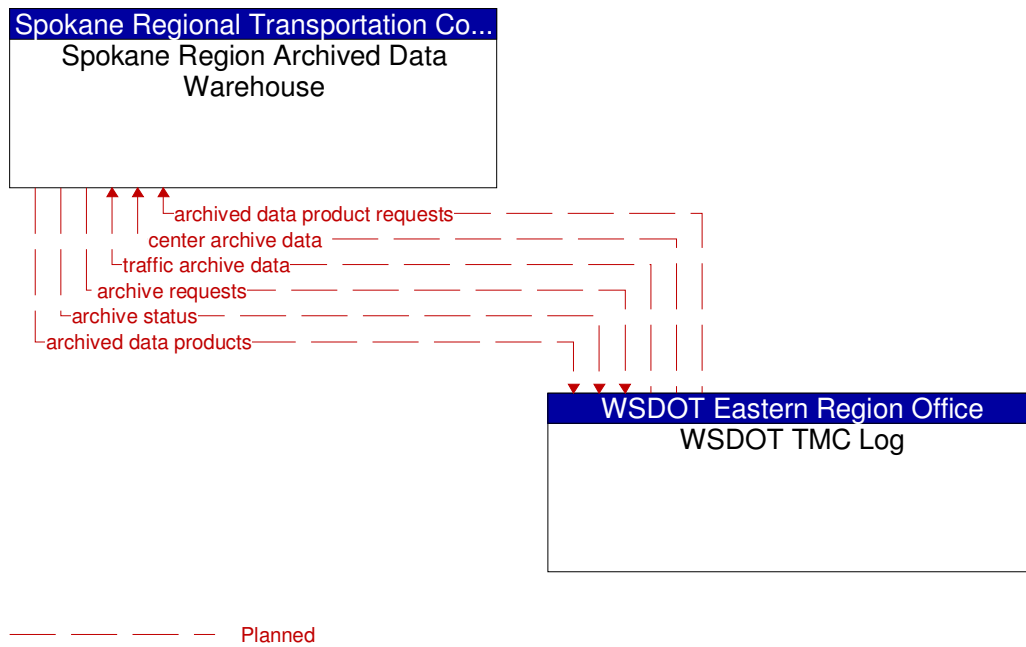
Figure 91: Spokane Region Archived Data Warehouse - WSDOT TMC Log Interface
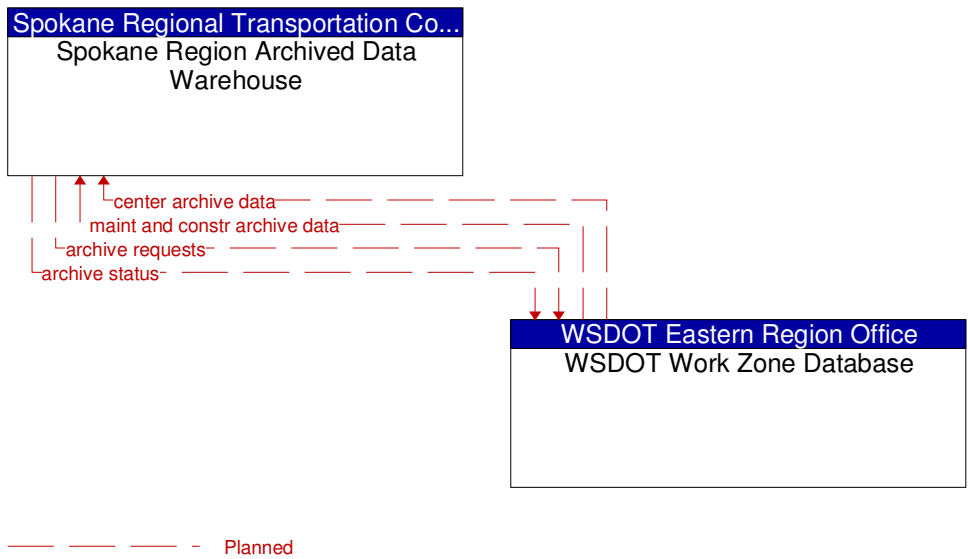
Figure 92: Spokane Region Archived Data Warehouse - WSDOT Work Zone Database Interface
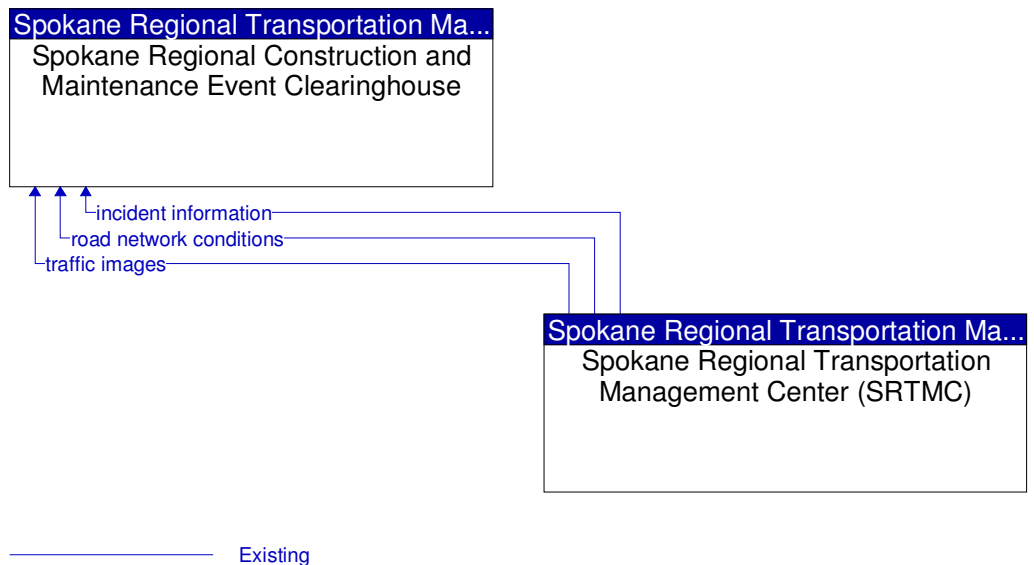
Figure 93: Spokane Regional Construction and Maintenance Event Clearinghouse - Spokane Regional Transportation Management Center (SRTMC) Interface
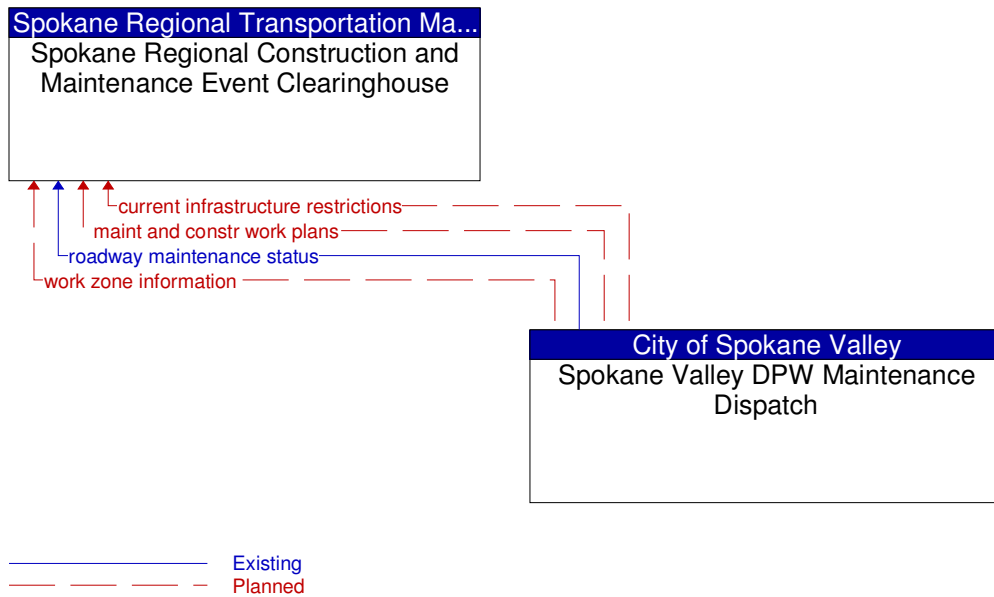
Figure 94: Spokane Regional Construction and Maintenance Event Clearinghouse - Spokane Valley DPW Maintenance Dispatch Interface
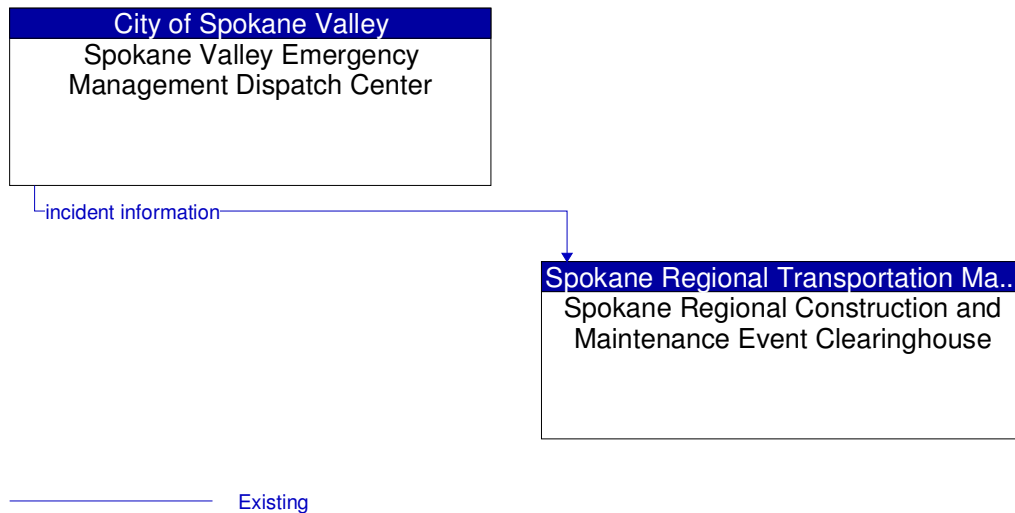
Figure 95: Spokane Regional Construction and Maintenance Event Clearinghouse - Spokane Valley Emergency Management Dispatch Center Interface
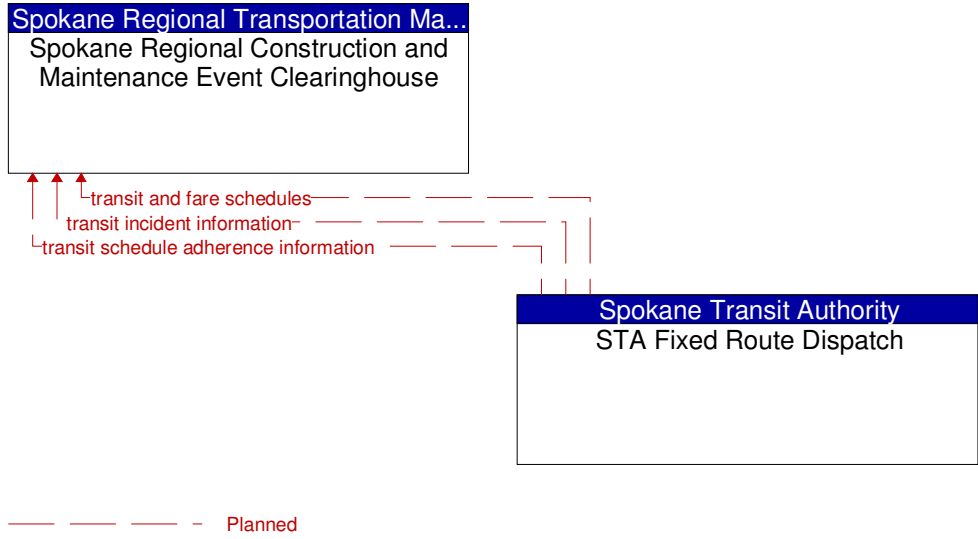
Figure 96: Spokane Regional Construction and Maintenance Event Clearinghouse - STA Fixed Route Dispatch Interface
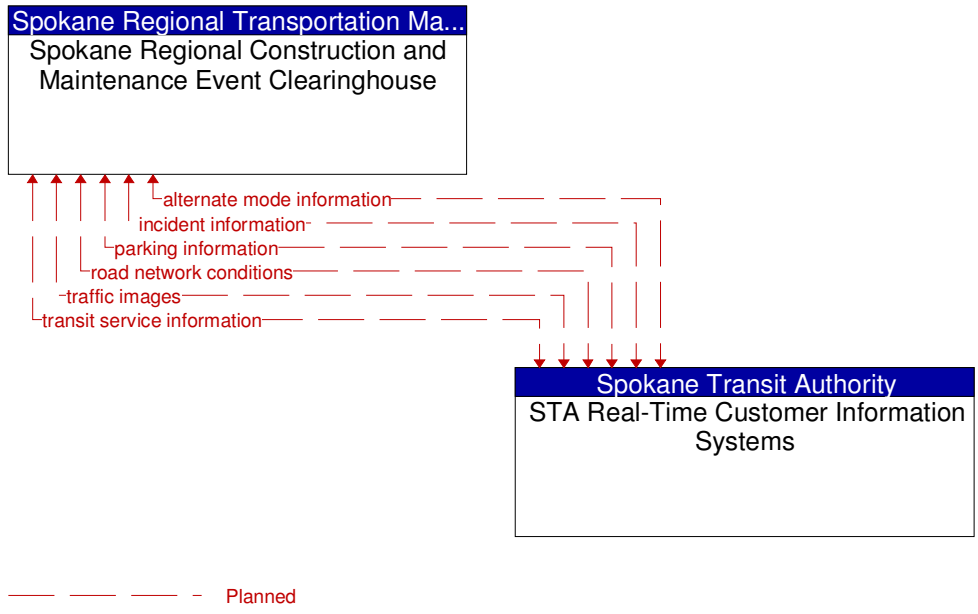
Figure 97: Spokane Regional Construction and Maintenance Event Clearinghouse - STA Real-Time Customer Information Systems Interface
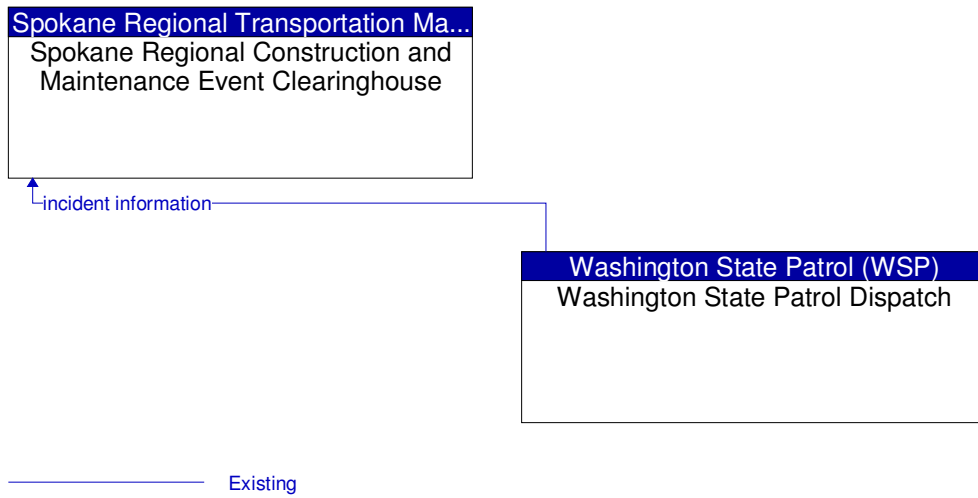
Figure 98: Spokane Regional Construction and Maintenance Event Clearinghouse - Washington State Patrol Dispatch Interface
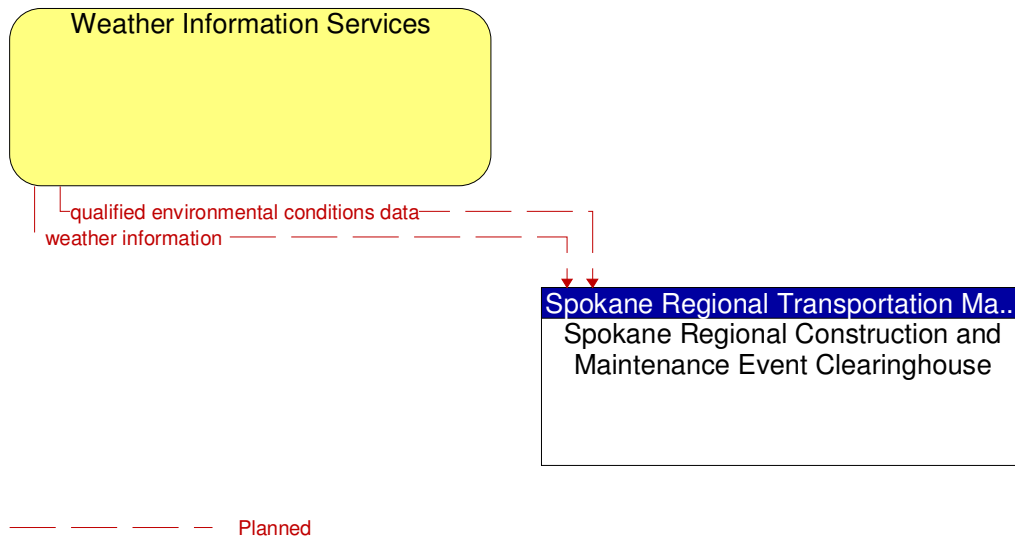
Figure 99: Spokane Regional Construction and Maintenance Event Clearinghouse - Weather Information Services Interface
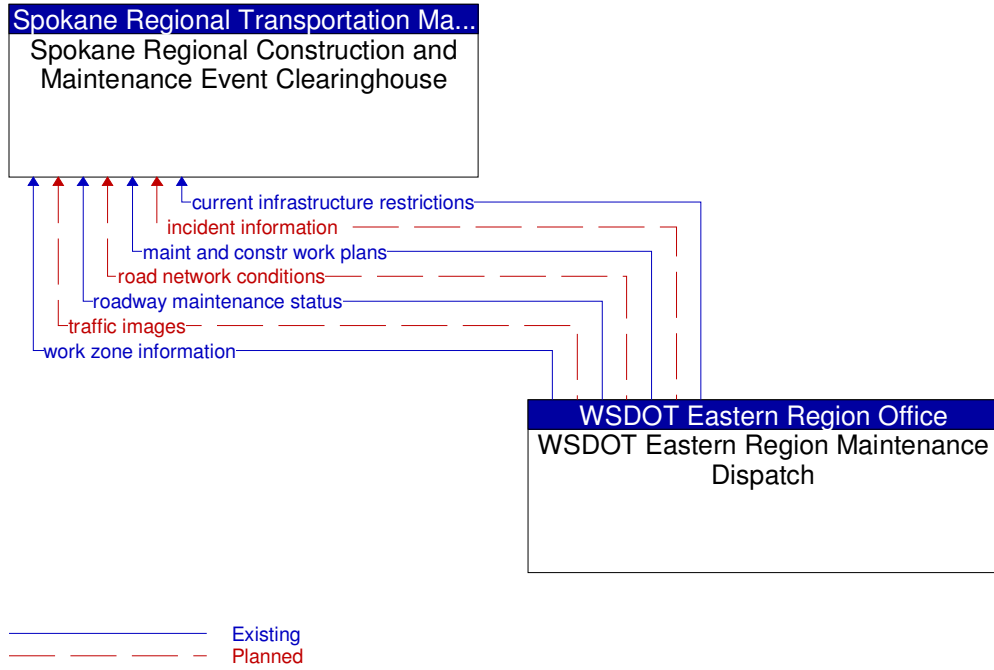
Figure 100: Spokane Regional Construction and Maintenance Event Clearinghouse - WSDOT Eastern Region Maintenance Dispatch Interface
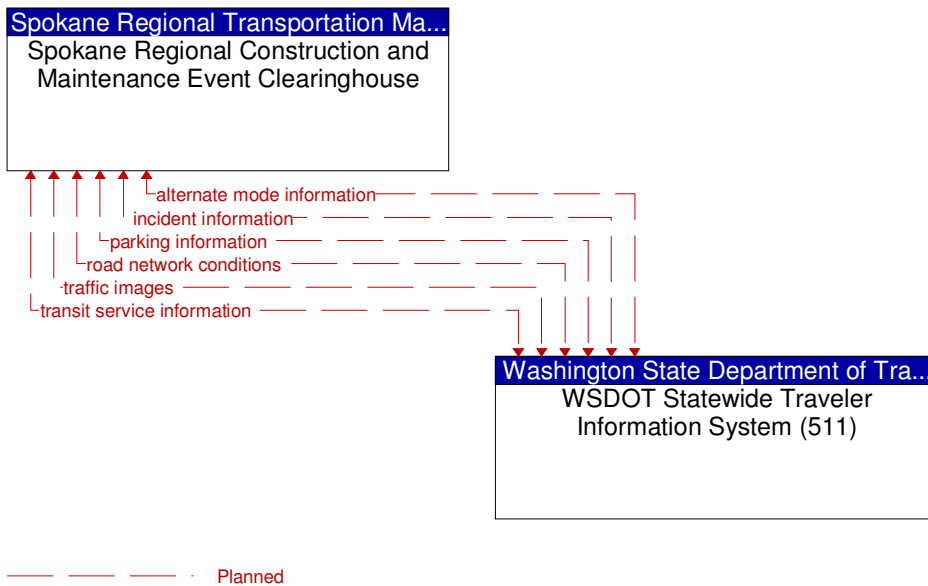
Figure 101: Spokane Regional Construction and Maintenance Event Clearinghouse - WSDOT Statewide Traveler Information System (511) Interface
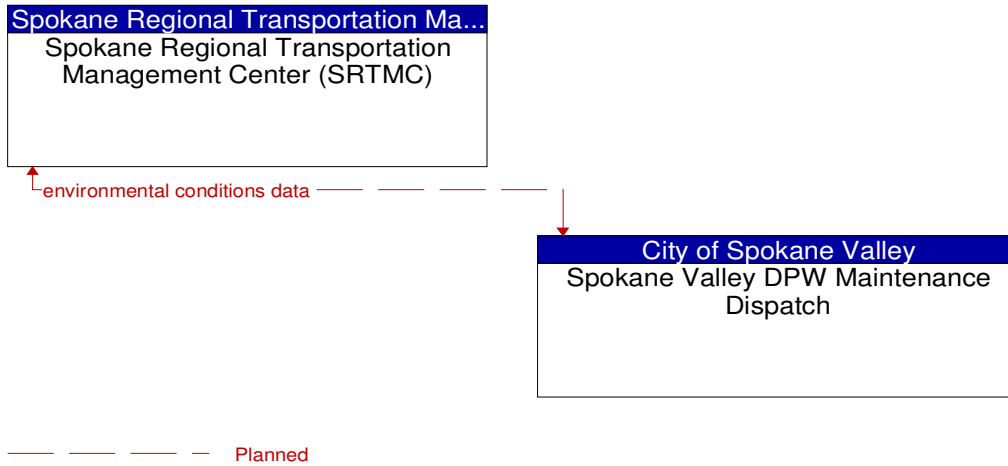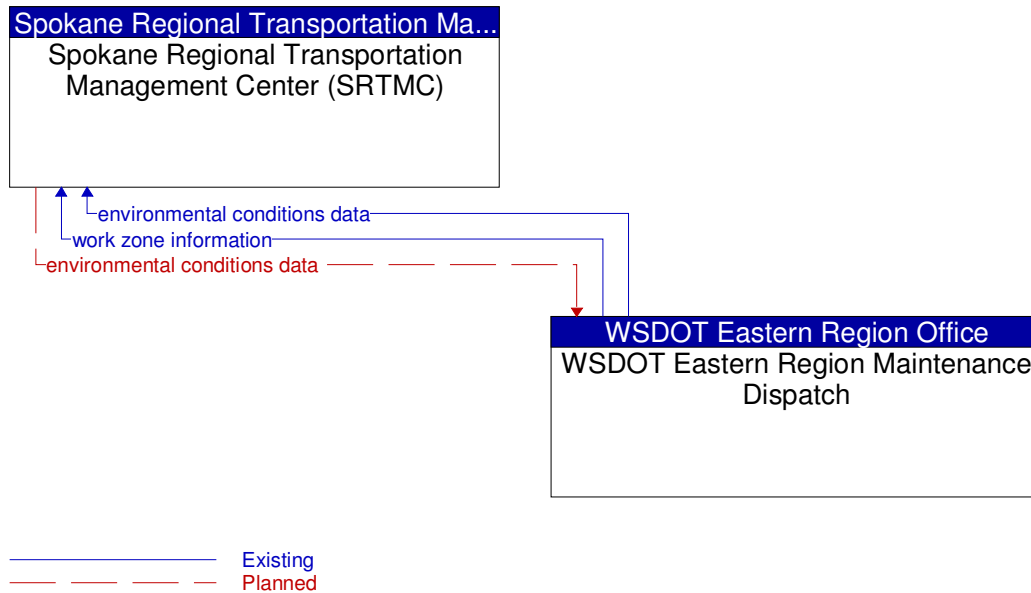
Figure 102: Spokane Regional Transportation Management Center (SRTMC) - Spokane Valley DPW Maintenance Dispatch Interface
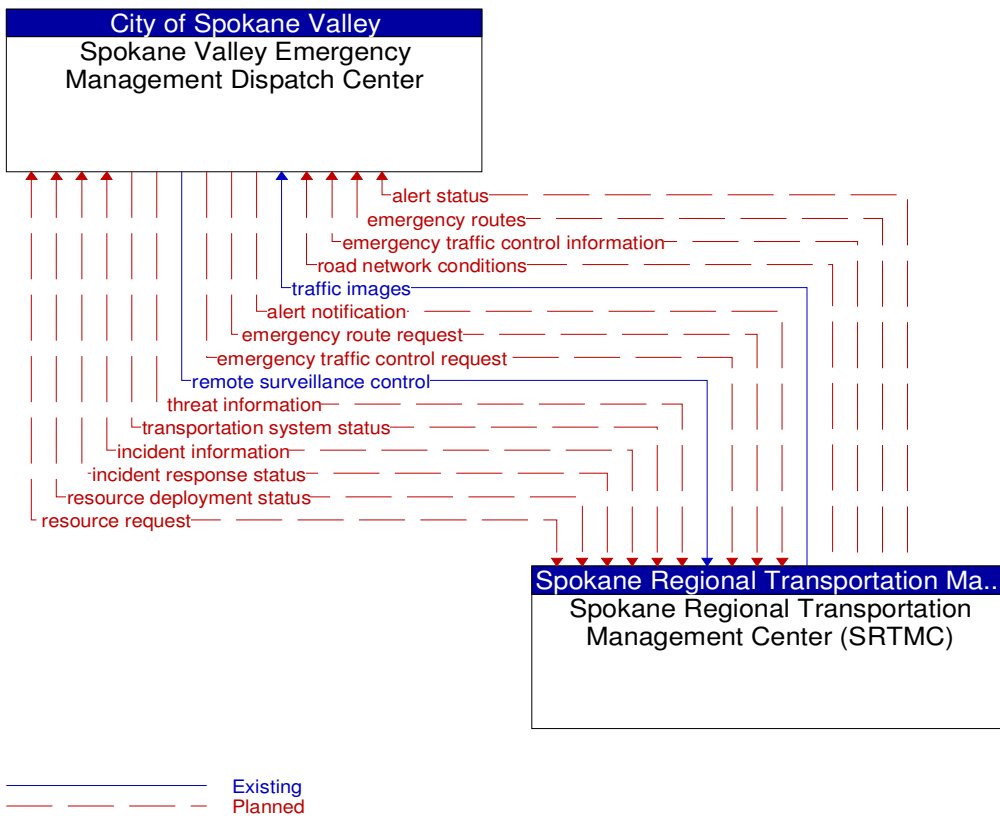
Figure 103: Spokane Regional Transportation Management Center (SRTMC) - Spokane Valley Emergency Management Dispatch Center Interface
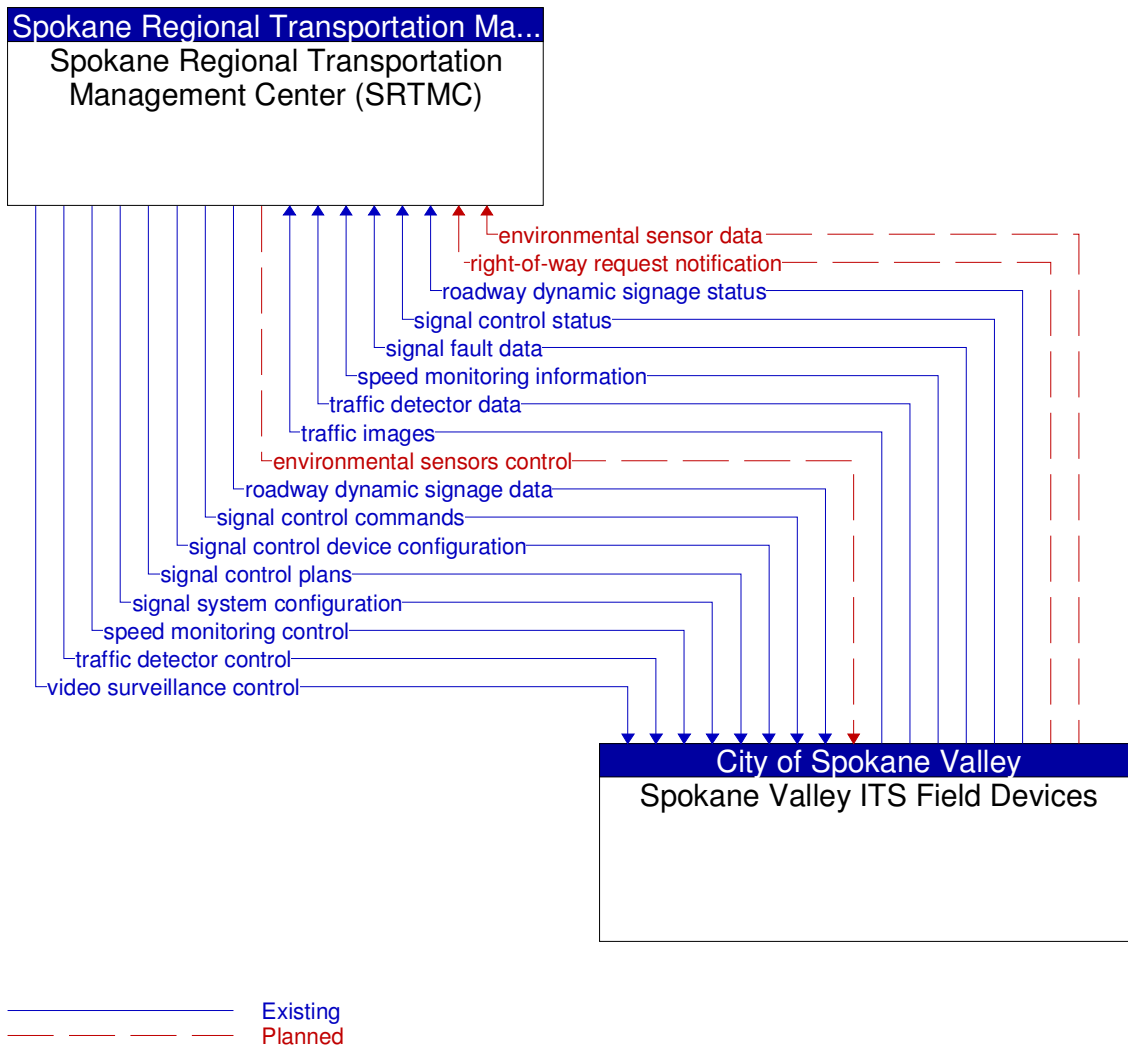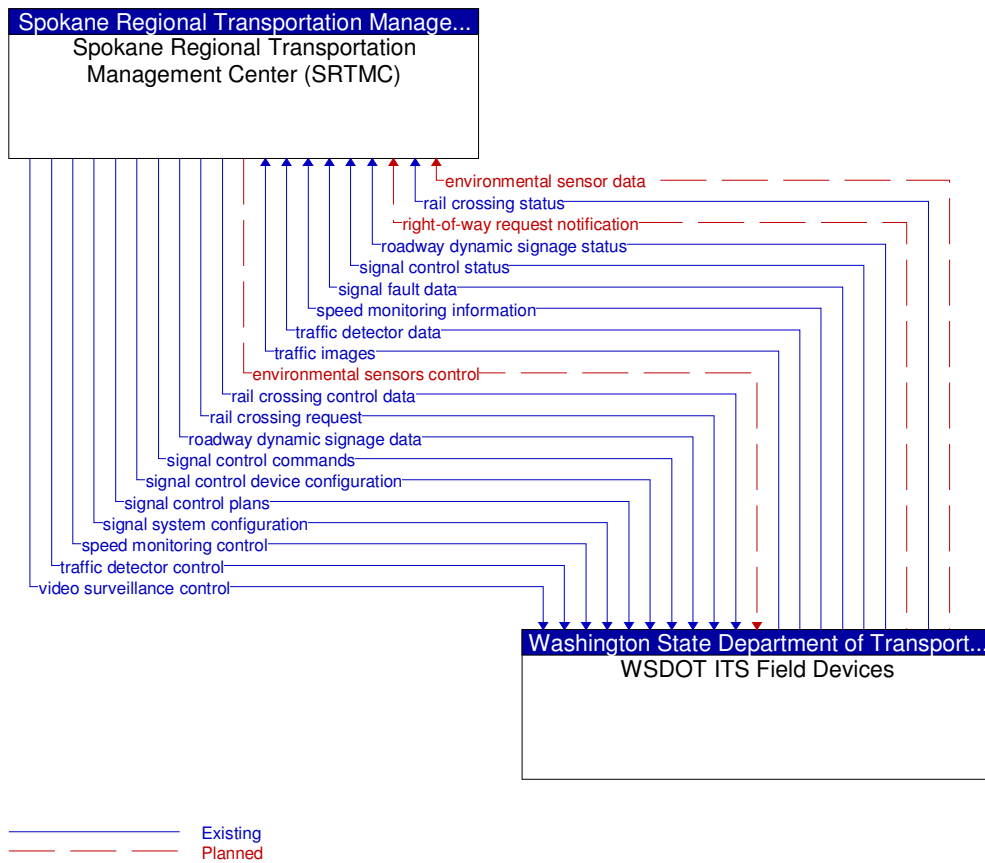
Figure 104: Spokane Regional Transportation Management Center (SRTMC) - Spokane Valley ITS Field Devices Interface
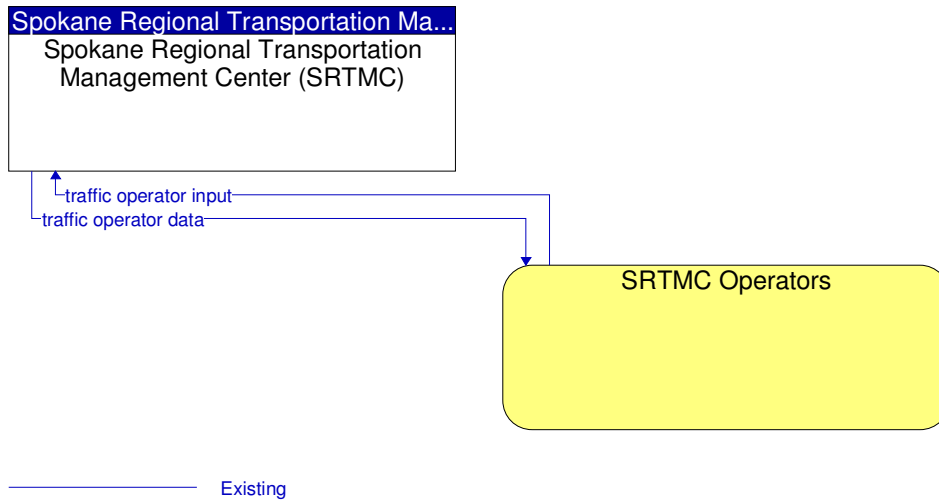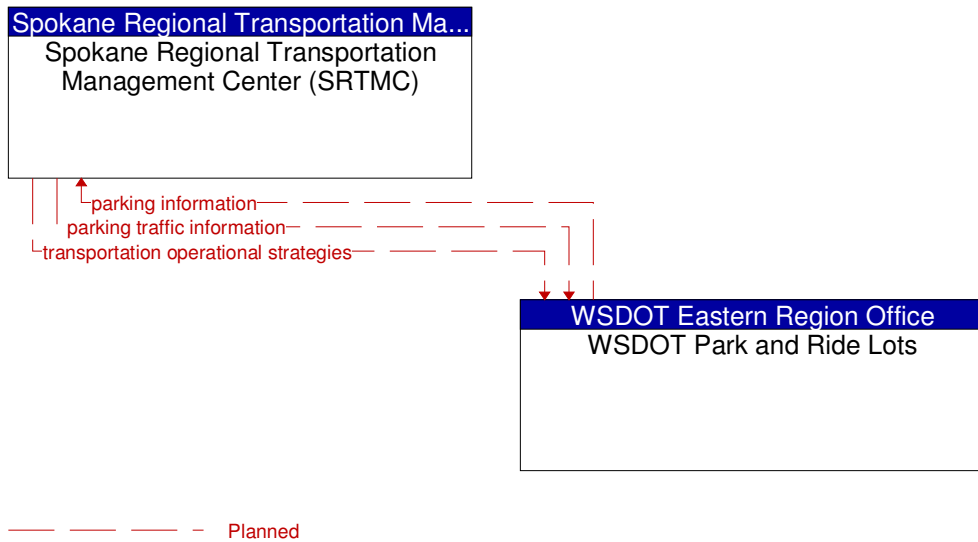
Figure 105: Spokane Regional Transportation Management Center (SRTMC) - SRTMC Operators Interface
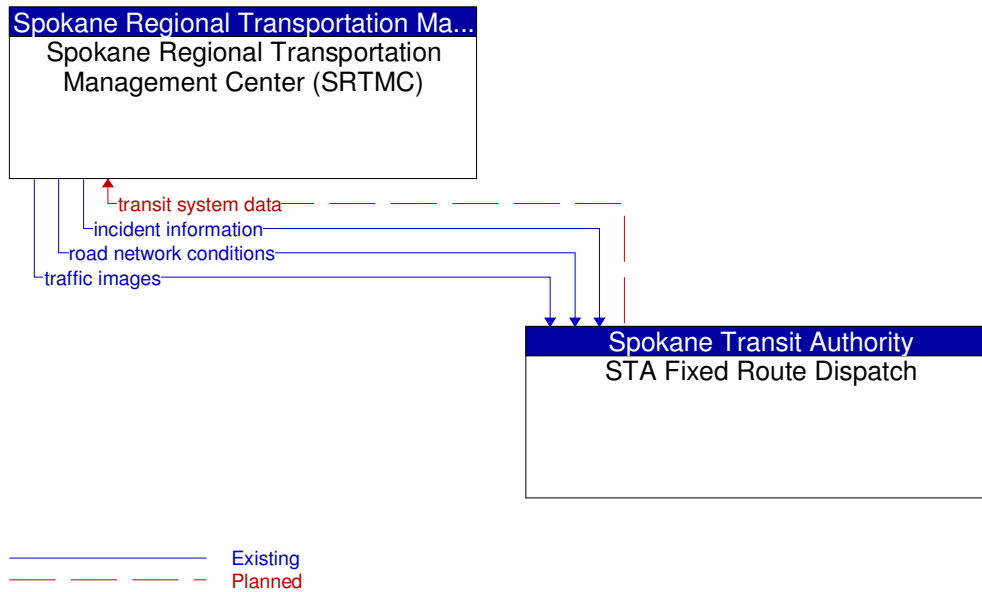
Figure 106: Spokane Regional Transportation Management Center (SRTMC) - STA Fixed Route Dispatch Interface
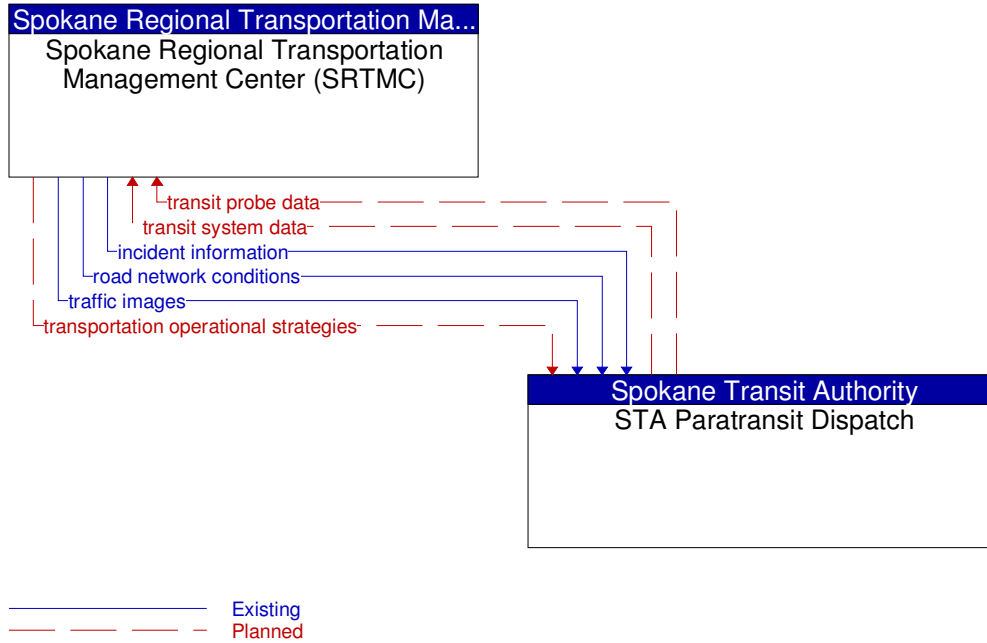
Figure 107: Spokane Regional Transportation Management Center (SRTMC) - STA Paratransit Dispatch Interface
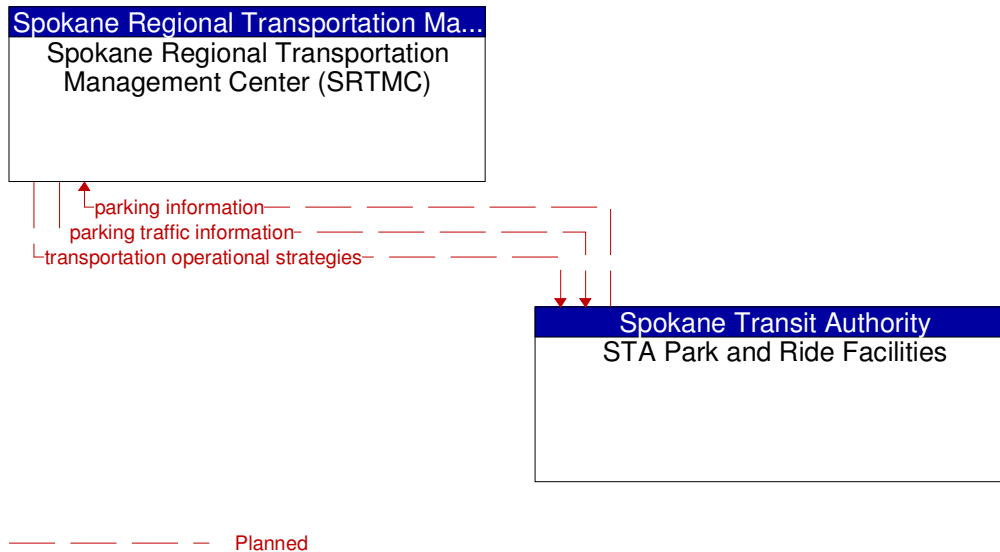
Figure 108: Spokane Regional Transportation Management Center (SRTMC) - STA Park and Ride Facilities Interface
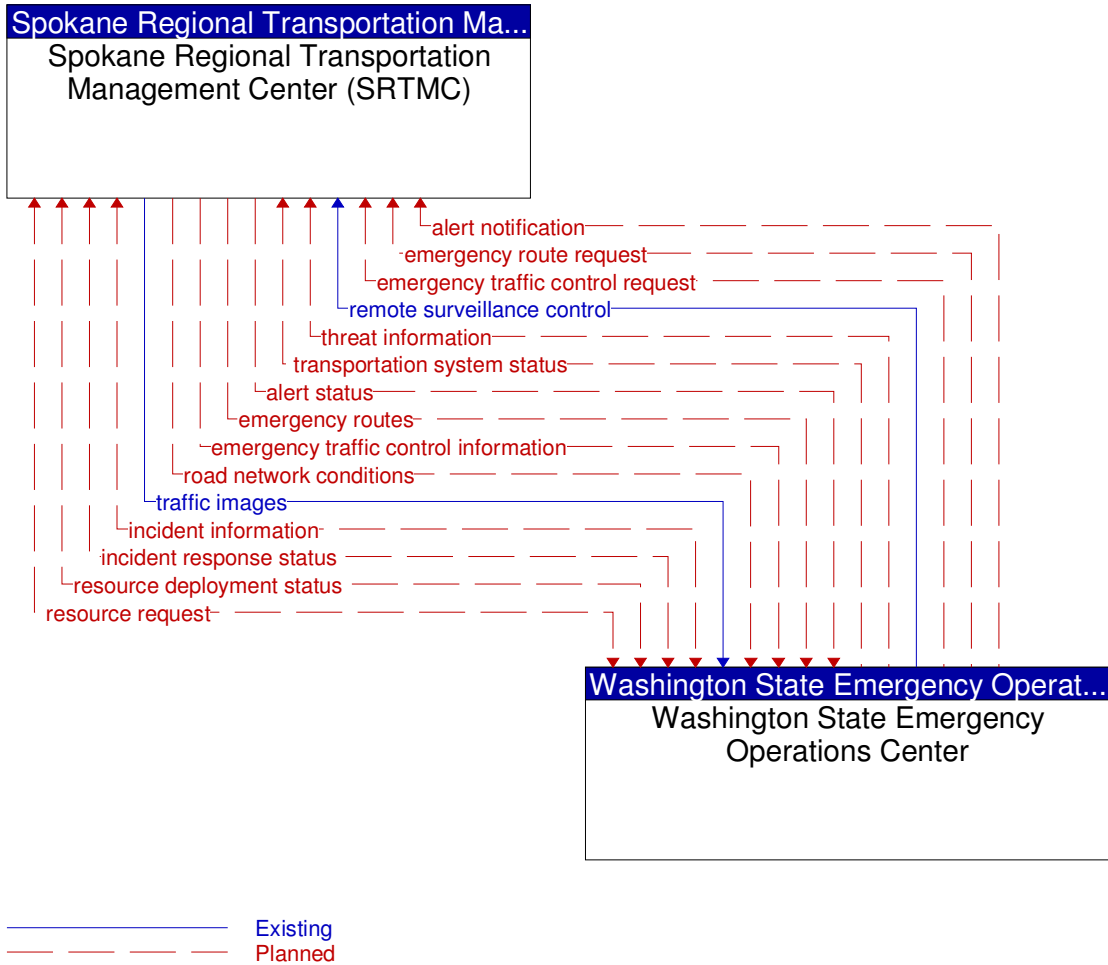
Figure 109: Spokane Regional Transportation Management Center (SRTMC) - Washington State Emergency Operations Center Interface
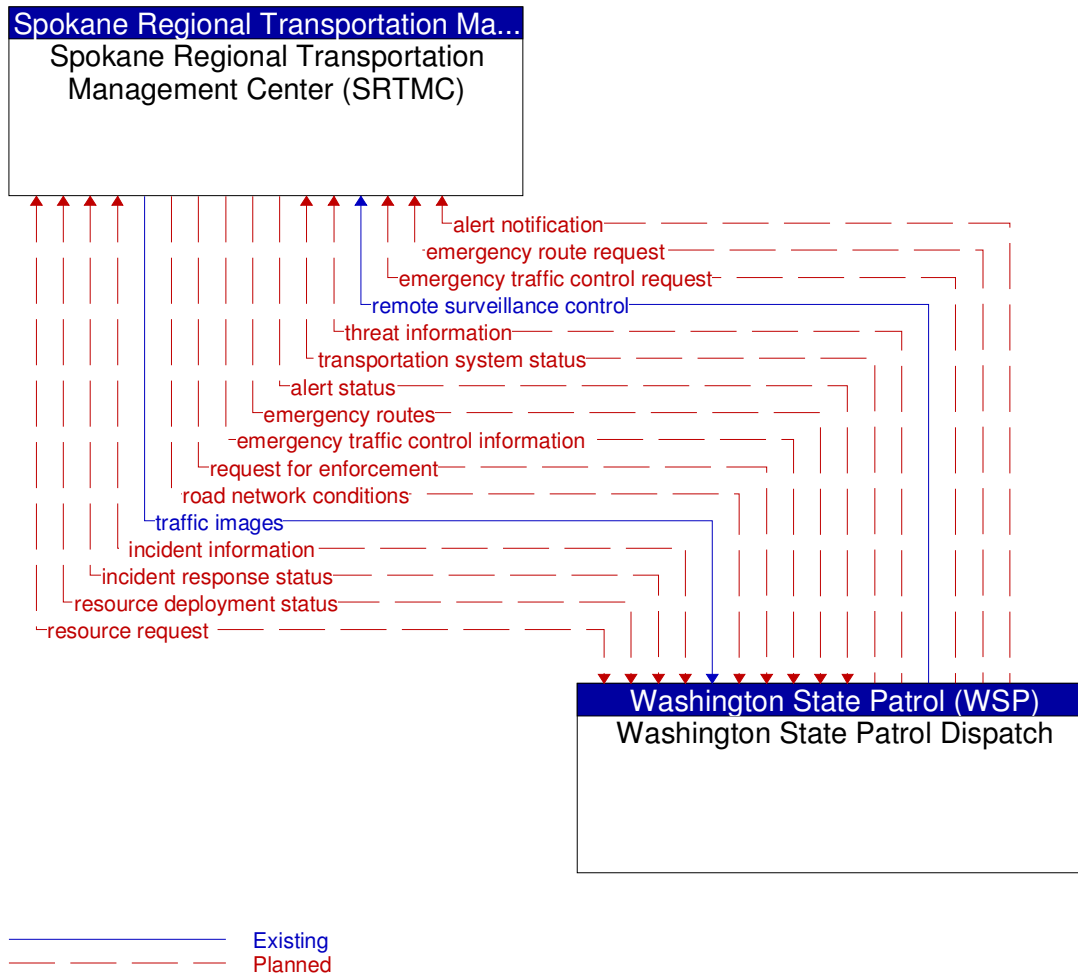
Figure 110: Spokane Regional Transportation Management Center (SRTMC) - Washington State Patrol Dispatch Interface
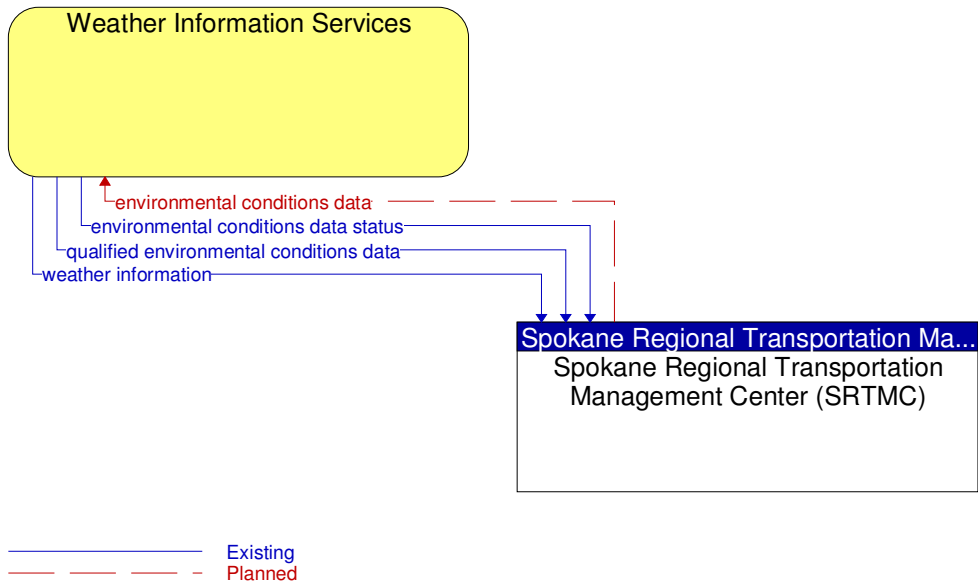
Figure 111: Spokane Regional Transportation Management Center (SRTMC) - Weather Information Services Interface

Figure 112: Spokane Regional Transportation Management Center (SRTMC) - WSDOT Eastern Region Maintenance Dispatch Interface

Spokane Regional Transportation Manage...
Spokane Regional Transportation
Management Center (SRTMC)

environmental sensor data
rail crossing status
right-of-way request notification
roadway dynamic signage status
signal control status
signal fault data
speed monitoring information
traffic detector data
traffic images
environmental sensors control
rail crossing control data
rail crossing request
roadway dynamic signage data
signal control commands
signal control device configuration
signal control plans
signal system configuration
speed monitoring control
traffic detector control
video surveillance control

Washington State Department of Transport...
WSDOT ITS Field Devices

Existing
Planned

Figure 113: Spokane Regional Transportation Management Center (SRTMC) - WSDOT ITS Field Devices Interface

Figure 114: Spokane Regional Transportation Management Center (SRTMC) - WSDOT Park and Ride Lots Interface
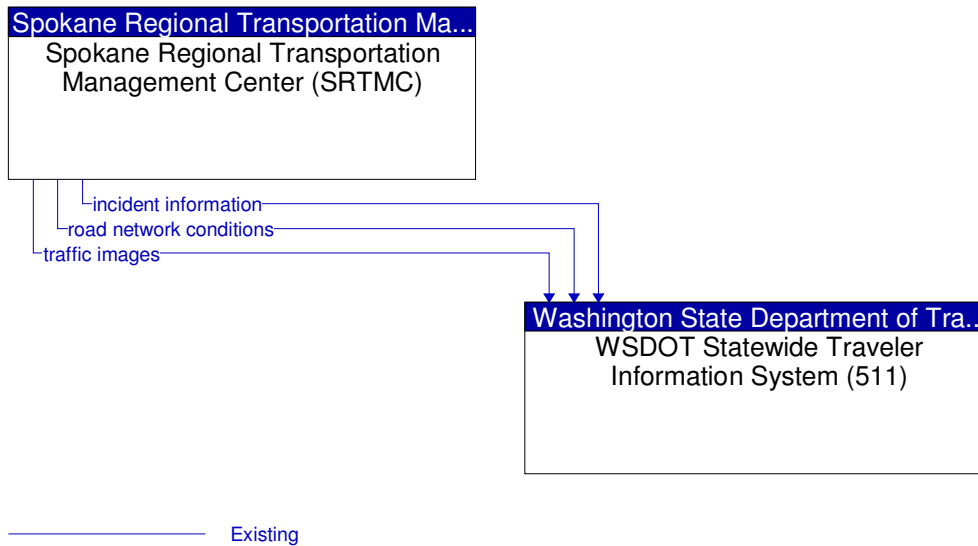
Figure 115: Spokane Regional Transportation Management Center (SRTMC) - WSDOT Statewide Traveler Information System (511) Interface
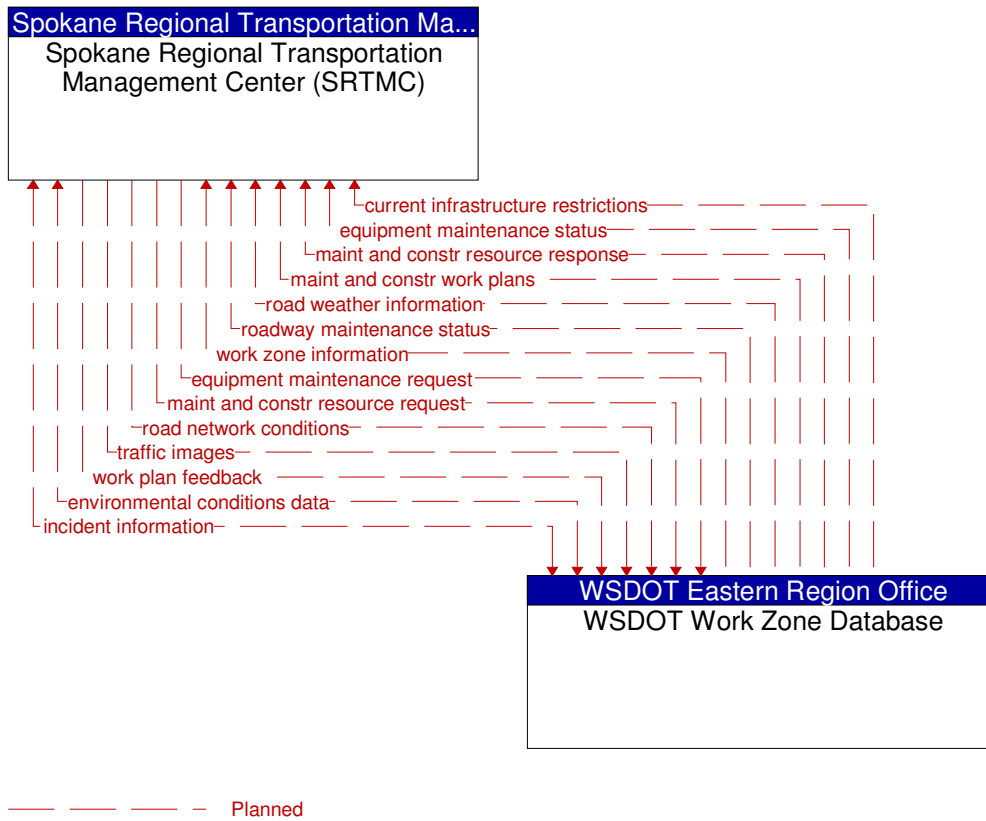
Figure 116: Spokane Regional Transportation Management Center (SRTMC) - WSDOT Work Zone Database Interface
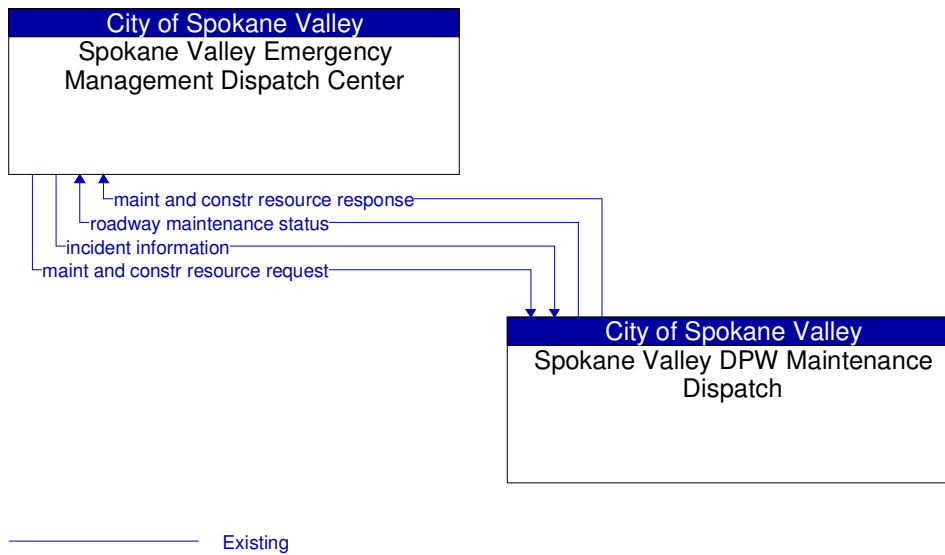
Figure 117: Spokane Valley DPW Maintenance Dispatch - Spokane Valley Emergency Management Dispatch Center Interface
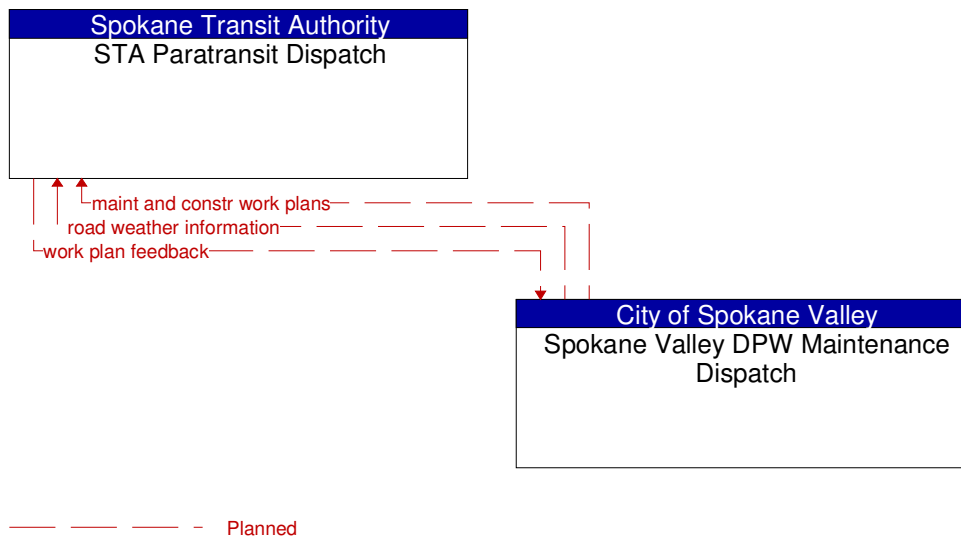
Figure 118: Spokane Valley DPW Maintenance Dispatch - STA Paratransit Dispatch Interface
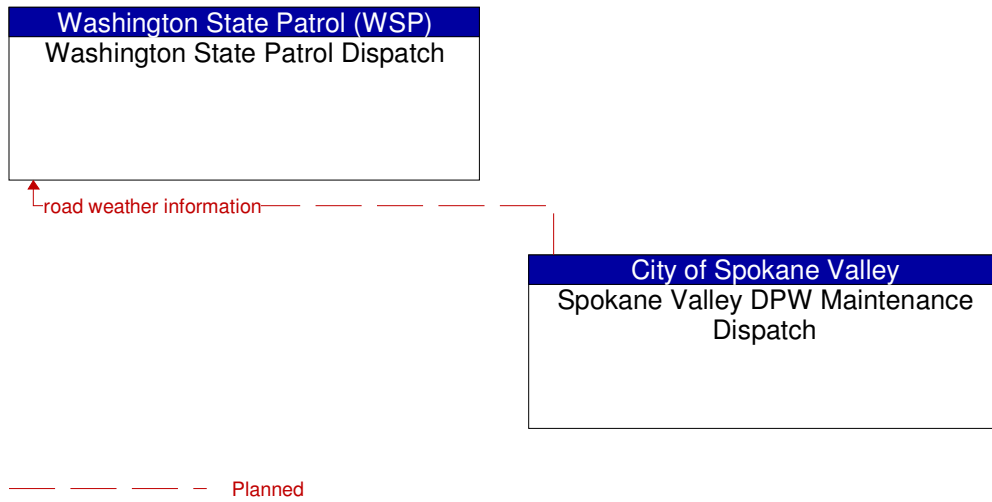
Figure 119: Spokane Valley DPW Maintenance Dispatch - Washington State Patrol Dispatch Interface
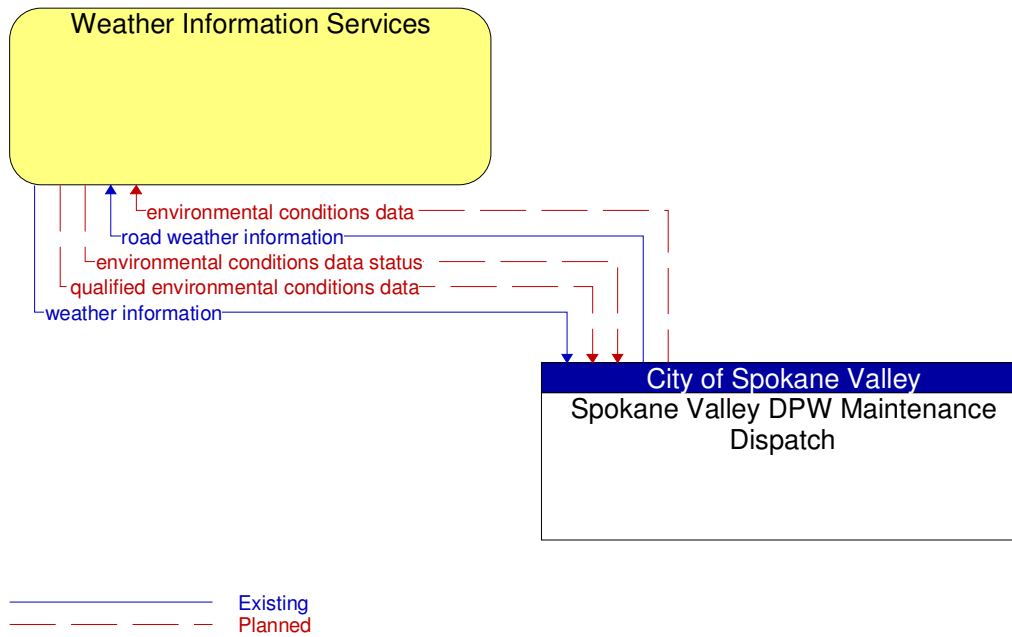
Figure 120: Spokane Valley DPW Maintenance Dispatch - Weather Information Services Interface
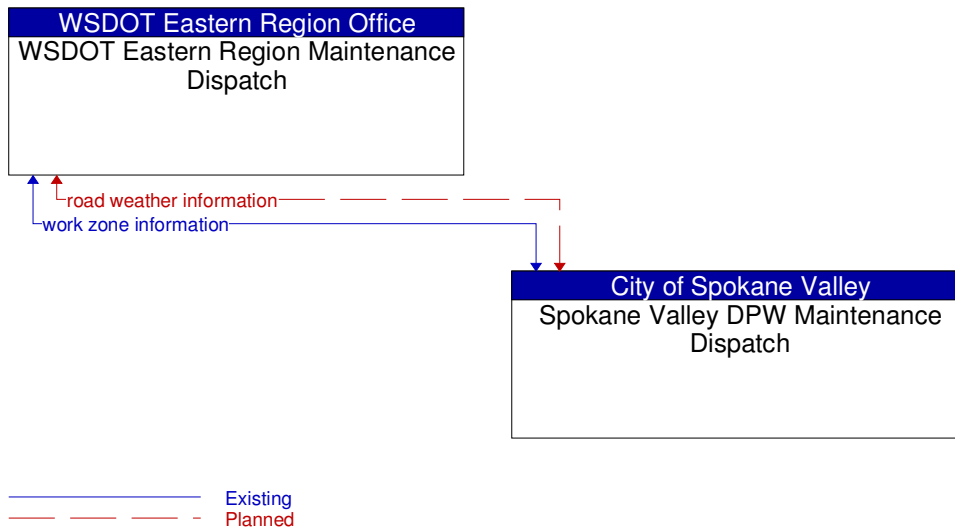
Figure 121: Spokane Valley DPW Maintenance Dispatch - WSDOT Eastern Region Maintenance Dispatch Interface
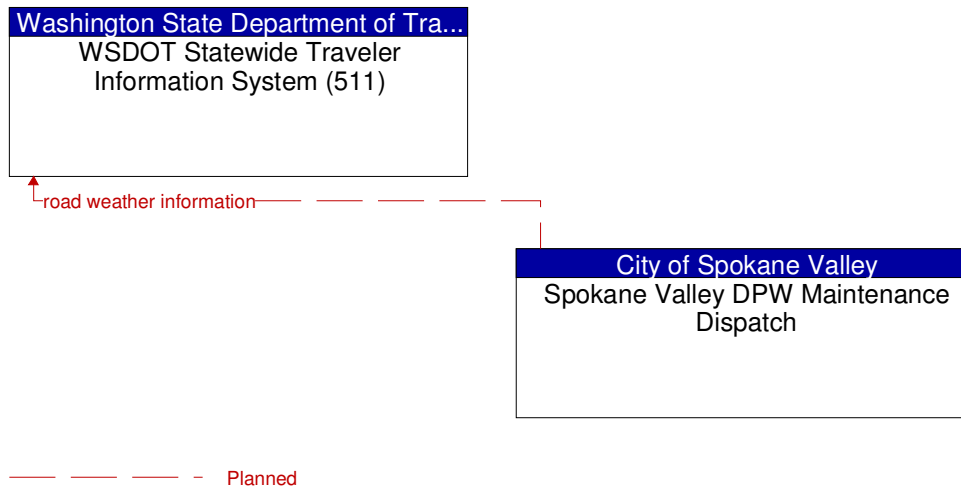
Figure 122: Spokane Valley DPW Maintenance Dispatch - WSDOT Statewide Traveler Information System (511) Interface
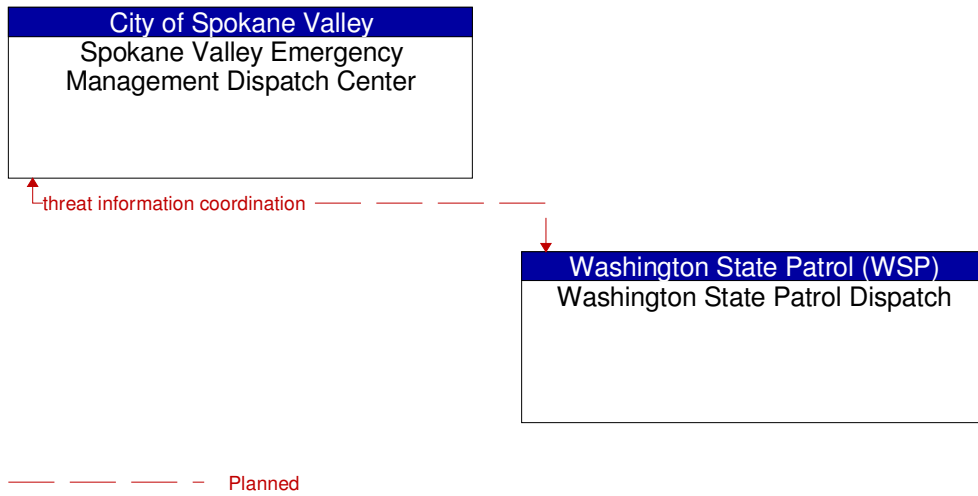
Figure 123: Spokane Valley Emergency Management Dispatch Center - Washington State Patrol Dispatch Interface
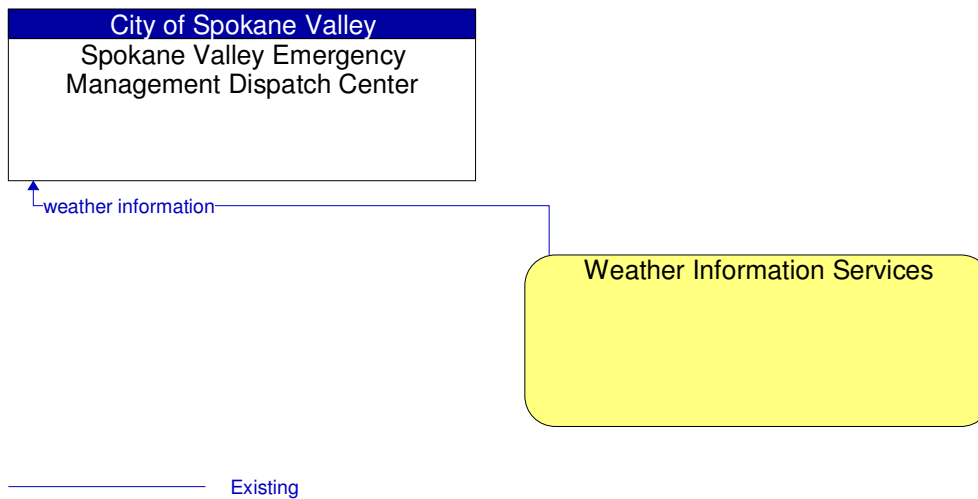

Figure 124: Spokane Valley Emergency Management Dispatch Center - Weather Information Services Interface
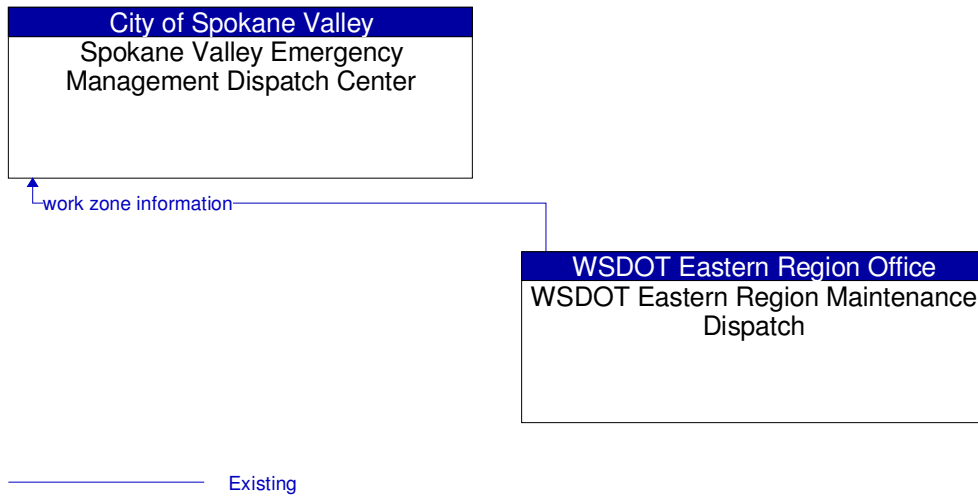
City of Spokane Valley
Spokane Valley Emergency
Management Dispatch Center

work zone information

WSDOT Eastern Region Office
WSDOT Eastern Region Maintenance
Dispatch

Existing

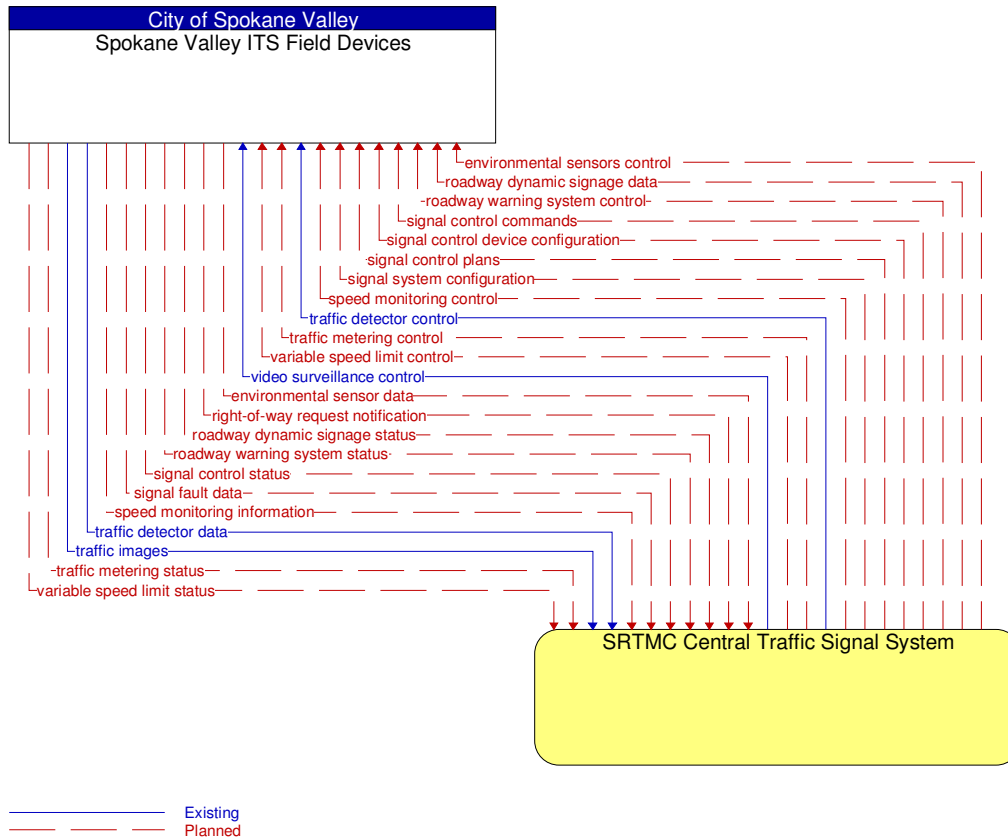**Figure 125: Spokane Valley Emergency Management Dispatch Center - WSDOT Eastern Region Maintenance Dispatch Interface**

City of Spokane Valley
Spokane Valley ITS Field Devices

environmental sensors control
roadway dynamic signage data
roadway warning system control
signal control commands
signal control device configuration
signal control plans
signal system configuration
speed monitoring control
traffic detector control
traffic metering control
variable speed limit control
video surveillance control
environmental sensor data
right-of-way request notification
roadway dynamic signage status
roadway warning system status
signal control status
signal fault data
speed monitoring information
traffic detector data
traffic images
traffic metering status
variable speed limit status

SRTMC Central Traffic Signal System

Existing
Planned

Figure 126: Spokane Valley ITS Field Devices - SRTMC Central Traffic Signal System Interface
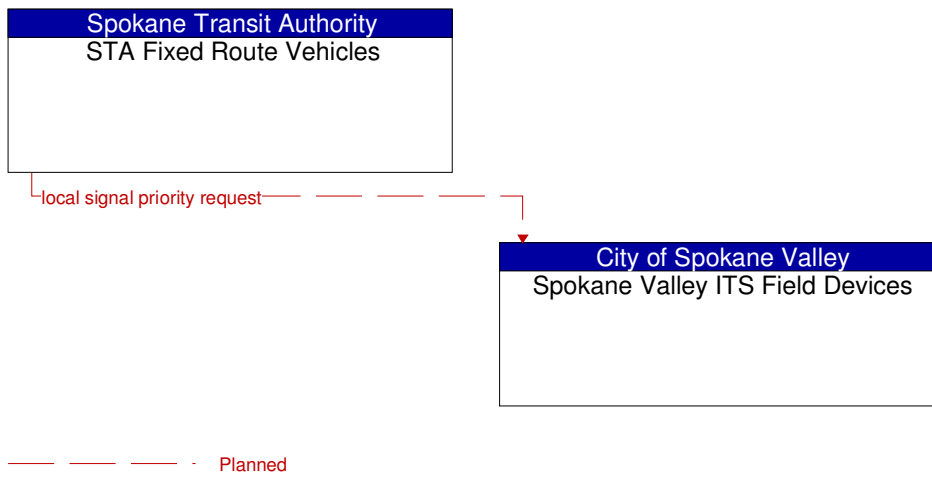
288

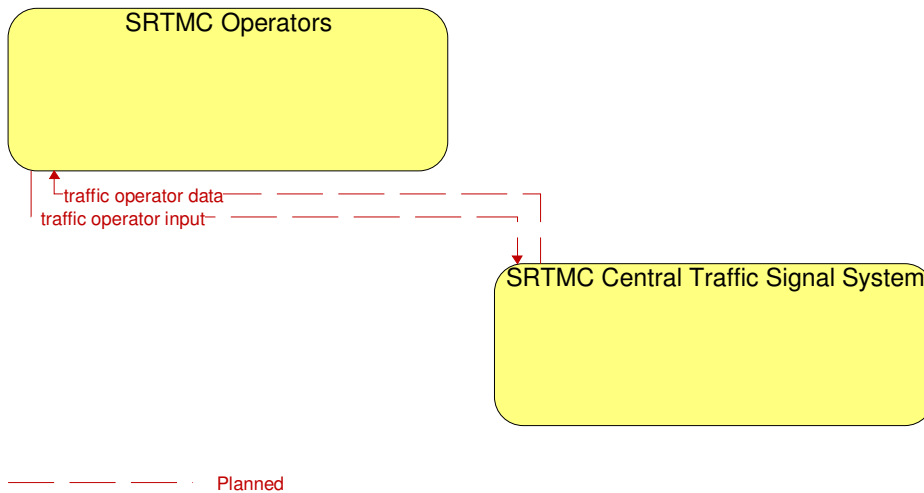**Figure 127: Spokane Valley ITS Field Devices - STA Fixed Route Vehicles Interface**

Figure 128: SRTMC Central Traffic Signal System - SRTMC Operators Interface
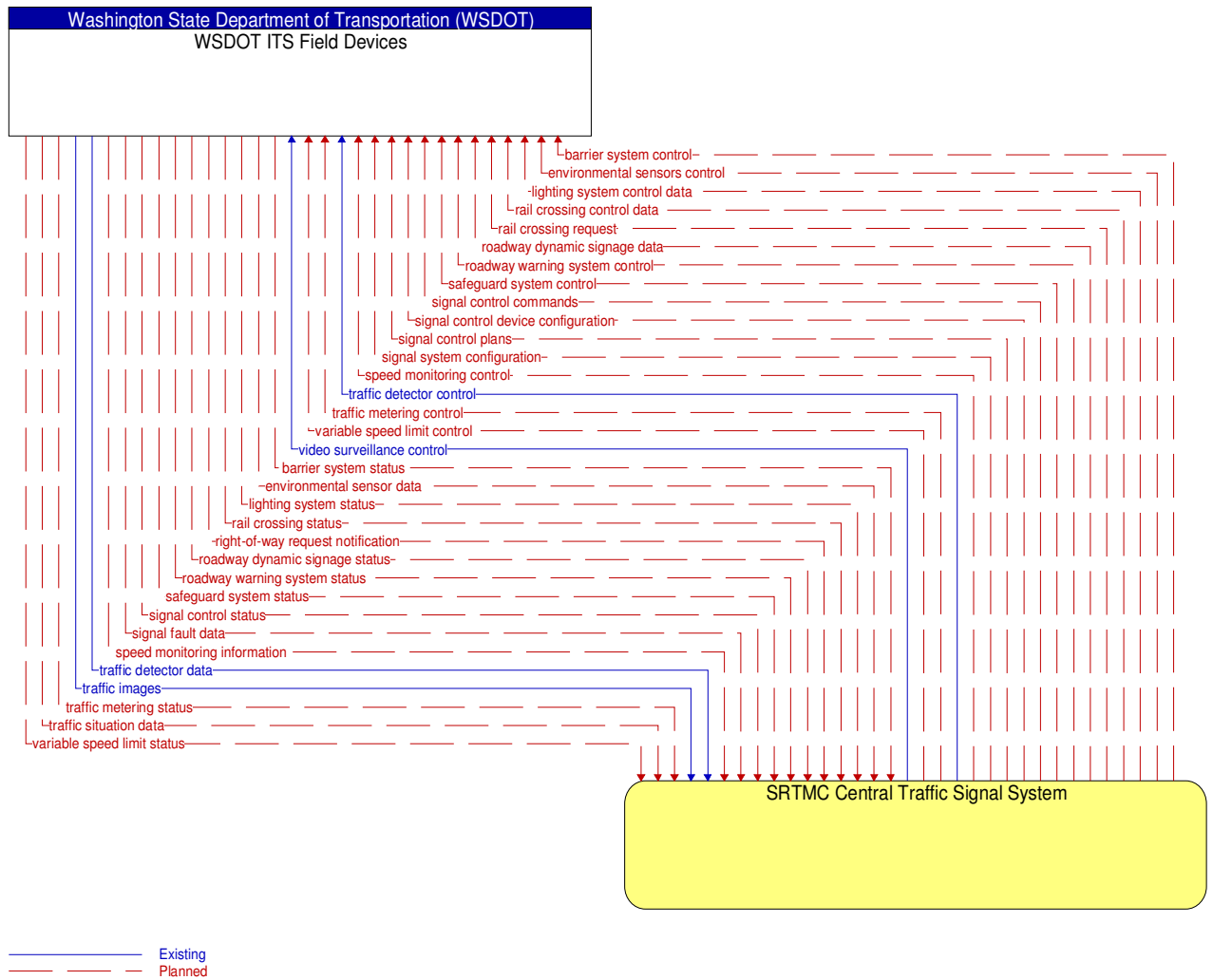
Washington State Department of Transportation (WSDOT)
WSDOT ITS Field Devices

barrier system control
environmental sensors control
lighting system control data
rail crossing control data
rail crossing request
roadway dynamic signage data
roadway warning system control
safeguard system control
signal control commands
signal control device configuration
signal control plans
signal system configuration
speed monitoring control
traffic detector control
traffic metering control
variable speed limit control
video surveillance control
barrier system status
environmental sensor data
lighting system status
rail crossing status
right-of-way request notification
roadway dynamic signage status
roadway warning system status
safeguard system status
signal control status
signal fault data
speed monitoring information
traffic detector data
traffic images
traffic metering status
traffic situation data
variable speed limit status

SRTMC Central Traffic Signal System

Existing
Planned

Figure 129: SRTMC Central Traffic Signal System - WSDOT ITS Field Devices Interface
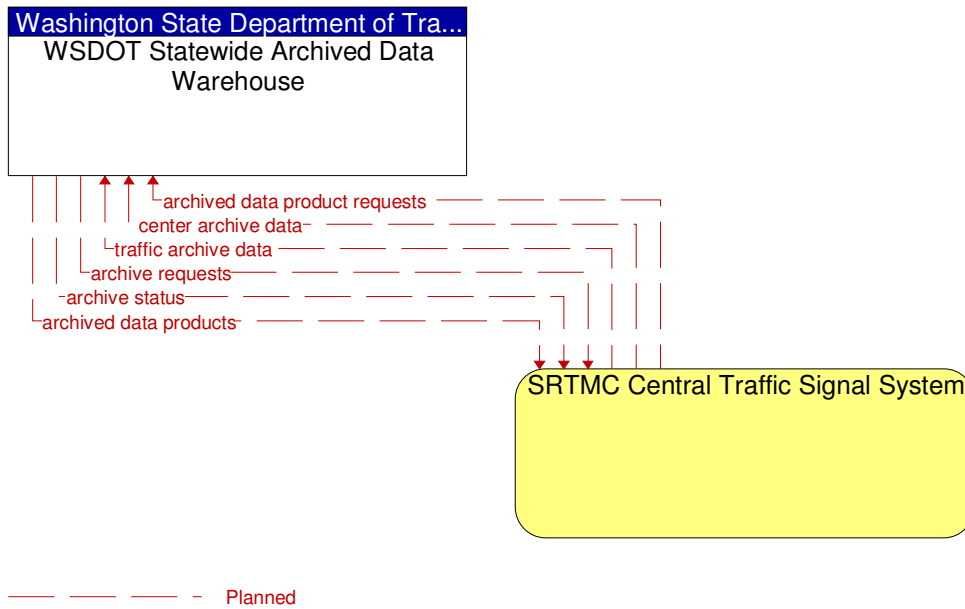
Figure 130: SRTMC Central Traffic Signal System - WSDOT Statewide Archived Data Warehouse Interface
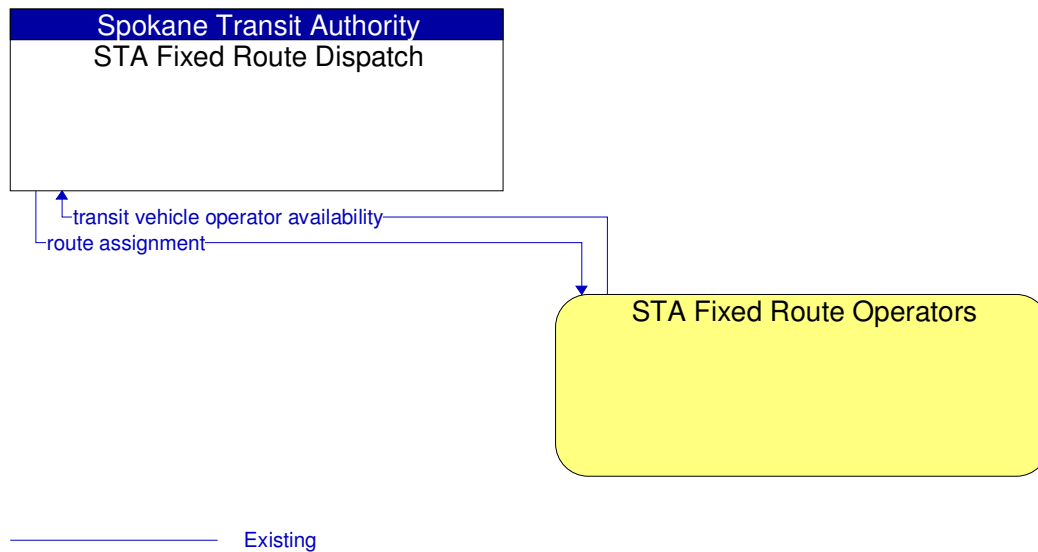
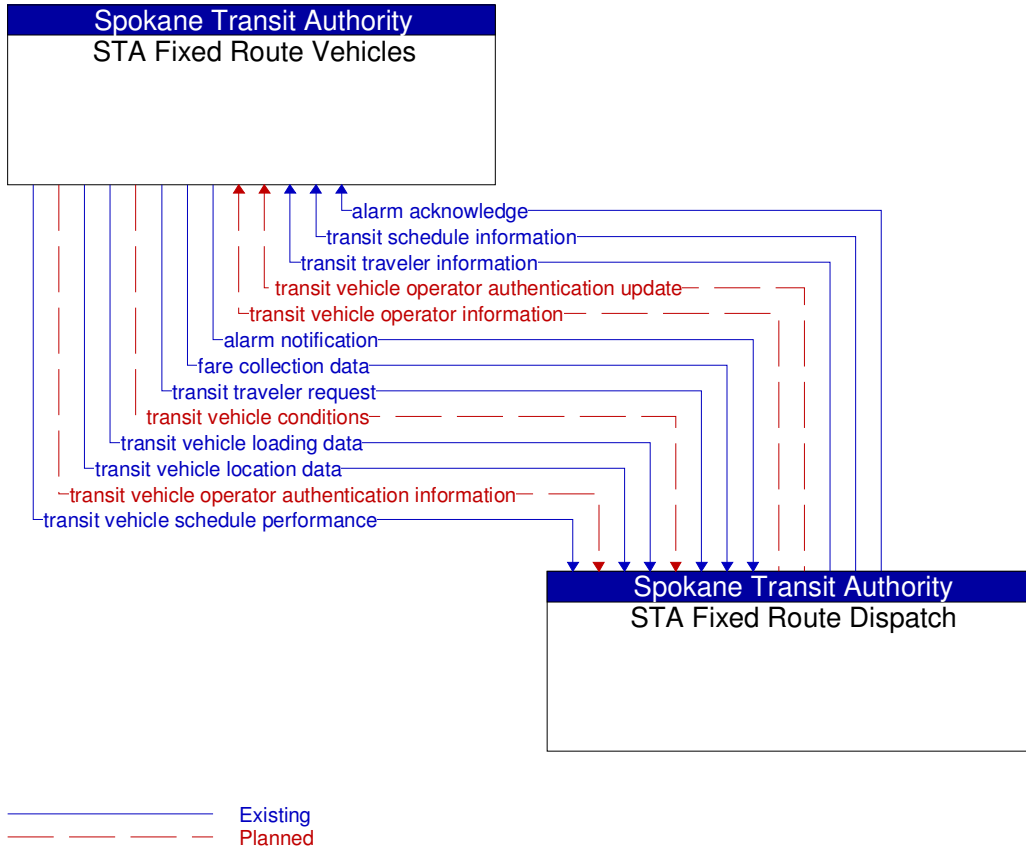**Figure 131: STA Fixed Route Dispatch - STA Fixed Route Operators Interface**

Figure 132: STA Fixed Route Dispatch - STA Fixed Route Vehicles Interface
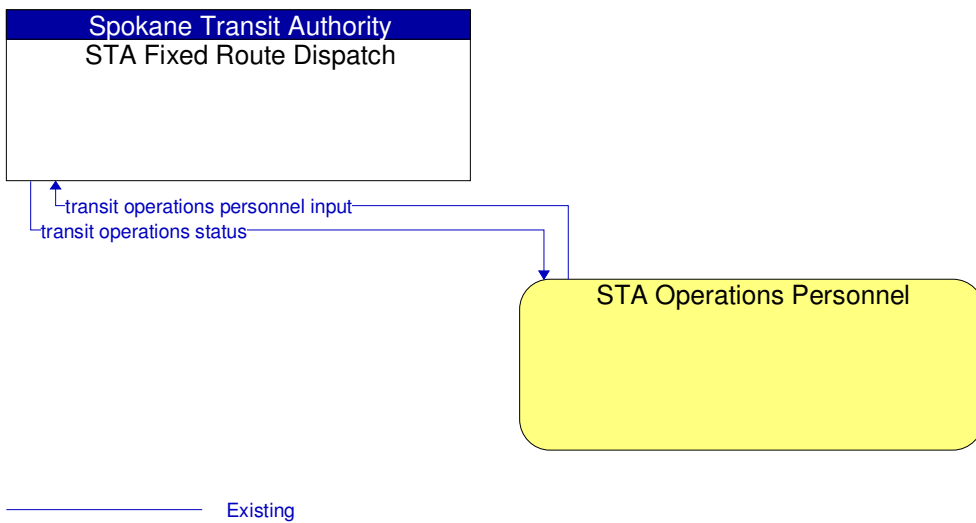

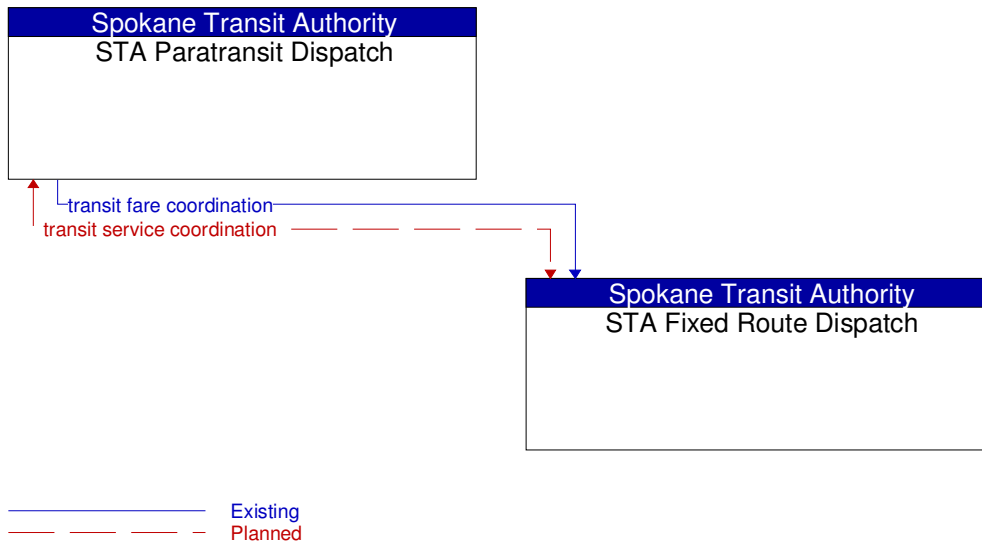**Figure 133: STA Fixed Route Dispatch - STA Operations Personnel Interface**

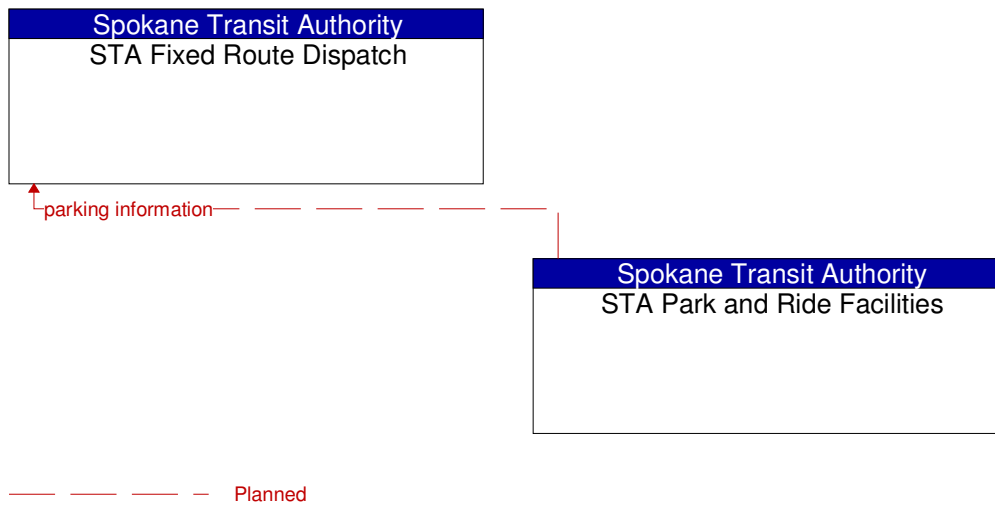**Figure 134: STA Fixed Route Dispatch - STA Paratransit Dispatch Interface**

Figure 135: STA Fixed Route Dispatch - STA Park and Ride Facilities Interface
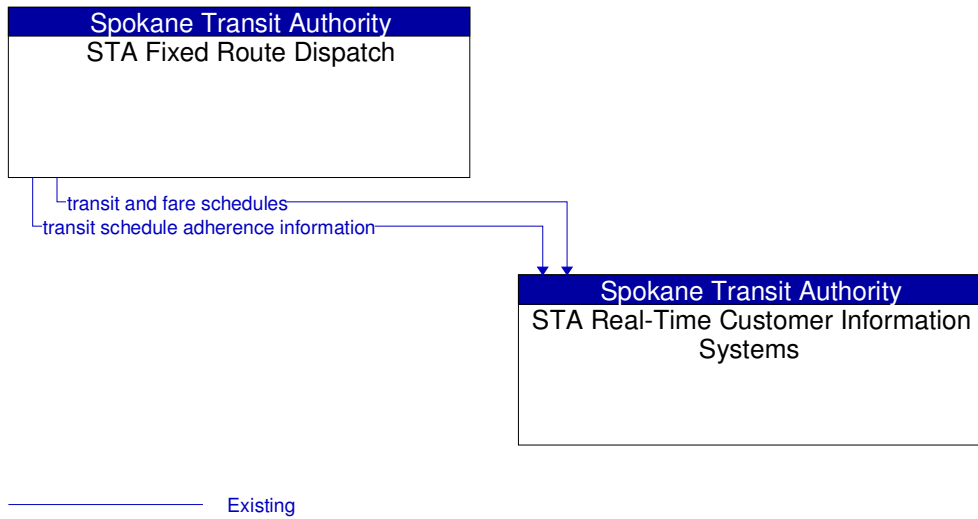
Figure 136: STA Fixed Route Dispatch - STA Real-Time Customer Information Systems Interface
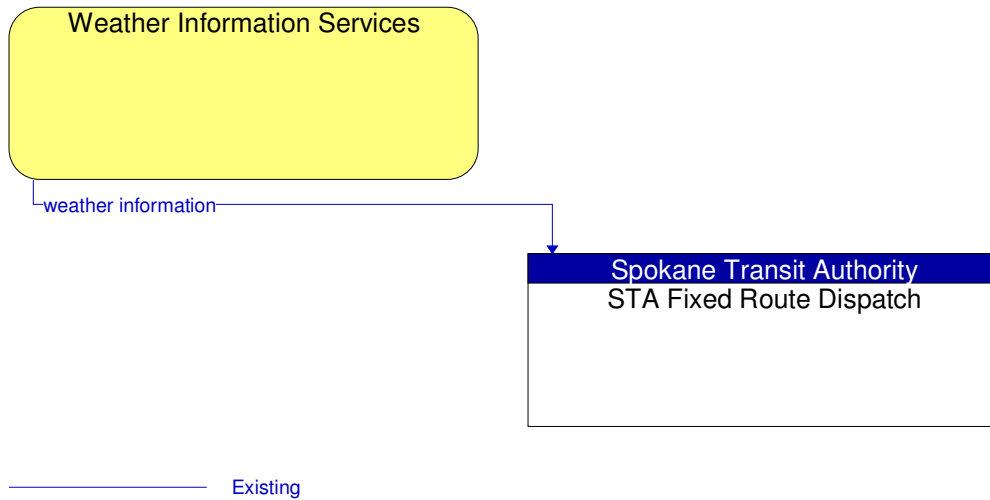

Figure 137: STA Fixed Route Dispatch - Weather Information Services Interface
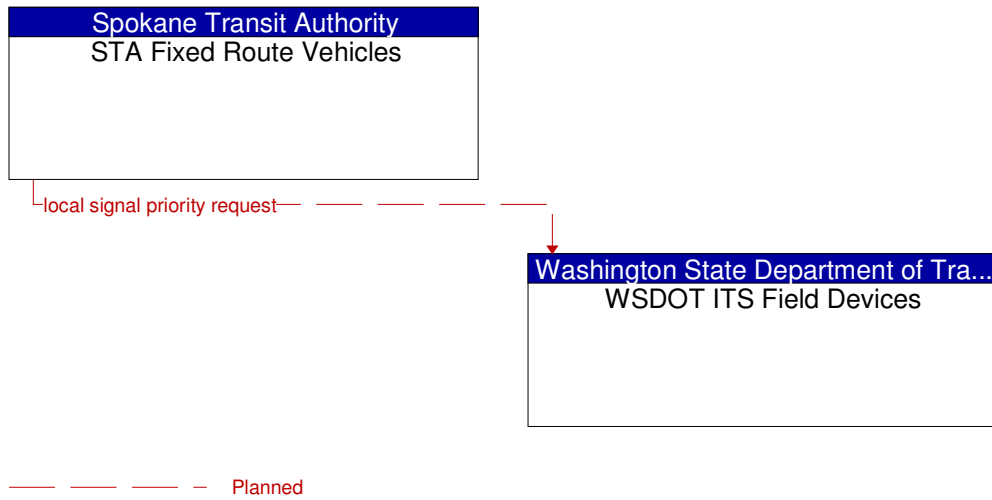
Figure 138: STA Fixed Route Vehicles - WSDOT ITS Field Devices Interface
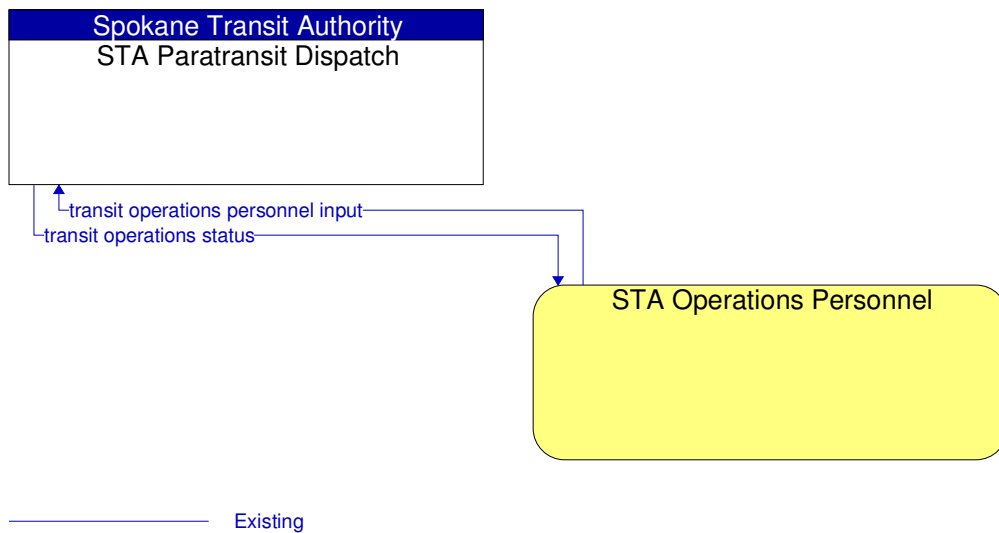

Figure 139: STA Operations Personnel - STA Paratransit Dispatch Interface
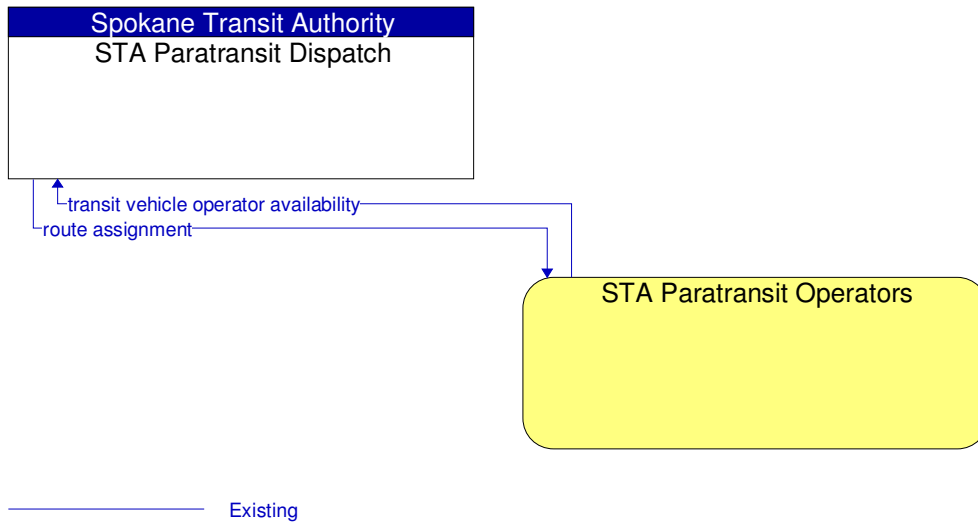
Figure 140: STA Paratransit Dispatch - STA Paratransit Operators Interface
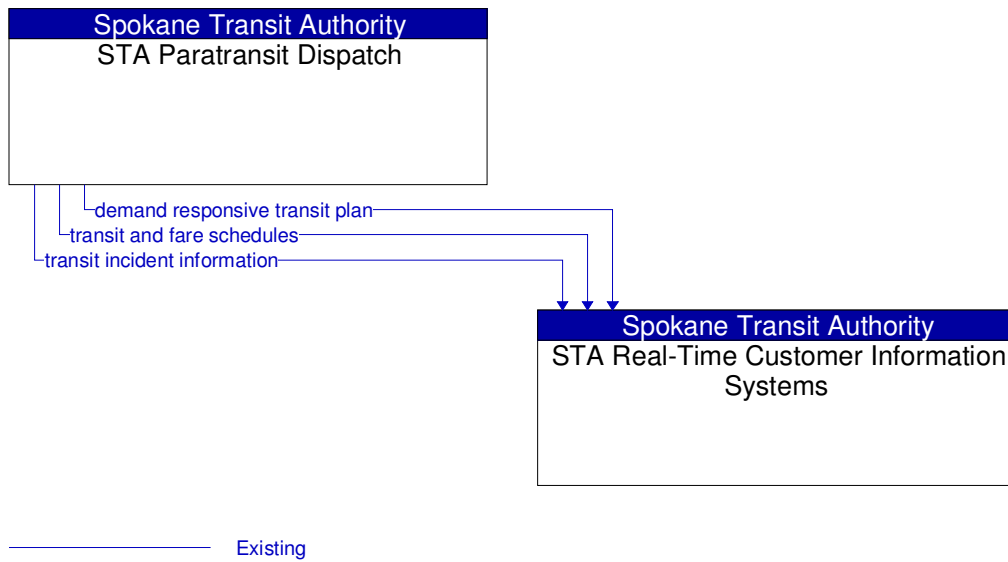

Figure 141: STA Paratransit Dispatch - STA Real-Time Customer Information Systems Interface
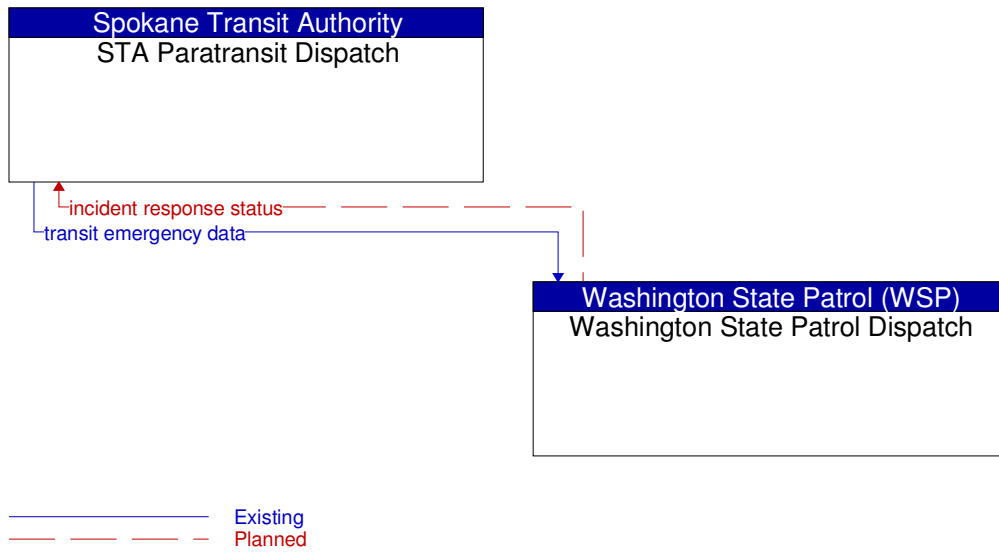
Figure 142: STA Paratransit Dispatch - Washington State Patrol Dispatch Interface
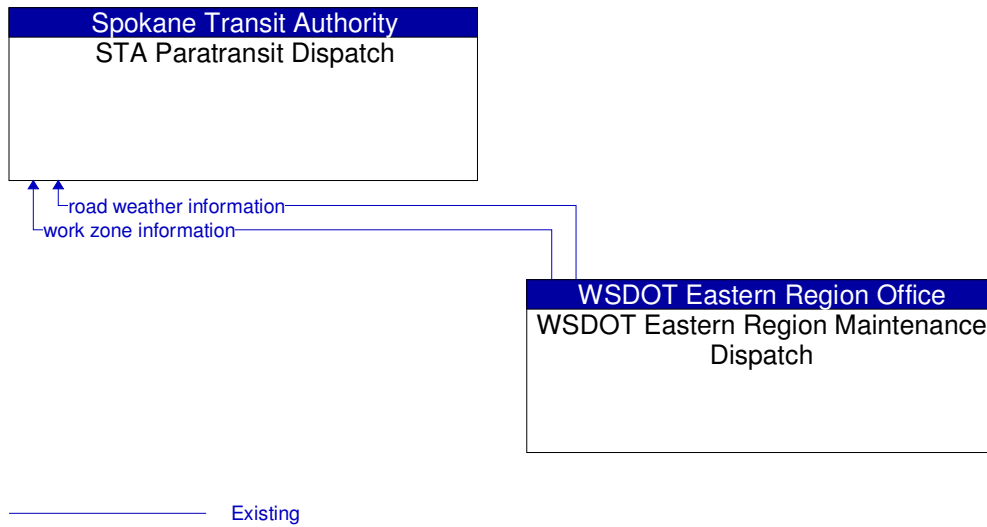
Figure 143: STA Paratransit Dispatch - WSDOT Eastern Region Maintenance Dispatch Interface
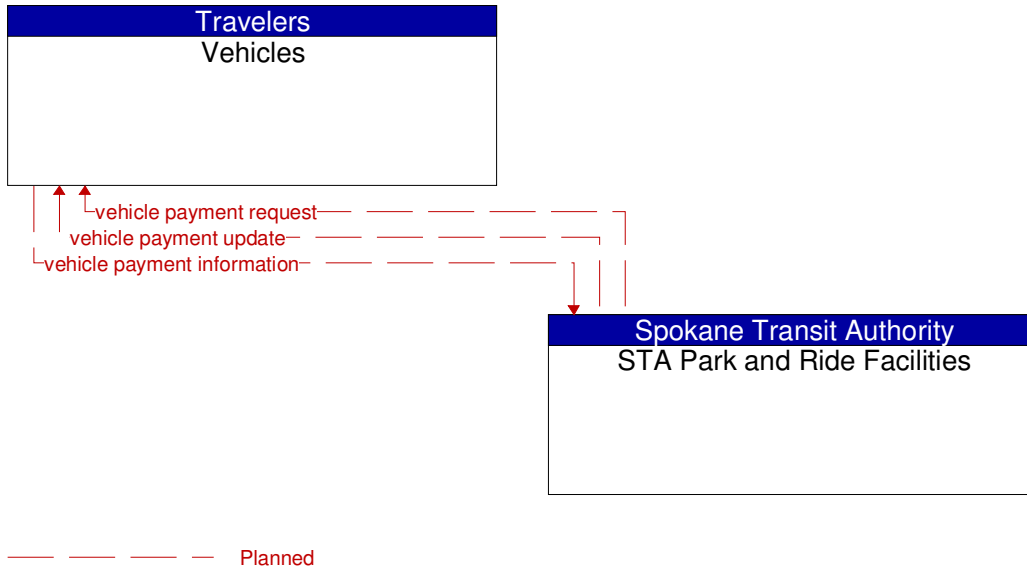
Figure 144: STA Park and Ride Facilities - Vehicles Interface
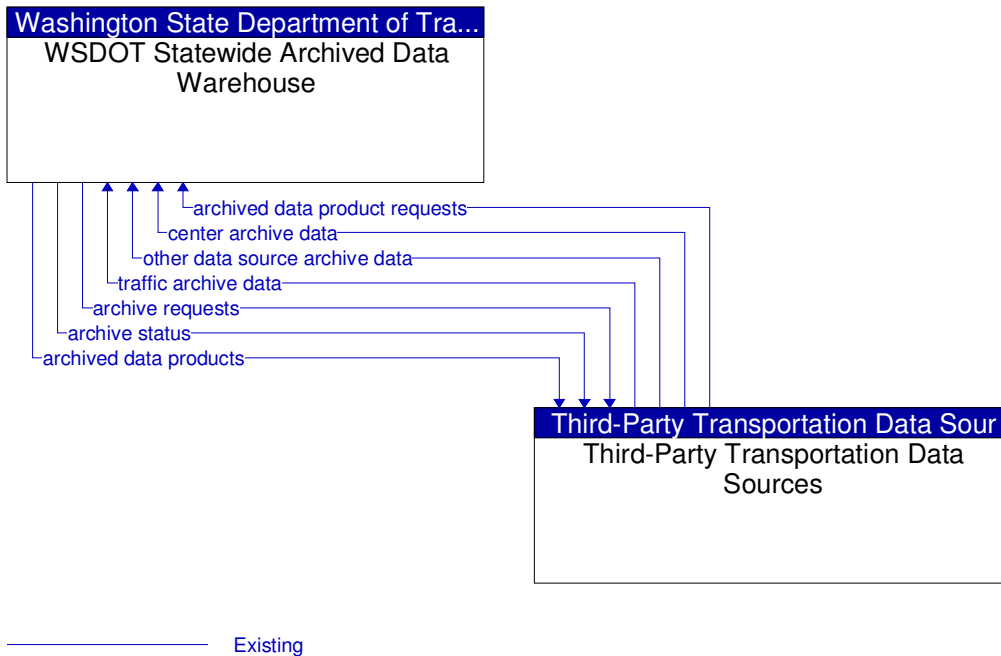
Figure 145: Third-Party Transportation Data Sources - WSDOT Statewide Archived Data Warehouse Interface
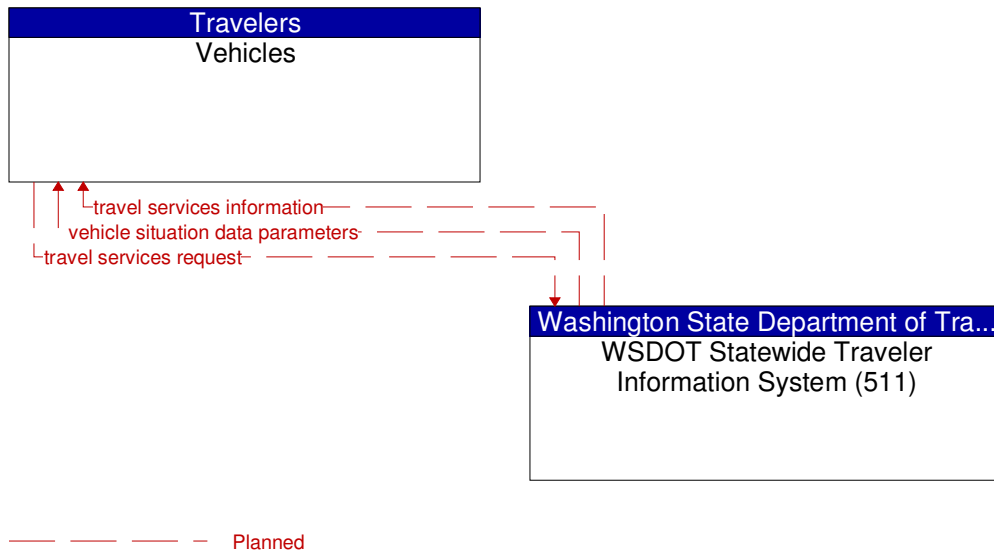
Figure 146: Vehicles - WSDOT Statewide Traveler Information System (511) Interface
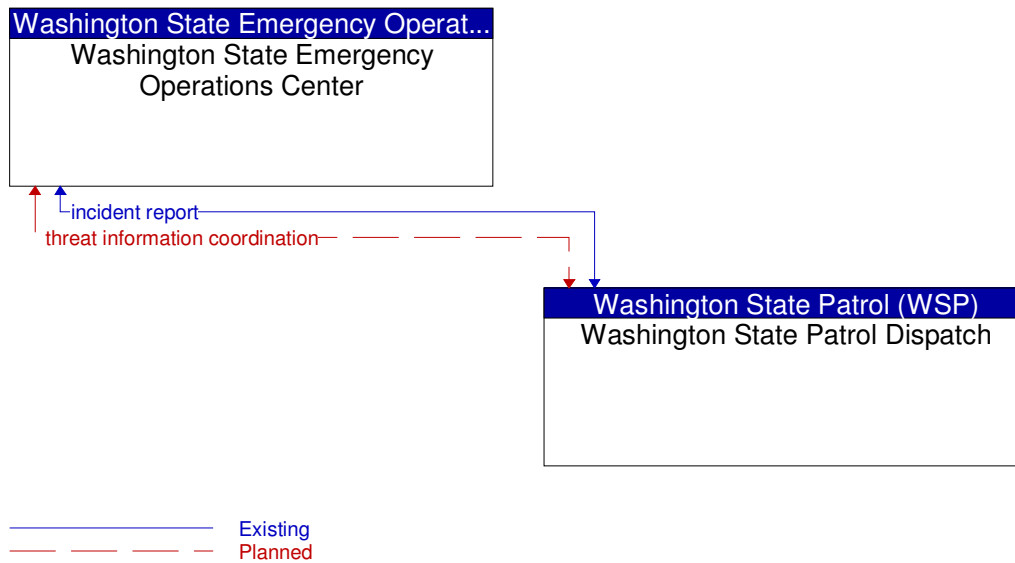
Figure 147: Washington State Emergency Operations Center - Washington State Patrol Dispatch Interface
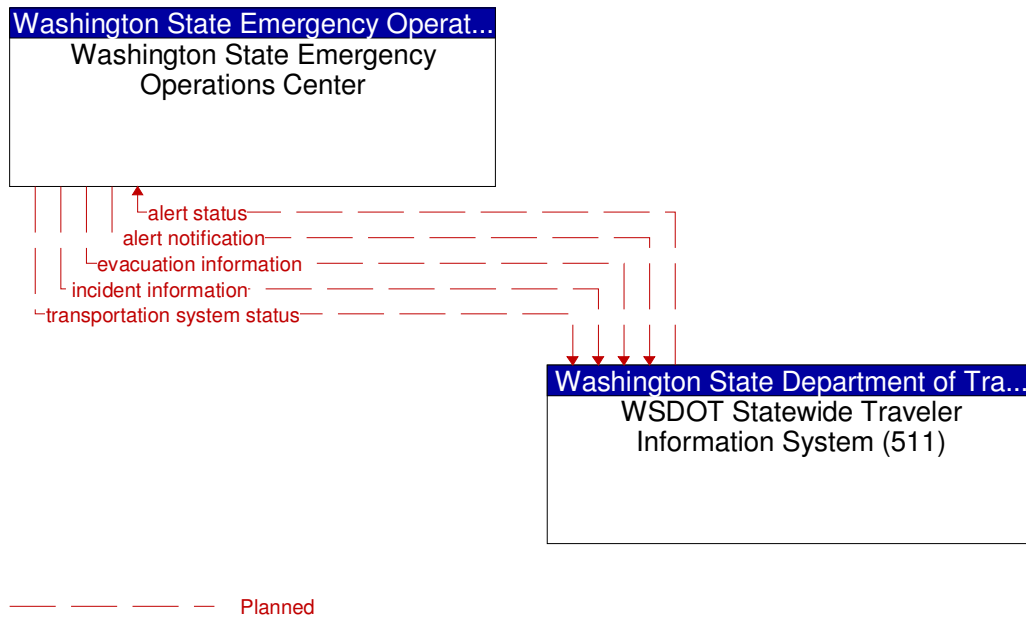
Figure 148: Washington State Emergency Operations Center - WSDOT Statewide Traveler Information System (511) Interface
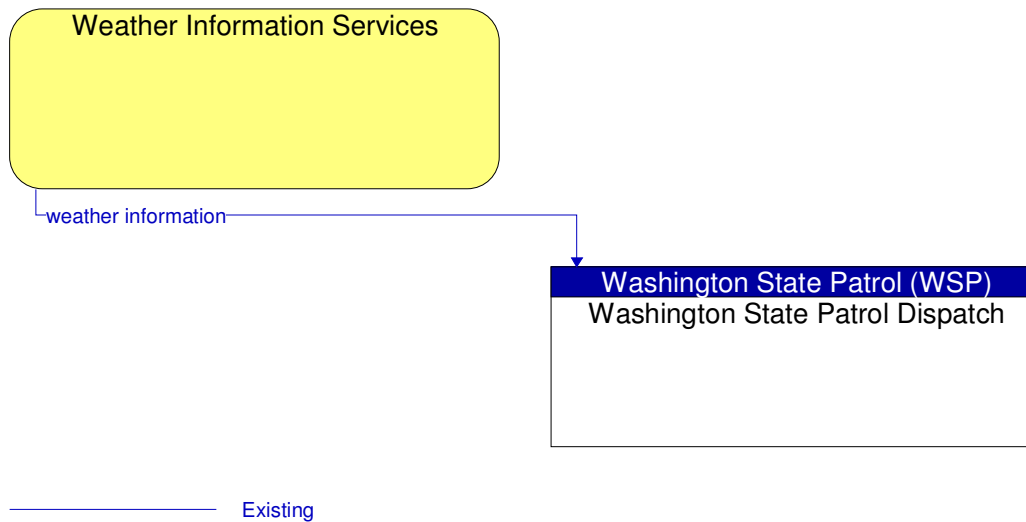
Figure 149: Washington State Patrol Dispatch - Weather Information Services Interface
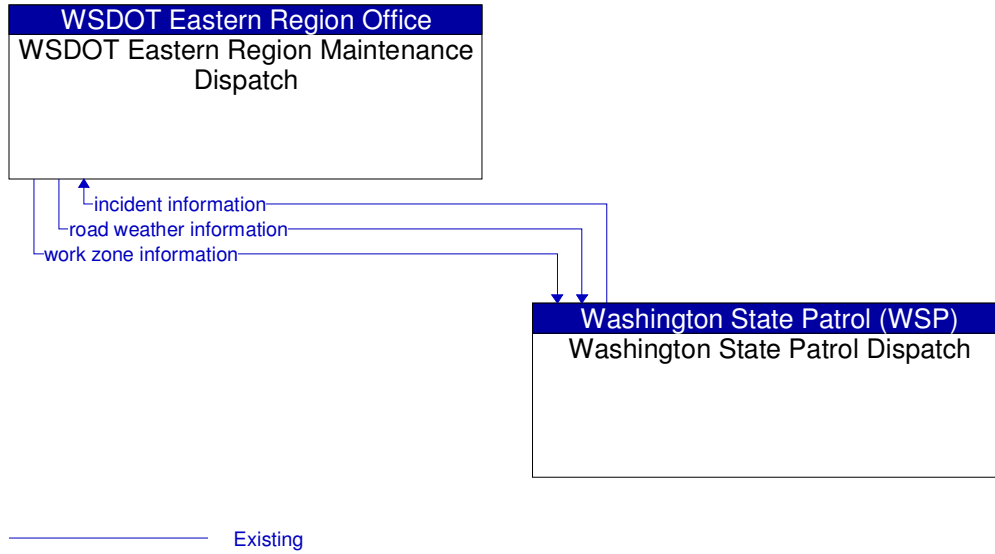
Figure 150: Washington State Patrol Dispatch - WSDOT Eastern Region Maintenance Dispatch Interface
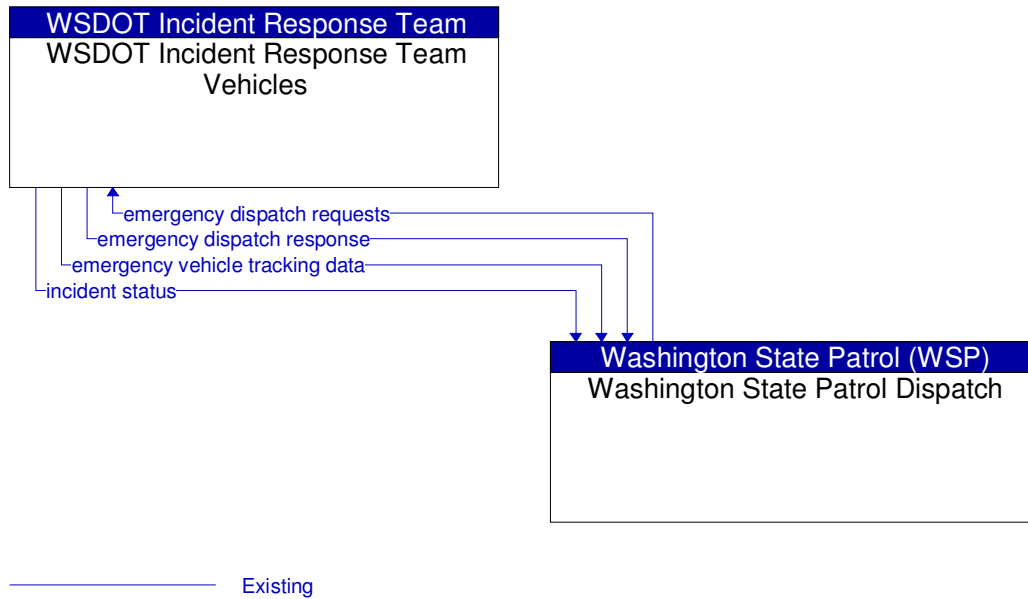
Figure 151: Washington State Patrol Dispatch - WSDOT Incident Response Team Vehicles Interface

Existing
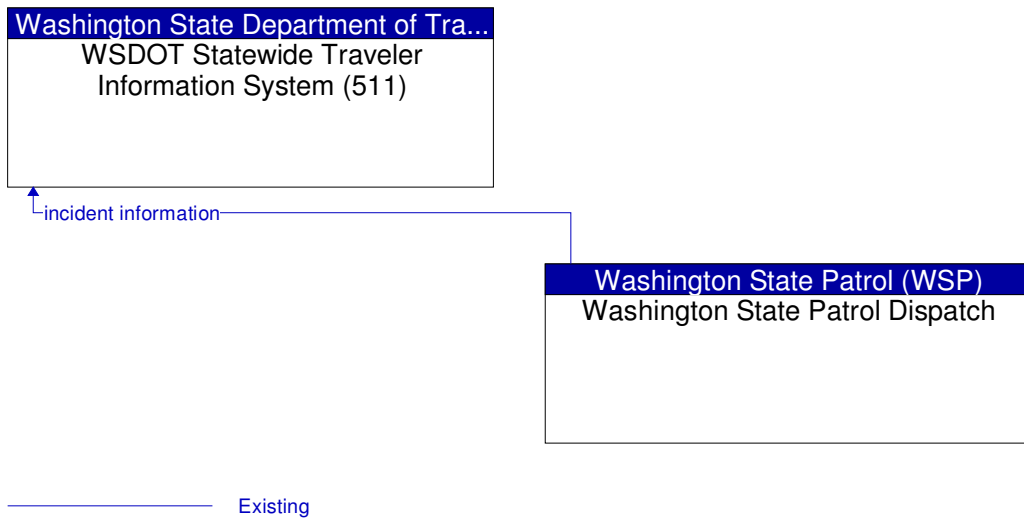
Figure 152: Washington State Patrol Dispatch - WSDOT Statewide Traveler Information System (511) Interface

Existing
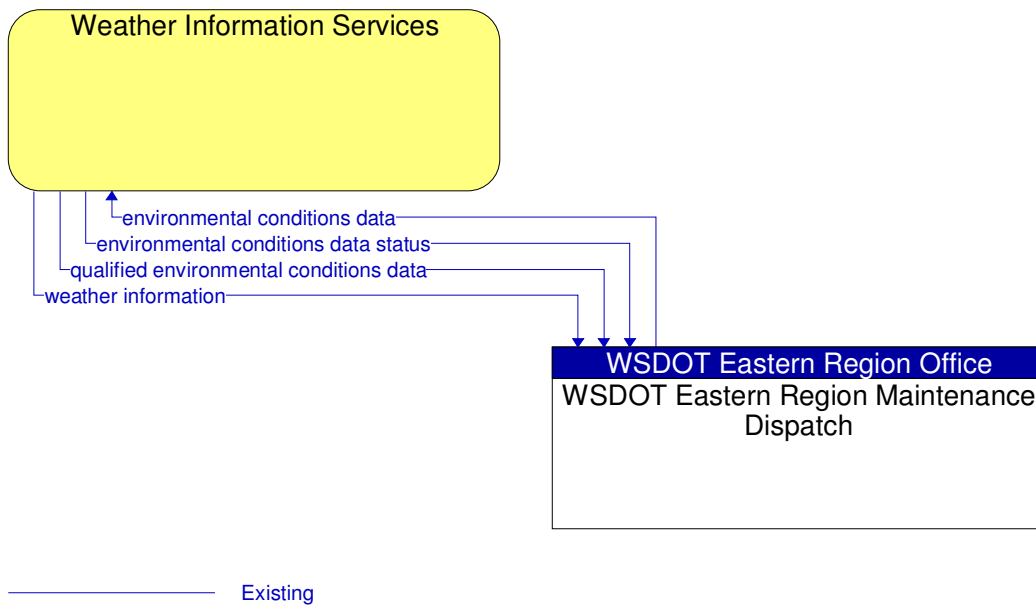
Figure 153: Weather Information Services - WSDOT Eastern Region Maintenance Dispatch Interface

Weather Information Services

environmental sensor data

environmental sensors control

Washington State Department of Tra...
WSDOT ITS Field Devices

———————— Existing
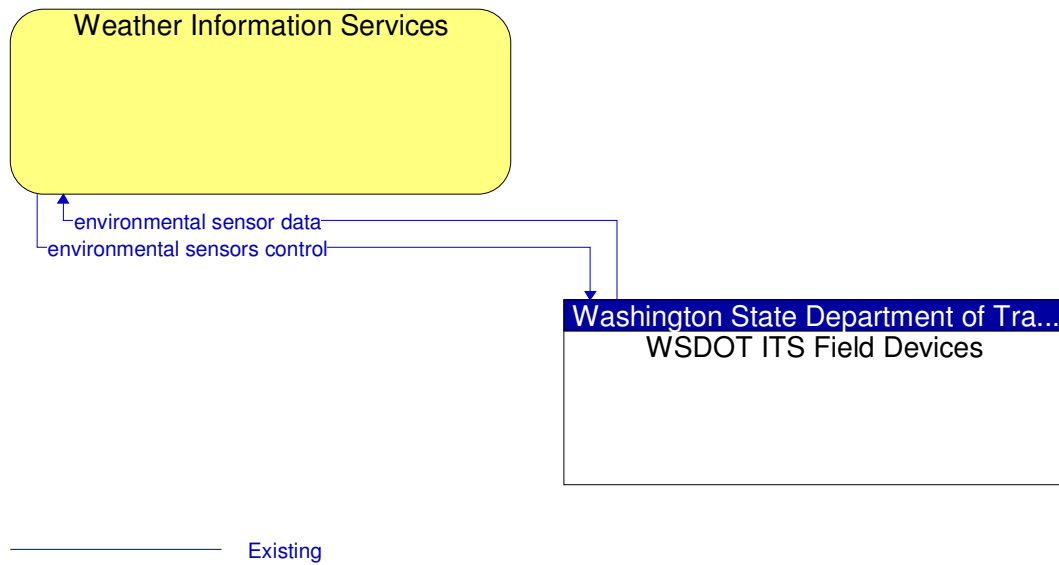
Figure 154: Weather Information Services - WSDOT ITS Field Devices Interface

Weather Information Services

qualified environmental conditions data

weather information

Washington State Department of Tra...
WSDOT Statewide Traveler
Information System (511)

———————— Existing
— — — — Planned
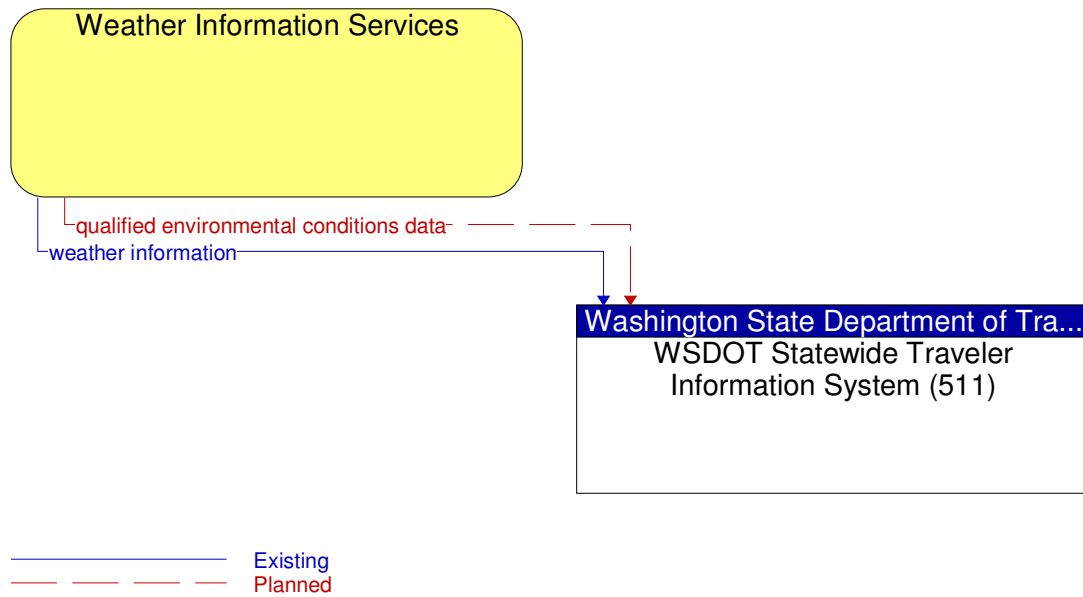
Figure 155: Weather Information Services - WSDOT Statewide Traveler Information System (511) Interface

Existing
Planned
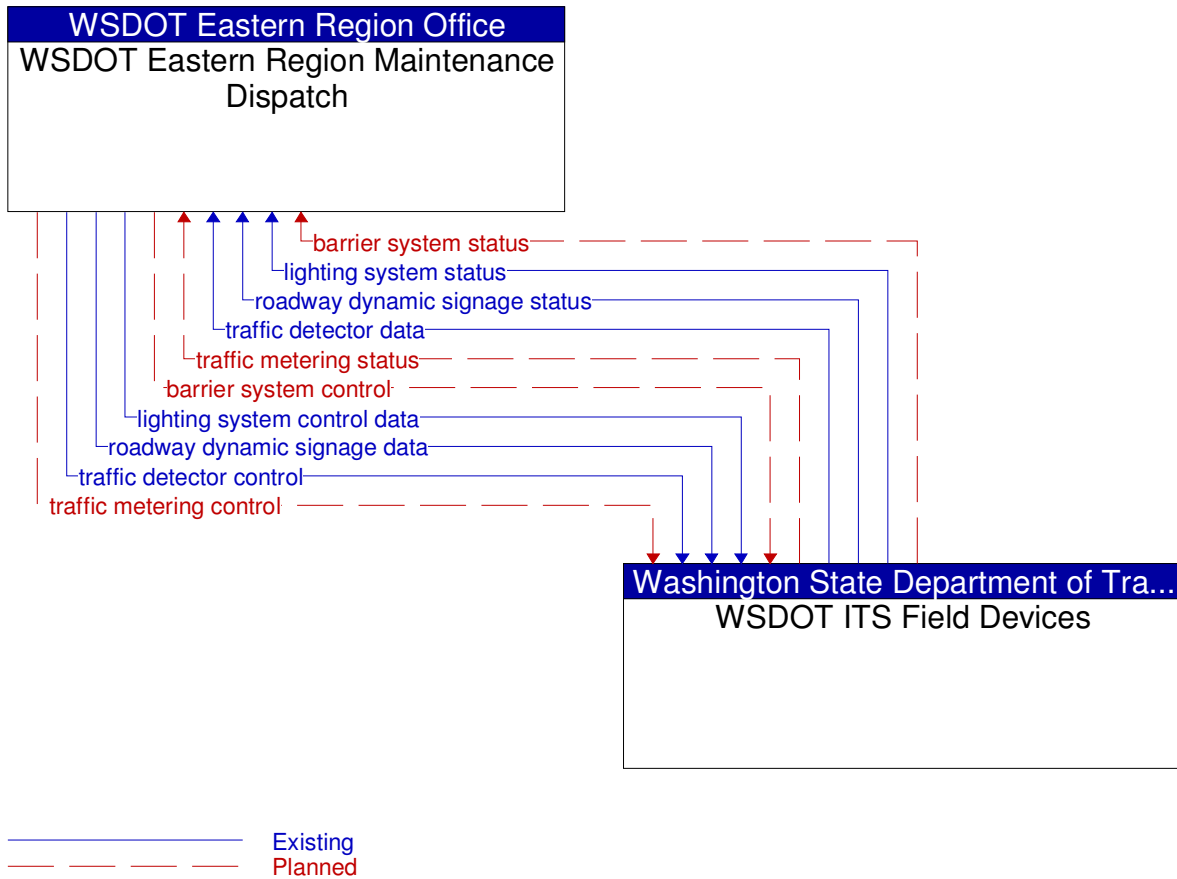
Figure 156: WSDOT Eastern Region Maintenance Dispatch - WSDOT ITS Field Devices Interface

WSDOT Eastern Region Office
WSDOT Eastern Region Maintenance Dispatch

environmental sensor data
maint and constr dispatch status
maint and constr vehicle location data
maint and constr vehicle operational data
environmental sensors control
maint and constr dispatch information
maint and constr vehicle system control

WSDOT Eastern Region Office
WSDOT Maintenance Vehicles

Existing
Planned

Figure 157: WSDOT Eastern Region Maintenance Dispatch - WSDOT Maintenance Vehicles Interface

Washington State Department of Tra...
WSDOT Statewide Traveler Information System (511)

road weather information

WSDOT Eastern Region Office
WSDOT Eastern Region Maintenance Dispatch

Existing

Figure 158: WSDOT Eastern Region Maintenance Dispatch - WSDOT Statewide Traveler Information System (511) Interface

Figure 159: WSDOT Eastern Region Maintenance Dispatch - WSDOT Work Zone Database Interface
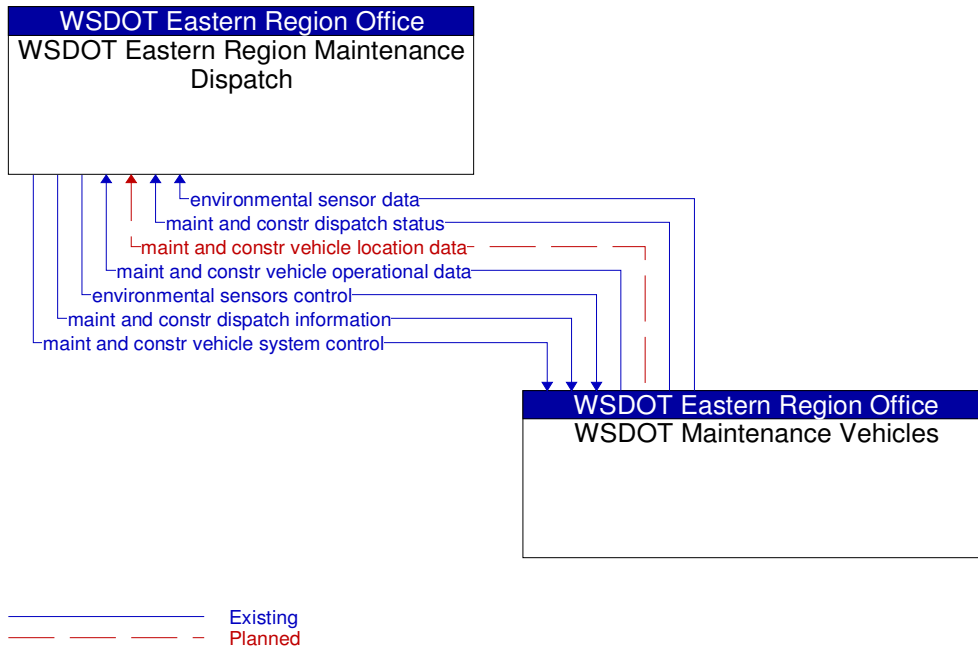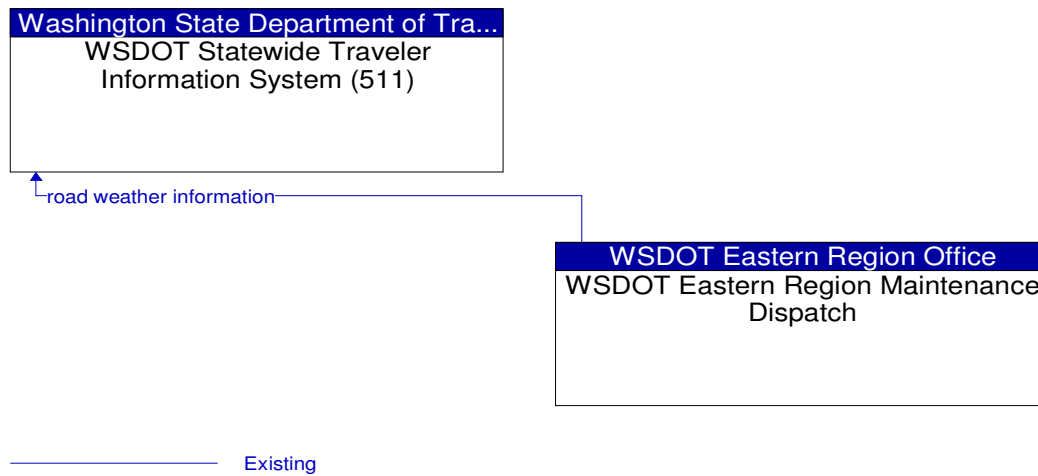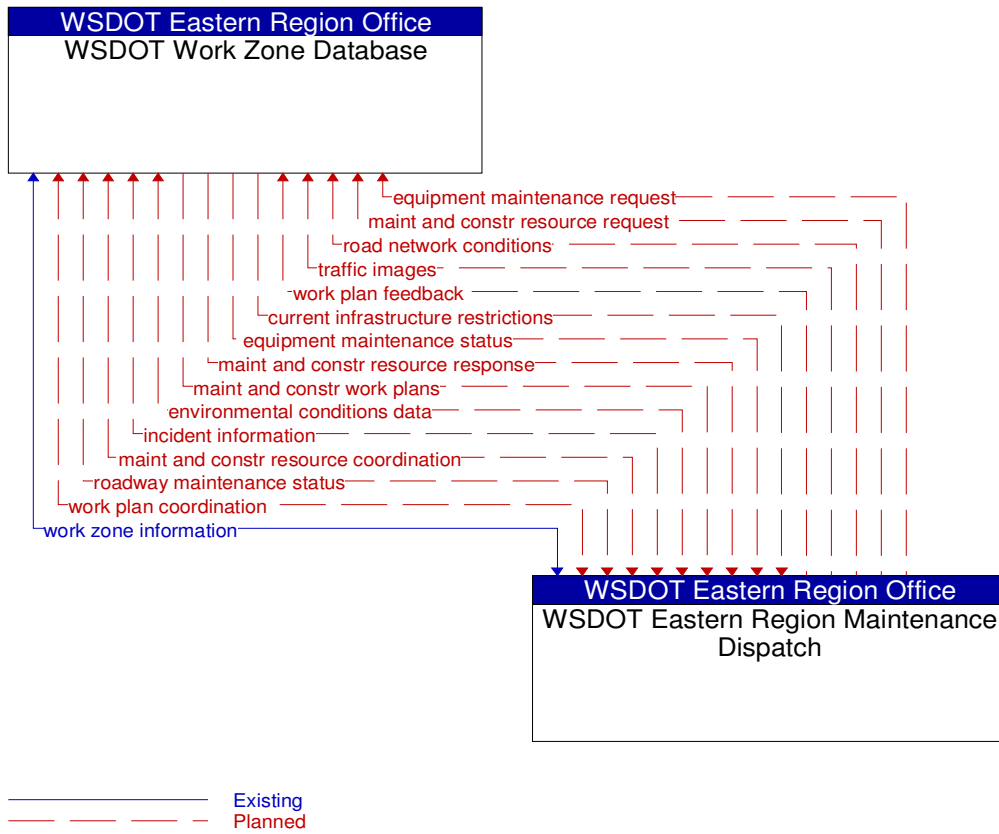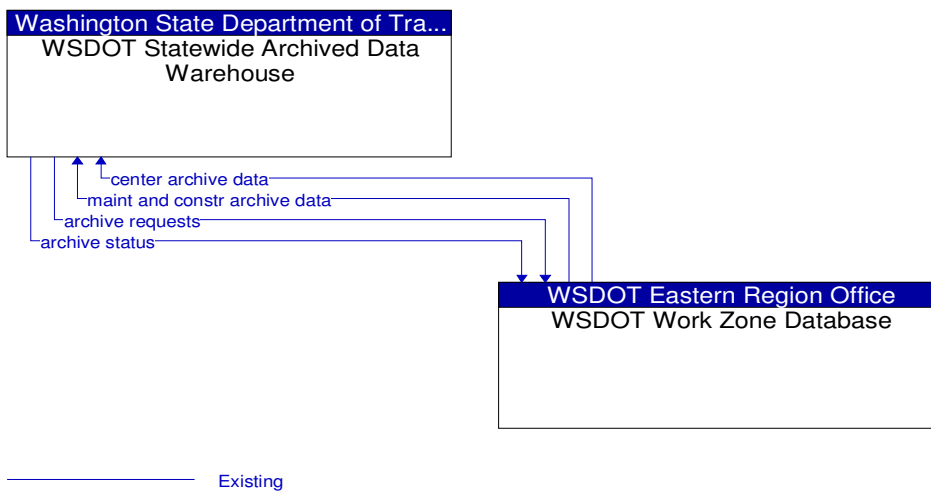

Figure 160: WSDOT Statewide Archived Data Warehouse - WSDOT Work Zone Database Interface

Architecture Flow Definitions

Flow Name	Description
alarm acknowledge	Confirmation that alarm was received, instructions and additional information for the alarm initiator, and requests for additional information.
alarm notification	Notification of activation of an audible or silent alarm by a traveler in a public area or by a transit vehicle operator using an on-board device.
alert notification	Notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The flow identifies the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This flow may also identify specific information that should not be released to the public.
alert notification coordination	Coordination of emergency alerts to be distributed to the public. This includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public and status of the public notification.
alert status	Information indicating the current status of the emergency alert including identification of the traveler and driver information systems that are being used to provide the alert.
alternate mode information	Schedule information for alternate mode transportation providers such as air, ferry, and passenger-carrying heavy rail.
archive analysis requests	A user request that initiates data mining, analytical processing, aggregation or summarization, report formulation, or other advanced processing and analysis of archived data. The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archive analysis results	Processed information products, supporting meta data, and any associated transaction information resulting from data mining, analytical processing, aggregation or summarization, report formulation, or other on-line processing and analysis of archived data.
archive coordination	Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.
archive request confirmation	Confirmation that an archive request has been received and processed with information on the disposition of the request.
archive requests	A request to a data source for information on available data (i.e., "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.
archive status	Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.
archived data product requests	A user-specified request for archived data products (i.e., data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archived data products	Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.
barrier system control	Information used to configure and control barrier systems that are represented by gates, barriers and other automated or remotely controlled systems used to manage entry to roadways.
barrier system status	Current operating status of barrier systems. Barrier systems represent gates, barriers and other automated or remotely controlled systems used to manage entry to roadways. Status of the systems includes operating condition and current operational state.
broadcast traveler information	General traveler information that contains traffic and road conditions, link travel times, incidents, advisories, restrictions, transit service information, weather information, parking information, and other related traveler information.
center archive data	Information describing center operations and measures that reflect the impact of these operations on the transportation system. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
current infrastructure restrictions	Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
data collection and monitoring control	Information used to configure and control data collection and monitoring systems.

Flow Name	Description
decision support information	Information provided to support effective and safe incident response, including local traffic, road, and weather conditions, hazardous material information, and the current status of resources (including vehicles, other equipment, supplies) that have been allocated to an incident.
demand response passenger and use data	Data collected on board a demand response vehicle relating to the picking up and discharging of passengers.
demand responsive transit plan	Plan regarding overall demand responsive transit schedules and deployment.
emergency archive data	Logged emergency information including information that characterizes identified incidents (routine highway incidents through disasters), corresponding incident response information, evacuation information, surveillance data, threat data, and resource information. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
emergency dispatch requests	Emergency vehicle dispatch instructions including incident location and available information concerning the incident.
emergency dispatch response	Request for additional emergency dispatch information and provision of en route status.
emergency personnel information presentation	Presentation of information to emergency personnel in the field including dispatch information, incident information, current road network conditions, device status, and other supporting information.
emergency personnel input	User input from emergency personnel in the field including dispatch coordination, incident status information, and remote device control requests.
emergency plan coordination	Information that supports coordination of emergency management plans, continuity of operations plans, emergency response and recovery plans, evacuation plans, and other emergency plans between agencies. This includes general plans that are coordinated prior to an incident and shorter duration tactical plans that are prepared during an incident.
emergency route request	Request for access routes for emergency response vehicles and equipment. This may be a request for ingress or egress routes or other emergency routes.
emergency routes	Suggested ingress and egress routes for access to and between the scene and staging areas or other specialized emergency access routes.
emergency traffic control information	Status of a special traffic control strategy or system activation implemented in response to an emergency traffic control request, a request for emergency access routes, a request for evacuation, a request to activate closure systems, a request to employ driver information systems to support public safety objectives, or other special requests. Identifies the selected traffic control strategy and system control status.
emergency traffic control request	Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems. For example, this flow can request all signals to red-flash, request a progression of traffic control preemptions along an emergency vehicle route, request a specific evacuation traffic control plan, request activation of a road closure barrier system, or place a public safety or emergency-related message on a dynamic message sign.
emergency traveler information	Public notification of an emergency such as a natural or man-made disaster, civil emergency, or child abduction. This flow also includes evacuation information including evacuation instructions, evacuation zones, recommended evacuation times, tailored evacuation routes and destinations, traffic and road conditions along the evacuation routes, traveler services and shelter information, and reentry times and instructions.
emergency traveler information request	Request for alerts, evacuation information, and other emergency information provided to the traveling public.
emergency vehicle tracking data	The current location and operating status of the emergency vehicle.
environmental conditions data	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by fixed and/or mobile environmental sensors and aggregated by the data collector. Attributes relating to the data collection (and aggregation) are also included.
environmental conditions data status	Status of the data quality of environmental conditions data provided by a data contributor. Includes not only status by sensor, but statistical data regarding the quality checking of data provided.

Flow Name	Description
environmental sensor data	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by fixed and/or mobile environmental sensors. Operational status of the sensors is also included.
environmental sensors control	Data used to configure and control environmental sensors.
equipment maintenance request	Identification of field equipment requiring repair and known information about the associated faults.
equipment maintenance status	Current status of field equipment maintenance actions.
evacuation coordination	Coordination of information regarding a pending or in-process evacuation. Includes evacuation zones, evacuation times, evacuation routes, forecast network conditions, and reentry times.
evacuation information	Evacuation instructions and information including evacuation zones, evacuation times, and reentry times.
fare and price information	Current transit, parking, and toll fee schedule information.
fare collection data	Fare collection information including the summary of fare system data and financial payment transaction data.
fare management information	Transit fare information and transaction data used to manage transit fare processing.
incident command information coordination	Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.
incident information	Notification of existence of incident and expected severity, location, time and nature of incident. As additional information is gathered and the incident evolves, updated incident information is provided. Incidents include any event that impacts transportation system operation ranging from routine incidents (e.g., disabled vehicle at the side of the road) through large-scale natural or human-caused disasters that involve loss of life, injuries, extensive property damage, and multi-jurisdictional response. This also includes special events, closures, and other planned events that may impact the transportation system.
incident information for public	Report of current desensitized incident information prepared for public dissemination.
incident report	Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.
incident response coordination	Incident response procedures and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow provides current situation information, including a summary of incident status and its impact on the transportation system and other infrastructure, and current and planned response activities. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.
incident response status	Status of the current incident response including a summary of incident status and its impact on the transportation system, traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides), and current and planned response activities.
incident status	Information gathered at the incident site that more completely characterizes the incident and provides current incident response status. This includes notification of medical facility transport and details about the vehicle occupants being transported.
interactive traveler information	Traveler information provided in response to a traveler request. The provided information includes traffic and road conditions, advisories, incidents, payment information, transit services, parking information, weather information, and other travel-related data updates and confirmations.
lighting system control data	Information used to configure and control roadside lighting systems.
lighting system status	Status of roadside lighting controls including operating condition and current operational state.
local signal priority request	Request from a vehicle to a signalized intersection for priority at that intersection. This flow also allows the vehicle to cancel a priority request (for example, when the vehicle clears the intersection).
logged vehicle routes	Anticipated route information for guided vehicles, special vehicles (e.g., oversize vehicles) or groups of vehicles (e.g., governor's motorcade) that may require changes in traffic control strategy.

Flow Name	Description
maint and constr archive data	Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
maint and constr dispatch information	Information used to dispatch maintenance and construction vehicles, equipment, and crews and information used to keep work zone crews informed. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, alert notifications, and corrective actions.
maint and constr dispatch status	Current maintenance and construction status including work data, operator status, crew status, and equipment status.
maint and constr resource coordination	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.
maint and constr resource request	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response. The request may poll for resource availability or request pre-staging, staging, or immediate dispatch of resources.
maint and constr resource response	Current status of maintenance and construction resources including availability and deployment status. General resource inventory information covering vehicles, equipment, materials, and people and specific resource deployment status may be included.
maint and constr vehicle location data	The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.
maint and constr vehicle operational data	Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).
maint and constr vehicle system control	Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.
maint and constr work plans	Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
mixed use safety warning control	Configuration and control of equipment that monitors and manages mixed use crossings and provides visual displays and warnings to drivers when non-motorized users are occupying a cross walk or other mixed use path crossing.
mixed use safety warning status	Current operational status and state of pedestrian crossings and other mixed use path crossing warning systems.
other data source archive data	Data extracted from other data sources. A wide range of ITS and non-ITS data and associated meta data may be provided.
parking archive data	Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
parking information	General parking information and status, including current parking availability.
parking traffic information	Instructions for operation of local parking facilities to support regional traffic management objectives (e.g., which parking lot exits to use). Also, includes inputs from traffic sensors to monitor parking queues and support more effective management of parking entrances and exits.
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
payment device update	Information updated concerning traveler's personal data including name, address, user account information, trip records, and profile data.
personal transit information	General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

Flow Name	Description
qualified environmental conditions data	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that has had quality checks performed on it and has been formatted and consolidated by the Clarus system. Attributes relating to the data collection (and aggregation) are also included.
rail crossing control data	Data required for HRI information transmitted at railroad grade crossings and within railroad operations.
rail crossing request	A request for highway-rail intersection status or a specific control request intended to modify HRI operation.
rail crossing status	Status of the highway-rail intersection equipment including both the current state or mode of operation and the current equipment condition.
remote surveillance control	The control commands used to remotely operate another center's sensors or surveillance equipment so that roadside surveillance assets can be shared by more than one agency.
request for payment	Request to deduct cost of service from user's payment account.
resource coordination	Coordination of resource inventory information, specific resource status information, resource prioritization and reallocation between jurisdictions, and specific requests for resources and responses that service those requests.
resource deployment status	Status of resource deployment identifying the resources (vehicles, equipment, materials, and personnel) available and their current status. General resource inventory information and specific status of deployed resources may be included.
resource request	A request for resources to implement special traffic control measures, assist in clean up, verify an incident, etc. The request may poll for resource availability or request pre-staging, staging, or immediate deployment of resources. Resources may be explicitly requested or a service may be requested and the specific resource deployment may be determined by the responding agency.
right-of-way request notification	Notice that a request has occurred for signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.
road network conditions	Current and forecasted traffic information, road and weather conditions, and other road network status. Either raw data, processed data, or some combination of both may be provided by this flow. Information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements) in effect is included.
road network traffic situation data	Aggregated route usage, travel times, and other aggregated data collected from probe vehicles that can be used to estimate current traffic conditions.
road weather information	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
roadside archive data	A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. This data also indicates the status of the sensors and reports of any identified sensor faults.
roadway dynamic signage data	Information used to initialize, configure, and control dynamic message signs. This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.
roadway dynamic signage status	Current operating status of dynamic message signs, highway advisory radios, or other configurable field equipment that provides dynamic information to the driver.
roadway maintenance status	Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).
roadway warning system control	Information used to configure and control roadway warning systems.
roadway warning system status	Current operating status of roadway warning systems.
route assignment	Route assignment information for transit vehicle operator.
safeguard system control	Data that controls safeguard systems (remotely controlled equipment used to mitigate the impact of incidents on transportation infrastructure, such as blast shields, exhaust systems, etc.).
safeguard system status	Current operating status of safeguard systems (remotely controlled equipment used to mitigate the impact of incidents on transportation infrastructure, such as blast shields, exhaust systems, etc.). Status of the systems includes operating condition and current operational state.
signal control commands	Control of traffic signal controllers or field masters including clock synchronization.

Flow Name	Description
signal control device configuration	Data used to configure traffic signal control equipment including local controllers and system masters.
signal control plans	Traffic signal timing parameters including minimum green time and interval durations for basic operation and cycle length, splits, offset, phase sequence, etc. for coordinated systems.
signal control status	Operational and status data of traffic signal control equipment including operating condition and current indications.
signal fault data	Faults reported by traffic signal control equipment.
signal system configuration	Data used to configure traffic signal systems including configuring control sections and mode of operation (time based or traffic responsive).
speed monitoring control	Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.
speed monitoring information	System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.
suggested route	Suggested route for a dispatched emergency or maintenance vehicle that may reflect current network conditions and the additional routing options available to en route emergency or maintenance vehicles that are not available to the general public.
threat information	Threats regarding transportation infrastructure, facilities, or systems detected by a variety of methods (sensors, surveillance, threat analysis of advisories from outside agencies, etc.
threat information coordination	Sensor, surveillance, and threat data including raw and processed data that is collected by sensor and surveillance equipment located in secure areas.
traffic archive data	Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
traffic detector control	Information used to configure and control traffic detector systems such as inductive loop detectors and machine vision sensors.
traffic detector data	Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents). This flow includes the traffic data and the operational status of the traffic sensor system.
traffic images	High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and meta data that describes the images.
traffic information for media	Report of traffic conditions including traffic incident reports for public dissemination through the media. The reports may also include information on diversions and alternate routes, closures, and special traffic restrictions in effect.
traffic metering control	Control commands and operating parameters for ramp meters, interchange meters, mainline meters, and other systems equipment associated with roadway metering operations.
traffic metering status	Current operational status and operating parameters for ramp meters, interchange meters, mainline meters and other control equipment associated with roadway metering operations.
traffic operator data	Presentation of traffic operations data to the operator including traffic conditions, current operating status of field equipment, maintenance activity status, incident status, video images, security alerts, emergency response plan updates and other information. This data keeps the operator appraised of current road network status, provides feedback to the operator as traffic control actions are implemented, provides transportation security inputs, and supports review of historical data and preparation for future traffic operations activities.
traffic operator input	User input from traffic operations personnel including requests for information, configuration changes, commands to adjust current traffic control strategies (e.g., adjust signal timing plans, change DMS messages), and other traffic operations data entry.
transit and fare schedules	Transit service information including routes, schedules, and fare information.
transit archive data	Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
transit emergency data	Initial notification of transit emergency at a transit stop or on transit vehicles and further coordination as additional details become available and the response is coordinated.
transit fare coordination	Fare and pricing information shared between local/regional transit organizations.

Flow Name	Description
transit incident information	Information on transit incidents that impact transit services for public dissemination.
transit information user request	Request for special transit routing, real-time schedule information, and availability information.
transit operations personnel input	User input from transit operations personnel including instructions governing service availability, schedules, emergency response plans, transit personnel assignments, transit maintenance requirements, and other inputs that establish general system operating requirements and procedures.
transit operations status	Presentation of information to transit operations personnel including accumulated schedule and fare information, ridership and on-time performance information, emergency response plans, transit personnel information, maintenance records, and other information intended to support overall planning and management of a transit property.
transit probe data	Aggregate probe data derived from tracking transit vehicles. Data collected could include transit vehicle speeds and travel times for a given link or collection of links.
transit schedule adherence information	Dynamic transit schedule adherence and transit vehicle location information.
transit schedule information	Current and projected transit schedule information used to initialize the transit vehicle with a vehicle assignment, monitor schedule performance, and develop corrective actions on-board.
transit service coordination	Schedule coordination or AVL information shared between local/regional transit organizations. This includes coordination of connections between transit properties.
transit service information	Transit service information including routes, schedules, and fare information as well as dynamic transit schedule adherence and transit vehicle location information.
transit system data	Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.
transit traveler information	Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, alerts and advisories, and general transit service information.
transit traveler request	Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.
transit vehicle conditions	Operating conditions of transit vehicle (e.g., engine running, oil pressure, fuel level and usage).
transit vehicle loading data	Data collected on board the transit vehicle relating to passenger boarding and alighting.
transit vehicle location data	Current transit vehicle location and related operational conditions data provided by a transit vehicle.
transit vehicle operator authentication information	Information regarding on-board transit operator authentication
transit vehicle operator authentication update	Results of authentication process or update of on-board authentication database.
transit vehicle operator availability	Transit vehicle operator availability data that can be used to develop vehicle operator assignments and detailed operations schedules.
transit vehicle operator display	Visual, audible, and tactile outputs to the transit vehicle operator including vehicle surveillance information, alarm information, vehicle system status, information from the operations center, and information indicating the status of all other on-board ITS services.
transit vehicle operator information	Transit service instructions, wide area alerts, traffic information, road conditions, and other information for both transit and paratransit operators.
transit vehicle operator input	Transit vehicle operator inputs to on-board ITS equipment, including tactile and verbal inputs. Includes authentication information, on-board system control, emergency requests, and fare transaction data.
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.

Flow Name	Description
transportation operational strategies	Operational strategies for each operating agency in a transportation corridor, downtown area, or other travel-impacted area, providing an integrated operations strategy for the freeways, tollways, arterials, transit services, parking facilities, and other transportation-related facilities in the area. These strategies can include dynamic adjustments to transit fares and tolls, parking fees and restrictions, dynamic lane restriction changes, and other active demand management strategies.
transportation system status	Current status and condition of transportation infrastructure (e.g., tunnels, bridges, interchanges, TMC offices, maintenance facilities). In case of disaster or major incident, this flow provides an assessment of damage sustained by the surface transportation system including location and extent of the damage, estimate of remaining capacity and necessary restrictions, and time frame for repair and recovery.
travel services information	Travel service information and reservations for tourist attractions, lodging, dining, service stations, emergency services, and other services and businesses of interest to the traveler.
travel services request	Request for travel service information including tourist attractions, lodging, restaurants, service stations, and emergency services. The request identifies the type of service, the area of interest, optional reservation request information, parameters that are used to prioritize or filter the returned information, and sorting preferences.
traveler alerts	Traveler information alerts reporting congestion, incidents, adverse road or weather conditions, parking availability, transit service delays or interruptions, and other information that may impact the traveler. Relevant alerts are provided based on traveler-supplied profile information including trip characteristics and preferences.
traveler archive data	Data associated with traveler information services including service requests, facility usage, rideshare, routing, and traveler payment transaction data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
traveler information for media	General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.
traveler input	User input from a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.
traveler interface updates	Visual or audio information (e.g., routes, messages, guidance, emergency information) that is provided to the traveler.
traveler request	A request for traveler information including traffic, transit, toll, parking, road weather conditions, event, and passenger rail information. The request identifies the type of information, the area of interest, parameters that are used to prioritize or filter the returned information, and sorting preferences.
trip confirmation	Acknowledgement by the driver/traveler of acceptance of a trip plan with associated personal and payment information required to confirm reservations.
trip plan	A travel itinerary identifying a route and associated traveler information and instructions identifying recommended modes and transfer information, ride sharing options, and transit and parking reservation information.
trip request	Request for trip planning services that identifies the trip origin, destination(s), timing, preferences, and constraints. The request may also include the requestor's location or a request for transit and parking reservations and ridesharing options associated with the trip.
user profile	Information provided to register for a travel service and create a user account. The provided information includes personal identification, traveler preferences (e.g., maximum transfer wait time, maximum walking distance, mode preferences, special needs), device information, a user ID and password, and information to support payment transactions, if applicable.
variable speed limit control	Information used to configure and control variable speed limit systems including the equipment used to provide current speed limits and other information to drivers and the equipment used to monitor traffic and environmental conditions along the roadway.
variable speed limit status	Current operating status of the variable speed limit systems including the state of the equipment.
vehicle payment information	Information provided for payment of tolls, parking, and other transportation fees including identification that can be used to identify the payment account or source and related vehicle and service information that are used to determine the type and price of service requested. The information exchange normally supports an account debit to pay fees, but an account credit may be initiated where pricing strategies include incentives.
vehicle payment request	Request for information supporting payments. For fee structures that include incentives, the request may support either an account debit or an account credit or reimbursement.
vehicle payment update	Data written to vehicle equipment to support electronic toll collection or parking payment.

Flow Name	Description
vehicle situation data parameters	A request for vehicle situation data that includes parameters used to control the data that is reported and the flow of data reported by the vehicle. This flow identifies the type of data/snapshots that are requested and reporting parameters such as snapshot frequency, filtering criteria (data thresholds for reporting), and reporting interval.
video surveillance control	Information used to configure and control video surveillance systems.
weather archive data	Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.) as well as qualified environmental sensor data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
weather information	Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).
work plan coordination	Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.
work plan feedback	Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.
work zone information	Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.