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Alexandria Regional ITS Architecture Updates

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Prepared for:

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Prepared by:

Stantec

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Glossary

ATSC – Actuated Traffic Signal Controller
ATCMTD – Advanced Transportation and Congestion Management Technologies Deployment
ATIS – Advanced Traveler Information System
ATMS – Advanced Traffic Management System
ATRANS – Alexandria Transit
AVL – Automated Vehicle Location
CAD – Computer Aided Dispatch
CCTV – Closed Circuit Television
CFR – Code of Federal Regulations
CLRP – Central Louisiana Regional Port
CMAQ – Congestion Mitigation and Air Quality
CMU – Conflict Monitor Units
DCM – Data Collection and Monitoring
DMS – Dynamic Message Signs
DOTD – Department of Transportation and Development
FHWA – Federal Highway Administration
FMS – Field Management Stations
FTA – Federal Transit Administration
HAR – Highway Advisory Radio
HRI – High-rail Intersection
ITS – Intelligent Transportation Systems
LADOTD – Louisiana Department of Transportation and Development
LSP – Louisiana State Police
MAP – Motorist Assistance Patrol
MPO – Metropolitan Planning Organization
MTP – Metropolitan Transportation Plan
MS/ETMCC – Message Sets for External Traffic Management Center Communications
NTCIP – National Transportation Communications for Intelligent Transportation System Protocol
O & M – Operations and Maintenance
OHSEP – Office of Homeland Security and Emergency Preparedness
PCMS – Portable Changeable Message Signs
PDA – Personal Digital Assistant
RAD-IT – Regional Architecture Development for Intelligent Transportation
RAPC – Rapides Area Planning Commission
RR – Roles and Responsibilities
SCP – Signal Control and Prioritization
SDO – Standards Development Organizations
SSM – Signal System Master
SSL – Signal System Local
TDM – Travel Demand Management
TIM – Traffic Incident Management
TIP – Transportation Improvement Program
TMC – Traffic Management Center
TMDD – Traffic Management Data Dictionary
TSS – Transportation Sensor Systems
USDOT – United States Department of Transportation
XML – Extensive Markup Language
VHT – Vehicle Hours Traveled
VMT – Vehicle Miles Traveled

1 INTRODUCTION

This document describes the Intelligent Transportation System (ITS) architecture for the Alexandria region. A Regional ITS Architecture is "a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects." Paragraph 940.9 (a) states that:

> "A regional ITS architecture shall be developed to guide the development of ITS projects and programs and be consistent with ITS strategies and projects contained in applicable transportation plans. The Architecture Reference for Cooperative and Intelligent Transportation shall be used as a resource in the development of the regional ITS architecture. The regional ITS architecture shall be on a scale commensurate with the scope of ITS investment in the region. Provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: highway agencies; public safety agencies (e.g., police, fire, emergency/medical); transit operators; Federal lands agencies; State motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration."

This architecture conforms to Federal Highway Administration (FHWA) Final rule 940 Part 11, which mandates that projects planning to use federal funds in their ITS deployments must have established an ITS Architecture for the region. Regional ITS Architectures have been promoted by the United States Department of Transportation (USDOT) as descriptive tools, using a standard vocabulary and set of concepts for regional deployments in order to aid the integration of User Services and Service packages in addressing regional transportation problems. Regional ITS Architectures are also used to constrain projects, funded by the FHWA using high technology products, to highway or transit applications.

1.1 BACKGROUND

What are Intelligent Transportation Systems or ITS? Simply put, they are the application of technology to highway or transit applications. The formal description states:

> "ITS improves transportation safety and mobility and enhances productivity through the use of advanced information and communication technologies. Intelligent transportation systems (ITS) encompass a broad range of wireless and wire line communications-based information and electronics technologies. When integrated into the transportation system's infrastructure, and in vehicles themselves, these technologies relieve congestion, improve safety and enhance American productivity."

To effectively apply ITS to highway and transit projects, the Architecture Reference for Cooperative and Intelligent Transportation, initiated in 1991 and sponsored by USDOT, describes a wide range of likely ITS applications, using high technology products, for highway and transit projects. In 2001 the FHWA and Federal Transit Administration (FTA) established 23 Code of Federal Regulations (CFR) 940 Part 11, which required agencies using federal funds to establish ITS Architectures for their regions. The architecture must contain the following elements:

1. Description of the region – **Section 2**
2. Identification of the participating agencies and other stakeholders – **Section 4**
3. Roles and responsibilities of the participating agencies and other stakeholders – **Section 8**
4. Agreements needed for operation – **Section 12**
5. System functional requirements – **Section 9**
6. Interface requirements and information exchanges with planned and existing systems – **Appendix B** (*also see* the Alexandria Regional ITS Architecture RAD-IT source file)
7. Identification of applicable standards (ITS Standards) – **Section 11**

8. Sequence of projects necessary for implementation traceable to a portion of the regional architecture – **Section 8**

The products derived from architecture development processes provide a number of benefits to the transportation planners and engineers. The following are examples of these benefits:

1. Establishes a common terminology for the various ITS elements needed to implement and operate ITS applications.
2. Defines those elements and the functions they perform, and identifies, in theory, all of the possible interrelationships among the ITS elements.
3. The Architecture Reference for Cooperative and Intelligent Transportation does not dictate a specific approach to implementing or operating any ITS application; rather, it provides a common set of terms and concepts that local ITS implementers are encouraged to utilize in describing their specific ITS activities.
4. Provides a “living” planning document that promotes modularity and integration and minimizes impacts when needs to regional issues change.
5. Promotes a thorough, coordinated and multi-jurisdictional “systems” approach to ITS and the use of a Systems Engineering process to its deployment.
6. Fosters the utilization of the “standards” that are being developed through the USDOT Architecture Reference for Cooperative and Intelligent Transportation program.

2 ARCHITECTURE SCOPE

The Alexandria Regional ITS Architecture is a roadmap for transportation systems integration. The architecture was developed through a cooperative effort of transportation stakeholders in the region. It represents a shared vision of how each agency's systems will work together, sharing information and resources to provide a safer, more efficient, more effective and seamless transportation system for travelers in the region.

The architecture provides an overarching framework that spans the region's transportation organizations and individual transportation projects. Using the architecture, each ITS 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.

2.1 GEOGRAPHIC SCOPE

The geographic coverage area for this ITS Architecture corresponds with the urbanized area under the jurisdiction of the Rapides Area Planning Commission (RAPC). The Metropolitan Planning Organization (MPO) housed within RAPC provides transportation planning for the urbanized area of Rapides Parish. **Figure 1** shows a map of the MPO boundary.

2.2 SERVICE SCOPE

This Regional ITS Architecture covers a range of ITS services intended to address transportation needs identified within the defined geographic scope. These transportation deficiencies in the region may be existing or emerging transportation issues. Various services based on the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) service packages shall be selected and programmed into projects to address the transportation needs in a logical manner. **Section 6** of this document shows a range of existing and planned ITS services.

2.1 TIMEFRAME

The Alexandria Regional ITS Architecture would be progressively expanded with new systems being added to the existing based on the functions desired for an efficient and effective transportation system. The desired services and associated functions defined in this architecture may take several years implement. The stakeholders have identified projects that could be used to realized the services desired with a five year planning horizon in mind. The Architecture is a living document and can be updated whenever necessary to meet regional need. **Section 9** provides additional information on maintaining the ITS architecture.

2.2 MAINTAINER

Louisiana Department of Transportation and Development (DOTD), with the assistance of RAPC will maintain the Alexandria Regional ITS Architecture.

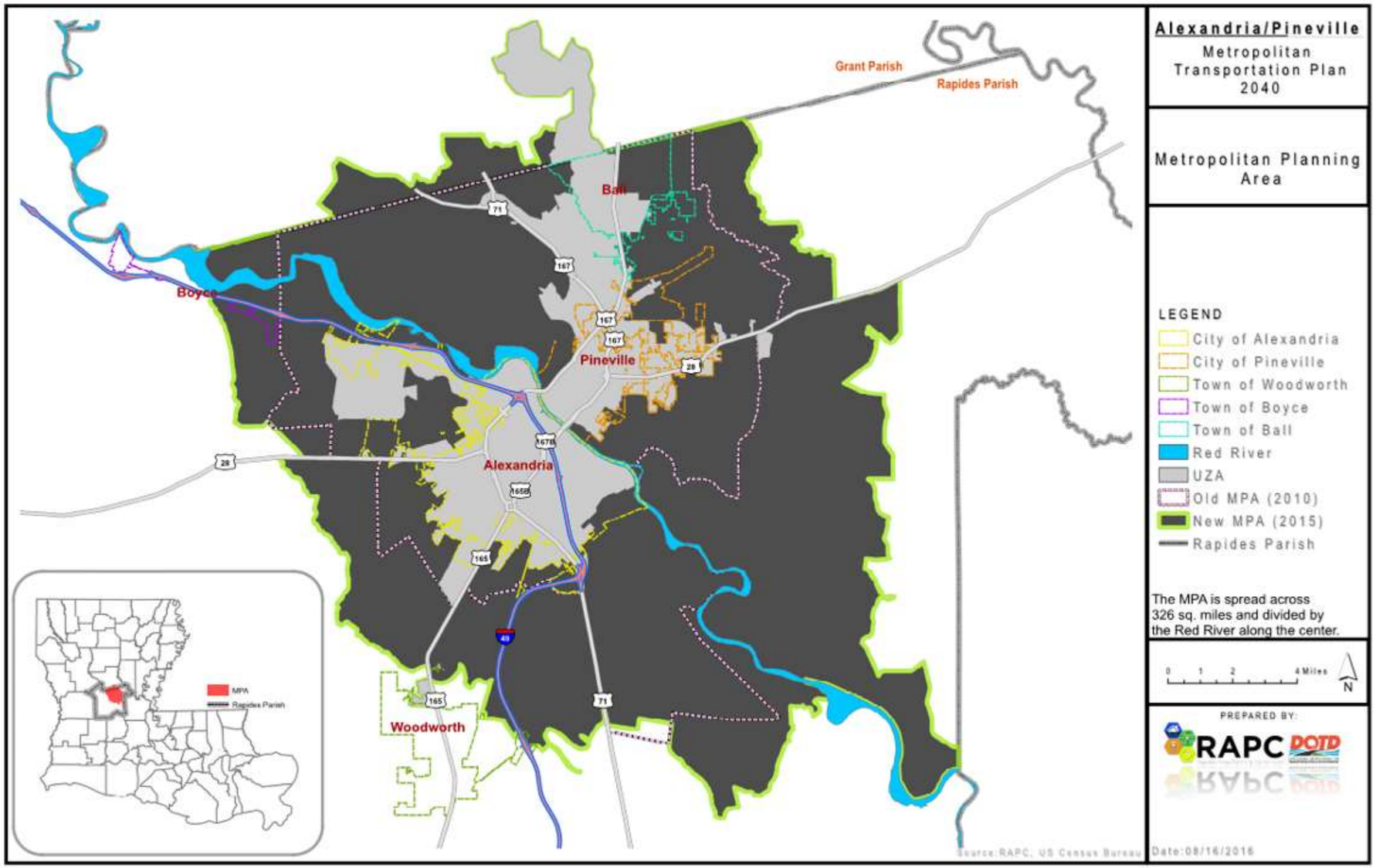

Figure 1: Alexandria Regional ITS Architecture Boundary

3 RELATIONSHIP TO REGIONAL PLANNING

The Alexandria Regional ITS Architecture is an integral part of planning for the operations and maintenance strategies that are addressed by the regional transportation planning process. The architecture provides a framework that connects operations and maintenance objectives and strategies with the integrated transportation system improvements that are implemented as a progressive series of ITS projects. The Metropolitan Transportation Plan[1] has identified the following objectives for the application of intelligent transportations systems:

- Increase number of congested intersections and corridors managed by intelligent transportation systems
- Increase flexibility of the transportation network by increasing the number of intersections and corridors managed by intelligent transportation systems

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 the regional plan. These planning elements are connected with ITS services in the RAD-IT database.

[1] http://www.rapc.info/assets/mtp-2040-final-oct-2016.pdf (accessed 6/23/2020)

Table 1: Relationship to Planning

Number	Type	Name	Description	Source	Performance Measure Category	Performance Measure
1	Objective	Affordable, Convenient, Reliable Destination Access by Multiple Modes of Transportation	Increase percentage of trips made by bicycling, walking and public transit Increase alternative transportation options/choices to households that spend more than 45% of their income on housing and transportation Increase percentage of the population with an average in-vehicle travel time of 20 minutes or less for all trip types during peak hours within the metro area. Increase percentage of the population and employment within a quarter mile of a transit route (fixed or semi-fixed) with a frequency of thirty minutes or less during peak hours. Expand fixed-route and/or paratransit/demand response transit service to Sundays. Reduce annual hours of delay from recurring and non-recurring congestion experienced by motorists and transit riders of marked bicycle facilities. Improve on-time performance of fixed-route transit service Increase percentage of para-transit/demand-response trips that pick up passengers within two hours of request.	Alexandria/Pineville Urbanized Area Metropolitan Transportation Plan 2040	Mobility	Vehicle hours traveled (VHT), Vehicle miles traveled (VMT)
					Transit Ridership	Service Coverage
					Travel Time	Average Speed of Transit Vehicle
2	Objective	Minimize Delay on Principal Arterials Connecting Rural and Urban Areas	Increase scheduled public transit connections between communities within the Metropolitan Planning Area. Minimize railroad freight delay by improving operations, infrastructure and reducing railroad/roadway and railroad/land use conflicts. Minimize delay on DOTD designated freight corridors, as identified in the Louisiana Freight Mobility Plan. Maintain a minimum average speed of 55 mph on Interstate facilities for efficient freight travel. Increase metro area transit service by adding new destinations and increasing the frequency of existing service. Monitor and encourage increase of daily commercial flights between Alexandria International Airport and large, commercial service airport hubs such as Houston and Dallas-Fort Worth. Monitor and encourage increase of non-commercial aircraft operations and aircrafts based at airports while maintaining available storage/hanger space	Alexandria/Pineville Urbanized Area Metropolitan Transportation Plan 2040	Crashes	Crashes per year, Number of Fatalities

Number	Type	Name	Description	Source	Performance Measure Category	Performance Measure
3	Objective	Well Maintained and Efficient Transportation System	Reduce percentage of all Vehicle Miles Traveled (VMT) that occurs on roadways with a Pavement Condition Rating (PCR) of 72 or lower, indicating a need for resurfacing or reconstruction. Decrease number of daily vehicles traveling on bridges on public roads that are classified as Structurally Deficient or Functionally Obsolete. Reduce annual Vehicle Miles Traveled per capita and Vehicle Hours Traveled per capita through Transportation Demand Management strategies. Increase number of congested intersections and corridors managed by Intelligent Transportation Systems. Reduce number of underutilized roadway corridors in urban areas with projected 2040 Volume to Capacity ratios below 0.75 by reallocating roadway space to other modes and purposes where such reallocation is deemed appropriate. Increase fixed route and para-transit/demand response transit passenger trips while reducing the operating cost per passenger trip for both.	Alexandria/Pineville Urbanized Area Metropolitan Transportation Plan 2040	Infrastructure Condition	International Roughness Index (IRI), Pavement Condition Index (PCI)
4	Objective	Safe Secure and Resilient Transportation System	Reduce number of automobile crashes on public roads resulting in fatalities or serious injuries and the respective rates per 100 million Vehicle Miles Traveled. Reduce number of bicycle and pedestrian crashes resulting in fatalities or serious injuries and the respective rates per capita. Reduce number of safety and security incidents, injuries, and fatalities for all transit systems and the respective rates per 100,000 Vehicle Miles. Reduce number of highway-rail crossing accidents, injuries, and fatalities for freight and passenger rail. Reduce aviation-related incidents or accidents attributed to local airport operations or facilities. Increase redundancy and diversity of the transportation network by increasing the number of emergency evacuation alternatives for multiple modes of transportation. Improve flexibility of the transportation network by increasing the number of intersections and corridors managed by Intelligent Transportation Systems.	Alexandria/Pineville Urbanized Area Metropolitan Transportation Plan 2040	Capacity	Volume to capcity ratio (v/c)
					Crashes	Crashes per year, Incident Detection and Clearance Times (mins), Number of Fatalities
					Mobility	Vehicle hours traveled (VHT), Vehicle miles traveled (VMT)
5	Objective	Transportation System That Creates a Sense of Place, Tourism and Improves Public Health	Increase number of multi-modal way-finding elements in areas frequented by tourists, with special attention given to major gateways such as interstate exits, inter-city bus terminals, and airports. Increase efforts within the Ozone Advance Program to improve air quality.	Alexandria/Pineville Urbanized Area Metropolitan Transportation Plan 2040	Environmental	Carbon Emission, NOx
6	Objective	Transportation System That	Reduce disparity in the average travel time to work between EJ/LM areas and all other areas. Reduce disparity between	Alexandria/Pineville Urbanized Area	Crashes	Crashes per year, Number of Fatalities

Number	Type	Name	Description	Source	Performance Measure Category	Performance Measure
		Distributes Benefits and Burdens in an Equitable Manner	the travel time by driving versus by riding transit to primary employment centers and major medical and educational destinations in EJ/LM areas. Reduce disparity in exposure to arterial traffic (VMT) and associated greater air and noise pollution for EJ groups. Reduce disparity between bicycle and pedestrian crashes in EJ/LM areas and other areas.	Metropolitan Transportation Plan 2040	Transit Ridership	Passengers per vehicle hour, Passengers per vehicle mile
					Travel Time	Average Speed of Transit Vehicle

4 ITS STAKEHOLDERS

Effective ITS architecture development involves the integration of multiple stakeholders and their transportation systems. This section describes the stakeholders who either participated in the creation of the Alexandria Regional ITS Architecture or whom the participating stakeholders felt needed to be included in the architecture. **Table 2** gives a brief description of each stakeholder identified for the Alexandria Regional ITS Architecture. **Section 5** describes the ITS system inventory and the association of these stakeholders with the elements in this inventory.

Table 2: ITS Stakeholders

Stakeholder Name	Stakeholder Description
Alexandria Port Authority	A prime location in the center of the state, close to I-49 and Alexandria International Airport, gives the Port of Alexandria many advantages for commercial and industrial commerce. The Port of Alexandria has had the distinction of being the largest receiver and shipper of military equipment on inland waterways in the continental United States. The port's proximity to Fort Polk's Joint Readiness Training Center in Leesville has attracted heavy use by the U.S. Army and other military units, which use the river to move equipment in and out for training exercises at the nearby military post. Additionally, the Louisiana National Guard has regularly used the Port of Alexandria to ship barge-loads of equipment to such distant locales as Belize and Honduras for construction missions.
Atrans - transit	ATRANS provides transit service for the Cities of Alexandria and Pineville Monday through Saturday. The system is operated by the City of Alexandria. Eight routes provide scheduled fixed route service to the service area. Five of the eleven buses providing service are ADA accessible. ATRANS also provides a demand response paratransit service for qualifying persons who are unable to access the fixed route service because of disabilities. This service requires users to fill out an application qualifying them for the service and requires a 24-hour notice to schedule service.
Central Louisiana Highway Safety Coalition	Central Louisiana Highway Safety Coalition has a primary goal is to reduce the number of traffic related fatalities and serious injuries by developing and implementing a regional safety action plan that focuses on the specific problems and issues facing the Central Region. The coalition promotes highway safety throughout 10 central Louisiana parishes through education, enforcement, engineering, and emergency response.
Central Louisiana Regional Port	The Central Louisiana Regional Port was created in 1988 but has a long history of contributing to the economy of Louisiana. It is located on the Red River and offers convenient, cost-effective access to regional, national and international markets. A consumer base of 30 million people lies within a days drive of the port, and excellent rail, highway and air service complete the areas attractive transportation picture. CLRP's river access makes economic sense because the benefits of water transportation is typically one-third the cost of rail and one-fifth the cost of motor freight. Barge transport is not only safe and energy efficient, but also allows for transport of oversized cargo that would be difficult or impossible to move by land or air.
City of Alexandria	The City of Alexandria is responsible for traffic management, incident management, emergency response and management, and other transportation system management activities within its jurisdiction.
City of Pineville	The City of Pineville is responsible for street maintenance and is impacted by incidents along the Pineville expressway.
DOTD	Louisiana Department of Transportation and Development (DOTD) is an arm of the Louisiana government responsible for state-wide transportation. The DOTD is responsible for statewide transportation system operations. This stakeholder group includes all DOTD units (ITS, Office of Planning Programming, Highway Safety, Weights and Standards, Traffic Services, and Traffic Engineering) involved in transportation planning, operations, and maintenance. Some of the typical responsibilities include incident detection and response, evacuation planning and management, transportation data collection, management, and distribution for the local region as well as for the entire state. The specific systems/facilities included in this group are ATM/EOC Center, 511 System, etc.

Stakeholder Name	Stakeholder Description
England Airpark (international airport)	Alexandria International Airport is a public use airport located approximately four miles west of the central business district of Alexandria, in Rapides Parish, Louisiana, United States. The airport is operated by the England Authority, also known as the England Economic and Industrial Development District, an independent political subdivision of the State of Louisiana. Despite its name, the airport operates no international flights nor flights to cities near border lines.
Fort Polk	Fort Polk is a United States Army installation located in Vernon Parish, approximately 7 miles east of Leesville, Louisiana and 20 miles north of DeRidder, Louisiana. It was named in honor of the Right Reverend Leonidas Polk, the first Episcopal Bishop of the Diocese of Louisiana, and a distinguished Confederate general in the American Civil War. The post encompasses approximately 198,000 acres. Of this, 100,000 acres are owned by the Department of the Army and 98,125 acres by the U.S. Forest Service, mostly in the Kisatchie National Forest. Fort Polk is the only Combat Training Center that also trains and deploys combat units.
Governors Office of Homeland Security and Emergency Preparedness (GOHSEP)	The Governor's Office of Homeland Security and Emergency Preparedness leads, coordinates, and supports the emergency management system, in order to protect lives and prevent the loss of property from all hazards. GOHSEP is responsible for planning and managing emergency response to major disasters on a state-wide basis.
Leesville	Leesville is a city in and the parish seat of Vernon Parish, Louisiana, United States. The population was 6,612 according to the 2010 census. Leesville is part of the Fort Polk South Micropolitan Statistical Area. The city is home to the Fort Polk U.S. Army installation. The populations of Fort Polk and Leesville, if combined, would result in a city with a population of more than 20,000.
Local Emergency Medical Providers	This includes local hospitals and emergency medical service providers (i.e., ambulance, air vac, etc) that are components of emergency management.
Local Railroad	There are a few at-grade level rail crossings that would benefit from ITS technology.
Local/Regional Public Safety Agencies	Responsible for operating local police, fire, and EMS offices and vehicles throughout region. This stakeholder group includes all the regional agencies that are involved in emergency, fire, police, and other public safety/emergency response activities.
Louisiana State Police	Louisiana State Police agency is responsible for operating Louisiana State Police Centers. Includes Computer Aided Dispatch database, which collects incident/emergency detection, dispatch, response, and status information related to the Louisiana State Police officers/equipment. Also responsible for Louisiana State Police vehicles.
Media	This stakeholder group includes local TV/Radio stations, and print media that is responsible for receiving and distributing transportation information like traffic conditions, incidents and road weather conditions.
Public	Members of the general public own and operate various devices/systems to access ITS information, including PDAs, cell phones, and personal computers.
Rapides Area Planning Commission	The Rapides Area Planning Commission is a regional organization providing land use planning, development, technical assistance, geographical information, and other planning services for member governments. RAPC offers building code enforcement through permits and inspections to all of Central Louisiana. The Planning Commission also houses The Metropolitan Planning Organization which provides transportation planning for the urbanized area of Rapides Parish and Transit Planning for all the Kisatchie-Delta Planning and Development District, and the Central Louisiana Highway Safety Coalition which is responsible for the regional strategic highway plan and improvements
Rapides Parish Police Jury	The Police Jury is the governing authority for Rapides Parish. Rapides Parish is located in central Louisiana and encompasses 1,362 square miles and has a population of over 131,000.
Tourism and Traveler Information Service Providers	Various tourism agencies, chambers of commerce, hotel associations, motorist services
Town of Ball	Ball is the third largest municipality in Rapides Parish, Louisiana. Located in the central part of the state, just 141 miles northwest of the capital city of Baton Rouge and 219 miles from New Orleans. According to the 2010 census, Ball has a total population of 4000.
Vernon Parish Police Jury	The Vernon Parish Police Jury is composed of 12 Police Jurors, each representing a district in the parish and a Secretary/Treasurer that oversees the financial and administrative operations for the parish. The Vernon Parish Police Jury meets in regular sessions on the third Monday of every month at 10:00am and the committee meeting is on the second Monday of every month at 5:00pm. Both meetings take place at the Parish Government Complex Building, 2nd Floor, 300 South 3rd Street, Leesville, Louisiana.

5 ITS SYSTEM INVENTORY

An inventory of existing and planned transportation systems is the basis for the Alexandria Regional ITS Architecture. The transportation system inventory was developed based on existing or planned stakeholder systems in the region. The inventory includes a list of ITS elements and the associated stakeholder responsible for system operation. This section describes the surface transportation inventory element for the region. A transportation element can be a center, a vehicle, a traveler or a piece of field equipment. Each transportation element listed below has one or more stakeholders associated with it from **Section 4**. Each transportation inventory element is mapped to at least one service package defined in the Architecture Reference for Cooperative and Intelligent Transportation services.

Table 3: ITS Inventory

Element Name	Element Description	Element Status	Stakeholder
Airport ITS Field Equipment	This elements represents the airports ITS field equipment such as CCTV cameras and weather information systems.	Existing	England Airpark (international airport)
Airport Landside Operations	This element represents the airports landside operations such as facility, grounds, parking etc for the Alexandria International Airport	Existing	England Airpark (international airport)
Alexandria TMC	This element represents traffic operations center that is responsible for local traffic management activities. The typical activities include traffic monitoring, traffic data collection, operation of ITS elements (CCTV, DMS, etc.), detection and verification of incidents, traffic signal monitoring, and other traffic management related activities. This also includes communicating with other agencies, districts, TMCs, and DOTD departments like maintenance for roadway maintenance activities. The Alexandria TMC is a local TMC as it only provides operations for the Rapides area	Planned	DOTD
ATRANS Transit Center	ATRANS provides transit service for the Cities of Alexandria and Pineville Monday through Saturday. The system is operated by the City of Alexandria. Eight routes provide scheduled fixed route service to the service area. Five of the eleven buses providing service are ADA accessible. ATRANS also provides a demand response paratransit service for qualifying persons who are unable to access the fixed route service because of disabilities. This service requires users to fill out an application qualifying them for the service and requires a 24-hour notice to schedule service.	Existing	City of Alexandria
ATRANS Transit Fleet	This element represents the fleet of buses and other public transit vehicles use to provide service to the citizens of Alexandria and Pineville.	Existing	City of Alexandria
City of Alexandria Police Department	This element represents the City of Alexandria Police dispatch center	Existing	City of Alexandria
City of Pineville Police Department	This element represents the City of Pineville Police dispatch center	Existing	City of Pineville
DOTD Camera	DOTD Camera sends traffic images to the TMC and is used for monitoring the roadway	Existing	DOTD
DOTD District 08 Traffic Operations	This element represents traffic operations or traffic engineering within the district office that is responsible for traffic management activities within the district jurisdiction. The typical activities include traffic monitoring, traffic data collection, operation of traffic signal operations, and other traffic management related activities. This also includes communicating with TMCs and other departments like maintenance for roadway maintenance activities.	Existing	DOTD
DOTD District 08 Traffic Signal System	This element represents traffic signals operated and maintained by the District	Existing	DOTD

Element Name	Element Description	Element Status	Stakeholder
DOTD DMS	The dynamic message sign (DMS) is a field device owned by DOTD and used for en-route traveler information.	Existing	DOTD
DOTD ITS Field Equipment	This element includes the equipment distributed on and along the roadway that monitors and controls traffic and monitors and manages the roadway itself. Equipment includes traffic signals, traffic detectors, environmental sensors, highway advisory radios, dynamic message signs, CCTV cameras and video image processing systems, and grade crossing warning systems.	Existing	DOTD
DOTD ITS Section	This element represents ITS Section (Section 56) under the DOTD. The ITS section is responsible for statewide operations center located in DOTD headquarters. Also, the ITS section is responsible for management information system for transportation, statewide ITS elements operations, and maintenance. The ITS section is also responsible for maintenance of all ITS equipment in the state.	Existing	DOTD
DOTD MAP	This element represents the Motorist Assistance Patrol (MAP) vehicles contracted by DOTD's ITS Section, but operated and maintained by the DOTD's District Offices.	Existing	DOTD
DOTD Social Media	Facebook and Twitter	Existing	DOTD
DOTD Statewide TMC	This element represents traffic operations center that is responsible for traffic management activities throughout the state. The typical activities include traffic monitoring, traffic data collection, operation of ITS elements (CCTV, DMS, etc.), detection and verification of incidents, traffic signal monitoring, and other traffic management related activities. This also includes communicating with other agencies, districts, TMCs, and DOTD departments like maintenance for roadway maintenance activities.	Existing	DOTD
Local Emergency Medical	Local hospitals as well as local emergency medical service providers (e.g., emergency rescue, ambulance, etc)	Existing	Local Emergency Medical Providers
Local Emergency Operations Centers	This element represents emergency dispatch centers operated by local agencies including 911, emergency, and fire response dispatch center.	Existing	Local/Regional Public Safety Agencies
Local Print and Broadcast Channels	Local Newspapers as well as radio and television broadcast providing transportation information	Existing	Media
Louisiana 511/Website	This element provides traveler information service provided by the LA DOTD in conjunction with private partner.	Existing	DOTD
LSP Troop E	This element represents Louisiana State Police department; the Alexandria metropolitan area is covered by Troop E.	Existing	Louisiana State Police
Other Local Public Safety Agencies	These are the local police/sheriff departments and 911 centers for the agencies that do not have a primary role in Traffic incident management and enforcement on major highways in the area	Existing	Local/Regional Public Safety Agencies
Parish Office of Emergency Preparedness 911 Administration	This element represents the parish emergency response operations including City fire, police, 911, and any other emergency response operators.	Existing	Rapides Parish Police Jury
Parish Sheriffs Office	This element represents the Parish Sheriff's Office dispatch center	Existing	Local/Regional Public Safety Agencies
RAPC Database	This element represents RAPC data service which directly or indirectly collects and provides transportation system data.	Existing	Rapides Area Planning Commission
RR At Grade Crossing Controller	Railroad at grade crossing controllers identify if a train is currently present at the intersection. This status allows for systems to be aware of for active traffic management.	Existing	Local Railroad
Tourism and Travel Service Information Sources	Private Tourism and Traveler Information Websites, local hotel associations, visitor centers, etc.	Existing	Tourism and Traveler Information Service Providers

Element Name	Element Description	Element Status	Stakeholder
Traffic Engineering	This element represents traffic operations or traffic engineering within the city that is responsible for traffic management activities within the jurisdiction. The typical activities include traffic monitoring, traffic data collection, operation of traffic signal operations, and other traffic management related activities.	Existing	City of Alexandria
Traffic Signal System	This element represents traffic signals operated and maintained by City or Parish	Existing	City of Alexandria
Traveler	Motorist or user of the regional transportation system	Existing	Public

5.1 EXISTING REGIONAL ITS SYSTEMS AND OPERATIONS

The existing ITS equipment have been compiled in Table 4. The Alexandria area does not have a traffic management center (TMC) therefore all ITS field equipment except signals are monitored and operated from the Statewide TMC in Baton Rouge, Louisiana. DOTD traffic signal operations can also be remotely monitored and changes made to signal timing and phasing through the ATMS.now central software platform. This remote monitoring of signals has been enhanced with new fiber optic communications to the traffic signals in the US 71 and LA 28 corridors that are being provided under the Alexandria Phase 3 project. This will enable the DOTD District 08 to more effectively monitor the roadways, detect incidents and help with rapid clearance, and make the corridors more resilient especially during emergencies such as fog or icy conditions when sometimes Interstate 49 has to be closed and traffic rerouted to US 71, or during hurricane emergencies. Any incidents or congestion in the region is posted to the existing dynamic message signs (DMS) or the 511 Traveler Information System allows drivers to actively engage in smart travel by choosing less congested routes and avoiding incident areas. 511 can be reached by phones or accessed on the internet at www.511LA.org. The Information provided for Statewide 511 from Alexandria is limited to construction and lane closures on state routes and bridges. Usually law enforcement provides incident information. All 511 information is provided to the Statewide TMC via email as public notices.

The 511 lane closure and construction information is communicated from DOTD District 08 to the Statewide TMC. Incidents that occur on the state routes are communicated from the State Police and municipal police to the Statewide TMC. The speed information for the Alexandria area is extracted from Google speed data.

Table 4: ITS Deployments

ITS Equipment	Description	Service Area
Signal System	247 signals owned and maintained by DOTD	Traffic and Incident Management
City of Alexandria Signal System	66 signals including school crossing and caution lights	Traffic and Incident Management
Closed Circuit Television (CCTV) Cameras[2]	9 CCTV cameras located along I-49 at its interchanges with US 165/71, Pineville Expressway, and US 71 owned and maintained by DOTD	Traffic Monitoring

[2] The Alexandria Phase 3 project which is scheduled to be completed in November 2020, will add 11 cameras and 2 DMS

ITS Equipment	Description	Service Area
Portable Changeable Message Signs (PCMS)	17 Portable Message Signs owned and maintained by DOTD	Traveler Information
DMS	DMS located on I-49 NB	Traveler Information
Statewide 511	Disseminate information about construction, major incidents, freeway speed	Traveler Information

5.2 TRANSPORTATION ISSUES

5.2.1 Traffic Management Center

The stakeholders desire a Traffic Management Center at a location that will provide sufficient space to house other traffic operations and maintenance staff and equipment including MAP vehicles and a sign shop. RAPC envisions a transportation management center where both transit and surface and other modes are monitored from the same location. RAPC is of the opinion that the new office location at 803 Johnston Street will serve that purpose well and the proximity to all the major arterials including I-49 should work well for incident management. The building is currently a lease to own and RAPC occupies a portion of the building and hopes to acquire the remainder of the space at a later period. RAPC is open to finding appropriate location with input from other stakeholders.

5.2.2 Road Weather Information System

Flooding of low-lying areas especially near the ramp terminals from I-49 impact mobility and safety. Other roadways are rendered impassable because of floods and disrupts mobility in the vicinity. Currently DOTD District 08 has no way to remotely assess the presence and extent of flooding and impacts to mobility at those locations. Typically, a team has to be sent out to inspect each location and initiate any mitigation or closure of roads. This takes significant time and delays response.

DOTD District 08 uses gates at the ramps to I-49 to control access during ice and fog conditions. Ice is infrequent. There is a desire to be able to assess the status of gates and communicate to the public if ramps are open or closed.

5.2.3 Speed Harmonization

The Pineville Expressway is a critical corridor because incidents on this expressway create significant congestion on US 167, LA 28E, LA 107, and US 165. Sight distances are inadequate in the vicinity of two overpasses on this expressway and have caused some incidents in the past. Also, the limited available ramp length connecting the Pineville Expressway to LA 107 creates unsafe merging situations. Pineville Police identified this expressway as their number one issue. The US 167 corridor is prone to backs up during rush hour and excessive speeding can lead to crashes. DOTD District 08 desires speed harmonization on expressways to smooth flow and the use of variable speed limit signs to control approach speeds of vehicles towards the back of queues to mitigate crashes.

5.2.4 Growth in LA 28 Corridor

New develops or growth in the RAPC region is focused on the LA 28 corridor. As the demand increases in the corridor, there may be the need to add more ITS devices to help manage traffic and incidents. The LA 28 corridor from US 71 to LA 1243 has benefitted from addition of cameras, signal communications upgrades and installation of fiber optic cables in the Alexandria Phase 3 ITS deployment.

5.2.5 Traveler Information Systems

Traveler information systems are desired on all major arterials including additional deployments on I-49. The LA 28 corridor is also experiencing growth and traveler information system in the corridor is desired.

5.2.6 Signal Upgrades and Communications

Generally, signal systems should be upgraded to provide both bicycle and pedestrian detection to support safe multimodal travel. Signal communications should be upgraded to enable signal coordination and remote access. Fiber optic communications is desired along US 167 and US 165 to support proposed devices in corridor and also support remote communications to the signals on US 165. Certain signals in the US 165 corridor have local closed loop fiber optic communications between them for coordination. Communications capability will enable DOTD District 08 to remotely assess performance measures and facilitate signal operations and maintenance. Improved signal coordination on Jackson Street is required to enhance mobility in the area. Masonic Drive signals at Texas Avenue and Memorial Drive have been turned over to the City of Alexandria and could benefit from signal coordination. The signals along Bolton Avenue also need improved coordination. The signals along LA 28 East also need improved signal coordination.

5.2.7 Video Analytics

DOTD District 08 expressed a desire to leverage video analytics software with artificial intelligence to scan video streams from cameras and detect queues and incidents, and also facilitate the development and output of performance measures and metrics to support operations.

6 ITS SERVICES

ITS services 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 region.

Table 5: ITS Services

Service Package	Service Package Name	Service Package Description
CVO01	Carrier Operations and Fleet Management	This service package manages a fleet of commercial vehicles. The Fleet and Freight Management Center monitors the vehicle fleet and can provide routes using either an in-house capability or an external provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). A route is electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management Center and routing changes can be made depending on current road network conditions. This service package also supports maintenance of fleet vehicles with on-board monitoring equipment. Records of vehicle mileage, preventative maintenance and repairs are maintained.
CVO02	Freight Administration	This service package tracks the movement of cargo and monitors the cargo condition. Interconnections are provided to intermodal freight shippers and intermodal freight depots for tracking of cargo from origin to destination. In addition to exceptions that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management Center.
CVO10	Road Weather Information for Freight Carriers	The service package is a special case of the Road Weather Advisories and Warnings for Motorists service package that focuses on Freight Carrier users. It provides the capability to collect road weather data from connected vehicles and using that data to develop short term warnings or advisories that can be provided to individual commercial vehicles or to commercial vehicle dispatchers. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather commercial vehicle alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial vehicle dispatchers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.
CVO12	HAZMAT Management	This service package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material transport, including response to incidents. HAZMAT tracking is performed by the Fleet and Freight Management Center. The Emergency Management Center is notified by the Commercial Vehicle and the Fleet and Freight Management Center of the HAZMAT vehicle location and information about the HAZMAT load. If an incident occurs, the Emergency Management Center can use the information to coordinate the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Center. The latter information can be provided prior to the beginning of the trip, during the trip, or gathered following the incident depending on the selected policy and implementation.
CVO14	CV Driver Security Authentication	This service package provides the ability for Fleet and Freight Management to detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information. If an unauthorized driver has been detected, Fleet and Freight Management can activate commands to safely disable the commercial vehicle. Alarms can also be sent to emergency management to inform them of a potential commercial vehicle hijacking or theft and potential hazardous situation. In addition, Emergency Management can request Fleet and Freight Management to disable a specific vehicle in their fleet.

Service Package	Service Package Name	Service Package Description
CVO15	Fleet and Freight Security	This service package provides enhanced security for commercial vehicle fleets and freight. Internal and external alerts and advisories are monitored to identify potential threats to the safety and security of the fleet and freight. It provides for the planning and tracking of three aspects of commercial vehicle shipments. For each shipment, the commercial vehicle, the freight equipment, and the commercial vehicle driver are monitored for consistency with the planned assignment. Any unauthorized changes are determined by the Fleet and Freight Management Center and then the appropriate people and Centers are notified. As the freight is shipped and tracked, security and public safety agencies may also interrogate the freight container to determine if it has been breached and to identify container contents. Once a route has been assigned, changes must be coordinated. Commercial Vehicle Drivers are alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management Center, which can notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried). Freight managers may decide to take further action on the alerts and/or provide responses that explain that the alerts are false alarms. If no explanation is received, the Fleet and Freight Management Center may notify the Emergency Management Center.
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. The repositories could include a data registry capability that allows registration of data identifiers or data definitions for interoperable use throughout a region.
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.
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.
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.
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.

Service Package	Service Package Name	Service Package Description
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.
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.
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).
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.
MC09	Infrastructure Monitoring	This service package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts) using both fixed and vehicle-based infrastructure monitoring sensors. Fixed sensors monitor vibration, stress, temperature, continuity, and other parameters and mobile sensors and data logging devices collect information on current infrastructure condition. This service package also monitors vehicle probes for vertical acceleration data and other probe data that may be used to determine current pavement condition.
PM01	Parking Space Management	This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.
PM02	Smart Park and Ride System	This service package provides real-time information on Park and Ride capacity and supports traveler's decision-making on where best to park and make use of transit alternatives. Transit operators are provided arrival information to support efficient pickup and drop offs and drivers switching to transit are offered current transit information.
PM03	Parking Electronic Payment	This service package supports electronic collection of parking fees. It collects parking fees from in-vehicle equipment, contact or proximity cards, or any smart payment device. User accounts may be established to enhance services offered to frequent customers.
PM04	Regional Parking Management	This service package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. This service package also shares information with transit management centers and transportation information centers to support multimodal travel planning. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.

Service Package	Service Package Name	Service Package Description
PM06	Loading Zone Management	This service package manages the occupancy of spaces in a loading/ unloading zone. It monitors the current status of each loading/unloading zone space under its control and makes this information available to arriving vehicles. The service package also operates a reservation system for loading zones, providing the capability for loading zone users, including commercial vehicle drivers or fleet operators, to reserve and pay for future use of a loading/unloading space. Interfaces to the general Vehicle OBE are included since loading zones may be used by any vehicle, though commercial vehicles are the most frequent users.
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. This service package also 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.
PS02	Emergency Response	This service package supports emergency/ incident response by personnel in the field. It includes emergency vehicle equipment used to provide response status as well as video or images from either the vehicle or from emergency personnel in the field. Wide area wireless communications between the Emergency Management Center, Emergency Personnel and Emergency Vehicles supports a sharing of emergency response information. The service package also includes 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, including the functions and interfaces commonly supported by a mobile command center.
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.
PS04	Mayday Notification	This service package provides the capability for a vehicle to automatically transmit an emergency message when the vehicle has been involved in a crash or other distress situation. An automatic crash notification feature transmits key data on the crash recorded by sensors mounted in the vehicle (e.g. deployment of airbags) without the need for involvement of the driver. The emergency message is sent to emergency response services, which determines and carries out the appropriate response. This service package allows passing vehicles to receive and forward mayday requests in areas where no communications infrastructure exists. Emergency notifications from personal devices are also supported.
PS05	Vehicle Emergency Response	The Vehicle Emergency Response service package provides arriving public safety vehicles with information from connected vehicles involved in a crash. Emergency responders need information about the vehicles involved in a crash to respond safely and effectively to the vehicle crash. Information such as HAZMAT data can assist the responders. Information about air bag activations and other measures indicating the severity of the crash can provide useful input to ambulance staff. In addition information about the power system of the vehicle (e.g. hybrid, electric, or internal combustion engine) can affect the response.

Service Package	Service Package Name	Service Package Description
PS06	Incident Scene Pre-Arrival Staging Guidance for Emergency Responders	This service package will provide situational awareness to and coordination among emergency responders - upon dispatch, while en route to establish incident scene work zones, upon initial arrival and staging of assets, and afterward if circumstances require additional dispatch and staging. It collects a variety of data from emergency, traffic, and maintenance centers. It includes a vehicle and equipment staging function that supplies the en route responders with additional information about the scene of an incident that they can use to determine where to stage personnel and equipment prior to their arrival on-scene. The service package also includes a dynamic routing function which provides emergency responders with real-time navigation instructions to travel from their base to the incident scene, accounting for traffic conditions, road closures, and snowplow reports if needed. In addition it includes an emergency responder status reporting function which continuously monitors the location of the en route responder vehicles as well as the vehicles already on-scene. The function develops and maintains the current position of the responder's vehicles and provides updates for estimated time of arrival (ETA).
PS07	Incident Scene Safety Monitoring	This service package employs communications technologies to provide warnings and alerts relating to incident zone operations. One aspect of the service is an in-vehicle messaging system that provides drivers with merging and speed guidance around an incident. Another aspect is providing in-vehicle incident scene alerts to drivers, both for the protection of the drivers as well as incident zone personnel. A third aspect is a warning system for on-scene workers when a vehicle approaching or in the incident zone is being operated outside of safe parameters for the conditions.
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.
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.

Service Package	Service Package Name	Service Package Description
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 websites.
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.

Service Package	Service Package Name	Service Package Description
PS12	Disaster Response and Recovery	This service package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks).The service package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The service package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response.The service package identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that form the overall disaster response. In this service package, the Emergency Management Center represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Center and the other centers provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this service package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities. This service package builds on the basic traffic incident response service that is provided by TM08, the Traffic Incident Management service package. This service package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers. Many users of ARC-IT will want to consider both TM08 and this service package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response.Disaster Response and Recovery is also supported by PS14, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.

Service Package	Service Package Name	Service Package Description
PS13	Evacuation and Reentry Management	This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.This service package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale 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. Information is shared with 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. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. 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.Evacuations are also supported by PS14, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.
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.
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.
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.

Service Package	Service Package Name	Service Package Description
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.
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.
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. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).Most of the surveillance and sensor data that is collected by this service package may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this service package. This service package also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.
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.
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.
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.
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.

Service Package	Service Package Name	Service Package Description
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.
PT14	Multi-modal Coordination	This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.
ST01	Emissions Monitoring	This service package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the Emissions Management Center for processing. Both area wide air quality monitoring and point emissions monitoring are supported by this service package. For area wide monitoring, this service package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this service package collects data from on-board diagnostic systems and measures tail pipe emissions to identify vehicles that exceed emissions standards and/or clean vehicles that could be released from standard emissions tests, depending on policy and regulations. Summary emissions information or warnings can also be displayed to drivers. The gathered information can be used to implement environmentally sensitive travel demand management (TDM) programs, policies, and regulations.
ST02	Eco-Traffic Signal Timing	The Eco-Traffic Signal Timing service package is similar to current adaptive traffic signal control systems; however, the service package's objective is explicitly to optimize traffic signals for the environment rather than the current adaptive systems' objective, which is to enhance the intersection level of service or throughput, which might improve the intersection's environmental performance. The Eco-Traffic Signal Timing service package processes real-time and historical connected vehicle data at signalized intersections to reduce fuel consumption and overall emissions at the intersection, along a corridor, or for a region. It evaluates 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.
ST08	Eco-Approach and Departure at Signalized Intersections	The Eco-Approach and Departure at Signalized Intersections service package uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service package performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. Finally, the service package may perform engine adjustments that provide increased fuel efficiency.
ST09	Connected Eco-Driving	The Connected Eco-Driving service package provides customized real-time driving advice to drivers so that they can adjust their driving behavior to save fuel and reduce emissions. Eco-driving advice includes recommended driving speeds, optimal acceleration, and optimal deceleration profiles based on prevailing traffic conditions, interactions with nearby vehicles, and upcoming road grades. The service package also provides feedback to drivers on their driving behavior to encourage drivers to drive in a more environmentally efficient manner. Finally, the service package may include vehicle-assisted strategies where the vehicle automatically implements the eco-driving strategy (e.g., changes gears, switches power sources, or reduces its speed in an eco-friendly manner).

Service Package	Service Package Name	Service Package Description
SU01	Connected Vehicle System Monitoring and Management	This service package provides monitoring, management and control services necessary to other applications and/or devices operating within the Connected Vehicle Environment. This service package maintains and monitors the performance and configuration of the connected vehicle system. This includes tracking and management of the infrastructure configuration as well as detection, isolation, and correction of infrastructure service problems. It also includes monitoring of performance of the infrastructure and mobile equipment, which includes RSEs, OBEs, the back office applications, as well as the communication links that connect the system.
SU02	Core Authorization	This service package manages the authorization mechanisms to define roles, responsibilities and permissions for connected vehicle applications . This allows system administrators to establish operational environments where different connected vehicle system users may have different capabilities. For instance, some Mobile elements may be authorized to request signal priority, or some Centers may be permitted to use the geographic broadcast service, while those without those permissions would not.
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.
SU07	ITS Communications	This service package provides secure, reliable communications between ITS devices. It provides the layered protocols and communications services and includes the physical network plant and network hardware that supports ITS communications. It also encompasses security services that protect communications and preserve privacy, and the management services that support network management.
SU08	Security and Credentials Management	This service package is used to ensure trusted communications between mobile devices and other mobile devices or roadside devices and protect data they handle from unauthorized access. The service package grants trust credentials to qualified mobile devices and infrastructure devices in the Connected Vehicle Environment so that those devices may be considered trusted by other devices that receive trust credentials from the SCM service package. The service package allows credentials to be requested and revoked and secures the exchange of trust credentials between parties, so that no other party can intercept and use those credentials illegitimately. The service package provides security to the transmissions between connected devices, ensuring authenticity and integrity of the transmissions. Additional security features include privacy protection, authorization and privilege class definition, as well as non-repudiation of origin.
SU10	Center Maintenance	This service package supports maintenance of the computers, networks, video walls, and other information technology assets that are installed in a center to support center operations. Like other support service packages, this SP is drawn at a high level of abstraction so the basic interfaces and functionality associated with maintaining center IT assets can be applied to any center.
SU11	Field Equipment Maintenance	This service package supports maintenance of ITS devices that are installed in the field. Like other support service packages, this SP is drawn at a high level of abstraction so the basic interfaces and functionality associated with maintaining field ITS assets can be applied to any field equipment. In particular, this service package supports maintenance of field subsystems like ITS Payment Equipment, Parking Management Systems, Traveler Support Equipment, and Commercial Vehicle Check Equipment where maintenance is not covered by a more specific Service Package. Two Field subsystems have more specific service packages associated with their maintenance: See MC05 for maintenance of ITS Roadway Equipment and SU01 for more specific interfaces associated with maintaining Connected Vehicle Roadside Equipment.

Service Package	Service Package Name	Service Package Description
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.
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.
TI03	Dynamic Route Guidance	This service package offers advanced route planning and guidance that is responsive to current conditions. The package augments a user's navigation system equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is used by the user equipment to provide real-time route guidance that factors in current conditions.
TI04	Infrastructure-Provided Trip Planning and Route Guidance	This service package offers the user trip planning and en route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real time network conditions. Unlike TI03, where the user equipment determines the route, the route determination functions are performed by the center in this service package. The trip plan may be confirmed by the traveler and advanced payment and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments, and ancillary services are accepted and processed. The confirmed trip plan may include specific routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.
TI05	Travel Services Information and Reservation	This service package provides travel service information and reservation services to the traveler pre-trip and while en route. This includes information for tourist attractions, lodging, dining, service stations, parking, emergency services, and other services and businesses of interest to the traveler.
TI06	Dynamic Ridesharing and Shared Use Transportation	This service package addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip . These inputs are then translated into “optimal” pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the service package to improve the user’s experience for future trips.The shared use aspect of the service package addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.

Service Package	Service Package Name	Service Package Description
TI07	In-Vehicle Signage	This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.
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.
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).
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.
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.

Service Package	Service Package Name	Service Package Description
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.
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.
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.

Service Package	Service Package Name	Service Package Description
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 personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel. This service package is closely related with the Public Safety service packages, which focus on services that support first responders. In particular, local management of the incident using an incident command system is covered by PS02.
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.
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.
TM15	Railroad Operations Coordination	This service package provides an additional level of strategic coordination between freight rail operations and other transportation centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.

Service Package	Service Package Name	Service Package Description
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.
TM18	Drawbridge Management	This service package supports systems that manage drawbridges at rivers and canals and other multimodal crossings (other than railroad grade crossings which are specifically covered by other service packages). The equipment managed by this service package includes control devices (e.g., gates, warning lights, dynamic message signs) at the drawbridge as well as the information systems that are used to keep travelers apprised of current and forecasted drawbridge status.
TM21	Speed Harmonization	This service package determines speed recommendations based on traffic conditions and weather information and uses connected vehicle technologies to assist in harmonizing speeds to these recommendations. The speed recommendations can be regulatory (e.g. variable speed limits) or advisory. The purpose of speed harmonization is to change traffic speed on links that approach areas of traffic congestion, bottlenecks, incidents, special events, and other conditions that affect flow. Speed harmonization assists in maintaining flow, reducing unnecessary stops and starts, and maintaining consistent speeds. The service package utilizes connected vehicle V2I communication to detect the precipitating roadway or congestion conditions that might necessitate speed harmonization, to generate the appropriate response plans and speed recommendation strategies for upstream traffic, and to broadcast such recommendations to the affected vehicles. The speed recommendations can be provided in-vehicle for connected vehicles, or through roadside signage for non-connected vehicles.
VS02	V2V Basic Safety	This service package exchanges basic safety messages with surrounding Connected Vehicles to support and augment the safety warning and control automation features identified in VS01. These exchanges support Connected Vehicle safety applications defined in SAE J2945/1: Emergency Electronic Brake Lights, Forward Crash Warning, Blind Spot Warning/Lane Change Warning, Intersection Movement Assist, Left Turn Assist, and Control Loss Warning. It also supports Do Not Pass Warning, Motorcycle Approaching indication, Tailgating Advisory, Stationary Vehicle, and Pre-Crash Actions applications from CVRIA.
VS04	V2V Special Vehicle Alert	This service package alerts the driver about the location of and the movement of public safety vehicles responding to an incident, slow moving vehicles, oversized vehicles, and other special vehicles that may require special attention from the driver. These public safety, commercial, and maintenance vehicles share their current status and location with surrounding vehicles so that other drivers in the vicinity can avoid interfering with their actions and avoid collisions.
VS05	Curve Speed Warning	This service package allows connected vehicles to receive information that it is approaching a curve along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the curve and its recommended speed. In addition, the vehicle can perform additional warning actions if the actual speed through the curve exceeds the recommended speed.

Service Package	Service Package Name	Service Package Description
VS07	Road Weather Motorist Alert and Warning	This service package collects road weather data from connected vehicles and uses that data to develop short term warnings or advisories that can be provided to individual motorists. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather motorist alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial service providers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.
VS08	Queue Warning	This service package utilizes connected vehicle technologies, including vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, to enable vehicles within the queue event to automatically broadcast their queued status information (e.g., rapid deceleration, disabled status, lane location) to nearby upstream vehicles and to centers (such as the TMC). The infrastructure will broadcast queue warnings to vehicles in order to minimize or prevent rear-end or other secondary collisions. This service package is not intended to operate as a crash avoidance system. In contrast to such systems, this service package will engage well in advance of any potential crash situation, providing messages and information to the driver in order to minimize the likelihood of his needing to take crash avoidance or mitigation actions later. It performs two essential tasks: queue determination (detection and/or prediction) and queue information dissemination using vehicle-based, infrastructure-based, or hybrid solutions.
VS12	Pedestrian and Cyclist Safety	This service package supports the sensing and warning systems used to interact with pedestrians, cyclists, and other non-motorized users that operate on the main vehicle roadways, or on pathways that intersect the main vehicle roadways. These systems allow automated warning or active protection for this class of users. It integrates traffic, pedestrian, and cyclist information from roadside or intersection detectors and new forms of data from wirelessly connected, non-motorized traveler-carried mobile devices to request right-of-way or to inform non-motorized travelers when to cross and how to remain aligned with the crosswalk or pathway based on real-time Signal Phase and Timing (SPaT) and MAP information. In some cases, priority will be given to non-motorized travelers, such as persons with disabilities who need additional crossing time, or in special conditions (e.g., weather) where non-motorized travelers may warrant priority or additional crossing time. This service package will enable a service call to be routed to the traffic controller from a mobile device of a registered person with disabilities after confirming the direction and orientation of the roadway that the individual is intending to cross. It also provides warnings to the non-motorized user of possible infringement of the crossing or pathway by approaching vehicles.
VS16	Automated Vehicle Operations	This service package provides full vehicle automation, controlling both the steering and acceleration/deceleration on areas of the highway system that support full automation. Communications between vehicles and between the vehicles and supporting infrastructure equipment supports cooperative check-in to the automated portion of the system and transition to automated mode, coordination of maneuvers between vehicles in automated mode, and checkout from the automated system. This service package is distinguished from the most advanced CACC systems in that full longitudinal and lateral control automation are supported, enabling closely spaced, tightly coupled platoons of vehicles to operate with short fixed gaps, providing greatly enhanced highway capacity and throughput with enhanced efficiency since aerodynamic drag is reduced.

Service Package	Service Package Name	Service Package Description
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.
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.

7 INTERFACE BETWEEN SYSTEMS

The interfaces of the transportation systems in this architecture are based on the Architecture Reference for Cooperative and Intelligent Transportation and tailored to reflect the plan for this region. Architecture diagrams display the transportation systems in the Alexandria Regional ITS Architecture and, more importantly, how these systems are and will be connected with one another so that information can be exchanged and transportation services can be coordinated. Stakeholders may use these diagrams to identify integration opportunities. Each system in the region can be represented with two types of diagrams: an overall interconnect diagram and element specific architecture flow context diagram. These diagrams are described below.

The interconnect context diagram shows the connections between systems (i.e., Elements). 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, shown as planned or existing. An architecture flow context diagram shows a particular system and all other systems with which it is interconnected, the information being shared (i.e. architecture flows), and the direction of the flow. Descriptions of the architecture flow definitions are included in **Appendix A**. The architecture context flow and interconnect context diagrams are also presented in **Appendix B** to better illustrate the interconnections and information flow between the interfaces of the systems in the region. In order to ease reading these figures, some flow diagrams have been substituted with the corresponding interconnect context diagram. Detailed flow diagrams for each element are contained in the RAD-IT database. RAD-IT can be used to create tailored interconnect and architecture flow diagrams for any system in the database.

8 OPERATIONAL CONCEPT

The Operational Concept lists the roles and responsibilities (RR) that each participating agency must take on to provide the ITS services included in the ITS Architecture. Changing needs may arise that will require an agreement to be formed between all affected parties that defines new or additional roles. 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.

Table 6: Operational Concept

RR Area Name	RR Area Description	Stakeholder	RR Description	RR Status
Emergency Management	There are a few emergency contingencies related to weather such as hurricane, flooding or icing. The emergency management system will seek to minimize the impacts of extreme events and restore transportation functions and help develop resilient networks and help protect lives.	City of Alexandria, City of Pineville, Louisiana State Police	Emergency response	Existing
		DOTD	Infrastructure monitoring, ITS Software and hardware maintenance, ITS Field Equipment maintenance and construction	Existing
		DOTD	Traffic signal system maintenance and construction	Existing
		England Airpark (international airport)	resource provider	Existing
		Local Emergency Medical Providers	Medical response	Existing
		Louisiana State Police	Traffic control	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Public	End user of traveler information	Existing
Freeway Management	Safety and mobility on the freeways will support economic growth and livability for all residents and travelers through the region.	City of Alexandria	Incident management	Existing
		City of Alexandria	Incident response, Emergency response	Existing
		City of Pineville	Incident response, Incident management, Emergency response	Existing
		DOTD	Traffic data collection, Infrastructure monitoring, Motorist information systems, Traffic Control, ITS Field Equipment maintenance and construction	Planned
		DOTD	Traffic operations, Event monitoring	Existing

RR Area Name	RR Area Description	Stakeholder	RR Description	RR Status
		Louisiana State Police	Incident response, Speed enforcement, Emergency response	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Rapides Area Planning Commission	Archive data management	Existing
		Rapides Area Planning Commission	Transportation planning	Existing
Incident Management	Incidents can lead to secondary incidents and loss of lives or loss in productivity. An incident management system will facilitate mitigation of the impacts of incidents and help protect lives.	City of Alexandria, City of Pineville	Incident response, Incident management	Existing
		DOTD	Traffic data collection, Infrastructure monitoring, Traffic Control	Planned
		DOTD	Traffic operations, Event monitoring, Motorist information systems	Existing
		Local Emergency Medical Providers	Medical response	Existing
		Local/Regional Public Safety Agencies	Incident response	Existing
		Local/Regional Public Safety Agencies, Louisiana State Police	Traffic control	Existing
		Louisiana State Police	Incident response, Speed enforcement, Emergency response	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Rapides Area Planning Commission	Crash data collection , Crash data, Traffic data collection	Existing
		Rapides Area Planning Commission	Transportation planning	Existing
Information Management	This will leverage all data sources including operational data generated from field devices or other stakeholder business operations, connected vehicle environment and any emerging sources such as big data to enhance the real time management of the	DOTD	Traffic data collection	Existing
		Local Emergency Medical Providers	Medical response	Existing
		Louisiana State Police	Incident response, Speed enforcement, Emergency response	Existing

RR Area Name	RR Area Description	Stakeholder	RR Description	RR Status
	transportation network. Data Management and Governance policies will be established for privacy and security of data. Data fusion and data analytics tools will be used to develop actionable information to enhance operations and management of the transportation infrastructure.	Rapides Area Planning Commission	Archive data management	Existing
		Rapides Area Planning Commission	Transportation planning,	Existing
Maintenance and Construction	Maintenance and construction will help improve the infrastructure and support socioeconomic activities. A well-maintained infrastructure will be critical to the economic growth of the region.	City of Alexandria, City of Pineville	Traffic signal system maintenance and construction, Surface street maintenance and construction	Existing
		DOTD	Infrastructure monitoring, ITS Software and hardware maintenance, ITS Field Equipment maintenance and construction	Planned
		DOTD	Traffic signal system maintenance and construction, Roadway maintenance and construction	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	motorist information	Existing
		Rapides Area Planning Commission	Archive data management	Existing
		Rapides Area Planning Commission	Transportation planning	Existing
Surface Street Management	Surface street management to reduce congestion and incidents will make businesses and services more accessible with fewer emissions or environmental impacts. This could include timing improvements and coordination of traffic signal systems, pedestrian, and bicyclist safety.	City of Alexandria	Traffic signal system maintenance and construction, Surface street maintenance and construction, Traffic operations	Existing
		City of Pineville	Surface street maintenance and construction, Traffic operations	Existing
		City of Pineville	Traffic signal system maintenance and construction	Planned
		DOTD	Infrastructure monitoring, Traffic Control, ITS Software and hardware maintenance, ITS Field Equipment maintenance and construction	Existing
		DOTD	Traffic operations, Traffic signal system maintenance and construction, Roadway maintenance and construction	Existing

RR Area Name	RR Area Description	Stakeholder	RR Description	RR Status
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Rapides Area Planning Commission	Traffic data collection	Existing
		Rapides Area Planning Commission	Transportation planning	Existing
Transit Services	Transit plays a vital role in providing mobility for many giving them access to work, healthcare and other socio-economic activities. Emerging trends in micro mobility and transportation network companies and other innovative solutions with ebikes, scooters, etc. to supplement public transit to provide more efficient services to meet the general mobility needs of the public.	City of Alexandria	Transit Provider	Existing
Traveler Information	Providing timely real time information pre-trip and en-route based on prevailing transportation system status for freeways, surface streets and transit would help the public make smarter decisions about the need for the trip and when and how that trip need will be met.	City of Alexandria, City of Pineville	Motorist information	Existing
		DOTD	Motorist information systems	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Media, Tourism and Traveler Information Service Providers	Motorist information	Existing
		Public	End user of traveler information	Existing

8.1 ITS DEPLOYMENT PLAN-SEQUENCE OF PLANNED PROJECTS

The Alexandria Regional ITS Architecture is implemented one ITS project at a time. This section lists the projects that have been identified as part of the regional ITS architecture. Additional details for each of these ITS projects are included in the RAD-IT database.

Table 7: Project Sequence

Project Name	Description	Service Scope	Service Packages	Geographic Scope	Priority
Alexandria ITS Deployment Phase 2	Deployment of ITS field equipment along major arterial routes and integration with ATMS	Deploy ITS field equipment including but not limited to DMS, CCTV Cameras, automated prepare to stop signs for bridge crossing railroads, and vehicle detection . Operations of equipment envisioned to be provided by the Statewide TMC until Alexandria TMC is constructed. Maintenance is to be provided by DOTD ITS Section 56.	DM01, DM02, PS06, PS08, PS12, PS13, PS14TM01, MC05, MC06, MC08, MC09, TM06, TM07, TM08, TM09, TI01, VS02, VS03	US 167, Pineville Expressway and feeder routes, US 165, LA 28 and LA 107	1
Alexandria ITS Deployment Phase 4	Deployment of ITS field equipment along major arterial routes and integration with ATMS	Deploy ITS field equipment including but not limited to arterial DMS, CCTV Cameras, and Vehicle Detection. Operations of equipment envisioned to be provided by the Statewide TMC until Alexandria TMC is constructed. Maintenance is to be provided by DOTD ITS Section 56.	DM01, DM02, PS06, PS08, PS12, PS13, PS14TM01, MC05, MC06, MC08, MC09, TM06, TM07, TM08, TM09, TI01, VS02, VS03	I-49 , US 165, and US 167	2
I-49 Queue Warning System	This project will provide queue warning system (vehicle detectors and traveler information system) to enhance safety in the corridor and help mitigate associated with visibility of back of queues.	Traffic Monitoring Advanced Traveler Information	DM01, DM02, PS06, PS08, PS12, PS13, PS14TM01, MC05, MC06, MC08, MC09, TM06, TM07, TM08, TM09, TI01, TM17, TM20, TM21, VS02, VS03, VS08, VS09, VS15	I-49 Corridor within the RAPC MPO Boundary	3
Alexandria Traffic Signal Upgrades	Upgrade existing traffic signal corridors with communications and integration into the proposed Alexandria TMC and DOTD District 08 Traffic Operations for enhanced signal management and operations.	Support poles, cabinets, controllers, detection, wiring, indications, signage, push buttons, communications, central system software, and integration. Operations of signal systems are based on owner agencies and agreements established.	DM01, DM02, PT09, ST02, TM03, TM04, TM07, TM08, TM13, TM15,	State and Local Routes including the following: -LA 28 East -LA 1208 Jackson St. Extension -LA 1 Bolton Ave.	4
Alexandria TMC	Establish a local Transportation Management Center (TMC)	TMC Operations to include: -Active monitoring of traffic conditions on state and federal routes -Disseminating information for emergencies, congestion, incidents and amber alerts -Coordination for Traffic Incident Management -Agency outreach	TM01, TM02, TM03, TM05, TM06, TM07, TM08, TM09, TM13, TM17, TM19, TM20, TM21	Alexandria MPO area - Coverage to include state and federal routes	5
Traveler Information System	This project will provide traveler information system to the public. This will include major corridors into the City of Alexandria such as LA 28, Pineville Expressway, etc.	Disseminating information for emergencies, congestion, incidents and amber alerts	TI01, TI07	LA 28 US 167 I-49	6

8.2 OPERATIONS AND MAINTENANCE OF REGIONAL ITS

Currently, DOTD ITS Section (Section 56) is responsible for providing statewide ITS equipment O&M support for equipment on state and federal routes. DOTD Traffic Signals are maintained by the district office or by a municipality through an agreement. On other routes, the agency responsible for the ITS is the facility owner. Typically, ITS maintenance activities are performed on an as-needed basis with the exception of routine/preventive maintenance. Every regional ITS architecture does not have dedicated funding source/structure for periodic maintenance of the system. As the transportation funding resources struggle to keep up with the demand, it is critical to understand the capital cost versus O&M cost balance over the life-cycle of any ITS. As the Alexandria region continues to expand and enhance existing ITS, it is critical to identify which agency will be responsible for a proposed ITS and how much resources will be required for O&M of the system. The more ITS deployment there is in the region, the more money will be required for maintenance, and less money will be available for new ITS deployment in successive time periods if the ITS budget does not grow.

In **Table 5**, maintenance responsibilities have been identified/assigned to a particular agency for each applicable service package. Although, such O&M arrangements may differ at a project level based on specific agencies involved, the operations and maintenance requirements section under each service package provides guidelines on which agency should assume the maintenance responsibilities for each ITS component.

As far as the long term funding is considered, there is currently no dedicated long term maintenance funding for any ITS in the region. DOTD currently has a statewide ITS maintenance budget of about $3 million.

8.3 ITS FUNDING

As mentioned earlier, currently there is no dedicated funding source for ITS deployments in any particular regions including the Alexandria region. DOTD ITS Section has a capital budget of $14 million each year as part of the highway funding program, which is allocated statewide on a prioritized basis depending on need. There is currently no dedicated funding source for ITS in the Alexandria Regional Transportation Improvement Program (TIP) to cover all the identified projects. As part of the follow-up to this architecture effort, it is recommended that Rapides Area Planning Commission (RAPC), being the regional planning entity, collaborate with DOTD and the other Alexandria stakeholders and pursue or leverage funding sources for the ITS deployment within the region. Apart from the funds allocated to ITS development, other sources of funds meant for safety or congestion mitigation and air quality (CMAQ). FHWA's Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant awards can be a funding source leverage to pilot ITS projects in the State. The grant will pay up to 50% of the cost of the project only. However since this grant is awarded on competitive basis and FHWA desires to deploy ITS projects in diverse geographic areas, this funding should not been seen as a source for substantial recurring ITS deployments, and funding for the ATCMTD program is based on

9 ARCHITECTURE MAINTENANCE PLAN

This section discusses the proposed Maintenance Plan for the regional ITS Architecture. FHWA's Final Rule on ITS Architecture and Standards (23 CFR Part 940) requires development of an architecture maintenance plan. Paragraph 940.9 (f) states that:

> "The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining it, as needs evolve within the region."

In January 2004, FHWA issued guidance for developing and maintaining regional ITS infrastructure (http://ops.fhwa.dot.gov/its_arch_imp/guidance.htm). The Maintenance Plan for the Alexandria Regional ITS Architecture is based on the guidelines provided by FHWA's White Paper 1 on what should be contained in an architecture maintenance plan in order to be compliant with FHWA requirements. The White Paper on this subject is available at http://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm. This section provides some background on the need for architecture maintenance and addresses key issues under the following headings:

- Why Maintain a Regional ITS Architecture?
- Who Will Maintain the Architecture?
- When will the Architecture be updated?
- What will be maintained?
- How will the Architecture be maintained?

9.1 WHY MAINTAIN A REGIONAL ITS ARCHITECTURE

As ITS projects are implemented, the regional ITS architecture will need to be updated to reflect new ITS priorities and strategies that emerge through the transportation planning process. It will also need to be updated to account for expansion in ITS scope and to allow for the evolution and incorporation of new ideas. The goal of the maintenance plan is to guide controlled updates to the regional ITS architecture baseline so that it continues to accurately reflect the region's existing ITS capabilities and future plans.

9.2 WHO WILL MAINTAIN THE ARCHITECTURE?

To maintain a consensus regional ITS architecture, ideally all stakeholders should participate in the process. In practice, typically, one or two agencies take the lead responsibility to maintain the regional ITS architecture. The primary requirements of the regional architecture maintainer are the mission/authority to perform such functions and the necessary skills to perform the same. The mission of the ITS architecture maintainer most closely resembles a regional planning body that, consistent with its mission, has the authority to initiate, update, and document changes in regional planning documents. For the Alexandria Regional ITS Architecture, the DOTD will assume the role of the ITS Architecture keeper and maintainer as indicated in **Section 2.2**.

Like the regional transportation plans, architecture maintenance is recurring, and is a necessary long-term effort. To be effective in ITS architecture maintenance, DOTD will need to have staff that:

- Is knowledgeable of the existing regional ITS architecture. This implies a detailed technical understanding of the various parts of the architecture and how changes would affect each part.
- Has an understanding of transportation systems in the region. This understanding can reside jointly in the group of agencies/ stakeholders who participate in the maintenance process.

- Has an understanding of the tools used to create (and to update) the architecture. This might include, for example, knowledge of the RAD-IT tool, if that is used to hold some of the architecture information.

As the agency responsible for maintaining the architecture, the DOTD needs to have the skills within its own organization and/or use a qualified consultant. In either case, the agency needs the necessary funding to support the maintenance effort. The following are the recommended minimum resources for ITS architecture maintenance management:

- One individual to be the ITS architecture manager
- Two individuals trained in RAD-IT and ITS Planning (Considering this is a new functional/skill area, the training will need to be comprehensive and will require resources: three work days for RAD-IT training and four weeks to study regional and national architecture documents)
- Approximately sixteen man-hours per month for ITS architecture maintenance activities. This may be performed by the manager or designee.
- Manage the update of the Regional ITS Architecture RAD-IT source file with project level ITS architectures
- Facilitate ITS Steering Committee meetings annually. The ITS Steering Committee is made up of representative from each stakeholder in the region.
- A qualified consultant to assist with the ITS architecture maintenance activities. (DOTD has on a retainer contract a professional engineering consulting firm to provide ITS, TIM Program, TMC Operations Staffing and Systems Engineering Support)

Although DOTD will lead the architecture maintenance activities, like all other regional planning activities, ITS architecture maintenance will take close coordination between several agencies. DOTD will need to coordinate with other major stakeholders* in the region, including:

- Louisiana Department of Transportation and Development (DOTD) District 08
- DOTD ITS Section
- Louisiana State Police (Troop E)
- Rapides Area Planning Commission (RAPC)

*Note – Other stakeholders may be included as necessary based on ITS development and deployment activities.

As DOTD takes responsibility for architecture maintenance, they will use agreements to create a management/oversight function (e.g. a “Regional ITS Architecture Maintenance Committee”) to oversee regional ITS architecture maintenance work, which would have representation from the key stakeholders to the agreement as listed above. At minimum, such a committee will include two DOTD representatives, one RAPC representative, and one FHWA representative.

It is proposed that such a Regional ITS Architecture Maintenance Committee will be responsible for recommending/presenting the proposed changes to the MPO Technical Advisory Committee (Same committee that approves regional planning documents). The Regional ITS Architecture Maintenance Committee will meet annually to report/discuss any changes to ITS in the region. All the regional stakeholders will be responsible for informing/updating the regional maintenance committee about new ITS deployments in their region. The architecture maintenance committee will also be responsible for following up with all of the regional stakeholders to ensure that any and all ITS deployments are reported and documented in the regional plan.

Following this architecture adoption by the MPO, it is recommended that the Regional ITS Architecture Maintenance Committee meet at least once per year to:

- Review progress in ITS implementation projects
- Verify that the regional ITS architecture RAD-IT source file is kept up to date with the region's ITS projects
- Update plans for future deployments by each regional stakeholder
- Review changes in State and Architecture Reference for Cooperative and Intelligent Transportations, regulations, and requirements, if any
- Determine any needs for an update to the Alexandria Regional ITS Architecture

9.3 WHEN WILL THE ARCHITECTURE BE UPDATED?

The regional ITS architecture is not static. It must change as plans change, as ITS projects are implemented, and as the ITS needs and services evolve in the region.

At a minimum, the regional ITS architecture will be reviewed annually by the Regional ITS Architecture Maintenance Committee. The Regional ITS Architecture Maintenance Committee may meet and perform architecture updates more frequently to keep with the pace of the region's ITS implementation. Annual or more frequent updates will include integrating completed projects into the regional ITS architecture RAD-IT source file. A one page summary of the change will be added as an appendix to the regional ITS architecture document.

Regardless of the frequency selected for periodic updates, it is recommended that the Committee recognize the potential need for "Exception Maintenance" to occur in the event of major project implementations, major revisions to the Architecture Reference for Cooperative and Intelligent Transportation, or to meet the requirements of future regulations.

It is recommended that the regional ITS architecture is fully updated every five years, prior to the periodic updating of the Regional Transportation Improvement Program, which occurs once a year.

Upon recommendation of the Regional Architecture Maintenance Committee, the MPO Technical Advisory Committee will make a resolution to accept any revisions/changes/updates to the ITS architecture.

The following list includes many of the events that may cause change to a regional ITS architecture:

9.3.1 Changes in Regional Needs

Regional ITS architectures are created to support transportation planning in addressing regional needs. Over time these needs can change and the corresponding aspects of the regional ITS architecture that addresses these needs may need to be updated. These changes in needs should be expressed in updates to planning documents such as the Regional Transportation Plan.

9.3.2 New Stakeholders

Regional ITS architectures are created to support transportation planning in addressing regional needs. Over time these needs can change and new stakeholders will be introduced. The corresponding aspects of the regional ITS architecture that addresses these needs may need to be updated. These changes

in needs should be expressed in updates to planning documents such as the Regional Transportation Plan.

9.3.3 Changes in Scope of Service Considered

The range of services considered by the regional ITS architecture expands. This might happen because the Architecture Reference for Cooperative and Intelligent Transportation has been expanded and updated to include new user services or to better define how existing elements satisfy the user services. The Architecture Reference for Cooperative and Intelligent Transportation may have expanded to include a user service that has been discussed in a region, but not in the regional ITS architecture, or was included in only a very cursory manner. Changes in the Architecture Reference for Cooperative and Intelligent Transportation are not of themselves a reason to update a regional ITS architecture, but a region may want to consider any new services in the context of their regional needs.

9.3.4 Changes in Stakeholder of Element Names

An agency's name or the name used to describe their element(s) undergoes change. Transportation agencies occasionally merge, split, or are just renamed. In addition, element names may evolve as projects are defined. The regional ITS architecture should be updated to use the current, correct names for both stakeholders and elements.

9.3.5 Changes in Other Architectures

A regional ITS architecture covers not only elements and interfaces within a region, but also interfaces to elements in adjoining regions. Changes in the regional ITS architecture in one region may necessitate changes in the architecture in an adjoining region to maintain consistency between the two. Architectures may also overlap (e.g. a statewide ITS architecture and a regional ITS architecture for a region within the state) and a change in one might necessitate a change in the other.

9.3.6 Changes due to Project Definitions or Implementation

There are several changes relating to project definition that will cause the need for updates to the regional ITS architecture. When actually defined or implemented, a project may add, subtract or modify elements, interfaces, or information flows from the regional ITS architecture. Because the regional ITS architecture is meant to describe the current, as well as future, regional implementation of ITS, it must be updated to correctly reflect how the developed projects integrate into the region.

9.3.7 Changes due to Project Addition/Deletion

Occasionally a project will be added or deleted through the planning process, or through project delivery, and some aspects of the regional ITS architecture that are associated with the project may be expanded, changed, or removed.

9.3.8 Changes in Project Priority

Due to funding constraints, or other considerations, the planned project sequencing may change. Delaying a project may have a ripple effect on other projects that depend on it. Raising the priority for a project's implementation may impact other projects that are related to it.

9.4 WHAT WILL BE MAINTAINED?

Those constituent parts of a regional ITS architecture that will be maintained is referred to as the "baseline." This section considers the different "parts" of the regional ITS architecture and whether they should be a part of the baseline. Baseline parts are annually updated within the regional ITS architecture RAD-IT file and every five years within the document. The parts discussed are:

- Description of Region
- List of Stakeholders
- Operational Concepts
- List of ITS Elements
- List of Agreements
- Interfaces between Elements
- System Functional Requirements
- Applicable ITS Standards
- Project Sequencing

One of the benefits of a regional ITS architecture is to enable the efficient exchange of information between ITS elements in a region and with elements outside the region. Efficiency refers to the economical deployment of ITS elements and their interfaces. The result of these ITS deployments should be contributions to the safe and efficient operation of the surface transportation network. Each of the components in the regional ITS architecture below have a role in this economy and an appropriate effort should be levied to maintain them.

9.4.1 Description of Region

This description includes the geographic scope, functional scope, and architecture timeframe, and helps frame each of the following parts of a regional ITS architecture. Geographic scope defines the ITS elements that are "in" the region, although additional ITS elements outside the region may be need to be described if they communicate ITS information to elements inside the region. Functional scope defines which services are included in a regional ITS architecture. Architecture timeframe is the distance (in years) into the future that the regional ITS architecture will consider. The description of the region is usually contained in an architecture document, but may reside in a database containing aspects of the regional ITS architecture, and should certainly be a part of the baseline.

9.4.2 List of Stakeholders

Stakeholders are of great importance to the definition of the architecture. Within a region, they may consolidate or separate and such changes should be reflected in the architecture. Furthermore, stakeholders that have not been engaged in the past may be approached through outreach to be sure that the regional ITS architecture represents their ITS requirements as well. The stakeholders should be described in architecture documentation (and may also reside in a database representing aspects of the regional ITS architecture). Their listing and description should be part of the baseline.

9.4.3 Operational Concepts

It is crucial that the operational concepts represented as roles and responsibilities or as customized service packages in a regional ITS architecture accurately represent the consensus vision of how the stakeholders want their ITS to operate for the benefit of surface transportation users. These should be reviewed and, if necessary, changed to represent both what has been deployed (which may have been shown as "planned" in the earlier version of the regional ITS architecture) and the current consensus view of the stakeholders. Many of the remaining maintenance efforts will depend on the outcome of the

changes made here. The operational concept will reside in the architecture documentation and possibly in a diagramming tool if a customized service package approach is used, and should be part of the baseline.

9.4.4 List of ITS Elements

The inventory of ITS elements is a key aspect of the regional ITS architecture. Changes in stakeholders as well as operational concepts may impact the inventory of ITS elements. Furthermore, recent implementation of ITS elements may change their individual status (e.g. from planned to existing). The list of elements is often contained in architecture documentation and is key information in any architecture database. It is a key aspect of the baseline.

9.4.5 List of Agreements

One of the greatest values of a regional ITS architecture is to identify where information will cross an agency boundary, which may indicate a need for an agency agreement. An update to the list of agreements can follow the update to the Operational Concept and/or interfaces between elements. The list of agreements will usually be found in the architecture documentation. This listing should be a part of the baseline.

9.4.6 Interfaces between Elements

Interfaces between elements define the “details” of the architecture. They are the detailed description of how the various ITSs are or will be integrated throughout the timeframe of the architecture. These details are usually held in an architecture database. They are a key aspect of the architecture baseline and one that will likely see the greatest amount of change during the maintenance process.

9.4.7 System Functional Requirements

High-level functions are allocated to ITS elements as part of the regional ITS architecture. These can serve as a starting point for the functional definition of projects that map to portions of the regional ITS architecture. Usually this information is held in spreadsheets or databases, but may be included in the architecture document. They are a part of the baseline.

9.4.8 Applicable ITS Standards

The selection of standards depends on the information exchange requirements. But in addition, the maintenance process should consider how ITS standards may have evolved and matured since the last update and consider how any change in the “standards environment” may impact previous regional standards choices (especially where competing standards exist). For example, if Extensive Markup Language (XML) based Center-To-Center standards reach a high level of maturity, reliability, and cost-effectiveness, then a regional standards technology decision may be made to transition from investments in other standards technologies (e.g. Common Object Request Broker Architecture (CORBA) to XML). The description of the standards environment for the region, as well as the details of which standards apply to the architecture, should be part of the baseline.

9.4.9 Project Sequencing

While project sequencing is partly determined by functional dependencies (e.g. “surveillance” must be a precursor to “traffic management”), the reality is that most project sequences are local policy decisions. Project sequences should be reviewed to make sure that they are in line with current policy decisions. Furthermore, policy makers should be informed of the sequences and their input should be sought to

make the project sequences coincide with their expectations. This is crucial to eliminate the possibility of the regional ITS architecture becoming irrelevant. The project sequencing should be included in the architecture documentation and may also be held in a spreadsheet or database. These should be part of the architecture baseline.

9.5 HOW WILL THE ARCHITECTURE BE MAINTAINED?

DOTD ITS Section (Section 56) will oversee and ensure that the regional architecture is maintained. DOTD will utilize its contracted consulting services contract for ITS Traffic Incident Management (TIM) Program, TMC Operations Staffing and Systems Engineering Support for this effort. The guidelines contained within FHWA's Regional ITS Architecture Maintenance White Paper will be helpful in guiding the maintenance effort. In addition to detailing the recommended maintenance process, the White Paper also contains examples of Maintenance Plans developed by a range of agencies and regions throughout the country.

10 FUNCTIONAL REQUIREMENTS

Each ITS system operated by the stakeholders must perform certain functions to effectively deliver the ITS services desired by the region. The primary functions that each system needs to perform are broadly defined in the Alexandria Regional ITS Architecture. The high-level requirements are grouped into functional areas that identify requirements associated with each selected ITS service.

Due to the detail of the functional requirements in **Table 8**, they have not been fully included within the written Regional ITS Architecture. However, the functional requirements are available by running a report from the Regional ITS Architecture RAD-IT source file which can be made available upon request to the DOTD ITS Section. **Table 8** below shows a sample of the report output information that can be obtained from RAD-IT.

Table 8: Functional Requirements

Element Name	Physical Object Name	Functional Object	Functional Object Description	FO User Defined	Requirement #	Requirement	Status
Airport ITS Field Equipment	Security Monitoring Equipment	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.	No	03	The field element shall provide equipment status and fault indication of security sensor equipment to a center.	Existing
Airport ITS Field Equipment	Security Monitoring Equipment	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.	No	04	The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).	Existing

Element Name	Physical Object Name	Functional Object	Functional Object Description	FO User Defined	Requirement #	Requirement	Status
Airport ITS Field Equipment	Security Monitoring Equipment	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.	No	07	The field element shall include object detection sensors (such as metal detectors).	Existing
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	01	The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).	Planned
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	02	The center shall receive incident information from other transportation management centers to support the early warning system.	Planned

Element Name	Physical Object Name	Functional Object	Functional Object Description	FO User Defined	Requirement #	Requirement	Status
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	03	The center shall support the entry of alert and advisory information directly from the emergency system operator.	Planned
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	06	The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.	Planned
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	10	The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.	Planned
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	11	The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.	Planned

Element Name	Physical Object Name	Functional Object	Functional Object Description	FO User Defined	Requirement #	Requirement	Status
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	14	The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.	Planned
Alexandria TMC	Emergency Management Center	Emergency Early Warning System	'Emergency Early Warning System' monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies and uses this information to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to initiate the emergency response, including public notification using ITS traveler information systems, where appropriate.	No	15	The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.	Planned

11 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 9: ITS Standards

SDO	Document ID	Standard Title	Standard Type
American Public Transportation Association	APTA TCIP-S-001	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
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 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

SDO	Document ID	Standard Title	Standard Type
Consortium of AASHTO, ITE, and NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/Data
Institute of Electrical and Electronics Engineers	IEEE 1512	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Message/Data
Institute of Transportation Engineers	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/Data
International Organization for Standardization	ISO 19091	Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections	Other Standard
Profile	DSRC-UDP	Vehicle-to-Vehicle/Infrastructure using UDP	Standard Profile
Profile	DSRC-WSMP	Vehicle-to-Vehicle/Infrastructure using WSMP	Standard Profile
Profile	NTCIP-DATEX	NTCIP using DATEX	Standard Profile
Profile	NTCIP-SNMPv1	NTCIP using SNMPv1	Standard Profile
Profile	NTCIP-SNMPv1 Secure	NTCIP-SNMPv1 Secure	Standard Profile
Profile	NTCIP-SNMPv3	NTCIP-SNMPv3	Standard Profile
Profile	NTCIP-STMP	NTCIP using STMP	Standard Profile
Profile	RSE-C2F	RSE - Center to Field Communications	Standard Profile
Profile	RSE-C2F-SNMP	RSE - Center to Field Communications - SNMP	Standard Profile
Profile	RSE-F2F	Roadside Equipment to ITS Roadway Equipment	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	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 J2945/9	Vulnerable Road User Safety Message Minimum Performance Requirements	Other Standard
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 were or will be exchanging information generated prior to implementing relevant projects. This list identifies the agreements that should be established but does not define the agreements themselves.

Table 10: Agreements

Agreement Title	Agreement Status	Description	Lead Stakeholder	Associated Stakeholders
Alexandria Regional Motorist Assistance Patrol	Existing	Cooperative endeavor Agreement between DOTD and the Rapides Region for providing motorist assistance patrol.	DOTD	Local Emergency Medical Providers, Local/Regional Public Safety Agencies, Louisiana State Police
Traffic Signal Maintenance Agreement - DOTD/Alexandria	Existing	Agreement between DOTD and City of Alexandria for providing maintenance and operations of traffic signals at state intersections within the city limits. Maintenance and operations include payment for electricity, inspection, replacement of inoperative light bulbs and fuses, and straightening of signal heads and signs.	DOTD	City of Alexandria, DOTD

APPENDIX - A. ARCHITECTURE FLOW DEFINITIONS

Table 11: Architecture Flow Definitions

Flow Name	Flow 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 coordination	Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.
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.
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.
commercial vehicle archive data	Information describing commercial vehicle travel and commodity flow characteristics. 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.
device control request	Request for device control action
device status	Status information from devices
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 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.

Flow Name	Flow Description
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 traffic coordination	Coordination supporting disaster response including evacuation and reentry. Includes coordination of special traffic control strategies that support efficient evacuation and reentry while protecting and optimizing movement of response vehicles and other resources responding to the emergency.
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.
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.
environmental situation data	Aggregated and filtered vehicle environmental data collected from vehicle safety and convenience systems including measured air temperature, exterior light status, wiper status, sun sensor status, rain sensor status, traction control status, anti-lock brake status, and other collected vehicle system status and sensor information. This information flow represents the aggregated and filtered environmental data sets that are provided by the RSE to the back office center. Depending on the RSE configuration and implementation, the data set may also include environmental sensor station data collected by the RSE.
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.
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.
field equipment status	Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.
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 for public	Report of current desensitized incident information prepared for public dissemination.
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.

Flow Name	Flow Description
infrastructure monitoring sensor control	Data used to configure and control infrastructure monitoring sensors.
infrastructure monitoring sensor data	Data read from infrastructure-based sensors that monitor the condition or integrity of transportation infrastructure including bridges, tunnels, interchanges, pavement, culverts, signs, transit rail or guideway, and other roadway infrastructure. Includes sensor data and the operational status of the sensors.
infrastructure situation data	Aggregated and filtered vehicle data collected from vehicle safety and convenience systems that are indicative of infrastructure condition including traction control status, anti-lock brake status, accelerometer status, and other collected vehicle system status and sensor information. This information flow represents the aggregated and filtered environmental data sets that are provided by the RSE to the back office center.
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.
intersection control status	Status data provided by the traffic signal controller including phase information, alarm status, and priority/preempt status.
intersection safety application info	Intersection and device configuration data, including intersection geometry, and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
intersection safety application status	Infrastructure safety application status reported by the RSE. This includes current operational state and status of the RSE and a record of intersection safety issues identified and alerts and warnings issued.
intersection status	Current signal phase and timing information for all lanes at a signalized intersection. This flow identifies active lanes and lanes that are being stopped and specifies the length of time that the current state will persist for each lane. It also identifies signal priority and preemption status and pedestrian crossing status information where applicable.
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.
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 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 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 crossing status	Current pedestrian and other mixed use crossing information including an indication of whether the call button has been activated, the current state of the mixed use crossing signal, and information indicating whether non-motorized users are currently occupying the cross walk.
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.
multimodal archive data	Operational information from alternate passenger transportation modes including air, rail transit, taxis, and ferries. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
multimodal service data	Detailed real-time schedule and other service information from alternate modes that supports coordination between modes to facilitate efficient transfer at connection points.

Flow Name	Flow Description
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 coordination	Information that enables parking management activities to be coordinated between different parking operators or systems in a region.
parking information	General parking information and status, including current parking availability, parking pricing, and parking space availability information.
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.
passive vehicle monitoring control	Control commands used to control detection systems that rely on infrastructure-based identification of individual vehicles to measure travel times and other related measures by identifying the same vehicle at different points in the network. Related technologies include Bluetooth readers and license plate recognition systems.
passive vehicle monitoring data	Time stamped identifiers that identify the vehicles that have passed through a detection zone.
personal crossing safety information	Current crossing status including permission to cross, crossing time remaining, and warnings in the event that a vehicle reports an imminent intersection infringement that may impact non-motorized users including pedestrians and cyclists.
personal location	The current location (latitude, longitude, and elevation) reported by the personal information device
personal location information	Pedestrian, bicyclist, and other non-motorized user locations at an intersection as detected and reported by an RSE.
personal signal service request	A request for right of way from a personal device that indicates the type of traveler (pedestrian, special needs pedestrian, bicyclist, etc.), anticipated time of arrival, travel path, and crossing duration.
personal transit information	General and personalized transit information for a particular fixed route, flexible route, or paratransit system.
queue warning application information	Information regarding formed or impending queues (location of the end of queue, estimated duration of the queue, and other descriptions of the queue condition) and recommendations for upstream vehicles including speed reduction, lane change, or diversion recommendations. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
queue warning application status	Queue warning application status reported by the RSE. This includes current operational state and status of the RSE and a record of measured vehicle speeds and identified queues.
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.
regional situation data	This general flow represents the traffic, environmental, and emissions situation data that is collected from connected vehicles and aggregated, filtered, and distributed to other centers as a regional information product for use in operations, performance monitoring, and analysis.
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.
remote vehicle disable	Signal used to remotely disable a transit vehicle.
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.

Flow Name	Flow Description
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 environmental situation data	Aggregated environmental situation data collected from vehicles and other sources for the road network. Aggregated information would include measured air temperature, exterior light status, wiper status, sun sensor status, rain sensor status, traction control status, ALB status, and other collected vehicle system status and sensor information for the region.
road network status assessment	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.
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 advisories	Segment-specific weather and road conditions including real-time advisories of deteriorating road and weather conditions, medium-term advisories for the next 2–12 hours, and long-term advisories more than 12 hours into the future. The advisories may include advisories that are issued by the RSE based on locally collected environmental data (e.g., an ice on bridge advisory).
road weather advisory info	Road weather advisories and associated configuration and control information that are used to manage the RSE. Advisories include segment-specific weather and road conditions including real-time advisories of deteriorating road and weather conditions, medium-term advisories for the next 2–12 hours, and long-term advisories more than 12 hours into the future. This flow includes a schedule for issuing the included advisories.
road weather advisory status	Current RSE application status that is monitored by the back office center including the operational state of the RSE, current configuration parameters, and a log of advisories issued. The advisories may include advisories that are issued by the RSE based on locally collected environmental data (e.g., an ice on bridge advisory).
road weather information	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
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 equipment coordination	The direct flow of information between field equipment. This includes transfer of information between sensors and driver information systems (e.g., DMS, HAR, variable speed limit signs, dynamic lane signs) or control devices (e.g., traffic signals, ramp meters), direct coordination between adjacent control devices, interfaces between detection and warning or alarm systems, and any other direct communications between field equipment.
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.
secure area sensor control	Information used to configure and control threat sensors (e.g., thermal, acoustic, radiological, chemical), object, motion and intrusion detection sensors. The provided information controls sensor data collection, aggregation, filtering, and other local processing.
secure area sensor data	Data provided by threat sensors (e.g., thermal, acoustic, radiological, chemical), and intrusion, motion, and object detection sensors in secure areas indicating the sensor's operational status, raw and processed sensor data, and alarm indicators when a threat has been detected.
secure area surveillance control	Information used to configure and control audio and video surveillance systems used for transportation infrastructure security in secure areas. The provided information controls surveillance data collection, aggregation, filtering, and other local processing.
secure area surveillance data	Data collected from surveillance systems used to monitor secure areas. Includes video, audio, processed surveillance data, equipment operational status, and alarm indicators when a threat has been detected.
service information request	Request to multimodal (possibly non-roadway) transit provider for general services information and specific trip information or reservation.

Flow Name	Flow Description
service information response	Multimodal (possibly non-roadway) transit provider services information and trip reservation confirmations.
signal control commands	Control of traffic signal controllers or field masters including clock synchronization.
signal control data	Information used to configure local traffic signal controllers.
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 service request	A call for service or extension for a signal control phase that is issued by the RSE for connected vehicles approaching an intersection and/or pedestrians at a crosswalk. This flow identifies the desired phase and service time.
signal system configuration	Data used to configure traffic signal systems including configuring control sections and mode of operation (time based or traffic responsive).
speed management application information	Current speed targets, advisories, and limits including time of day, week, or season speed limits as necessary, and application parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
speed management application status	Speed management application status reported by the RSE. This includes current operational state and status of the RSE and a record of measured vehicle speeds and current speed targets, advisories, and limits.
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.
speed warning application info	Roadway configuration data, current speed limits including time of day, week, or season speed limits as necessary, and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
speed warning application status	Speed warning application status reported by the RSE. This includes current operational state and status of the RSE and a record of measured vehicle speeds and notifications, alerts, and warnings issued.
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 control information	Represents the flow of traffic control and status information from a TMC to a third party TIC. This is reporting only, not actual control.
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.
transit information user request	Request for special transit routing, real-time schedule information, and availability information.
transit multimodal information	Transit schedule information for coordination at modal interchange points.
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 information	Transit service information including routes, schedules, and fare information as well as dynamic transit schedule adherence and transit vehicle location information.

Flow Name	Flow Description
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 information	Transit service instructions, wide area alerts, traffic information, road conditions, and other information for both transit and paratransit operators.
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.
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 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 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.
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 signage application info	In-vehicle signing application configuration data and messaging parameters. This flow provides a list of regulatory, warning, and information messages to be displayed and parameters that support scheduling and prioritizing messages to be issued to passing vehicles. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.

Flow Name	Flow Description
vehicle signage application status	In-vehicle signing application status reported by the RSE. This includes current operational state and status of the RSE and a log of messages sent to passing vehicles.
vehicle signage local data	Information provided by adjacent field equipment to support in-vehicle signing of dynamic information that is currently being displayed to passing drivers. This includes the dynamic information (e.g., current signal states, grade crossing information, local traffic and road conditions, detours, advisories, parking availability, etc.) and control parameters that identify the desired timing, duration, and priority of the signage data.
video surveillance control	Information used to configure and control video surveillance systems.
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.

APPENDIX - B. ALEXANDRIA REGIONAL ITS ARCHITECTURE FLOW AND CONTEXT DIAGRAMS

(Where a detailed flow context diagram is too complex to show in this report, the corresponding interconnect context diagram is used. All diagrams can be obtained from the RAD-IT file)

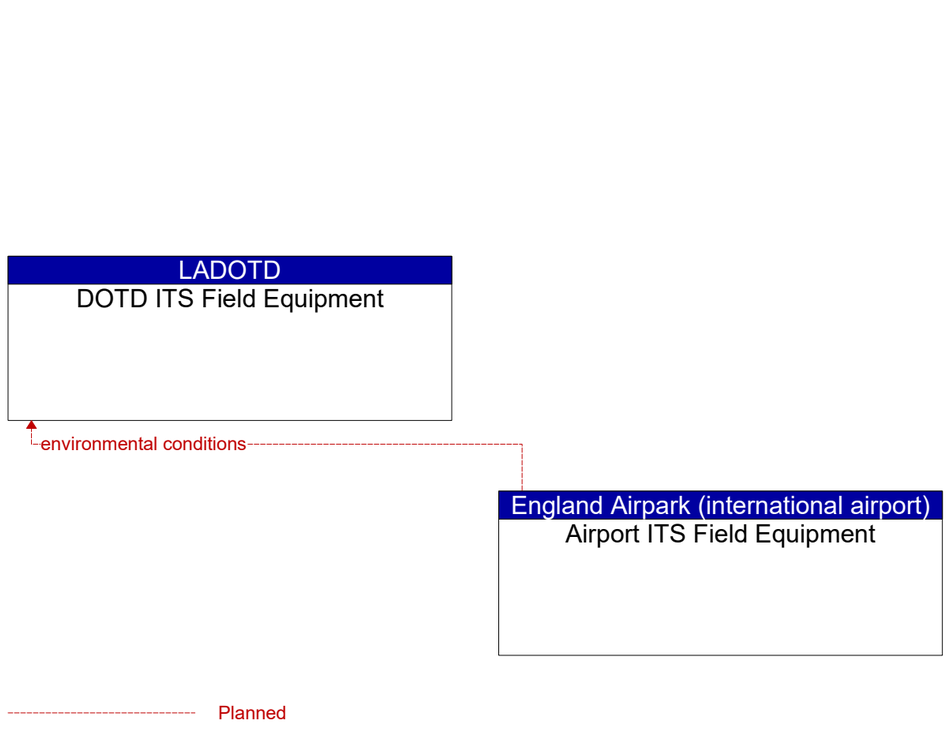

Figure 2: Airport ITS Field Equipment Flow Context Diagram

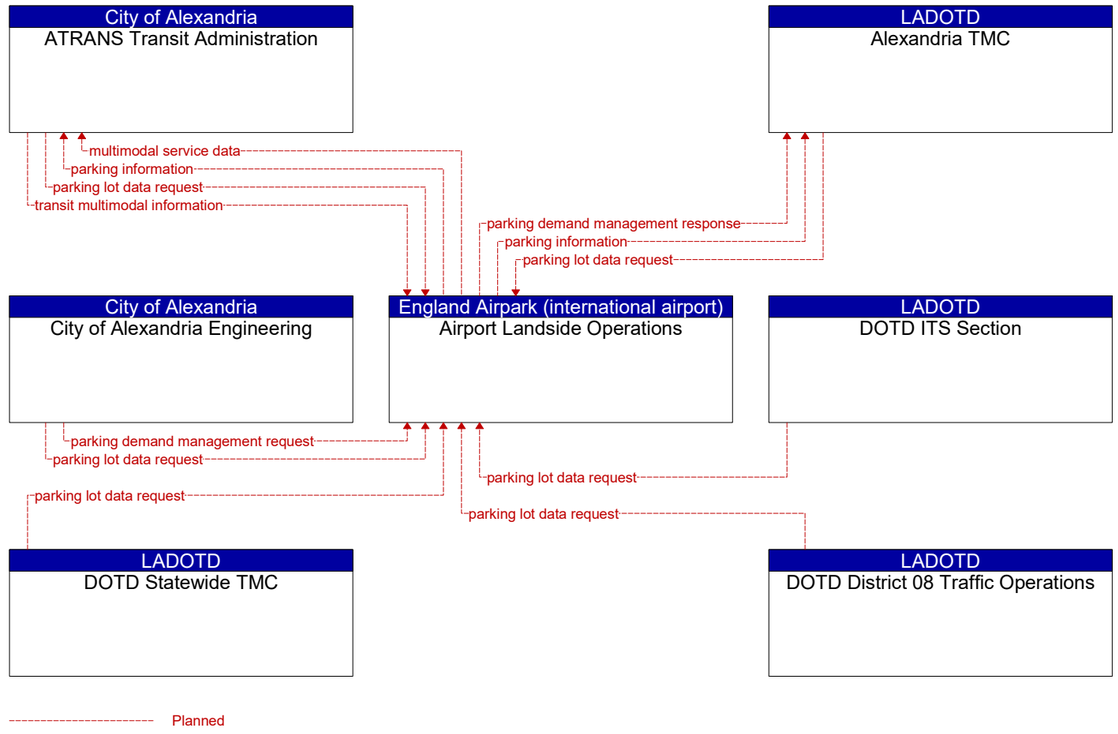

Figure 3: Airport Landside Operations Flow Context Diagram

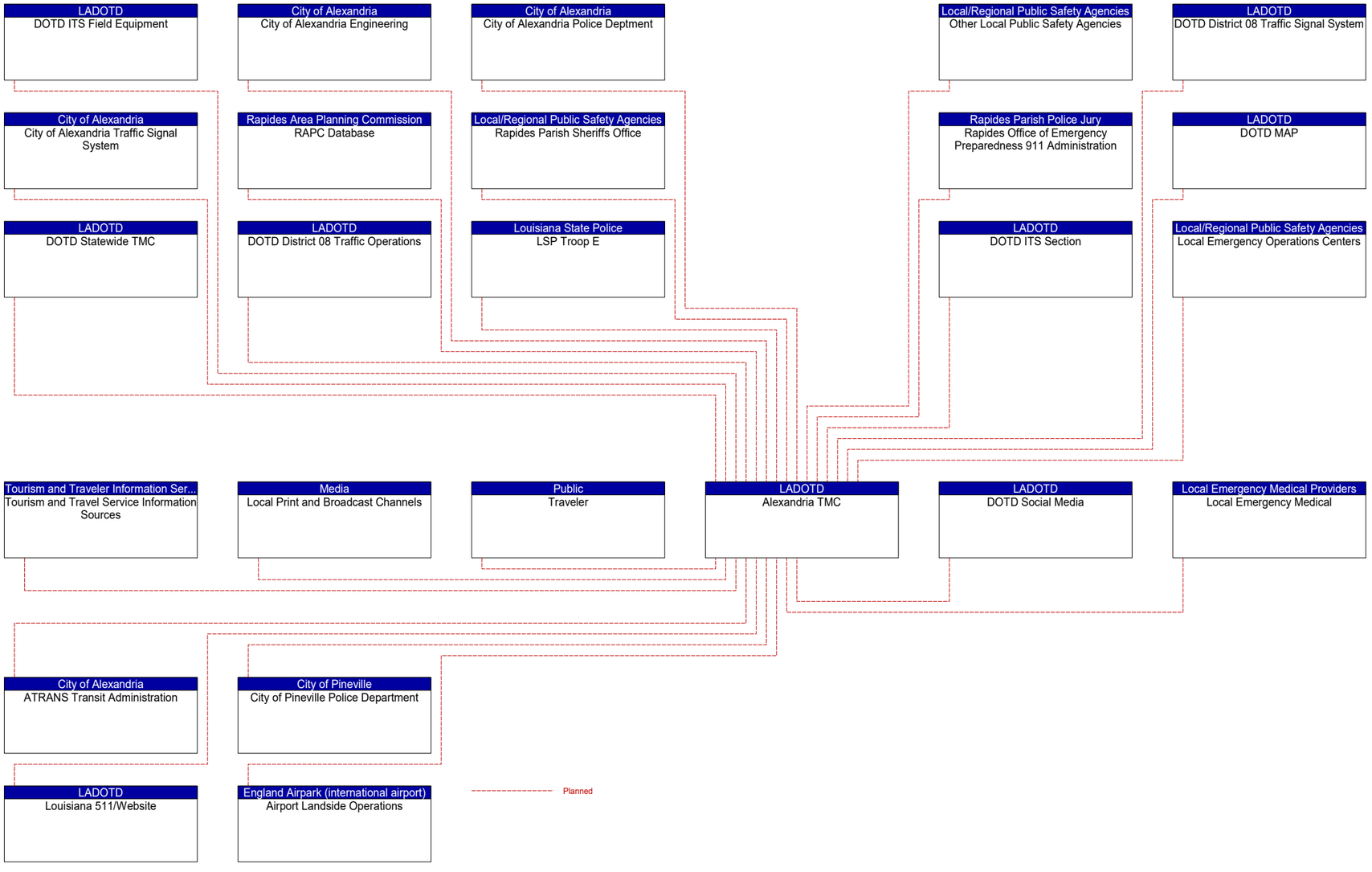

Figure 4: Alexandria TMC Interconnect Context Diagram

(The context diagram is shown here for simplicity. The more detailed flow diagram can be obtained from RAD-IT)

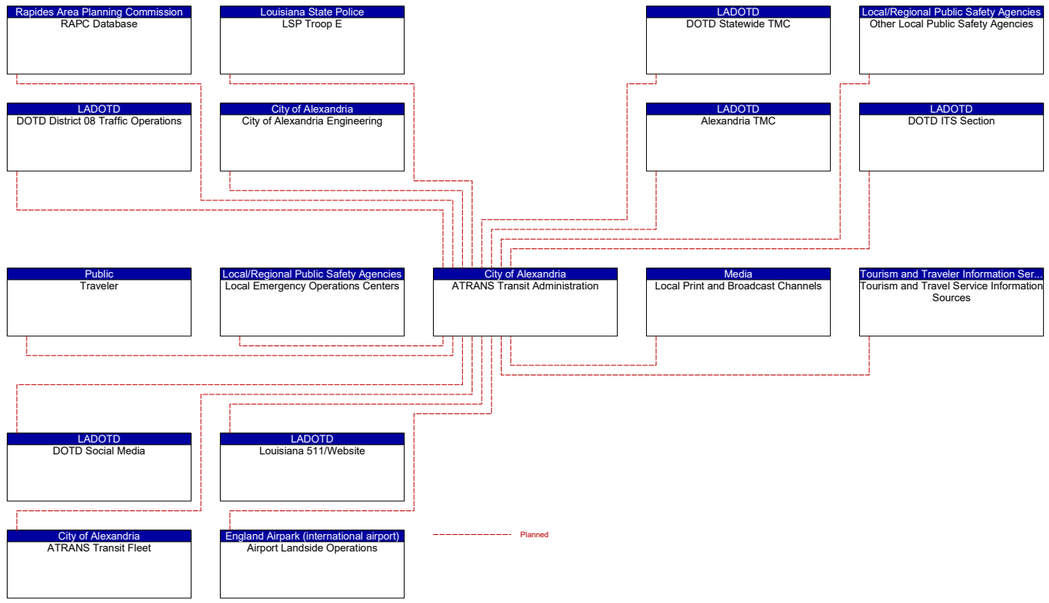

Figure 5: ATRANS Transit Administration Interconnect Context Diagram

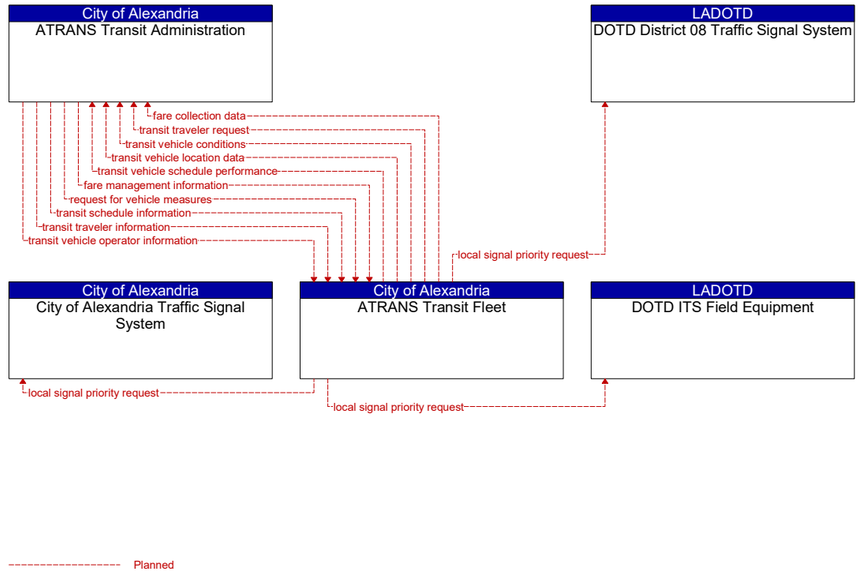

Figure 6: ATRANS Transit Fleet Flow Context Diagram

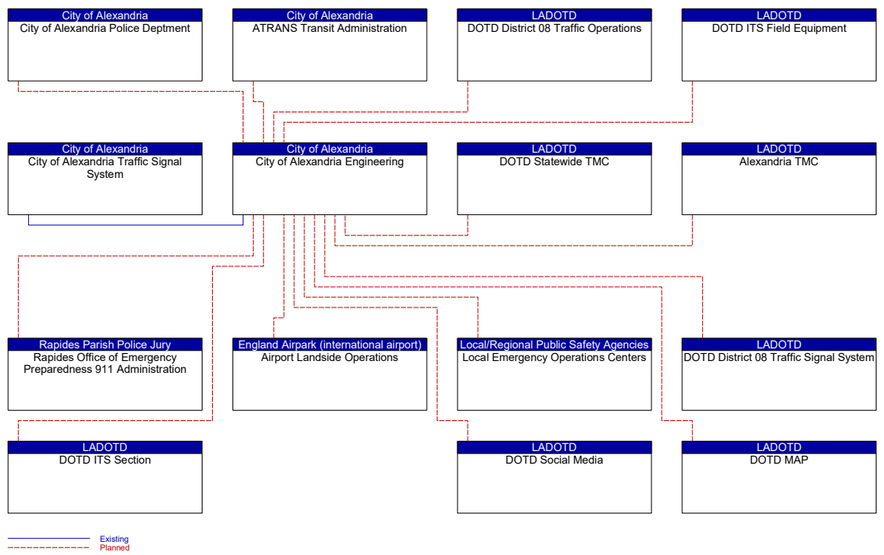

Figure 7: City of Alexandria Engineering Interconnect Context Diagram

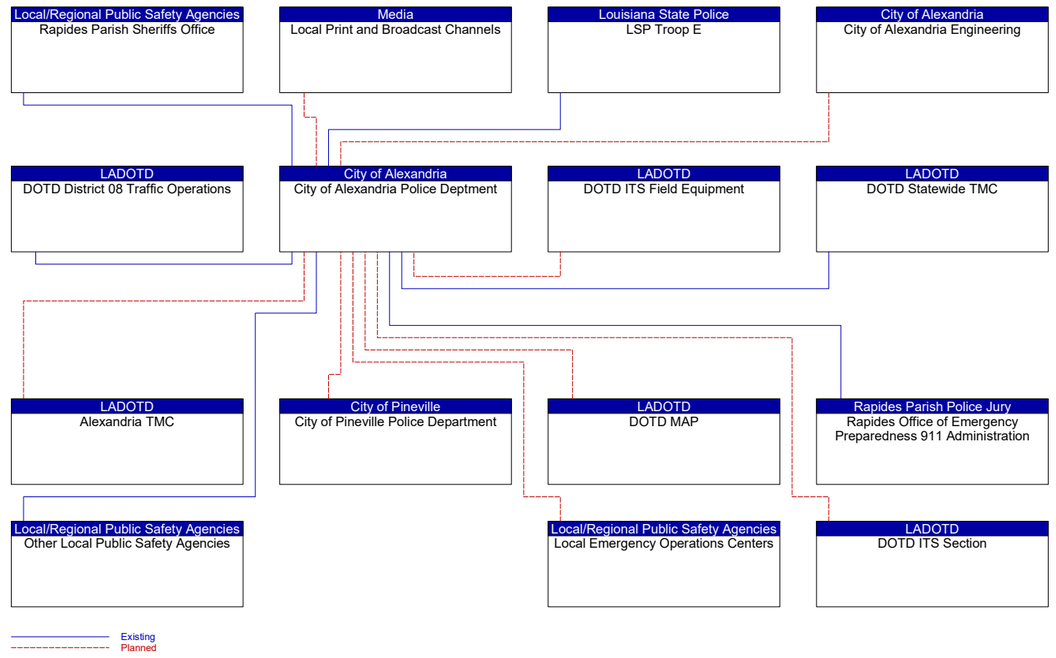

Figure 8: City of Alexandria Police Department Interconnect Context Diagram

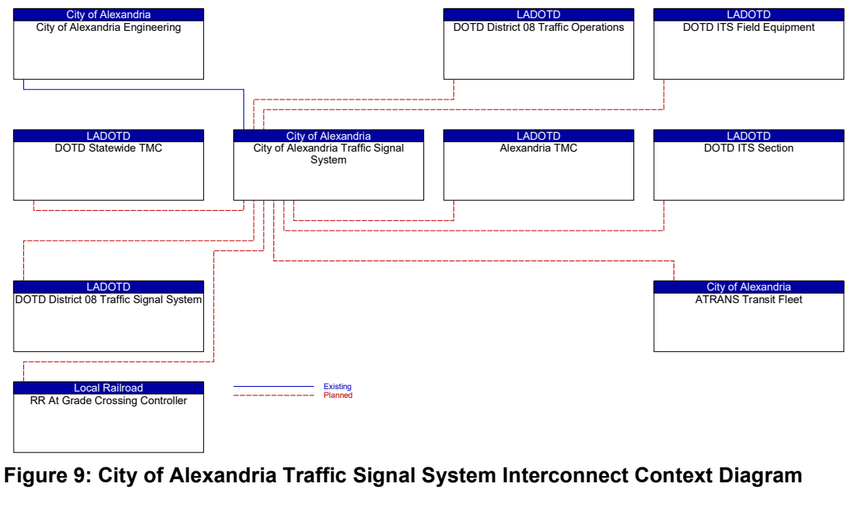

Figure 9: City of Alexandria Traffic Signal System Interconnect Context Diagram

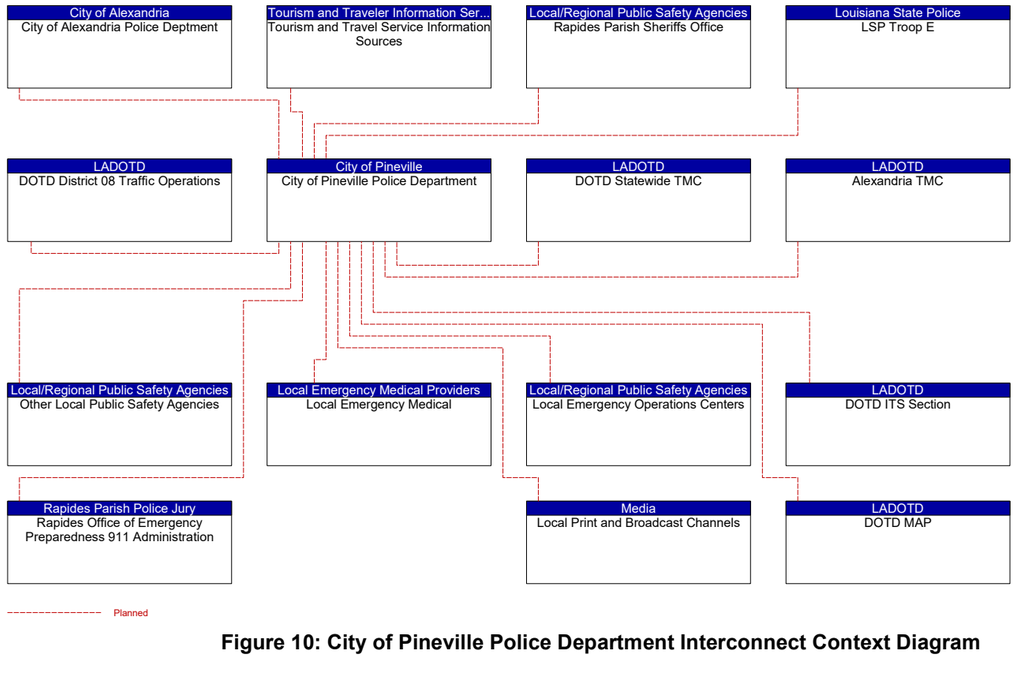

Figure 10: City of Pineville Police Department Interconnect Context Diagram

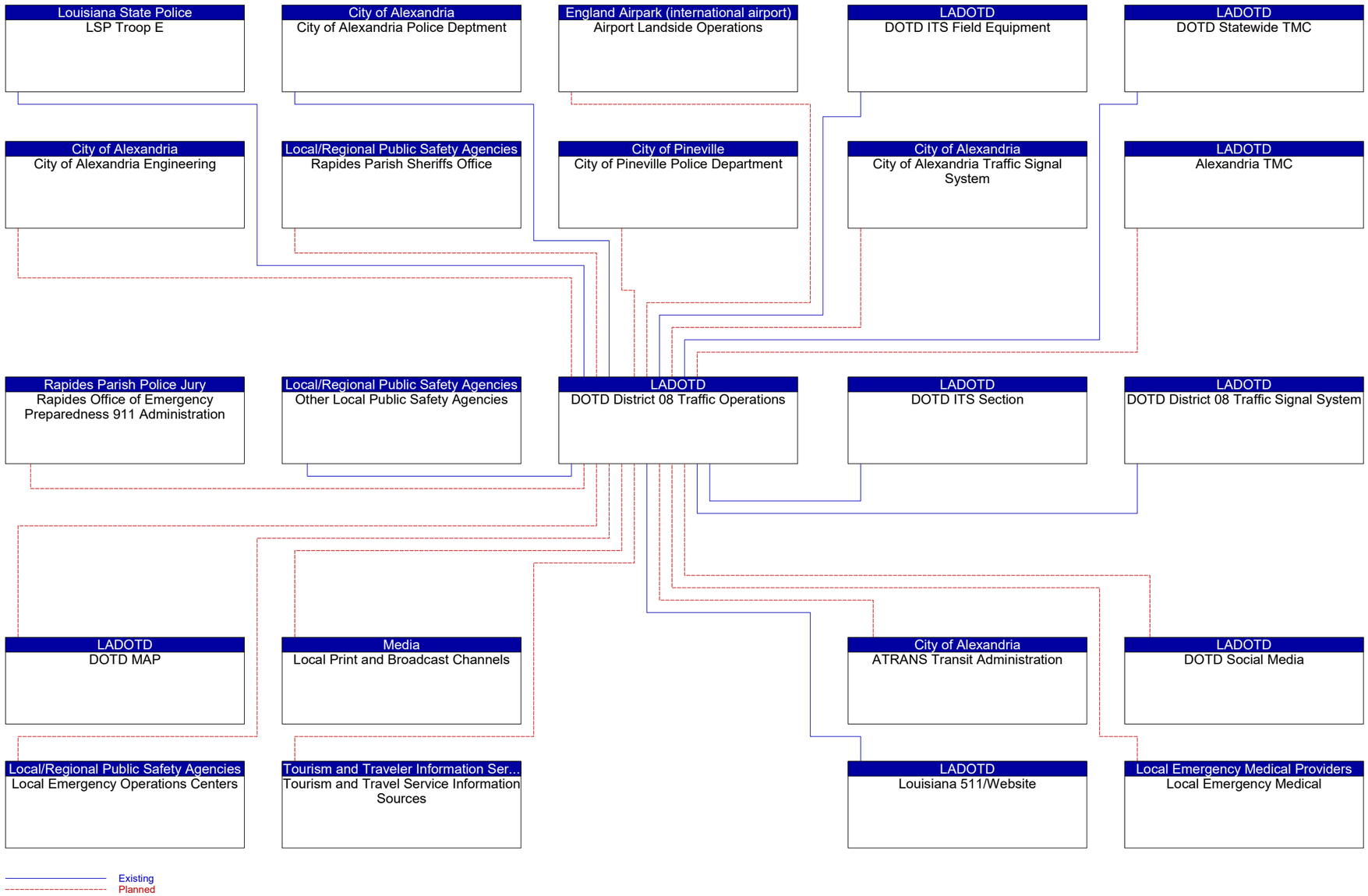

Figure 11: DOTD District 08 Traffic Operations Interconnect Context Diagram

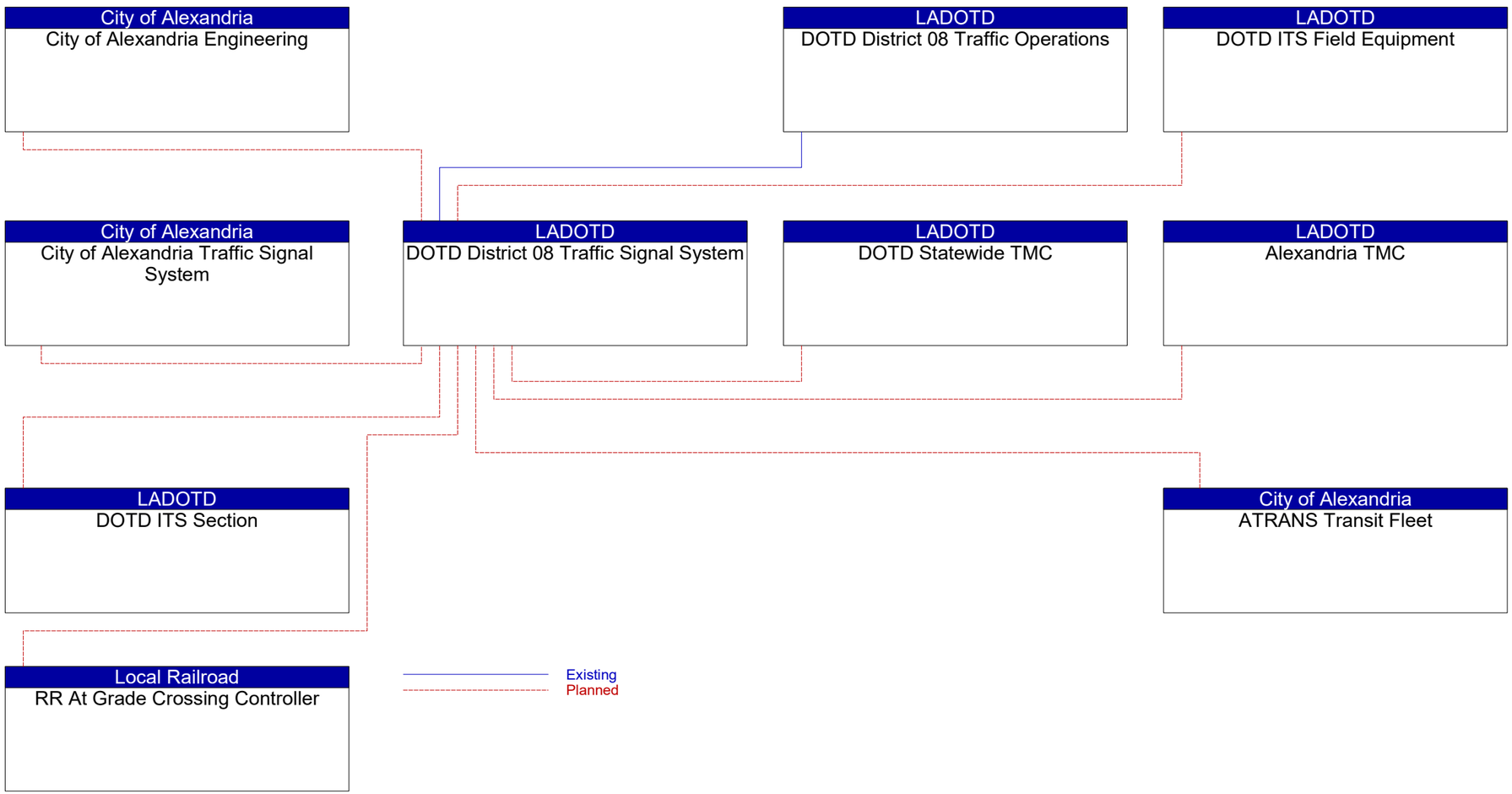

Figure 12: DOTD District 08 Traffic Signal System Interconnect Context Diagram

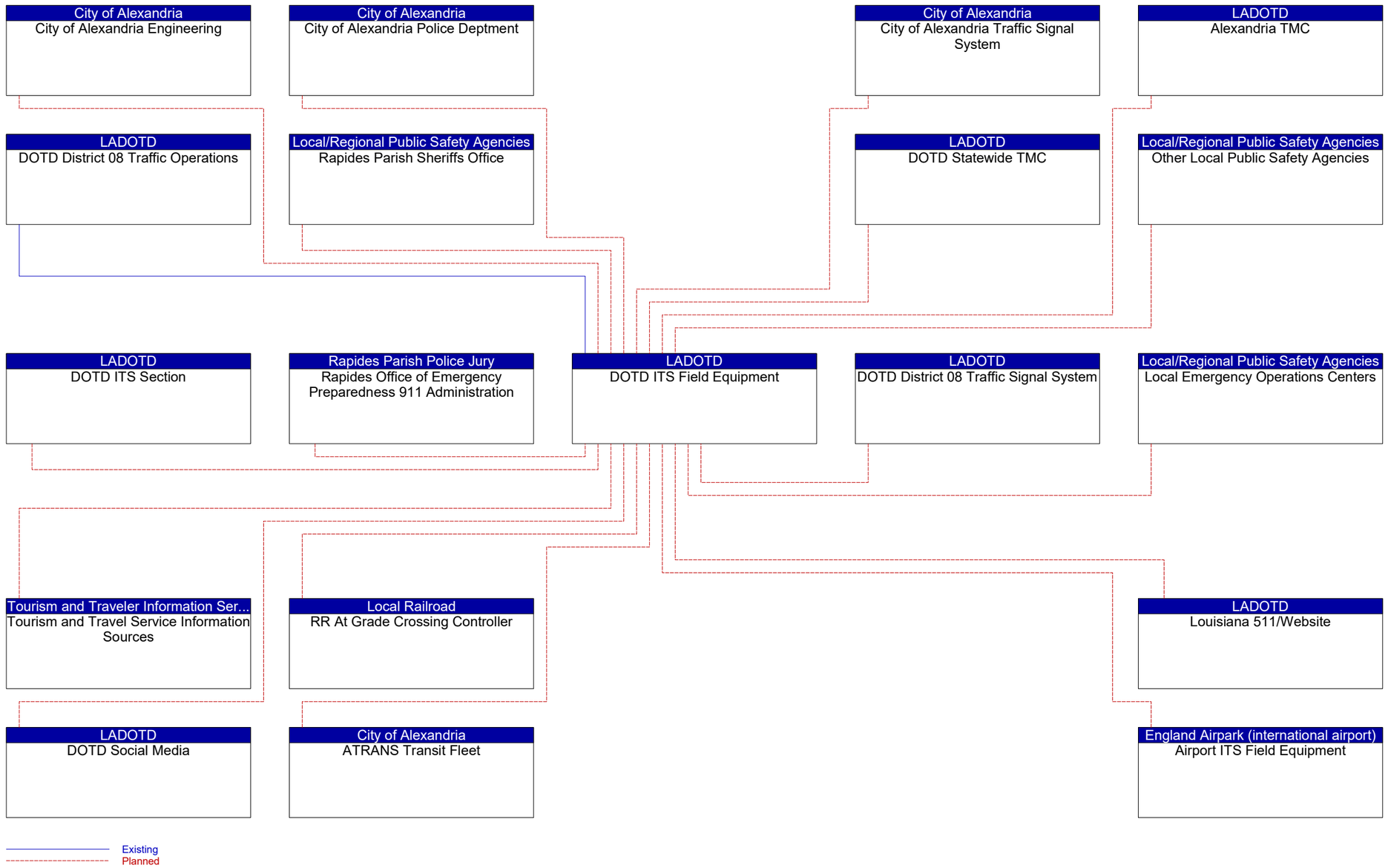

Figure 13: DOTD ITS Field Equipment Interconnect Context Diagram

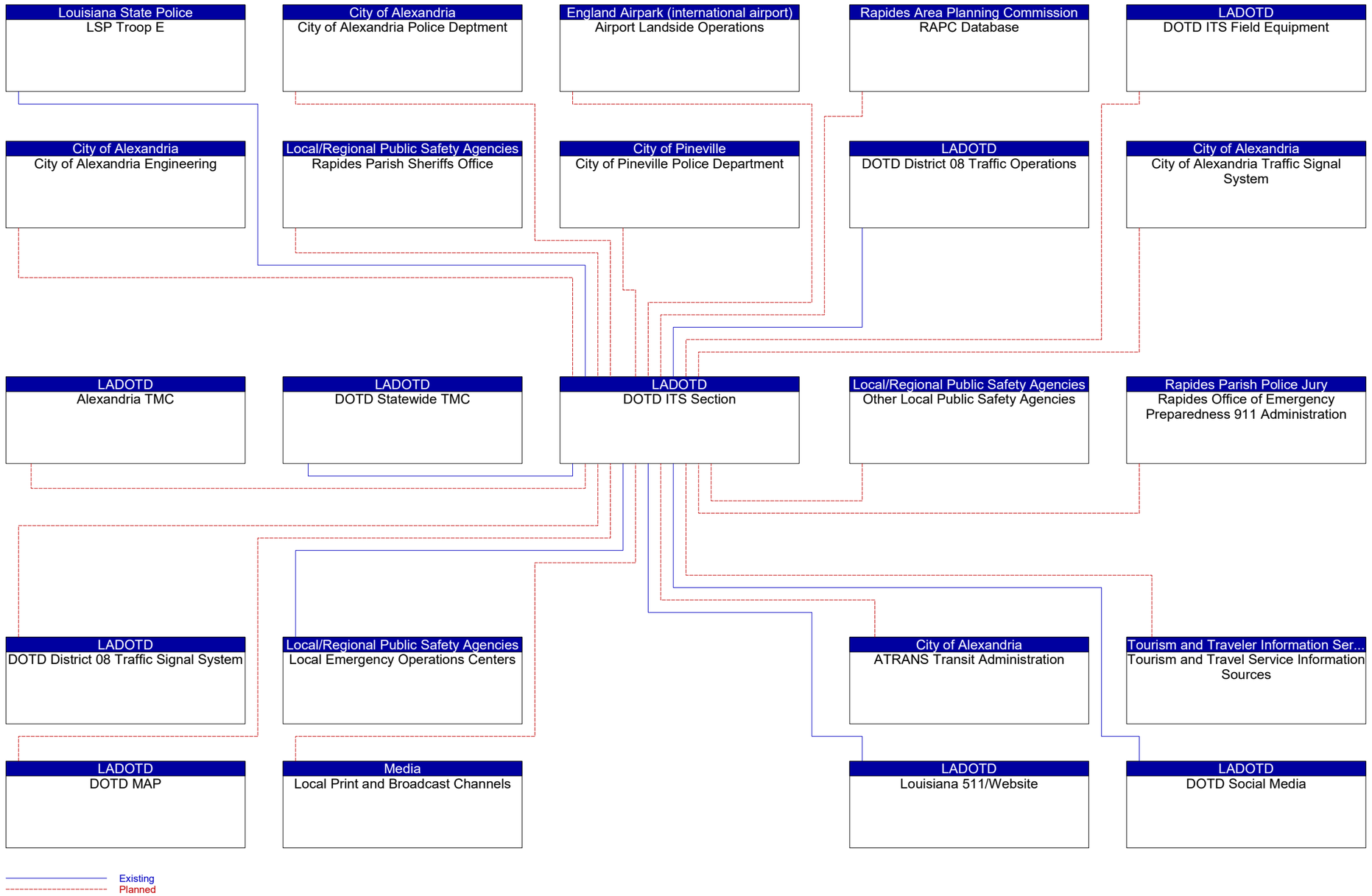

Figure 14: DOTD ITS Section Interconnect Context Diagram

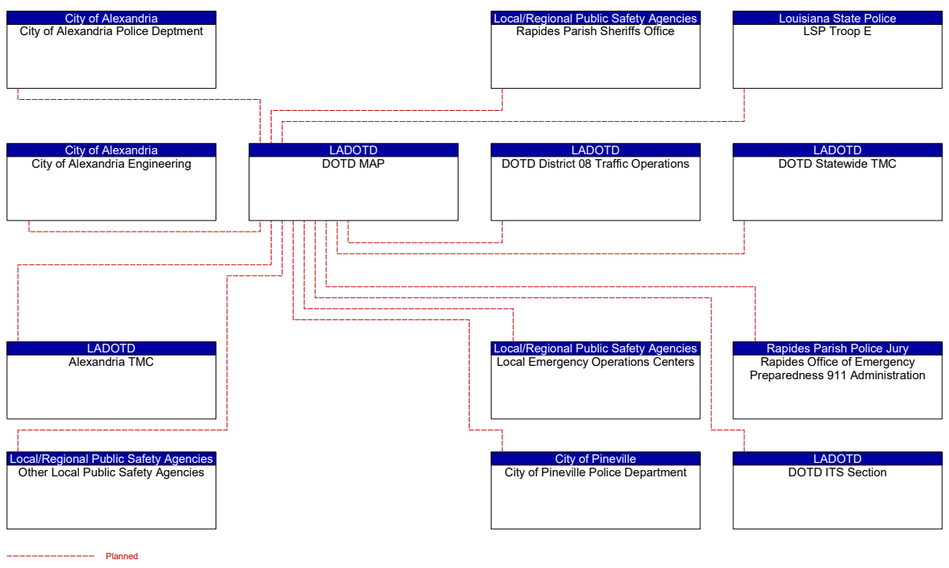

Figure 15: DOTD MAP Interconnect Context Diagram

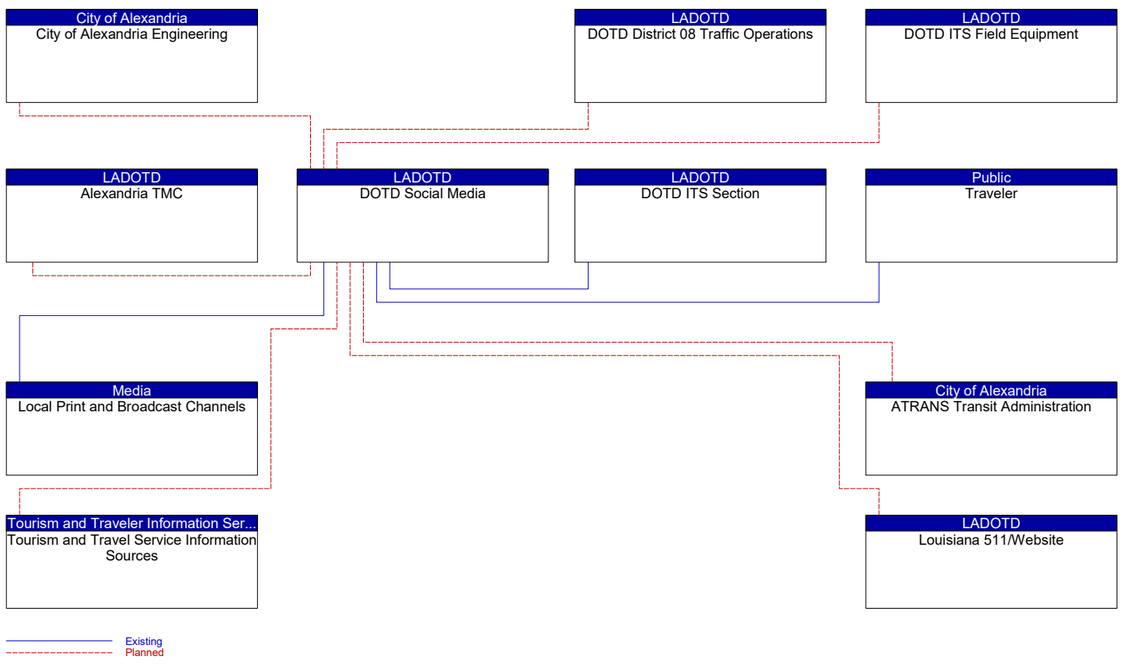

Figure 16: DOTD Social Media Interconnect Context Diagram

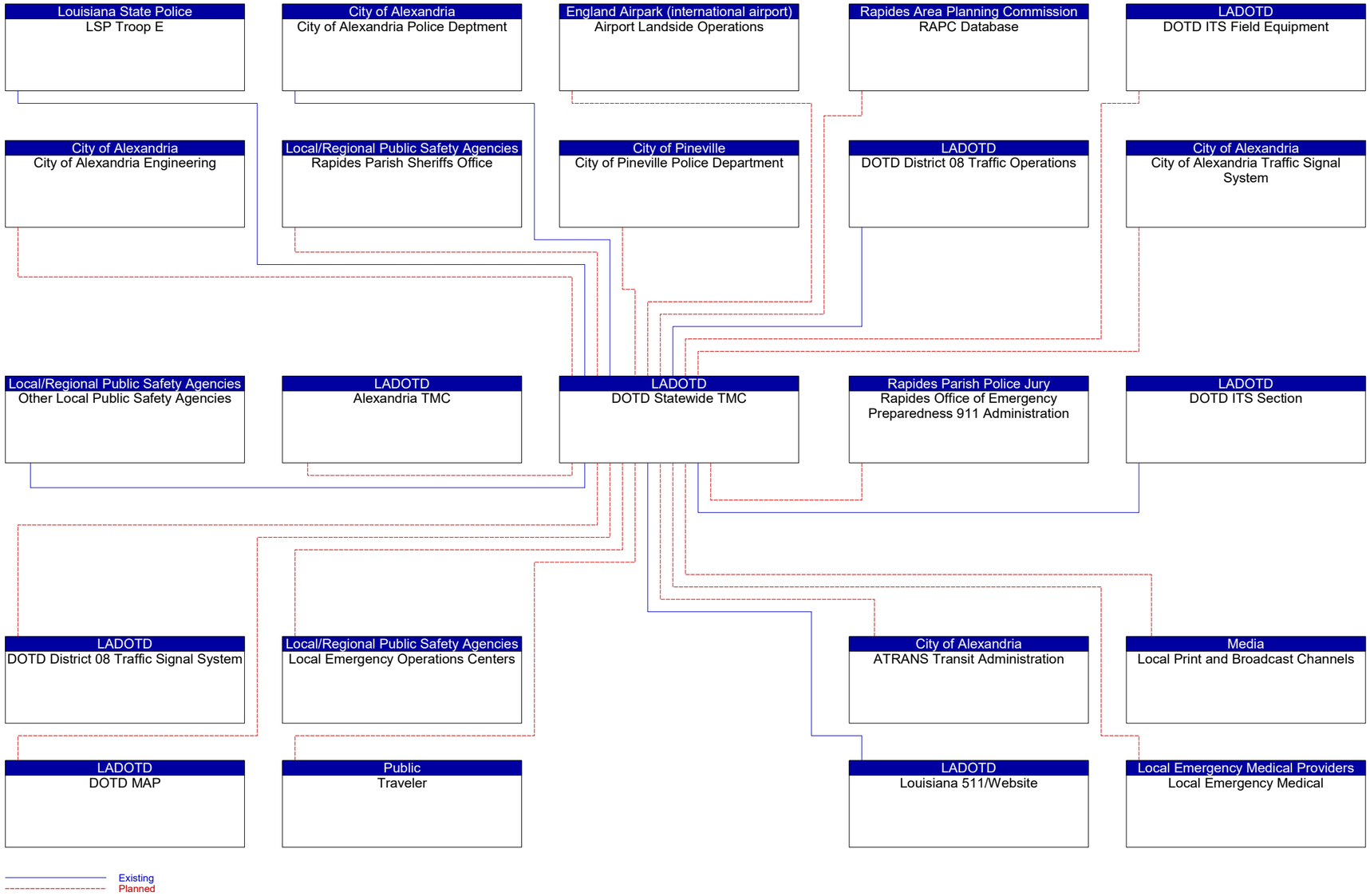

Figure 17: DOTD Statewide TMC Interconnect Context Diagram

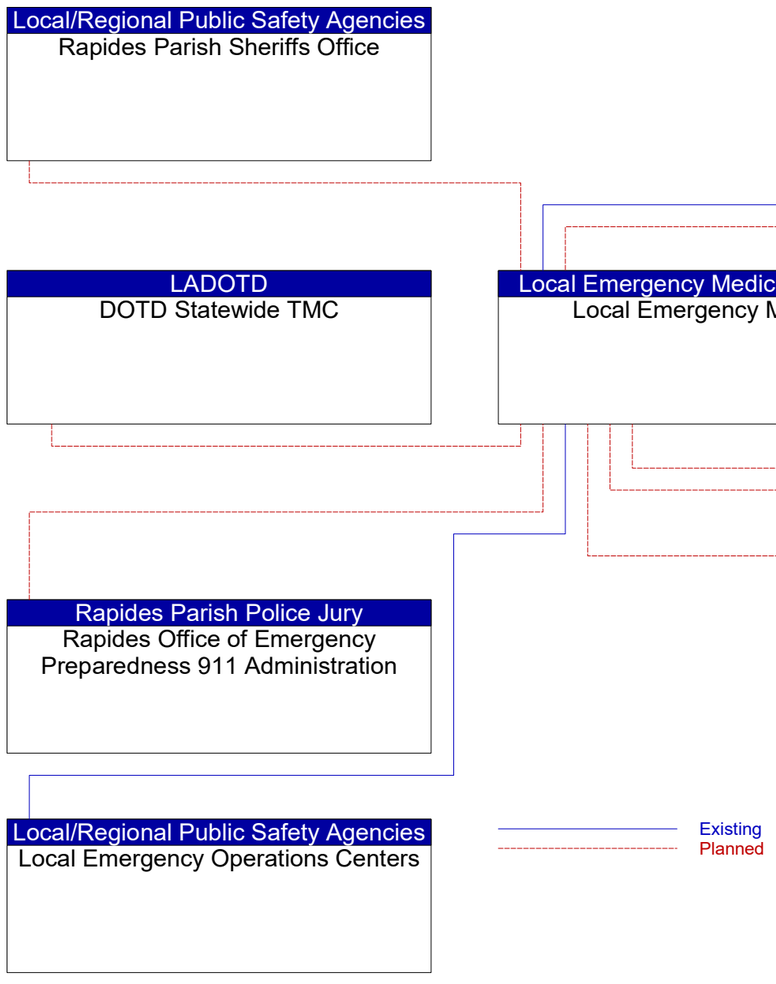

Figure 18: Local Emergency Medical Interconnect Context Diagram

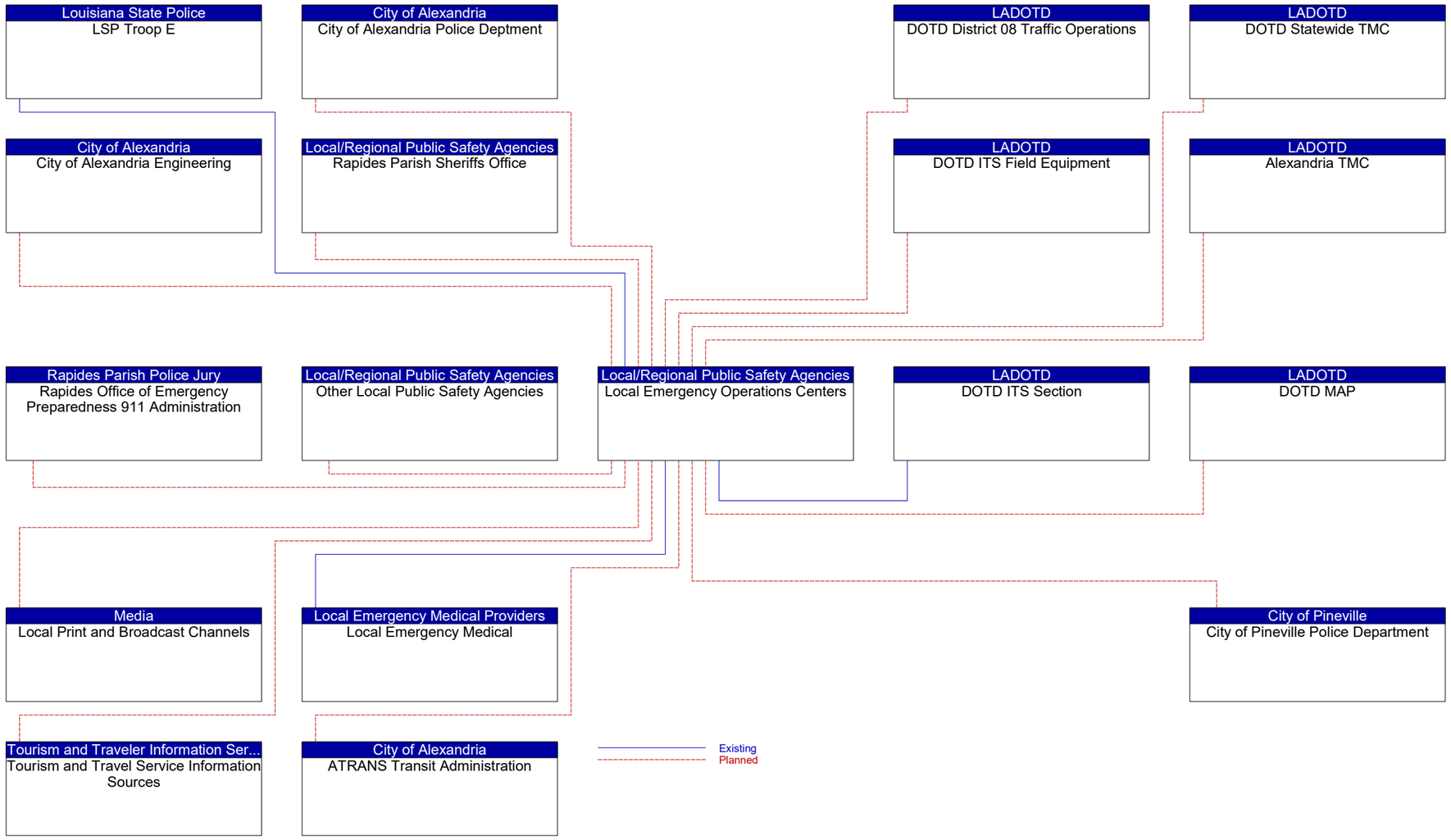

Figure 19: Local Emergency Operations Centers Interconnect Context Diagram

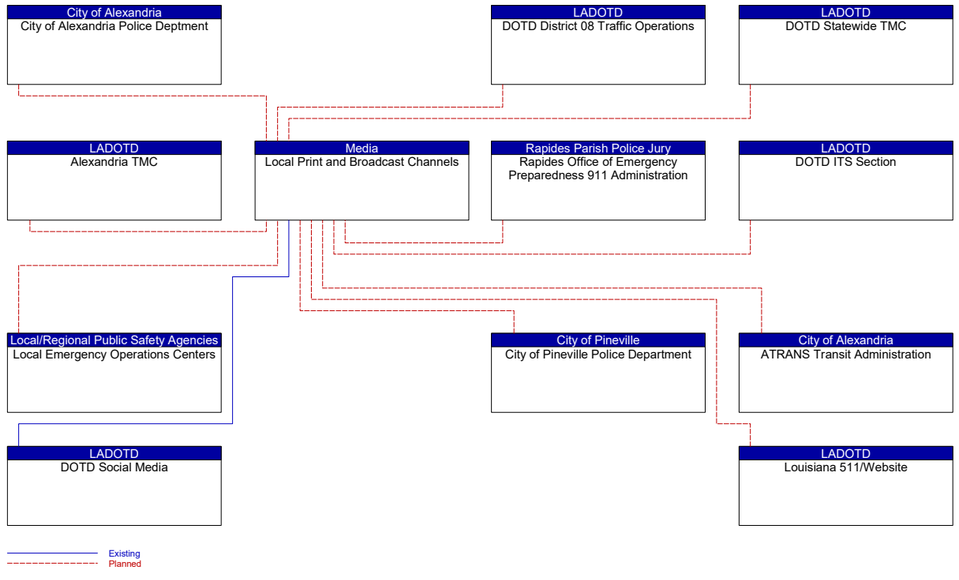

Figure 20: Local Print and Broadcast Channels Interconnect Context Diagram

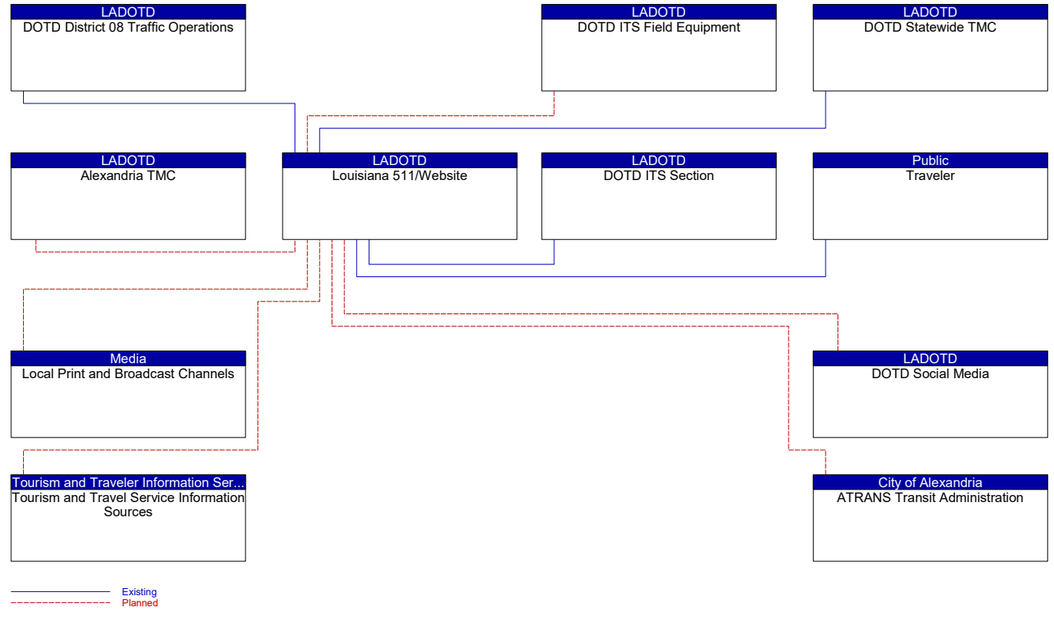

Figure 21: Louisiana 511 Website Interconnect Context Diagram

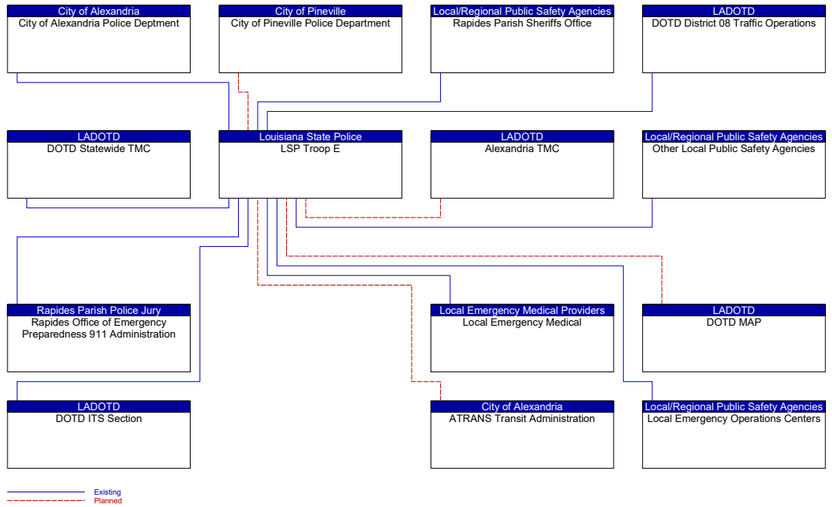

Figure 22: LSP Troop E Interconnect Context Diagram

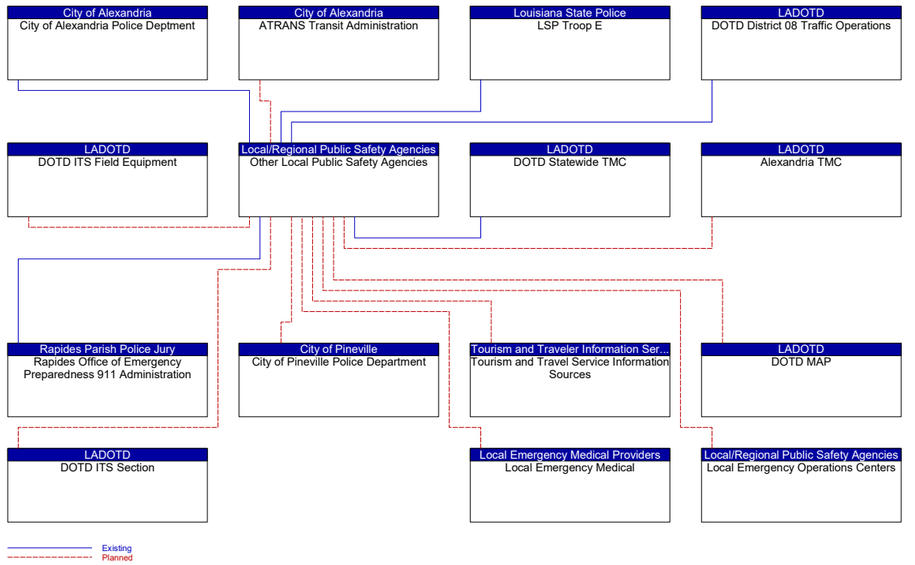

Figure 23: Other Local Public Safety Agencies Interconnect Context Diagram

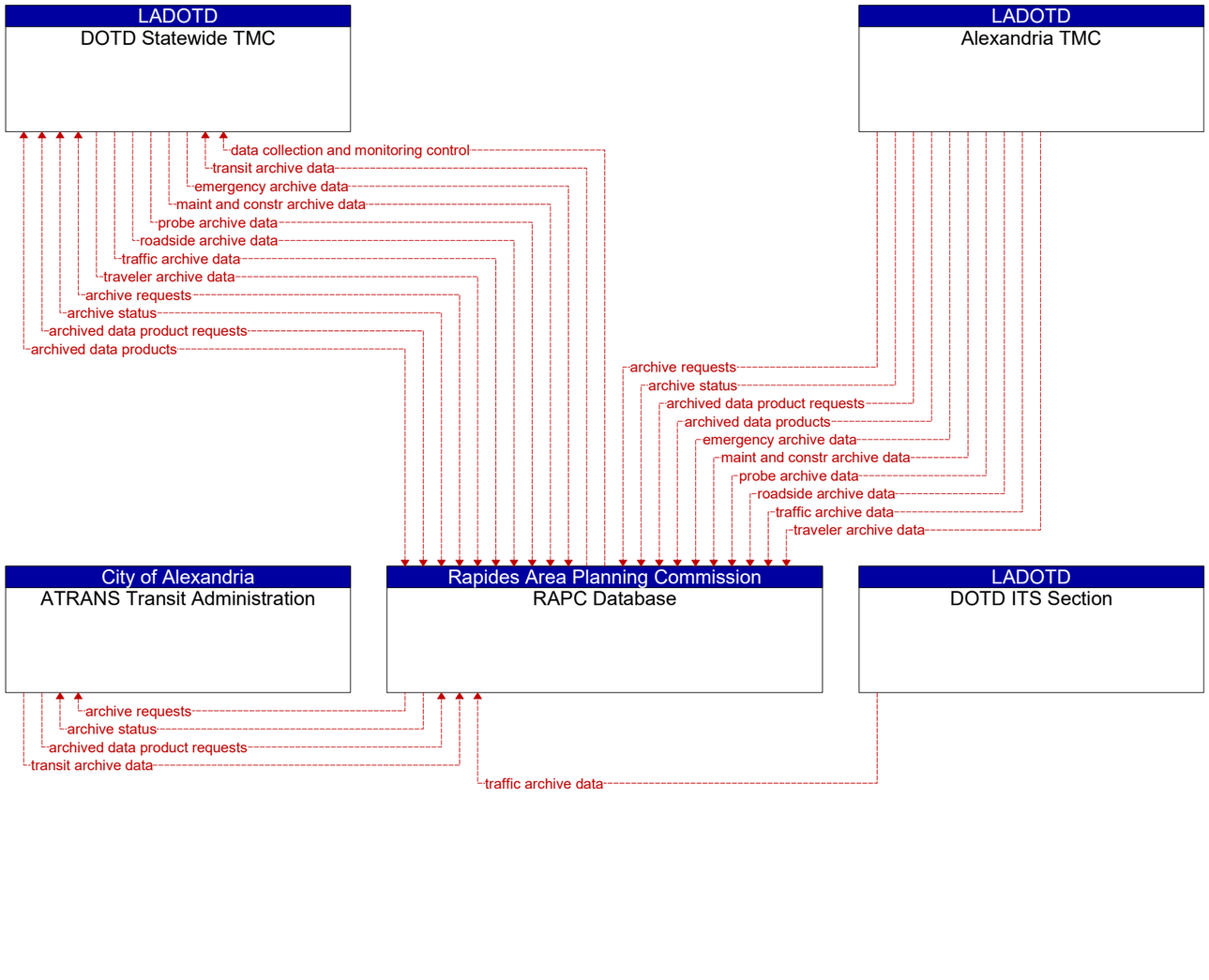

Figure 24: RAPC Database Flow Context Diagram

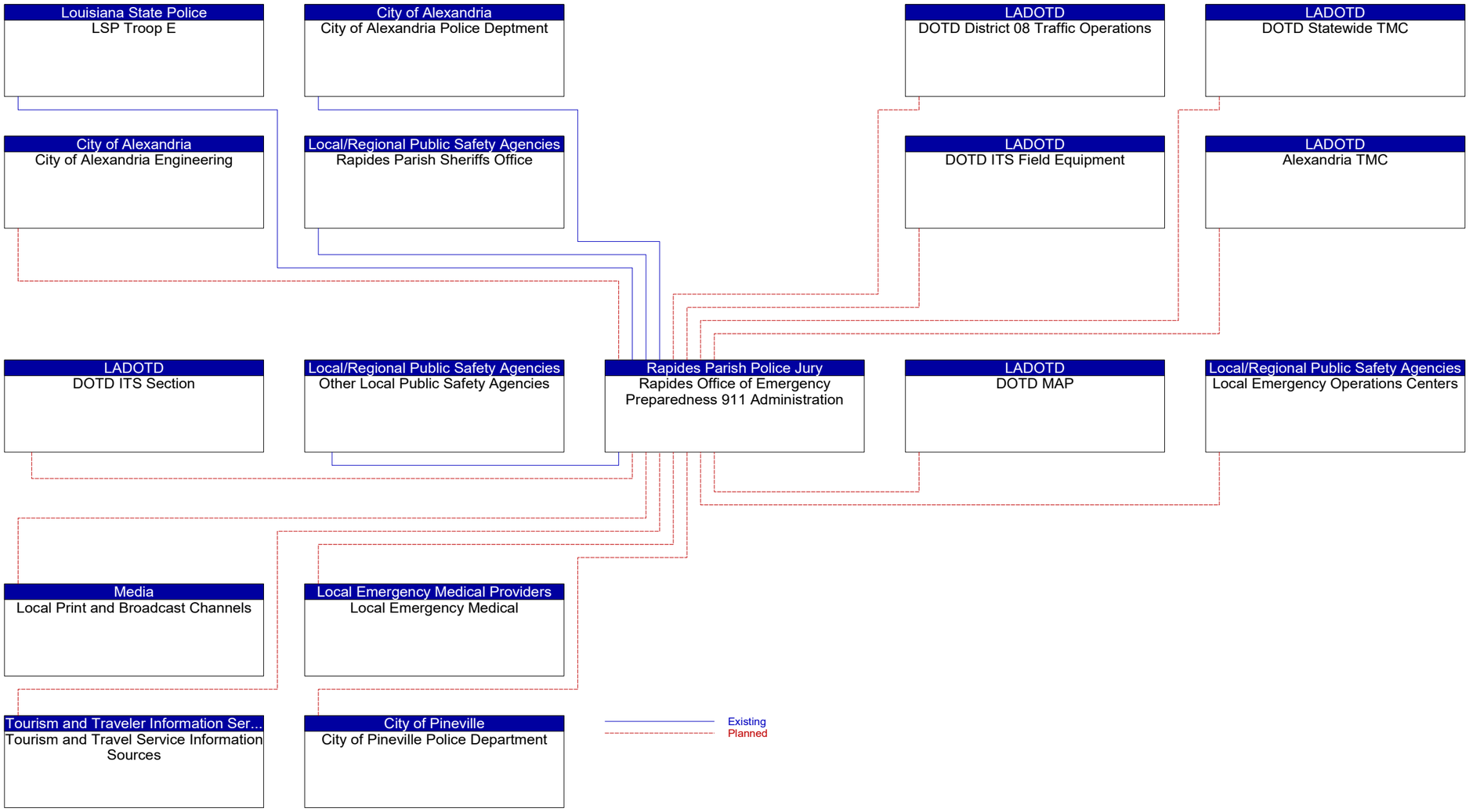

Figure 25: Rapides Office of Emergency Preparedness 911 Administration Interconnect Context Diagram

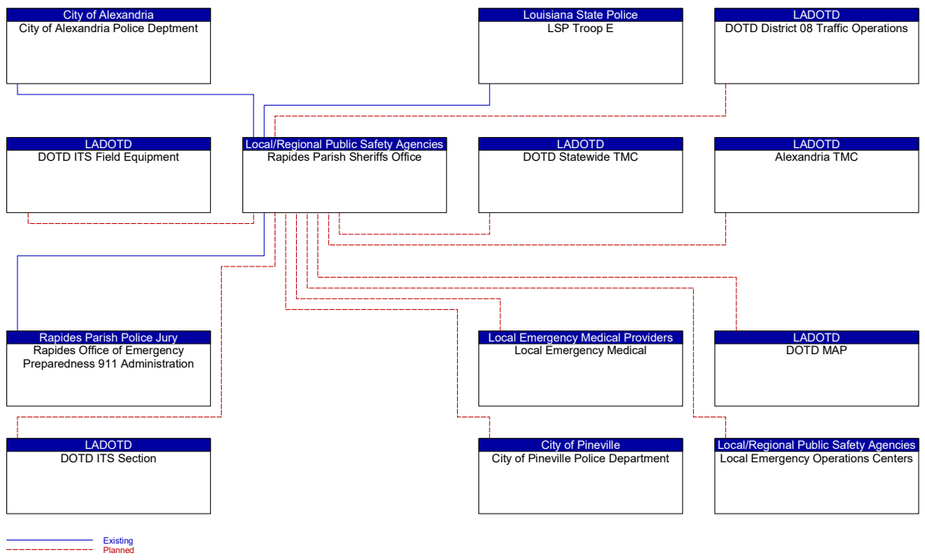

Figure 26: Rapides Parish Sheriff's Office Interconnect Context Diagram

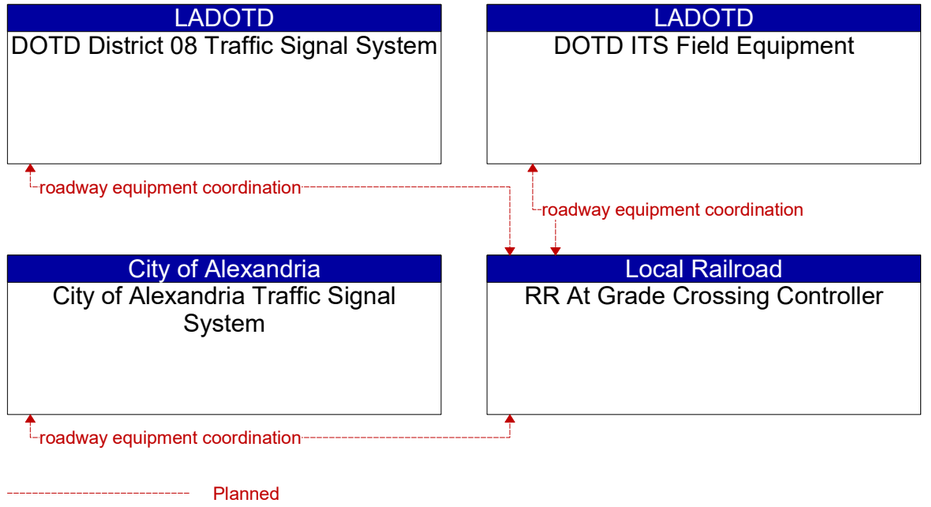

Figure 27: Rail Road At Grade Crossing Controller Flow Context Diagram

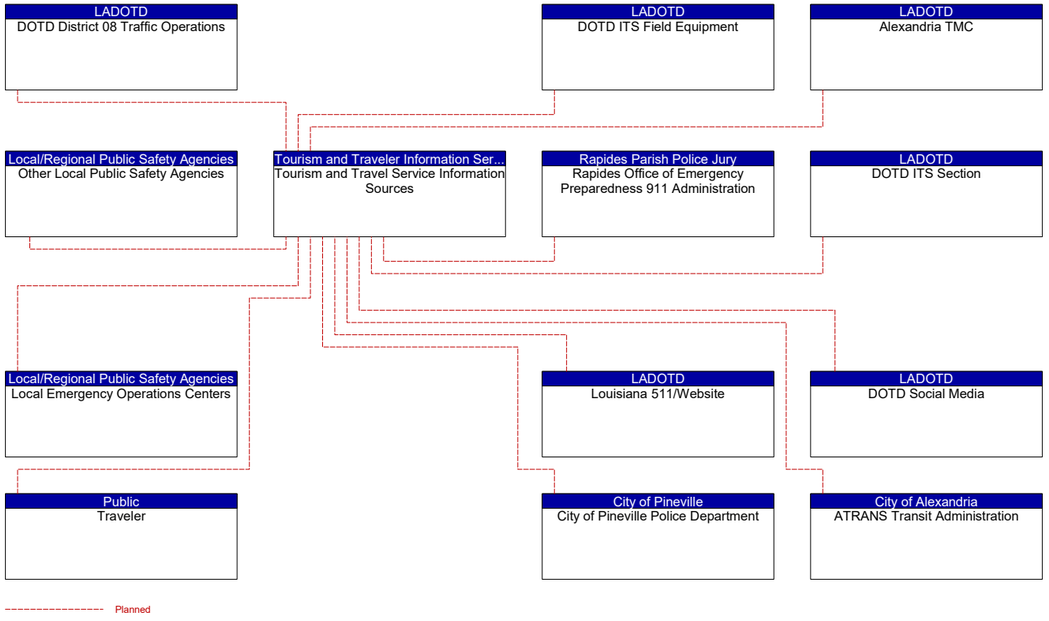

Figure 28: Tourism and Travel Service Information Sources Interconnect Context Diagram

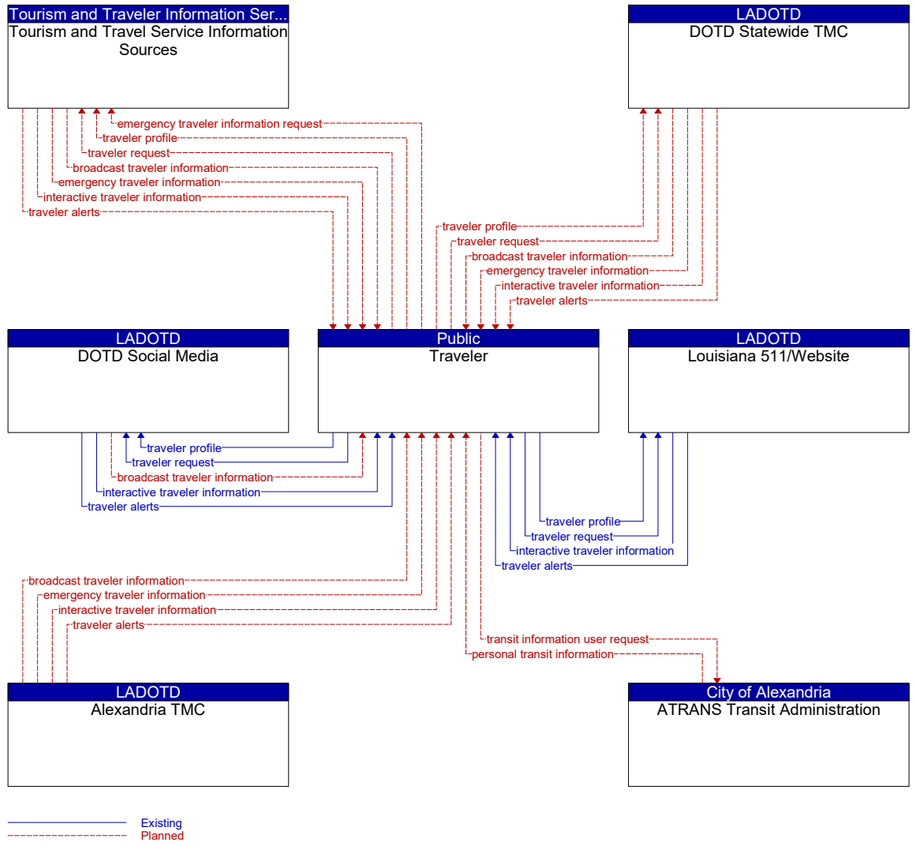

Figure 29: Traveler Flow Context Diagram