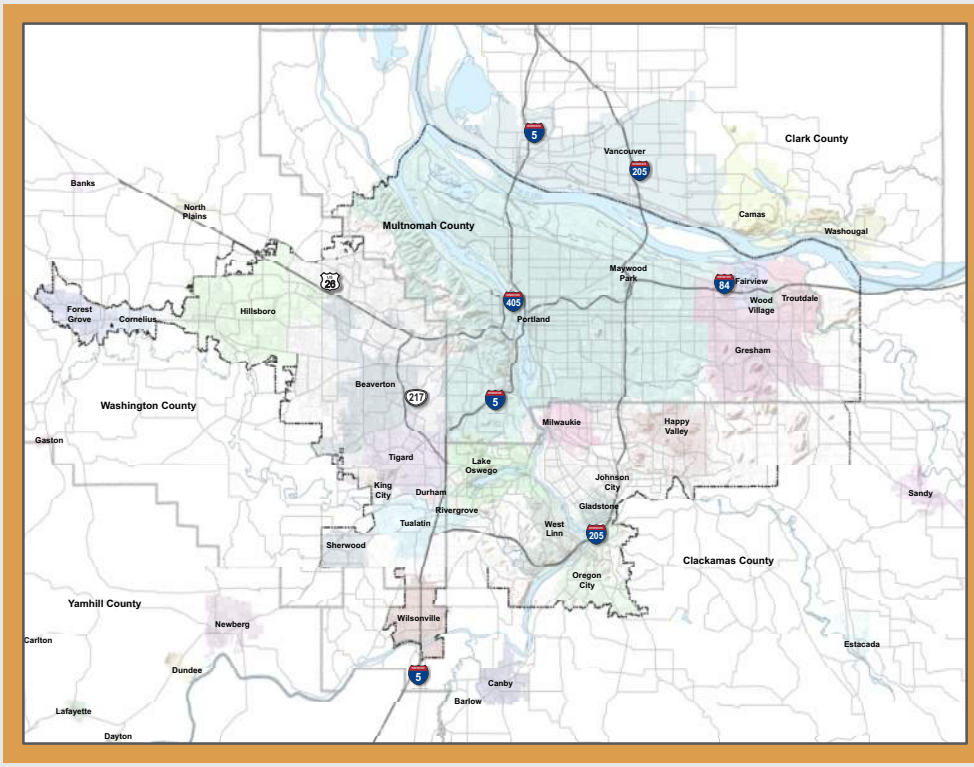
Regional ITS Architecture & Operational Concept Plan for the Portland Metro Region

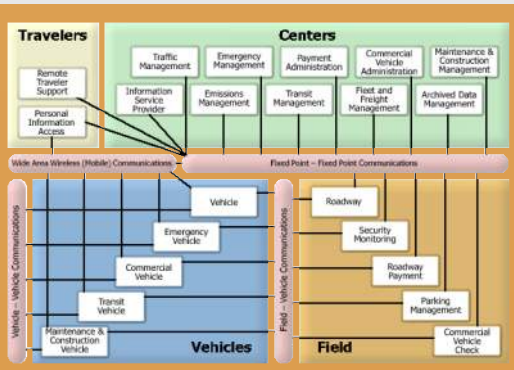
prepared for

TransPort

Oregon Department of Transportation

Metro





prepared by

DKS

IBI

December 2016

ACKNOWLEDGMENTS

Metro Project Manager

Chris Myers	Metro

TransPort Committee

Jabra Khasho	City of Beaverton
Aszita Mansor	City of Beaverton
Tina Nguyen	City of Beaverton
Jim Gelhar	City of Gresham
Dan Hazel	City of Hillsboro
Tegan Enloe	City of Hillsboro
Amanda Owings	City of Lake Oswego
Willie Rotich	City of Portland
Peter Koonce	City of Portland
Mike Ward	City of Wilsonville
Bikram Raghubansh	Clackamas County
Nathaniel Price	Federal Highway Administration
Caleb Winter	Metro
Andrew Dick	Oregon Department of Transportation
Kate Freitag	Oregon Department of Transportation
Galen McGill	Oregon Department of Transportation
Dennis Mitchell	Oregon Department of Transportation
Kristin Tufte	Portland State University
Mike Coleman	Port of Portland
Phil Healy	Port of Portland
Steve Callas	TriMet
A.J. O'Connor	TriMet
Ken Turner	TriMet
Stacy Shetler	Washington County

Other Stakeholders/Contributors

Ron White	TriMet
Bob Hart	Regional Transportation Committee (RTC)

Consultant Team

DKS Associates

Jennifer Bachman	Jim Peters
Renee Hurtado	Danella Whitt
Adrian Pearmine	Alexis Biddle

IBI Group

Mike Haas	Keith Ponto
Bruno Peters	June Park

TABLE OF CONTENTS

1 Contents

APPENDICES

Appendix A. Glossary of Acronyms
Appendix B. Summary of Changes to National ITS Architecture
Appendix C. Stakeholder list
Appendix D. Change Log - Stakeholders
Appendix E. System Inventory
Appendix F. Change Log - System Inventory
Appendix G. Service Packages
Appendix H. Change Log - Service Packages
Appendix I. Sample of ODOT ITS Architecture Compliance Checklist and the ITS Architecture Change Request Forms

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

The objective of this report is to update the TransPort Regional Intelligent Transportation System (ITS) Architecture and Operational Concept Plan for the Portland, Oregon metropolitan area, which was originally created in 2001 and last updated in 2005. This update is intended to cover a five to ten-year timeframe. However, with quickly evolving technology and the emergence of connected vehicles, updating the plan sooner should be considered.

1.1 What Was Updated?

While the project updated the entire TransPort ITS Architecture and Operational Concept Plan, one of the big advancements since the 2005 update is the emergence of connected vehicle technologies. Although connected and automated vehicle (CAV) technologies have been part of the national ITS conversation for many years, these technologies are now maturing at a rapid pace. Connected vehicles are those able to send data to and/or receive data from their environments while in operation. Automated vehicles are vehicles in which at least some portion of the vehicle's control operates without driver input.

In this update, the Operational Concept Plan identifies potential connected vehicle applications for each of the six service areas. In 2014, FHWA published the Connected Vehicle Reference Implementation Architecture (CVRIA) and has since made updates through Version 2.2[1]. The CVRIA provides physical, functional, communications, and enterprise viewpoints based on numerous CAV developments and research projects. It provides the basis for a common language definition and early deployment concepts that will ultimately be integrated into the National ITS Architecture. Although CVRIA is separate from the National ITS Architecture, Version 7.1 of the National ITS Architecture included linkages to CVRIA. Since the CVRIA is not yet linked to Turbo (the ITS Architecture software), the connected vehicle applications are discussed in the Operational Concept Plan, but not integrated into the TransPort Turbo Architecture.

Updating the TransPort ITS Architecture and Operational Concept Plan was a collaborative effort between the project team and the TransPort Committee which meets monthly.

1.2 Who is TransPort?

The Transportation Portland (TransPort) Committee is a consortium of transportation agencies with the following mission: "To provide safe, efficient multi-modal travel in the Portland-Vancouver metropolitan area by using technology and public/private cooperation to integrate the operation of regional transportation facilities."[2] TransPort partners include DOT's (Oregon Department of Transportation, Washington State Department of Transportation, and Federal Highway Administration),

[1] *Connected Vehicle Reference Implementation Architecture Version 2.2*. Office of the Assistant Secretary for Research and Technology, U.S. Department of Transportation. Last updated July 7, 2016. https://www.iteris.com/cvria/index.html.

[2] *TransPort: A New Way of Thinking* (brochure). Prepared by the Oregon Department of Transportation for TransPort.

Metro, TriMet, Portland State University, counties (Clackamas, Multnomah, and Washington), Cities (Portland, Beaverton, Gresham, Hillsboro, Lake Oswego, Wilsonville, and numerous other cities in the metropolitan area). The TransPort Committee was initially formed in 1993 and representatives from member agencies currently meet monthly to reach consensus on ITS deployment throughout the region.

The TransPort Committee is also an official subcommittee of Metro's Transportation Policy Alternatives Committee (TPAC). Metro, which is the metropolitan planning organization for the Portland area, serves the 1.3 million residents in 25 cities and the urban portions of Clackamas, Multnomah, and Washington counties. TPAC provides technical input to Metro's Joint Policy Advisory Committee on Transportation (JPACT) on transportation planning and funding priorities. Through the Metro committee structure, the TransPort Committee provides the regional guidance on ITS planning and funding.

1.3 What is ITS?

Intelligent transportation systems (ITS) involve the application of advanced technologies and proven management techniques to relieve congestion, enhance safety, provide services to travelers, and assist transportation system operators in implementing suitable traffic management strategies. ITS focuses on increasing the efficiency of existing transportation infrastructure, which enhances the overall system performance and reduces the need to add capacity (e.g., travel lanes). Efficiency is achieved by providing services and information to travelers so they can (and will) make better travel decisions and to transportation system operators so they can better manage the system. ITS technologies are currently used by many agencies in the Portland metropolitan area today and plans are in place to expand the use of ITS applications in the future. The TransPort Regional ITS Architecture and the Operational Concept Plan play a key role in guiding institutional agreements and technical integration for ITS project deployment throughout the region.

1.4 Why Develop an ITS Architecture?

An ITS architecture provides a framework of policies, procedures, and strategies for integration of the region's existing resources to effectively meet future Portland area transportation needs and expectations. The following reasons provide the basis for developing the TransPort ITS Architecture:

- The Portland region cannot build itself out of congestion.
- The architecture helps maximize the efficiencies and improve the safety of the existing infrastructure.
- The architecture fosters multi-agency coordination for system operations.
- The architecture can be used during project development to assist with the project concept of operations, high-level and detailed requirements, design components, and specifications.
- The Federal Highway Administration requires that all ITS projects funded through the Highway Trust Fund shall be in conformance with the National ITS Architecture and applicable standards.

1.5 Report Elements

This report documents the following elements:

- Overview of the National ITS Architecture
- TransPort ITS Architecture
    - Description of process, boundary, timeframe and scope
    - ITS stakeholders within the region
    - Inventory of existing and planned systems
    - User services needed in the region
    - Service packages that address user services
- Maintenance Plan
- Operational Concept Plans (six service areas)
    - Regional Traffic Control
    - Traveler information
    - Incident Management
    - Maintenance and Construction Management
    - Public Transportation Management
    - Archived Data Management

Appendix A includes a list of acronyms included in this report.

2 NATIONAL ITS ARCHITECTURE OVERVIEW

The U.S. Department of Transportation developed the National ITS Architecture to ensure that intelligent transportation systems deployed around the country can communicate with one another and share information to maximize the return of investment on ITS. "The National ITS Architecture is a general framework for planning, defining, and integrating ITS. It was developed to support ITS implementations over a 20-year time period in urban, interurban, and rural environments across the country."[3] The National ITS Architecture, currently Version 7.1, is fully documented online[4]. The version number is updated when a number of changes or additions are made to the architecture.

For example, if a transportation agency wants to clear incidents faster, the architecture defines a function to monitor roadways and identifies the interconnection and information flows between the roadway, the traffic operations center, and the emergency management center needed to provide responders with incident information. The architecture provides the framework for the process, but does not define how this is done with technology or management techniques.

The Federal Highway Administration (FHWA) published a Final Rule policy[5] that all agencies seeking federal highway trust funding for ITS projects must develop a regional architecture that is compliant with the National ITS Architecture. The Federal Transit Administration (FTA) published a similar policy[6] that applies to federal funding from the mass transit account of the highway trust fund.

In summary, the primary reasons for developing a regional ITS architecture that conforms with the National ITS Architecture include the following:

- Develop a framework for institutional agreements and technical integration for organized ITS project deployment that meets local transportation user needs.
- Build consensus among regional stakeholders about resource and information sharing and activity coordination.
- Meet federal funding requirements.

The National ITS Architecture is comprised of two components: the logical architecture and the physical architecture. The following subsections provide a brief overview of these concepts.

---

[3] *Regional ITS Architecture Guidance: Developing, Using, and Maintaining an ITS Architecture for Your Region (Version 2.0),* Report FHWA-OP-02-024. U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration, National ITS Architecture Team, Oct. 12, 2001. Updated in 2006.

[4] *National ITS Architecture Version 7.1*. Developed by Iteris Inc. for the U.S. Department of Transportation, April 2015. http://itsarch.iteris.com/itsarch/.

[5] *Intelligent Transportation System Architecture and Standards: Final Rule*. FHWA Docket No. FHWA-99-5899. U.S. Department of Transportation, Federal Highway Administration, Jan. 8, 2001.

[6] *Federal Transit Administration National ITS Architecture Policy on Transit Projects: Notice*. FTA Docket No. FTA-99-6147. Federal Transit Administration, Jan. 8, 2001.

2.1 Logical Architecture

The logical architecture defines the requirements needed to provide the selected user services. User services describe what functions ITS should perform from the user's perspective. The logical architecture is comprised of the following components:

- Processes: Activities and functions that must work together and share information to provide a user service.
- Terminators: Represent the people, systems, environment, and other subsystems that interact with intelligent transportation systems. These are described in more detail in the Physical Architecture subsection.
- Data Flows: Information exchange between processes or between processes and terminators. For example, light rail train arrival data is exchanged between wayside detectors in the tracks and traffic signal systems.
- Data Stores: Repositories of information maintained by the processes.

The logical architecture is typically described by data flow diagrams (DFD's) and process specifications (PSpecs) for specific project-related systems. Data flow diagrams graphically represent the processes, terminators, data flows, and data stores in a hierarchical format. The process specifications are used to write the specifications for specific project-related systems and consist of an overview, a set of functional requirements, and a complete listing of inputs and outputs. Public sector agencies tailor the logical architecture by identifying the processes, terminators, data flows and data stores that are existing or planned for a region.

2.2 Physical Architecture

The physical architecture creates a high-level structure around the processes and data flows included in the logical architecture. It consists of subsystems, equipment packages, terminators, architecture flows, and architecture interconnects, which are all described in this subsection. Figure 1 illustrates the high-level physical architecture of the National ITS Architecture and includes the subsystems and architecture interconnects between subsystems. Figure 2 depicts the interaction between the logical and physical architectures.

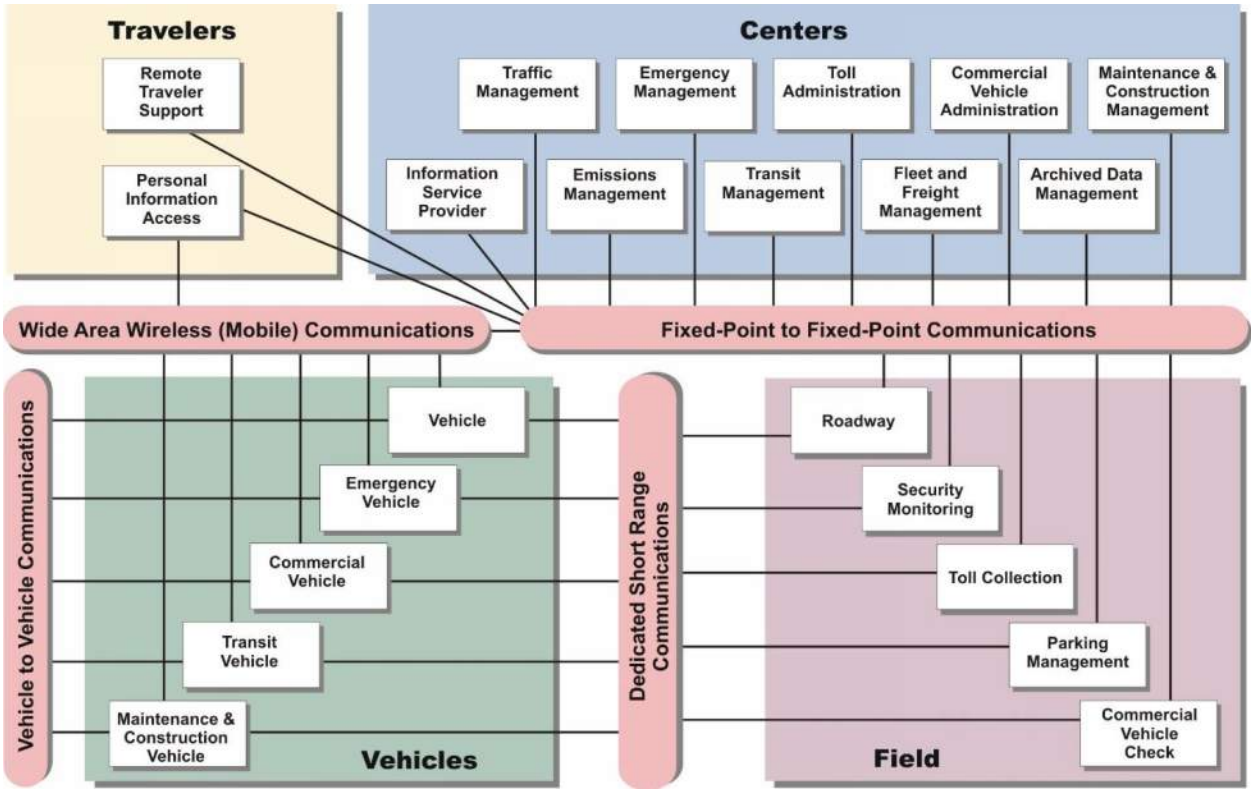


Figure 1. High-Level Physical National ITS Architecture

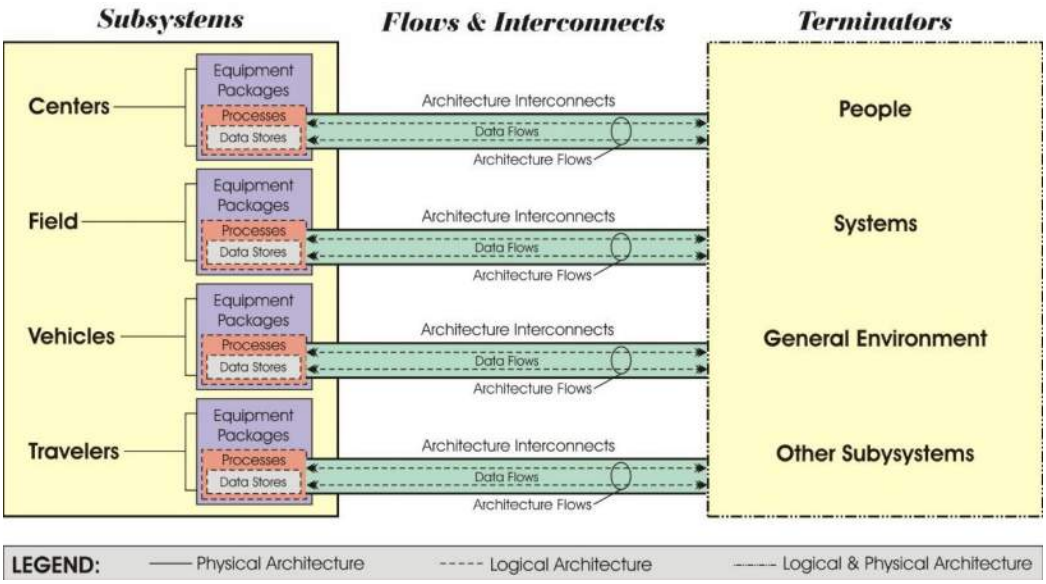


Figure 2. Logical and Physical Architecture Components

2.2.1 Subsystems

A subsystem represents a grouping of processes defined in the logical architecture that may be defined by single entities. There are 22 subsystems in the physical architecture that are assigned to four overarching classes that correspond to the physical world as described in Table 1 and illustrated in Figure 2.

Table 1. Subsystem Classes

Subsystem Class	Function	Real World Examples
Centers	Provide management, administration, and support functions for the transportation system.	▪ ODOT Transportation Management Operations Center (TMOC) ▪ 911 Centers (e.g. CCOM, BOEC)
Field	Provide direct interface to the roadway network, vehicles traveling on the roadway network, and travelers in transit.	▪ Traffic Signals ▪ Dynamic Message Signs ▪ Ramp Meters ▪ Weather Stations
Vehicles	Use the roadway network and provide driver information and safety systems.	▪ TriMet Fleet ▪ Fire and Police Vehicles
Travelers	Gain access to traveler information through the use of equipment.	▪ TripCheck Website ▪ Mobile Information Devices

2.2.2 Equipment Packages

Equipment packages group similar processes of a subsystem together into an implementable package that addresses user services. The equipment packages are considered the building blocks of the physical architecture subsystems. Table 2 lists several examples of equipment packages in the National ITS Architecture.

Table 2. Sample Equipment Packages

Equipment Package	Process Specifications (PSpecs)	User Service Addressed
Roadway Basic Surveillance	▪ Process Traffic Sensor Data ▪ Process Traffic Images	Traffic Control
Transit Center Tracking and Dispatch	▪ Manage Transit Vehicle Operations ▪ Update Transit Map Data	Public Transportation Management
Traffic and Roadside Data Archival	▪ Manage Roadside Data Collection	Information Management

2.2.3 Terminators

Terminators, also called entities, define the boundary of the architecture by representing the people, systems, other subsystems, and general environment that interface with intelligent transportation

systems. The National ITS Architecture includes interfaces between terminators and subsystems and processes, but does not allocate function requirements to terminators. For example, an emergency system operator is a terminator that interfaces with the emergency management subsystem; however, the architecture does not define the functions performed by the operator to support the agency. The same set of terminators applies to both the logical and physical architectures, but the logical architecture processes communicate using data flows and the physical architecture subsystems communicate using architecture flows.

2.2.4 Architecture Flows

Architecture flows, also called information flows, are groupings of data flows that represent the actual information exchanged between subsystems and terminators and are the primary tool used to define interfaces within a regional ITS architecture. For example, an accident report is an architecture flow that is exchanged between a 911 center (subsystem) and the appropriate emergency system operator (terminator).

2.2.5 Architecture Interconnects

Architecture interconnects, also called information interconnects, are the communications paths that carry architecture flows between the subsystems and terminators. These interconnects, shown in Figure 1 are typically grouped into one of the four categories listed in Table 3.

Table 3. Architecture Interconnects

Interconnect	Function	Real World Example
Fixed-Point to Fixed-Point Communications	Uses a communications network to link stationary entities.	▪ Fiber optic connection between a traffic operations center and a CCTV camera
Wide Area Wireless Communications	Uses wireless devices to link users and infrastructure-based systems.	▪ Mobile telephone used to access traveler information
Dedicated Short Range Communications	Uses wireless communications channels to link vehicles and the immediate infrastructure within close proximity.	▪ Radio waves between a roadside transmitter and a vehicle
Vehicle to Vehicle Communications	Uses a wireless system to link communications between vehicles.	▪ Future vehicle collision avoidance systems

3 TRANSPORT REGIONAL ITS ARCHITECTURE

As the name implies, a regional ITS architecture provides an ITS framework for a particular region. The TransPort Regional ITS Architecture was originally developed in 2001 to meet the federal architecture requirements. It was created in Turbo Architecture[7], which is a software tool designed to support development of regional and project architectures based on the National ITS Architecture. The Turbo Architecture database is intended to be a living document that gets updated by the key stakeholders as the regional needs change. The Turbo Architecture software is updated in conjunction with National ITS Architecture updates. Table 4 provides a timeline of the TransPort Regional ITS Architecture in relation to the various versions of the National ITS Architecture and the Turbo Architecture software. Minimal maintenance has been performed over the last decade; however, some agencies kept track of needed architecture updates as part of their jurisdictional ITS plan updates or as part of project-specific systems engineering checklists.

Table 4: TransPort Regional ITS Architecture Timeline

TransPort Regional ITS Architecture		National/Turbo Architecture[A]	
Version	**Timeline**	**Version[B]**	**Date**
1	2001 (June): Regional ITS Architecture was developed.	National 3.0 Turbo 1.1	Jan. 2000 April 2001
2	2003 (Feb.): Regional ITS Architecture was updated for the *Clackamas County ITS Plan*.	National 4.0 Turbo 2.0	April 2002 May 2002
3	2005 (Feb.): Regional ITS Architecture was updated for the *Washington County ITS Plan*.	National 5.0 Turbo 3.0	Oct. 2003 April 2004
4	2005 (Oct.): Regional ITS Architecture was updated.	National 5.1 Turbo 3.1	April 2005 May 2005
5	2016: Regional ITS Architecture is being updated as part of this project.	National 7.1 Turbo 7.1	April 2015 April 2015

A. A Connected Vehicle Reference Implementation Architecture (CVRIA) and associated Systems Engineering Tool for Intelligent Transportation (SET-IT) were developed in 2014 as a framework for early connected and automated deployments with the goal that it will ultimately be integrated into the National ITS Architecture and Turbo Architecture.

B. Starting with National ITS Architecture Version 7.0, the Turbo Architecture version numbering now aligns with the National ITS Architecture version numbering.

This section provides an overview of the numerous ITS plans established in the region, the architecture update process, and the various components of the TransPort Regional ITS Architecture:

[7] *Turbo Architecture*. Developed by Iteris, Inc. for the U.S. Department of Transportation, Federal Highway Administration. http://www.iteris.com/itsarch/html/turbo/turbomain.htm

- Geographic boundary
- Timeframe
- Scope
- Stakeholders
- System Inventory
- User services
- Service packages
- High-level physical architecture interconnects
- Functional requirements

3.1 Regional ITS Plans

A number of agencies within the Portland metropolitan area developed ITS plans specific to their agency or group of agencies as listed in Table 5. The highlighted rows represent ITS plans completed since the 2005 Regional ITS Architecture update. Several of the plans address ITS architecture components, although there is a single Turbo Architecture file that represents the ITS Architecture for the entire region. To accommodate a single Turbo Architecture file for the region, individual ITS plans use an ITS Architecture change log if the ITS Plan triggers a change to the regional ITS Architecture. This 2016 update incorporated changes identified by the individual agency ITS plans.

Each ITS plan varies in scope and timeframe, but all of the plans combined cover the geographic area of the Portland metropolitan area and include some form of project sequencing. For example, the TriMet ITS Plan summarizes the TransPort Regional ITS Architecture as it relates to TriMet since it was created in the same timeframe as the plan. The *Oregon ITS Strategic Plan* provides a statewide architecture, and the ITS plan for the Portland International Airport includes project-specific architectures. All of these regional ITS plans were taken into consideration as part of the update to the TransPort Regional ITS Architecture.

Table 5: Regional ITS Plans in the Portland Metropolitan Area

Agency	ITS Plan or Project	Includes Architecture or recommended updates?
Clackamas County	Clackamas County ITS Plan. Feb. 2003.	✓
	Clackamas County ITS Plan Update. June 2011.	
	Clackamas County Regional Freight ITS Project – **in progress**	
	OR 224/OR 212 Corridor ITS – **in progress**	
City of Gresham/ East Multnomah County	Gresham/East Multnomah County Traffic Signal System and Communications Master Plan Update. Sept. 2001.	✓
	East Metro Connections, June 2012.	
City of Portland	City of Portland Intelligent Transportation System Implementation Plan. June 1997.	
	Regional Concept for Transportation Operations. Prepared by City of Portland, Office of Transportation, Dec. 2007.	

Agency	ITS Plan or Project	Includes Architecture or recommended updates?
	City of Portland: Active Corridor Management Concept of Operations. March 2014.	✓
	N Going to Swan Island Freight Improvements **– in progress**	
ODOT	Oregon ITS Strategic Plan: 1997 – 2017. Oct. 1998.	✓
	TransPort ODOT Region 1 Intelligent Transportation System Implementation and Operations Plan. April 2000.	
	ODOT Region 1, Intelligent Transportation System Plan. July 2005.	
	US 26 Staley's Junction Variable Speed Signs. Concept of Operations. January 2010.	Updates over-ridden by OR 217 and Statewide VAS
	Oregon Statewide Variable Speed System – Concept of Operations., May 2013.	✓
	OR 217: Active Traffic Management – Concept of Operations., May 2013.	✓
	ODOT Region 1, Intelligent Transportation System Plan. January 2014.	
	ODOT Traffic Incident Management Strategic Plan. 2015.	
	Oregon Statewide ITS Architecture and Operational Concept Plan: • v1: Initial document creation • v2: Added Public Transportation Operational Concept. • v3: Added Road User Charging Operational Concept. May 2011. • v4: Adding Connected and Automated Vehicle Operational Concept – **in progress**	✓
	ODOT TTIP Enhancement – Local Entry Tool – **in progress**	
Port of Portland	Portland International Airport Intelligent Transportation Systems Master Plan. Feb. 2002.	✓
	Technology and Communications Plan for DMS at Portland International Airport. June 2004.	
TriMet	TriMet 5-Year Intelligent Transportation System Plan. 2001.	✓
Washington County	Washington County ITS Plan. Feb. 2005.	✓
	Washington County ITS Plan Update. Prepared by DKS Associates. Feb. 2014.	✓
	TIGER corridors – VSL on US26 and I-84; Fiber – Murray, 185th, Cornelius Pass Rd, Scholls Ferry**. Construction began summer 2016.**	Changes identified in OR 217 con ops

Agency	ITS Plan or Project	Includes Architecture or recommended updates?
TransPort	State of ITS in the Portland Region. October 2006.	
Metro	Regional Transportation System Management and Operation (TSMO) Plan, June 2010.	✓
Southwest Washington Regional TransPortation Council	Vancouver Area Smart Trek (VAST) – 2016 TSMO Plan Update and Implementation Plan. 2016	
	Vancouver Area Smart Trek (VAST) – Regional Transportation Systems Management and Operations Plan for Southwest Washington. June 2011.	

3.2 Architecture Update Process

This update to the TransPort Regional ITS Architecture was driven by several updates to the National ITS Architecture since 2005 as well as advances in the Portland region, such as the 2010 Portland Regional Transportation System Management and Operations (TSMO) Plan and other ITS Plans noted previously in Table 5.

The update was a collaborative effort between the project team and TransPort, which meets on a monthly basis. At each meeting, the project team provided updates and solicited feedback on each component throughout the project. Figure 3 illustrates the steps that were followed to update the TransPort Regional ITS Architecture.

In addition to ITS changes around the region, the Turbo Architecture software also had some notable updates since 2005:

- Changed the terminology of “market package” to “service package”
- Added service packages in the public transportation, traveler information, traffic management, and maintenance and construction service areas
- Provided the ability to link to MAP-21 goals, objectives, and performance measures
- Added an export feature to generate web pages of the regional ITS architecture for easy access by stakeholders.

As part of the update process, the new service packages were evaluated for inclusion in the Regional ITS Architecture. Appendix B includes a more detailed summary of the changes to the National ITS Architecture between Versions 5.1 and 7.1 that impact the TransPort Regional ITS Architecture.

Connected and automated vehicles evolved significantly since the 2005 Regional ITS Architecture was completed. Although Turbo Architecture does not yet include connected vehicle applications, TransPort does want to identify connected vehicle applications of interest to the region in the future. The Operational Concept section of this document describes connected vehicle applications developed by

the USDOT in the Connected Vehicle Reference Implementation Architecture (CVRIA) that the region may want to pursue in the future.

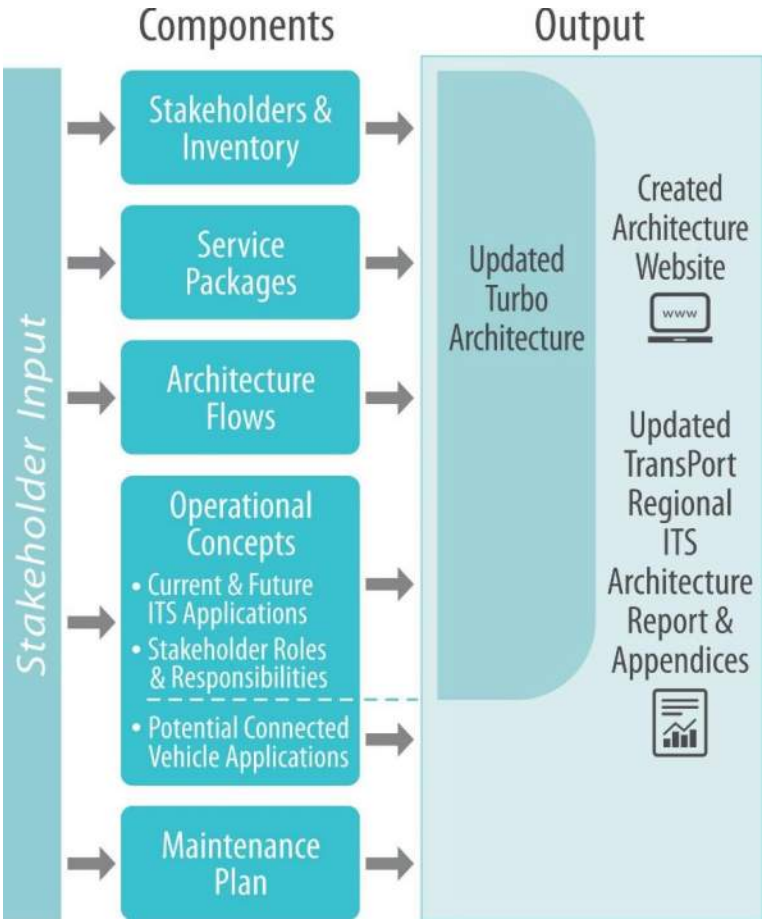


Figure 3: TransPort Regional Architecture Update Process

Each of the following elements are described in this section:

- Stakeholders: The TransPort Committee and other key stakeholders provided input throughout the architecture update process to obtain regional consensus. The stakeholder list was also updated in Turbo Architecture.
- System Inventory: Existing and planned ITS elements were updated in Turbo Architecture.
- User Services: The user services in use or planned for use were documented.
- Service Packages: The service packages were updated in Turbo Architecture based on updates to the system inventory and user services. New service packages added to the National ITS Architecture since 2005 were also selected.
- Interconnect and Information Flows: Information flows between subsystems were updated in Turbo Architecture to reflect changes to the aforementioned architecture changes.

Since Turbo Architecture does not generate any type of change log other than basic information (e.g. date of database maintenance, brief description), change log spreadsheets were created to document the changes to the stakeholder list, system inventory, and service packages and these can be found in Appendices D, F, and H, respectively. A change log was not generated for the changes to the interconnects and information flows due to the large number of flows contained within the TransPort Regional ITS Architecture.

3.2.1 Status Field in Turbo Architecture

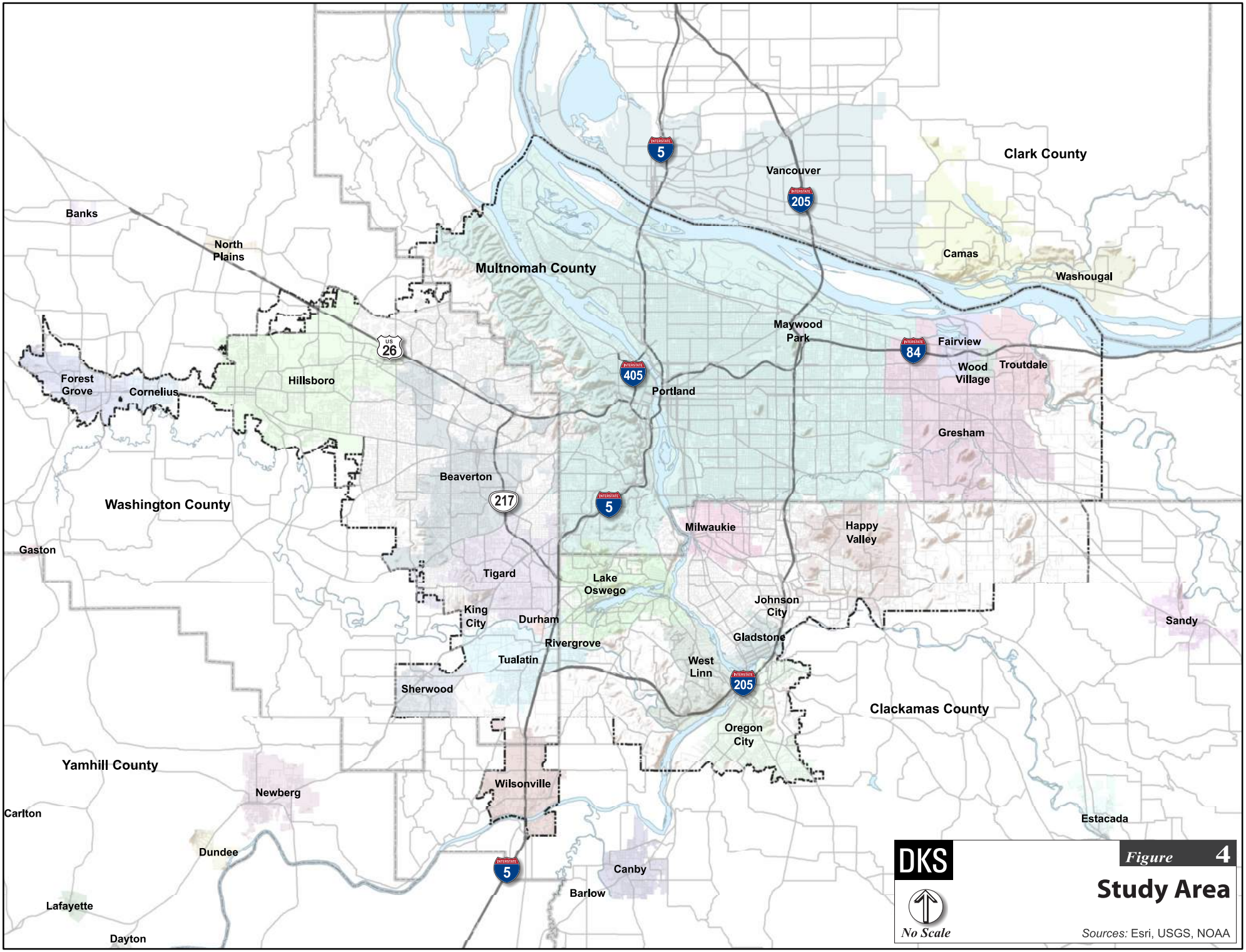
The previous 2005 update customized the status settings to allow for broader variety of statuses than simply "existing" or "not planned" for architecture items. The status settings include:

- Existing: Items that currently exist.
- Programmed: Items that are currently underway/under design or that have funding secured for deployment in the near future.
- Planned: Items that are included in regional plans but do not yet have funding.
- Future: Items that may occur within the architecture timeframe but are not included in any current regional plans and do not yet have funding.
- Not Planned: Items not currently planned for the region within the architecture timeframe.

3.3 Geographic Boundary

The geographic boundary of the TransPort Regional ITS Architecture is the same as the Metro boundary shown in Figure 4. This boundary includes 25 cities within the urban areas of Clackamas, Multnomah, and Washington counties. Although other areas of the three counties also have ITS needs and some systems in place or planned the TransPort Committee opted not to include them in the regional architecture since the operation of ITS in these areas is somewhat isolated and not dependent on system integration in the Portland metropolitan area. The Committee may opt to expand the geographic boundary in the future if the need for integration arises.

The original architecture boundary also included the Vancouver, Washington metropolitan area just north of Portland. The Vancouver area was removed as part of the 2005 architecture update since the Southwest Washington Regional Transportation Council (RTC) has decided to maintain the Vancouver Area Smart Trek (VAST) regional ITS architecture as a separate entity. Although the Portland and Vancouver area architectures will be maintained separately, several links in the TransPort Regional ITS Architecture were kept in place to link the two architectures. Additionally, several Vancouver area agencies will continue to participate in the TransPort consortium to ensure integration and coordination between the two regions.


Clark County
Vancouver
Banks
North Plains
Multnomah County
Camas
Washougal
Maywood Park
Fairview
Wood Village
Troutdale
Forest Grove
Cornelius
Hillsboro
Portland
Gresham
Beaverton
Washington County
Milwaukie
Happy Valley
Gaston
Tigard
Lake Oswego
King City
Durham
Johnson City
Sandy
Gladstone
Rivergrove
Tualatin
West Linn
Sherwood
Clackamas County
Oregon City
Yamhill County
Wilsonville
Newberg
Carlton
Estacada
Dundee
Canby
Barlow
Lafayette
Dayton
DKS
No Scale
Figure 4
Study Area
Sources: Esri, USGS, NOAA

3.4 Timeframe

This update to the TransPort Regional ITS Architecture spans a five-year timeframe from Years 2017 to 2022. The previous 2005 update covered the 10-year period from Years 2005 to 2015. However, with the quickly evolving connected vehicle environment and other technology advancements, the architecture should be re-evaluated before 10 years.

3.5 Scope

The National ITS Architecture includes nine service area categories. The TransPort Regional ITS Architecture, which primarily includes public agency stakeholders, focuses on eight of the service areas:

- Traffic Management
- Traveler Information
- Incident Management
- Public Transportation Services
- Advanced Vehicle Safety Systems
- Maintenance and Construction Management
- Archived Data Management
- Emergency Management

The TransPort Committee chose not to focus on the Commercial Vehicle Operations service area (including only a single service packages from that area) because these service packages are best suited to the statewide architecture.

3.6 Stakeholders

Stakeholders are the backbone of the TransPort Regional ITS Architecture and consensus amongst stakeholders has helped the Portland metropolitan area successfully deploy ITS projects in the past and will continue to ensure coordination and integration of future ITS endeavors. The key stakeholders include the transportation management, public transportation, and public safety agencies who primarily own and operate ITS throughout the region. Expanded stakeholders include other public agencies, private sector organizations, and travelers/system users. The following general updates were made to the list of stakeholders:

- Addition of detailed description for each stakeholder where needed
- Addition of new stakeholders not previously applicable

Appendix C contains the Turbo Architecture report of the complete list of the 46 stakeholders/ stakeholder groups and Appendix D includes a detailed change log of all the changes made to the stakeholder list.

3.6.1 Agreements

A number of agreements exist between key stakeholders today but nothing is documented in the Turbo Architecture database. Many regional agreements are informal or done on a handshake basis since agencies within the region have historically worked so well together. A number of intergovernmental agreements are project-specific (e.g. operations and maintenance of one traffic signal installation) and are hard to track down.

CTIC

The Cooperative Telecommunications Infrastructure Committee, or CTIC for short, is an important agreement for agencies to be aware of, but it is not documented in the TransPort ITS Turbo Architecture. CTIC was established through an IGA in 1999 to coordinate the use of network assets, such as funding, physical assets, rights-of-way, equipment, and labor in such a way as to benefit the member agencies whenever practical and avoid the development of duplicative network investment. The physical asset shared amongst the CTIC members is primarily fiber optic cable. Currently seven agencies in the Portland region are members of CTIC: Beaverton, Gresham, Portland, Clackamas County, Washington County[8], ODOT, and TriMet.

Signal Operations and Video Sharing

Several agencies have agreements to coordinate video sharing and operations of traffic signals. A few examples of those agreements include:

- City of Gresham maintains and operations the Multnomah County traffic signals within the city limits.
- City of Portland shares video images and camera control with ODOT.
- Cameras in City of Wilsonville were recently upgraded to high definition (HD) full access video with shared access to Clackamas County.

3.7 System Inventory

The TransPort Regional ITS Architecture includes a comprehensive inventory of the existing and planned ITS elements in the Portland metropolitan area. In Turbo Architecture each inventory element includes the element name, the associated stakeholder, and the associated subsystem(s) and/or terminator(s). There is also a field available for including a description. The TransPort Regional ITS Architecture primarily focuses on the elements that comprise the subsystems, but does include a few key terminators. Terminators typically play a larger role in project-specific architectures (e.g. the personnel that operate the actual subsystem). The following general updates were made to the system inventory based on input from the TransPort Architecture Subcommittee and other key stakeholders:

- Addition of detailed description for each element where needed
- Addition of new elements not previously applicable
- Update of element status (e.g. existing, programmed, planned, future, not planned)
- Update of selected subsystem(s) and/or terminator(s).

Appendix E contains the Turbo Architecture report of the complete list of system inventory elements, and a detailed change log of all the changes made to the system inventory list can be found in Appendix F.

[8] Washington County is not currently an official member of CTIC. They are "sponsored" by ODOT due to the connection to the Regional ITS Network. Washington County attends meetings, but does not participate in voting.

3.8 User Services

User services describe what functions intelligent transportation systems should perform from the user's perspective. Users encompass a broad range of groups such as the traveling public, transportation agency personnel, emergency management personnel, and commercial vehicle operators. Although a user service is a functional requirement of the system, it does not describe where components fit into the architecture or how the service will be implemented. Selection of user services provides a high-level means of identifying the services to provide that address the regional user needs and problems. To simplify the range of requirements in a broad area of services, the user services are logically grouped into eight user service bundles.

Table 6 includes these user service bundles and the 33 nationally defined user services and indicates the status of each one based on input from the TransPort Committee. A description of each user service may be found on the National ITS Architecture website[9].

Table 6. User Services in the TransPort Regional ITS Architecture

User Services Bundles and User Services		Status
1	**Travel and Traffic Management**	
1.1	Pre-Trip Travel Information	Existing
1.2	En-Route Driver Information	Existing/Planned
1.3	Route Guidance	Existing/Planned
1.4	Ride Matching and Reservation	Existing/Planned
1.5	Traveler Services Information	Existing
1.6	Traffic Control	Existing
1.7	Incident Management	Existing
1.8	Travel Demand Management	Existing
1.9	Emissions Testing and Mitigation	Existing
1.10	Highway Rail Intersection	Existing
2	**Public Transportation Management**	
2.1	Public Transportation Management	Existing
2.2	En-Route Transit Information	Existing
2.3	Personalized Public Transit	Existing
2.4	Public Travel Security	Existing
3	**Electronic Payment**	
3.1	Electronic Payment Services	Existing/Planned
4	**Commercial Vehicle Operations**	
4.1	Commercial Vehicle Electronic Clearance	Not Planned
4.2	Automated Roadside Safety Inspection	Not Planned

[9] *User Services*. U.S. Department of Transportation. http://www.iteris.com/itsarch/html/user/userserv.htm. Accessed August 16, 2016.

User Services Bundles and User Services		Status
4.3	On-Board Safety and Security Monitoring	Not Planned
4.4	Commercial Vehicle Administrative Processes	Not Planned
4.5	Hazardous Materials Security and Incident Response	Existing
4.6	Freight Mobility	Existing/Planned
5	**Emergency Management**	
5.1	Emergency Notification and Personal Security	Existing
5.2	Emergency Vehicle Management	Existing
5.3	Disaster Response and Evacuation	Existing
6	**Advanced Vehicle Safety Systems**	
6.1	Longitudinal Collision Avoidance	Planned
6.2	Lateral Collision Avoidance	Planned
6.3	Intersection Collision Avoidance	Existing
6.4	Vision Enhancement for Crash Avoidance	Planned
6.5	Safety Readiness	Planned/Future
6.6	Pre-Crash Restraint Development	Not Planned
6.7	Automated Vehicle Operation	Future
7	**Information Management**	
7.1	Archived Data	Existing
8	**Maintenance and Construction Management**	
8.1	Maintenance and Construction Operations	Existing

3.9 Service Packages

Service packages (renamed from market packages in the upgrade from National ITS Architecture Version 6.1 to 7.0) are deployment-oriented groupings of physical architecture entities that address specific user services. The user services identified in the previous section are too broad in scope to aid in the planning of actual deployments. Service packages are made up of one or more equipment packages that work together to deliver a transportation service and the architecture flows that connect them with subsystems and terminators. Figure 5 illustrates a sample service package that includes subsystems (the large rectangular boxes), the equipment packages (the small rectangular boxes), the terminators (the ovular boxes), and the architecture flows (the arrows).

The status of service packages previously selected for the Portland region were reviewed and newer service packages were also reviewed and selected based on regional needs. Table 7 lists the service packages selected by the TransPort Committee and includes both existing service packages already deployed and service packages that will be deployed within the next five to 10 years. The highlighted rows indicate service packages added to the National ITS Architecture since the 2005 Regional ITS Architecture Plan. Eight broad categories of interest are used to group the 97 service packages. Appendix G contains the Turbo Architecture service packages report, which includes a brief description

of each service package, its regional status, the applicable regional inventory elements associated with the service package, and any comments on how the service package applies to the region. Appendix H includes the change log of all the changes made to the service packages. Additional details about each service package may also be found on the National ITS Architecture website[10].

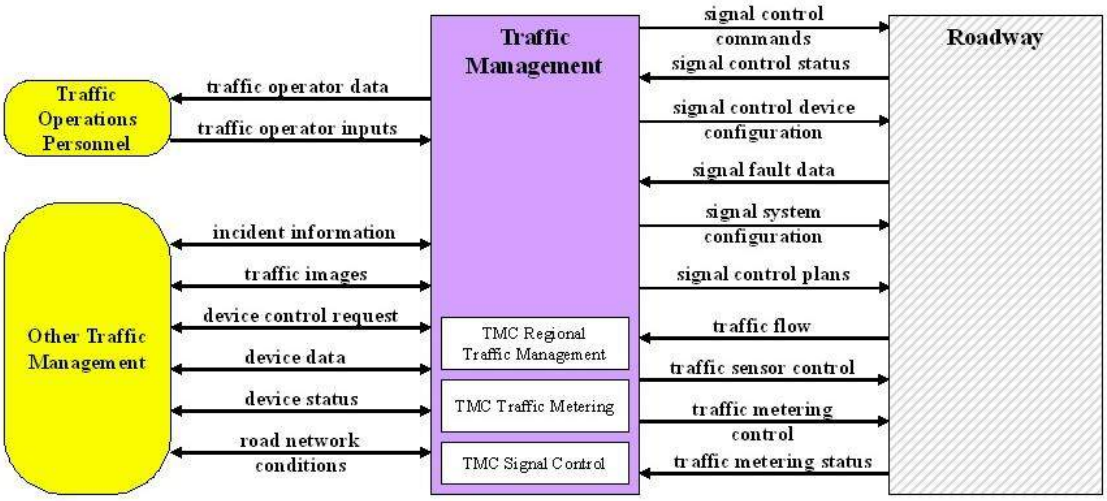


Figure 5: Sample Market Package Graphic: Regional Traffic Management (ATMS07)[11]

Table 7: Service Packages in the TransPort Regional ITS Architecture

Service Packages		Status
Archived Data (AD) Management		
AD1:	ITS Data Mart	Existing
AD2:	ITS Data Warehouse	Existing/Planned
AD3:	ITS Virtual Data Warehouse	Existing/Planned
Advanced Public Transportation Systems (APTS)		
APTS01:	Transit Vehicle Tracking	Existing
APTS02:	Transit Fixed-Route Operations	Existing
APTS03:	Demand Response Transit Operations	Existing
APTS04:	Transit Fare Collection Management	Existing
APTS05:	Transit Security	Existing
APTS06:	Transit Fleet Management	Existing
APTS07:	Multi-Modal Coordination	Existing/Planned

[10] *Service Packages*. U.S. Department of Transportation. http://www.iteris.com/itsarch/html/mp/mpindex.htm. Accessed August 16, 2016.

[11] *ATMS07- Regional Traffic Management*. U.S. Department of Transportation. March 23, 2015. http://itsarch.iteris.com/itsarch/html/mp/gatms03.htm. Accessed Sept. 22, 2005.

Service Packages		Status
APTS08:	Transit Traveler Information	Existing
APTS09:	Transit Signal Priority	Existing/Planned
APTS10:	Transit Passenger Counting	Existing
APTS11:	Multimodal Connection Protection	Planned
Advanced Traveler Information Systems (ATIS)		
ATIS01:	Broadcast Traveler Information	Planned
ATIS02:	Interactive Traveler Information	Existing
ATIS03:	Autonomous Route Guidance	Existing
ATIS04:	Dynamic Route Guidance	Existing
ATIS05:	ISP Based Trip Planning and Route Guidance	Existing
ATIS06:	Transportation Operations Data Sharing	Not Planned
ATIS07:	Travel Services Information and Reservation	Existing
ATIS08:	Dynamic Ridesharing	Existing/Planned
ATIS09:	In Vehicle Signing	Future
ATIS10:	Short Range Communications Traveler Information	Future
Advanced Traffic Management Systems (ATMS)		
ATMS01:	Network Surveillance	Existing
ATMS02:	Traffic Probe Surveillance	Existing/Planned
ATMS03:	Traffic Signal Control	Existing
ATMS04:	Traffic Metering	Existing
ATMS05:	HOV Lane Management	Future
ATMS06:	Traffic Information Dissemination	Existing
ATMS07:	Regional Traffic Management	Existing/Planned
ATMS08:	Traffic Incident Management System	Existing
ATMS09:	Transportation Decision Support and Demand Management	Future
ATMS10:	Electronic Toll Collection	Future
ATMS11:	Emissions Monitoring and Management	Existing
ATMS12:	Roadside Lighting System Control	Existing/Planned
ATMS13:	Standard Railroad Grade Crossing	Existing
ATMS14:	Advanced Railroad Grade Crossing	Planned
ATMS15:	Railroad Operations Coordination	Planned
ATMS16:	Parking Facility Management	Existing/Planned
ATMS17:	Regional Parking Management	Future
ATMS18:	Reversible Lane Management	Not Planned
ATMS19:	Speed Warning and Enforcement	Existing/Planned

Service Packages		Status
ATMS20:	Drawbridge Management	Existing
ATMS21:	Roadway Closure Management	Future
ATMS22:	Variable Speed Limits	Existing/Planned
ATMS23:	Dynamic Lane Management and Shoulder Use	Planned
ATMS24:	Dynamic Roadway Warning	Existing/Planned
ATMS25:	VMT Road User Payment	Planned
ATMS26:	Mixed Use Warning Systems	Planned
Advanced Vehicle Safety Systems (AVSS)		
AVSS01:	Vehicle Safety Monitoring	Existing/Future
AVSS02:	Driver Safety Monitoring	Not Planned
AVSS03:	Longitudinal Safety Warning	Planned
AVSS04:	Lateral Safety Warning	Planned
AVSS05:	Intersection Safety Warning	Future
AVSS06:	Pre-Crash Restraint Deployment	Not Planned
AVSS07:	Driver Visibility Improvement	Not Planned
AVSS08:	Advanced Vehicle Longitudinal Control	Future
AVSS09:	Advanced Vehicle Lateral Control	Future
AVSS10:	Intersection Collision Avoidance	Future
AVSS11:	Automated Vehicle Operations	Future
AVSS12:	Cooperative Vehicle Safety Systems	Future
Commercial Vehicle Operations (CVO)		
CVO01:	Carrier Operations and Fleet Management	Not Planned
CVO02:	Freight Administration	Not Planned
CVO03:	Electronic Clearance	Not Planned
CVO04:	CV Administrative Processes	Not Planned
CVO05:	International Border Electronic Clearance	Not Planned
CVO06:	Weigh-in-Motion	Not Planned
CVO07:	Roadside CVO Safety	Not Planned
CVO08:	On-Board CVO Safety	Not Planned
CVO09:	CVO Fleet Maintenance	Not Planned
CVO10:	HAZMAT Management	Existing
CVO11:	Roadside HAZMAT Security Detection and Mitigation	Not Planned
CVO12:	CV Driver Security Authentication	Not Planned
CVO13:	Freight Assignment Tracking	Not Planned
Emergency Management (EM)		
EM01:	Emergency Call-Taking and Dispatch	Existing

Service Packages		Status
EM02:	Emergency Routing	Existing/Planned
EM03:	Mayday and Alarms Support	Existing/Planned
EM04:	Roadway Service Patrols	Existing
EM05:	Transportation Infrastructure Protection	Existing
EM06:	Wide-Area Alert	Existing
EM07:	Early Warning System	Existing
EM08:	Disaster Response & Recovery	Existing/Planned
EM09:	Evacuation and Reentry Management	Existing/Planned
EM10:	Disaster Traveler Information	Planned
Maintenance and Construction (MC) Management		
MC01:	Maintenance and Construction Vehicle and Equipment Tracking	Existing/Planned
MC02:	Maintenance and Construction Vehicle Maintenance	Existing/Planned
MC03:	Road Weather Data Collection	Existing/Planned
MC04:	Weather Information Processing and Distribution	Existing
MC05:	Roadway Automated Treatment	Existing/Future
MC06:	Winter Maintenance	Existing/Planned
MC07:	Roadway Maintenance and Construction	Existing/Future
MC08:	Work Zone Management	Existing/Planned
MC09:	Work Zone Safety Monitoring	Existing/Future
MC10:	Maintenance and Construction Activity Coordination	Existing/Programmed
MC11:	Environmental Probe Surveillance	Existing/Planned
MC12:	Infrastructure Monitoring	Future
Note: Highlighted rows represent service packages added to the National ITS Architecture since the 2005 Regional ITS Architecture Plan		

3.10 High-Level Physical Architecture Interconnects

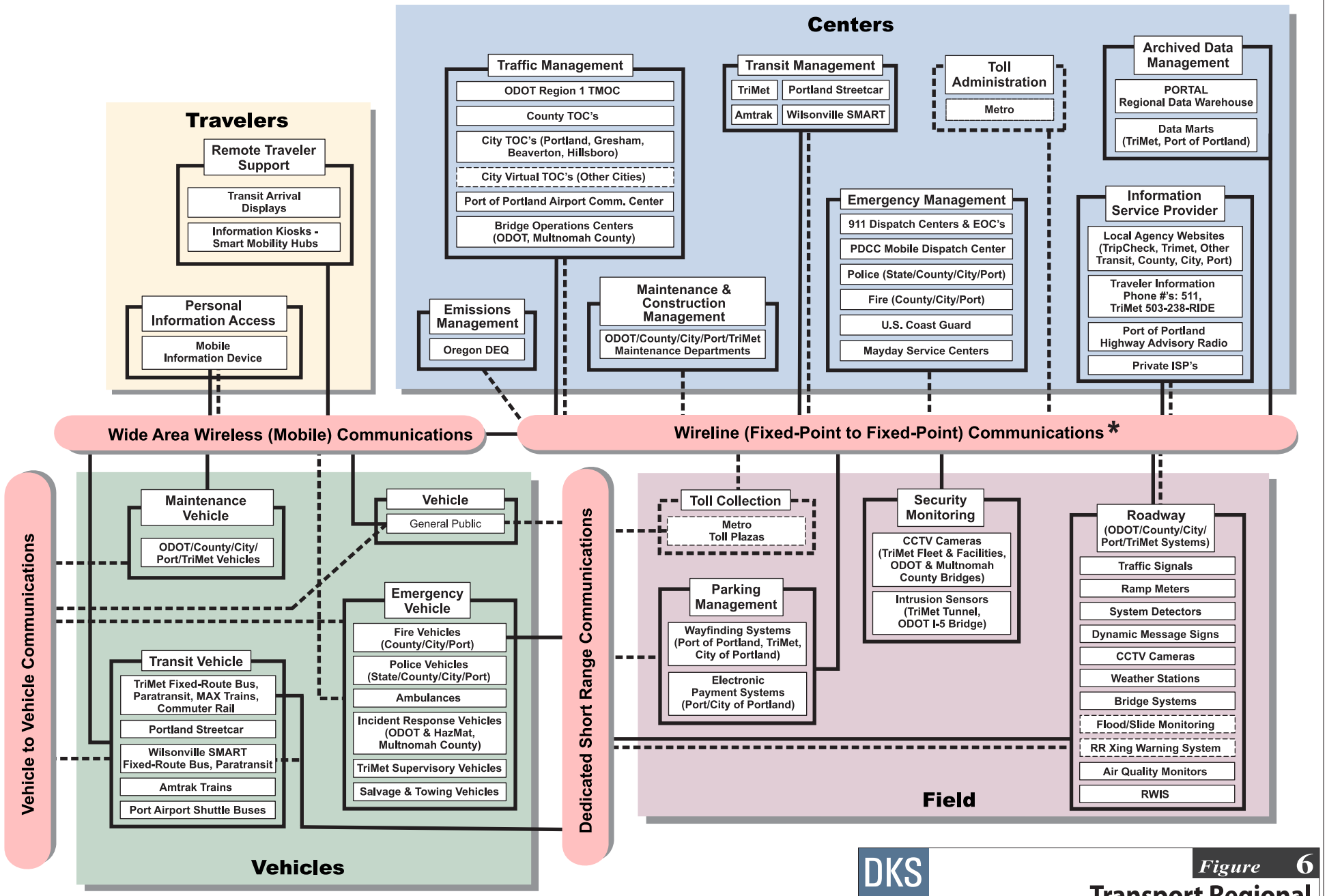
Figure 6 illustrates the subsystems and architecture interconnects that make up the high-level physical architecture for the Portland metropolitan area. This figure includes both existing and planned physical entities. The following general updates were made to the architecture interconnects:

- Update of interconnects to reflect changes to the system inventory
- Tailoring of the new interconnects to the system inventory as applicable
- Review of interconnects for completeness and accuracy.

Architecture interconnects have been included in the Turbo Architecture database that link the TransPort Regional ITS Architecture to the Oregon Statewide ITS Architecture and the Vancouver Regional ITS Architecture.

3.11 Functional Requirements

The TransPort Architecture Subcommittee maintains their decision to identify functional requirements at the project level for regional significant systems with interfaces that cross agency boundaries. Therefore, functional requirements are not included as part of the TransPort Regional ITS Architecture.


Centers
Traffic Management
ODOT Region 1 TMOC
County TOC's
City TOC's (Portland, Gresham, Beaverton, Hillsboro)
City Virtual TOC's (Other Cities)
Port of Portland Airport Comm. Center
Bridge Operations Centers (ODOT, Multnomah County)
Transit Management
TriMet
Portland Streetcar
Amtrak
Wilsonville SMART
Toll Administration
Metro
Archived Data Management
PORTAL Regional Data Warehouse
Data Marts (TriMet, Port of Portland)
Travelers
Remote Traveler Support
Transit Arrival Displays
Information Kiosks - Smart Mobility Hubs
Personal Information Access
Mobile Information Device
Emissions Management
Oregon DEQ
Maintenance & Construction Management
ODOT/County/City/Port/TriMet Maintenance Departments
Emergency Management
911 Dispatch Centers & EOC's
PDCC Mobile Dispatch Center
Police (State/County/City/Port)
Fire (County/City/Port)
U.S. Coast Guard
Mayday Service Centers
Information Service Provider
Local Agency Websites (TripCheck, Trimet, Other Transit, County, City, Port)
Traveler Information Phone #'s: 511, TriMet 503-238-RIDE
Port of Portland Highway Advisory Radio
Private ISP's
Wide Area Wireless (Mobile) Communications
Wireline (Fixed-Point to Fixed-Point) Communications *
Vehicle to Vehicle Communications
Maintenance Vehicle
ODOT/County/City/Port/TriMet Vehicles
Vehicle
General Public
Emergency Vehicle
Fire Vehicles (County/City/Port)
Police Vehicles (State/County/City/Port)
Ambulances
Incident Response Vehicles (ODOT & HazMat, Multnomah County)
TriMet Supervisory Vehicles
Salvage & Towing Vehicles
Transit Vehicle
TriMet Fixed-Route Bus, Paratransit, MAX Trains, Commuter Rail
Portland Streetcar
Wilsonville SMART Fixed-Route Bus, Paratransit
Amtrak Trains
Port Airport Shuttle Buses
Vehicles
Dedicated Short Range Communications
Toll Collection
Metro Toll Plazas
Parking Management
Wayfinding Systems (Port of Portland, TriMet, City of Portland)
Electronic Payment Systems (Port/City of Portland)
Security Monitoring
CCTV Cameras (TriMet Fleet & Facilities, ODOT & Multnomah County Bridges)
Intrusion Sensors (TriMet Tunnel, ODOT I-5 Bridge)
Roadway (ODOT/County/City/Port/TriMet Systems)
Traffic Signals
Ramp Meters
System Detectors
Dynamic Message Signs
CCTV Cameras
Weather Stations
Bridge Systems
Flood/Slide Monitoring
RR Xing Warning System
Air Quality Monitors
RWIS
Field
Existing
Future
* Center to vehicle radio communications are represented by the link between Wireline and Wide Area Wireless communications.
DKS
No Scale
Figure 6
Transport Regional ITS Architecture For Years 2016 - 2021

4 MAINTENANCE PLAN

The ITS Architecture project team used federal guidelines[12] to develop a maintenance plan for keeping the Regional ITS Architecture up to date. The development and implementation of an architecture maintenance plan is one of the requirements of the FHWA Final Rule and FTA Policy. The architecture is a fluid entity that must be updated as ITS needs and services evolve in the Portland metropolitan area.

During the next round of updates, connected vehicle applications from the CVRIA and the Turbo ITS Architecture software tool will be integrated into a common platform, currently in development by the Federal Highway Administration.

This section answers the following questions: Who? What? When? How?

4.1 Who Maintains the Regional ITS Architecture?

A TransPort member will be appointed as the ITS Architecture lead, and the role will rotate on an annual or biannual basis. The person in the lead role will be responsible for facilitating discussions at TransPort meeting about necessary ITS Architecture updates.

When updates are ready to implement, TransPort will need to determine whether to complete the update with agency staff or through a consultant. Historically, a consultant completed the TransPort Regional ITS Architecture update based on input from TransPort members, while Metro staff coordinated the process. Future updates should not preclude the option of using agency staff to complete the update.

4.2 What is Maintained in the Regional ITS Architecture?

The following items in the Regional ITS Architecture will be maintained to reflect the deployment of ITS projects and changes in regional needs:

- Stakeholders
- Inventory elements
- Regional user services
- Service packages
- Operational concept
- Interconnects and information flows between elements
- ITS standards

Deletions or additions to the TransPort Regional ITS Architecture should be accompanied with descriptive comments in Turbo Architecture to document the reasons for the changes.

[12] *Regional ITS Architecture Guidance: Developing, Using, and Maintaining an ITS Architecture for Your Region*. Report FHWA-HOP-06-112. U.S. Department of Transportation, Federal Highway Administration. Version 2.0, July 2006.

4.3 When is the Regional ITS Architecture Updated?

Approaches to architecture maintenance include periodic, project-based, or a combination of the two methods. Previously, the approach called for an update every two years after the Metropolitan Transportation Improvement Program (MTIP) was approved. However, since that approach was not routinely executed, this update provides a new approach.

4.3.1 Option 1: Periodic Update (Every Five to Ten Years)

With this option, the Turbo Architecture file will be updated concurrently when the ITS Architecture document is revised, typically on a five- to ten-year cycle.

For this option to be successful, a region-wide effort needs to be coordinated to document and maintain a log of ITS architecture change request forms and architecture compliance checklists for the region. The ITS architecture compliance checklist is required for all ODOT ITS related projects and is submitted to FHWA for approval. Other agencies could adopt using the "Section 2" portion of this checklist to ensure the project is represented in the Regional ITS Architecture. This checklist will identify whether the current ITS Architecture fully captures the project, and if not, a change should be requested.

The TransPort Basecamp website, operated by Metro, could be used to house all the documentation. By starting a new "TransPort ITS Architecture" project on the Basecamp website, all of the checklists and change logs could be stored in one location. When the region goes through a formal update (typically a five- to ten-year cycle), the changes identified in the ITS Architecture checklists and change logs will be easily accessible and can be incorporated. During the formal update process, the entire ITS Architecture and supporting documents will be reviewed and updated as necessary.

4.3.2 Option 2: Project-Based Update

If an ITS project opportunity arises, but funding hinges on accurately representing it in the Regional ITS Architecture, the project could include a component to update the Architecture specific to that project. The TransPort group will determine whether these project-based updates are needed on a case-by-case basis.

4.4 How is the Regional ITS Architecture Maintained?

Members of TransPort will be responsible for requesting changes to the Regional ITS Architecture based on things such as changes to existing ITS elements or operations, addition of new projects, or for securing ITS funding through the MTIP or other local funding sources. The request of changes will be documented using the ITS Architecture Change Logs. During the design phase for all ITS related projects, agencies will need to complete an ITS Architecture Change Request and Change Log to TransPort. The file can be housed on the TransPort Basecamp website until the next round of ITS Architecture updates. Table 8 lists the general process for maintaining the architecture.

Table 8. TransPort Regional ITS Architecture Update Process

Maintenance Step	Responsibility
Establish a "TransPort ITS Architecture" project on the Metro Basecamp website	Metro Staff
Document all ITS projects with an ITS Architecture Checklist/Change Request Form and submit to TransPort basecamp website (maintained by Metro)	Agency staff
Review and approve requests from the submitted ITS Architecture Checklists/Change Request Forms.	TransPort
Update approved changes in Turbo Architecture and supporting documents during Regional ITS Architecture update process (5-10 year cycle)	Maintainer
Log the changes and notify the stakeholders.	Maintainer

A sample of the ODOT ITS architecture compliance checklist and ITS architecture change request forms are included in Appendix I. A more generic change log may be more appropriate for large-scale updates to the architecture. These forms are currently available in Microsoft Excel and Word format but the Maintainer may find it more useful to convert these to a database or web-based format.

5 OPERATIONAL CONCEPT PLANS

This section presents the operational concept for the Portland metropolitan region, which describes how the region's stakeholders and systems work together to implement operations services and the specific roles and responsibilities of each regional partner in delivering those services. This section includes an introduction to operational concepts, the development approach, a description of the regional service areas, and a specific operational concept for each service area.

The deployment of ITS projects is unique because many of the benefits are realized only when ITS projects are implemented together on a region-wide basis, rather than on an individual basis. As a result, the implementation of ITS projects requires coordination and ongoing cooperation between various agencies within a region.

The operational concepts outlined in this document are intended to provide a regional, high-level perspective on the operational service areas identified for the Portland metropolitan region. It is not intended as a substitute for project-level concepts of operations that should be developed as part of individual ITS project deployments, consistent with the U.S. DOT systems engineering process. A project-level concept of operations describes the operations of a specific system as a basis for developing system functional requirements, specifications, and designs, as well as cementing agency roles and responsibilities associated with the delivery of that system.

For example, this regional operational concept may discuss requirements for regional video sharing, as illustrated by a video sharing information flow between two agencies. A project concept of operations, by contrast, would elaborate on more granular details associated with that information flow, such as the agency with day-to-day maintenance responsibilities for the CCTV cameras or situations where access to CCTV camera controls may be curtailed.

The main objectives of the operational concept are to:

- Provide an overview of the operation in the Portland metropolitan region for key areas.
- Identify current and future stakeholder roles and responsibilities in the implementation of operational strategies and regional intelligent transportation systems[13].
- Lay the groundwork for future agency agreements and project-level concepts of operations.
- Illustrate how agency personnel, systems, and other resources interact, as a basis for developing the updated ITS Architecture.
- Achieve buy-in on these roles and responsibilities and lay the groundwork for future agency agreements.

[13] *Regional ITS Architecture Guidance: Developing, Using, and Maintaining an ITS Architecture for Your Region.* Report FHWA-OP-02-024, Version 2.0. U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration, National ITS Architecture Team, July 2006.

An operational concept is a required component of a regional ITS architecture per the FHWA Final Rule 940 and FTA Policy. This section documents the operational concept development approach and agency roles and responsibilities for the key regional ITS service areas.

5.1.1 Operational Concept Development Approach

The operational concept was developed based on input from the project Steering Committee and the documents developed to date, including the Existing ITS Infrastructure, Needs Assessment, and ITS Vision. The Steering Committee and ITS documentation provided insight into stakeholder roles and responsibilities as well as consensus. The results discussed in the operational concept may not represent all of the potential interactions, but present key relationships, roles and responsibilities, and information flows.

5.1.2 Operational Concept Service Areas

The operational concept is organized into six service areas. Each service area covers a particular aspect of regional transportation system management and operations.

The following table describes the ITS functions covered by each service area.

Service Area	ITS Functions Covered
Regional Traffic Control: *Devices and Operations Resources used to manage freeway and arterial traffic in the region.*	Traffic Signal Control Regional Traffic Management Dynamic Roadway Warnings Variable Speed Limits Traffic Metering Emergency Vehicle Preemption Transit Signal Priority
Traveler Information: *Dynamic and static information provided to help travelers en-route and pre-trip.*	Broadcast Traveler Information (“pushed” information) Interactive Traveler Information (traveler-requested) Traffic Information Dissemination (via TMC) Regional Parking Management
Incident Management: *Multi-agency coordination for detecting and responding to planned and unplanned traffic incidents that impact traffic.*	Traffic Incident Management Roadway Service Patrols Coordination with Local and Statewide Partners
Maintenance & Construction (M&C) Information Management: *Coordination for maintenance and construction activities and closures.*	Roadway Maintenance and Construction Work Zone Management with ITS M&C Activity Coordination
Public Transportation: *All aspects of advanced public transit systems for fixed route and paratransit.*	Transit Vehicle Tracking Fixed-Route Operations Demand Response Operations Fare Collection Management Transit Security

Service Area	ITS Functions Covered
	Transit Traveler Information Transit Passenger Counting
Archived Data: *Storage and management of transportation data collected by ITS devices.*	ITS Data Mart (Individual archives) ITS Data Warehouse (Multiple data sources) ITS Virtual Data Warehouse (Direct access to remote archives)

5.1.3 Organization of the Operational Concept by Service Area

Each service area includes a general description followed by:

- **Current ITS Applications:** This topic describes the existing ITS devices and activities within the region and how these applications are currently operated. This topic has two sections: the first identifies the current conditions when the 2005 report was completed and the second identifies activities added since 2005.
- **Current Issues:** This topic describes the identified needs through an operational lens to identify the broader underlying issues behind them.
- **Future Applications and Vision:** This topic describes applications and vision for each ITS service area over the next five to ten years.
- **Potential Connected Vehicle Applications:** This topic references connected vehicle applications from the Connected Vehicle Reference Implementation Architecture (CVRIA)[14] that could be advanced in the future. Since the CVRIA is currently in draft form and not integrated with the Turbo Architecture software used to document the regional ITS architecture, the applications will be identified in the operational concepts, but not advanced further at this time.
- **Operational Concept Graphic:** The graphics depict both existing and future interactions and information flows between centers, field devices, information service providers, and travelers and vehicles. The graphics identify the regional electronic interactions that support the management and operations of the transportation network.
- **Stakeholders and their Roles and Responsibilities:** This topic lists stakeholders and their specific roles and responsibilities relative to the service area and organized by the general phase of ITS project deployment as described in the following table.

[14] Website: http://www.iteris.com/cvria/html/applications/applications.html. Accessed July 6, 2016.

Phase	Definition
Plan	This phase consists of developing processes and procedures to support operations and future expansion of ITS technologies. Upkeep may be performed by a combination of one or more project partners or contracting with a third party.
Design	This phase lays the framework for project implementation. It is comprised of all systems engineering and design aspects prior to project implementation. The key component is documentation. Design documents are needed for successful project execution and typically include: • concept of operations • high-level requirements • detailed requirements • high-level design • detailed design • operations and maintenance plans Documentation provides structure and understanding for project implementation, traces project to initial goals and objectives, and provides a point of reference for testing and validating project outcomes.
Construct	This phase uses the documents prepared in the design phase to construct and implement the ITS project. Tasks include developing and installing equipment, hardware and software; and integrating with existing systems.
Maintain and Operate	Maintenance includes hardware and software upkeep. Maintenance roles include repairing equipment outages, routine testing to ensure proper functioning, and replacement of equipment subcomponents. Operations includes tasks related to operating ITS equipment after implementation. This includes training technical or information technology staff and understanding any warranties, licenses, or registration agreements with vendors.
Integrate and Develop	Continue to seek ways to integrate new software and applications to improve operations such as automating performance measures.

5.2 Regional Traffic Control

Regional traffic control targets ways to improve communications, traffic signal operations, and network surveillance throughout the roadway network.

The Portland metropolitan area has taken a unique approach to managing traffic signals for a major metropolitan area. Based on a long history of working together and sharing the same local traffic signal hardware and software, the region has jointly selected and implemented a common central traffic signal system. This common central signal system provides the region with the unique opportunity to share resources required to manage and operate the region's traffic signals. The common system also supports back-up servers at separate physical locations in the region, and supports shared control of traffic signal operations for special events or unplanned incidents.

REGIONAL TRAFFIC CONTROL

Current ITS Applications

Regional Traffic Operations

- The City of Portland maintains and operates the shared regional central traffic signal system server and the region jointly operates and maintains the communications infrastructure to support traffic signal communications.
- The ODOT Traffic Management Operations Center operates 24 hours a day, seven days a week. The City of Portland TOC can provide backup functions for the ODOT TMOC. About 50% of the regions traffic signal controllers have been upgraded from 170s to 2070s.
- Some agencies in the region (e.g. Washington County, Clackamas County) have workstation-based TOCs that can be operated on an as-needed basis, typically during regular business hours.
- Several adaptive signal timing systems operate across the region (Gresham, Portland, ODOT, Clackamas County, and Washington County)
- ODOT is in the process of acquiring a new central signal system.
- ODOT maintains and operates ramp metering on freeways.
- Several agencies maintain and operate emergency vehicle preemption, transit signal priority, and dynamic roadway warnings.
- The City of Portland also operates freight signal priority/extension, and Washington County is in the process of installing it at select traffic signals.

Communications

- The region has a widespread communications network, which mostly uses fiber optic cable (see ITS Communications Plan for more information and future development plans).
- Communications throughout the region are IP based.
- Remote communications to TransSuite is supported to Multnomah County, City of Gresham, ODOT, Clackamas County, Washington County, City of Beaverton, and City of Lake Oswego; City of Hillsboro is actively working to enable access.
- The Cooperative Telecommunications Infrastructure Committee (CTIC) actively orchestrates

REGIONAL TRAFFIC CONTROL

agreements between agencies to share communication resources.

Network Surveillance

- Cameras and detection systems are widespread across the region and collect a variety of data (volume, speed, occupancy, and vehicle classification).
- The City of Portland TOC shares video images and camera control with ODOT.
- Agencies have the ability to view cameras operated by other agencies (requires a phone call if non-owner agency is requesting a different camera angle).
- Cameras in City of Wilsonville were recently upgraded to high definition (HD) full access video with shared access to Clackamas County.
- Clackamas County uses Genetech for video control and ODOT uses Chameleon.

Bicycle and Pedestrian Travel Management

- Bicycle detection operates at some signalized intersections.
- Bicycle specific traffic signal heads and timing are installed at various intersections.
- Pedestrian countdown signals operate across the region.

Other

- A variable speed system operates on OR 217 that uses both weather and congestion information to vary appropriate posted speeds. A similar system operates on I-5 and I-405 in downtown Portland using congestion information only.
- Collection of travel data has expanded to crowdsource methods such as GPS devices in smart phones.
- City of Portland and Port of Portland provide ITS devices to support electronic payment options for garage and on-street parking.
- City of Portland recently integrated a mobile app that allows travelers to pay for parking in Washington Park.
- The Port of Portland provides parking wayfinding by level in the short-term parking garage using a dynamic message sign at the entry of the garage that lists the status of each level as open or full and using dynamic message signs at the entry to each level that indicate whether the level is open or full
- RWIS data is being shared between Clackamas County and ODOT.

Current Issues/Needs

Regional Traffic Signal Operations

- Not all agencies have access to the central signal system (Ex: Cities of Hillsboro, Wilsonville, Oregon City, West Linn, Milwaukie).
- Some of the region's traffic signal controllers are outdated.
- Back-up support between ODOT and City of Portland (possibly other agencies) needs to be coordinated.

REGIONAL TRAFFIC CONTROL

- Region has shared control of traffic signal systems with multiple systems operating.

Communications

- Not all field devices are connected to a central communications center.
- Communications are still needed along some key corridors.
- Redundancy is needed for the communications network.
- IP-based communications raise Internet security concerns.

Network Surveillance

- The region needs expanded network surveillance coverage and possibly shared control agreements between agencies.

Bicycle and Pedestrian Travel Management

- There is limited data collection for pedestrians and bicyclists.
- There are limited performance measures processed for pedestrians and bicyclists.

Future Applications and Visions

Coordinate between agencies	Automate systems and pursue connected vehicle applications	Monitor Performance
• Expand communications and improve communication redundancy *(see ITS Communications Plan).* • Connect agencies to the central signal server if not yet connected (City of Hillsboro, Wilsonville, Oregon City, West Linn, Milwaukie) • Create formal agreements with partner agencies for shared control of traffic signal systems. • Expand network monitoring systems and create agreements/permissions for partner agencies to operate cameras from partner agencies in the region (viewing capabilities exist). • Integrate freeway and surface street systems so that traffic management is coordinated between the	• Expand adaptive signal systems where appropriate • Expand traffic signal system capabilities: upgrade traffic signal controllers to advanced traffic signal controllers (ATCs), implement adaptive signal systems, freight signal extension, transit signal priority, and automated bicycle and pedestrian detection where appropriate. • Expand ramp meter capabilities and bypass options for transit, freight, or other select vehicles. • Implement automated notification and safety measures for blockage detection at heavy rail crossings.	• Expand the locations where bicycle and pedestrian data is collected. • Automate traffic signal performance measures (especially arrival on green and split monitoring reports) to assess and improve operations.

REGIONAL TRAFFIC CONTROL		
two systems where they interface.		

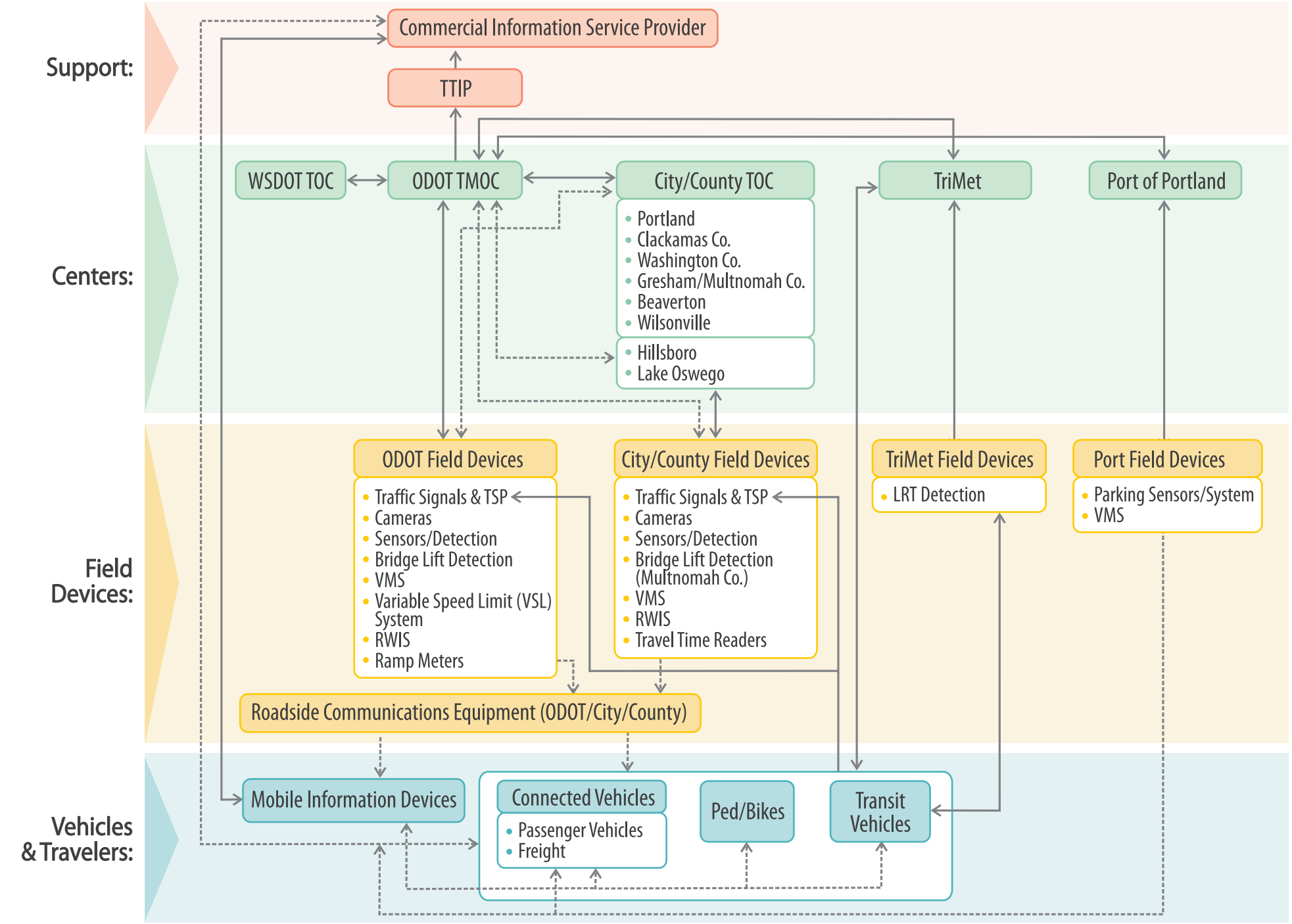
5.2.1 Potential Connected Vehicle Applications

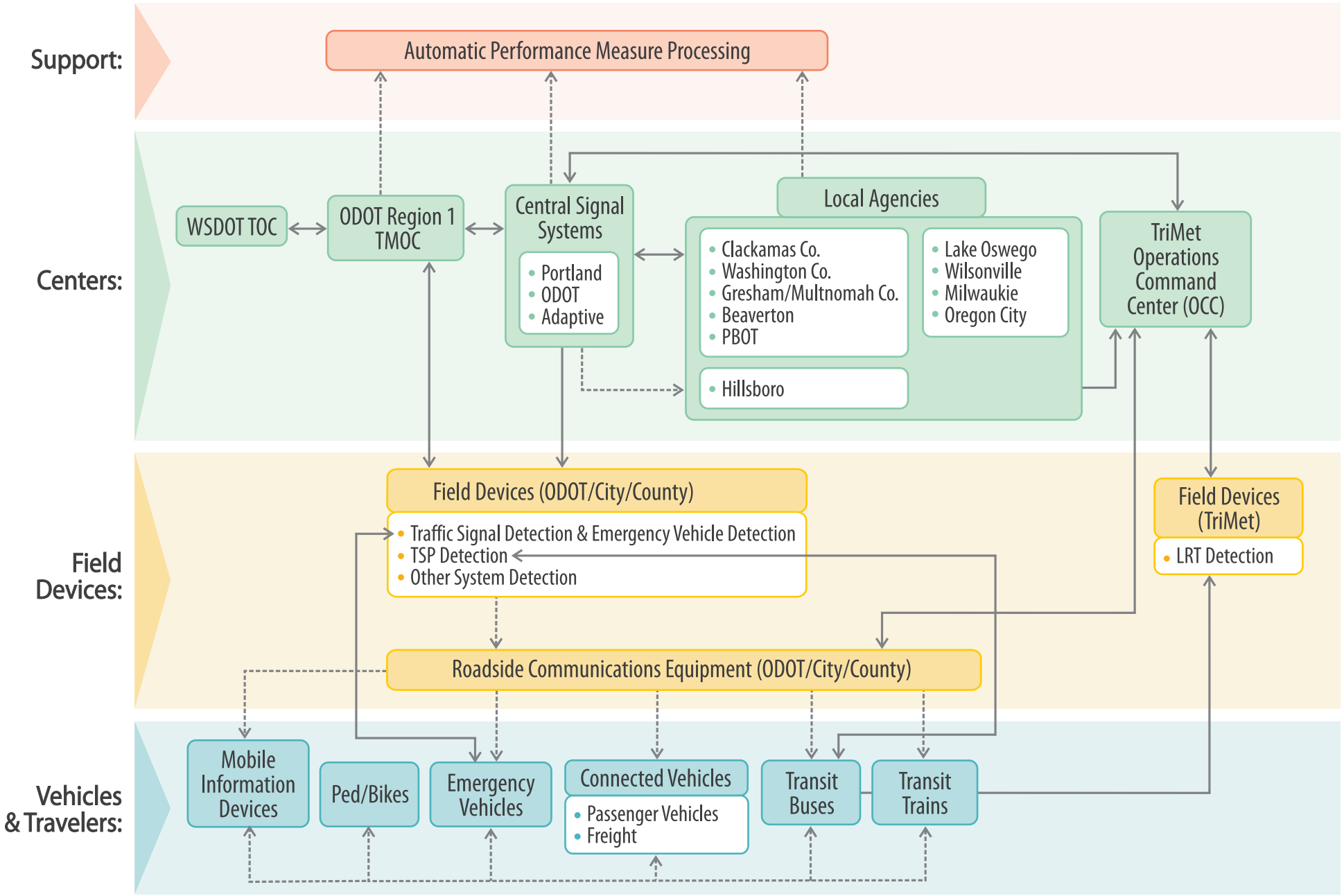
The CVRIA lists several applications that apply to regional traffic control. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Intelligent Traffic Signal System** – Use vehicle location and movement information for both connected vehicles and infrastructure measurement for non-equipped vehicles to improve traffic signal operations.
- **Freight Signal Priority** – Provide traffic signal priority for freight vehicles using either roadside detection equipment or connected vehicle technologies.
- **Pedestrian Mobility** – Improve roadside detection of pedestrians and integrate mobile devices to detect pedestrians and request a crosswalk phase. This application can also be used to provide priorities for pedestrians with disabilities or needs for longer crossing times.
- **Pedestrian in Signalized Crosswalk Warning** – Provide notification to vehicles, either through infrastructure detection or from mobile devices, when pedestrians are present in a crosswalk.
- **Variable Speed Limits for Weather-Responsive Traffic Management** – Use road weather information from connected vehicles to determine appropriate safe driving speed.
- **Integrated Corridor Management Decision Support System** (Eco-focused) – Use real-time sensors to determine operational decisions that are environmentally beneficial to the corridor.
- **Traffic Signal Timing** (Eco-focused) – Optimize traffic signal timing to maximize throughput, minimize vehicle stops, and improve environmental performance.
- **Ramp Metering** (Eco-focused) – Collect traffic and environmental data from connected vehicles to determine appropriate metering rate.
- **Speed Harmonization** (Eco-focused) – Use sensors to determine appropriate driving speed for areas approaching congestion, incidents, or other special events that affect traffic flow. Vehicle on-board equipment can be used to monitor emissions and environmental factors used to determine appropriate variable speed.

5.2.2 Operational Concept Graphic

Figure 7 illustrates the operational concept for regional traffic control within the Portland metropolitan area. For simplicity, the city and county field devices and traffic management centers are grouped together because they perform similar functions. Some of the flows depicted in the graphic are existing (solid lines) and others are planned or future (dashed lines). The operational concept specific to regional traffic signal control is provided in Figure 8.


Support:
Commercial Information Service Provider
TTIP
Centers:
WSDOT TOC
ODOT TMOC
City/County TOC
Portland
Clackamas Co.
Washington Co.
Gresham/Multnomah Co.
Beaverton
Wilsonville
Hillsboro
Lake Oswego
TriMet
Port of Portland
Field Devices:
ODOT Field Devices
Traffic Signals & TSP
Cameras
Sensors/Detection
Bridge Lift Detection
VMS
Variable Speed Limit (VSL) System
RWIS
Ramp Meters
City/County Field Devices
Traffic Signals & TSP
Cameras
Sensors/Detection
Bridge Lift Detection (Multnomah Co.)
VMS
RWIS
Travel Time Readers
TriMet Field Devices
LRT Detection
Port Field Devices
Parking Sensors/System
VMS
Roadside Communications Equipment (ODOT/City/County)
Vehicles & Travelers:
Mobile Information Devices
Connected Vehicles
Passenger Vehicles
Freight
Ped/Bikes
Transit Vehicles
DKS
Existing Information Flow
Future Information Flow
Regional Traffic Control
Operational Concept
7
figure



DKS

Existing Information Flow

Future Information Flow

Traffic Signal System *Operational Concept*

8 *figure*

5.2.4 Stakeholder Roles and Responsibilities

Agencies in the Portland metropolitan area are actively working together to share traffic information and control to support a regional traffic management and control strategy. A key to supporting this regional control strategy will be the ongoing maintenance and operations of the communications networks that support information sharing between centers and communications to field devices. The shared central traffic signal system is one example of the need for a robust and redundant communications network. All agencies using the system will need reliable communications to support the sharing of traffic signal system data and in some cases control of traffic signal timings. Stakeholder roles and responsibilities are shown in Table 9 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Key stakeholders include:

- City of Portland
- Clackamas County
- Multnomah County
- ODOT
- Other local agencies (Beaverton, Gresham, Hillsboro, Lake Oswego, Wilsonville)
- Port of Portland
- TriMet
- Washington County
- WSDOT

Table 9: Regional Traffic Control Roles and Responsibilities

Roles and Responsibilities	Stakeholders							
	ODOT	City of Portland	Clackamas Co.	Wash Co	Local Agencies*	Port of Portland	TriMet	WSDOT
PLAN								
Contribute to planning for field devices, communications, and interagency agreements in the Portland Metropolitan area region.								
Contribute to planning for a regional traffic management system to support all field devices, except traffic signals, using common protocol.								
DESIGN								
Design ITS traffic control field devices on agency facilities consistent with the central traffic signal system, and regional video monitoring systems and ITS standards.								
Design future locations for fiber optic communications.								
CONSTRUCT								
Construct and install ITS traffic control field devices on agency facilities consistent with regional traffic management systems and standard protocols.								
Install upgraded traffic signals and other ITS field devices.	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F
Expand communications infrastructure for optimal redundancy and connections (center-to-center and center-to-field).								
MAINTAIN/OPERATE								
Maintain and operate traffic control field devices on agency roadways.								
Maintain and operate the region's central traffic signal system (currently a TransSuite server at PBOT)								
Maintain and operate the remote connection to PBOT's central signal system.								
Maintain and operate TOCs within agency.								
Update signal timings on a routine basis.								
Update ramp meter timings on a routine basis.								
Maintain and operate emergency vehicle preemption								
Maintain and operate variable speed systems.								
Maintain and operate adaptive signal timing systems.								
Maintain and operate freight signal priority/extension systems								

Roles and Responsibilities	Stakeholders							
	ODOT	City of Portland	Clackamas Co.	Wash Co	Local Agencies*	Port of Portland	TriMet	WSDOT
Maintain and operate transit signal priority equipment.								
Maintain and operate ITS devices for parking systems (payment and/or occupancy information)								
INTEGRATE AND DEVELOP								
Implement interfaces between ITS field devices and/or systems using ITS standards.								
Implement software management systems to support video monitoring, message signs, and count stations.								
Integrate the Portland regional traffic signal system (currently using TransSuite) with the newly procured ODOT central signal system (Intelight)								
Automate traffic signal performance measures.								
Automate system performance monitoring							P/F	
Develop agreements between agencies to provide back-up (after hours) TOC support								
Integrate freeway and surface street system to coordinate traffic management between the two systems.								

*Local agencies include: City of Beaverton, City of Gresham, City of Hillsboro, City of Lake Oswego, Multnomah County, and Wilsonville

5.3 Traveler Information

Traveler information strategies provide travelers with real-time information about travel conditions including delays, incidents, weather, travel times, emergencies, and alternate routes. This allows travelers to make choices about departure times, modes, routes, and destinations in order for more efficient roadway use.

The traveler information disseminated includes roadway conditions, closure and detour information, special event information, bridge lift information, incident information, public transportation information, roadway maintenance and construction information, and emergency alerts and driver advisories. A variety of devices may be used to provide this information to travelers including dynamic message signs, phones, websites, mobile information devices, kiosks, or other in-vehicle devices.

TRAVELER INFORMATION
Current ITS Applications
• Camera images connect to TripCheck from: ODOT, City of Portland, Washington Co, Clackamas Co, and WSDOT cameras. • Agencies can use TripCheck Local Entry (TLE) to enter information about construction or other events that are then posted to TripCheck. • TripCheck includes information about maintenance activities (if entered by agencies), incidents, VMS information, and expected delays. • WAZE is integrated with TripCheck. • VMSs are installed along freeways and key arterials around the region and some provide travel time estimates for different routes. • Coordination occurs between ODOT and WSDOT for I-5, I-84, and I-205 travel time information displayed on VMSs. • Real-time parking availability is displayed by SmartPark garages and Port of Portland facilities. • Multnomah County maintains real-time bridge lift traveler information via a smartphone app as well as through news media outlets. • TriMet's Trip Planner helps plan trips incorporating transit, walking, and bicycling. The website and apps provide real-time arrival information and help plan multi-modal trips. • The City of Wilsonville provides static and real-time route information for their SMART transit services on their website.
Current Issues/Needs
• Improve access and use of the TripCheck Local Entry tool. • Create a more user-friendly Bridge lift app, allowing the user to specify when they want to receive notifications. • Coordinate with private sector app developers to route traffic through neighborhood streets during incidents or construction activities.
Future Applications and Vision

TRAVELER INFORMATION	
Share data using open portal and foster public private partnerships	**Integrate Multimodal Information**
• Enhance TripCheck Traveler Information Portal (TTIP) and the local entry tool so that data can be shared through an open data platform (ODP) that public and private entities can easily access. Note - project is currently underway to identify improvements. • Foster the relationship with commercial information service providers (such as WAZE, INRIX, Google, and others) to provide real-time traveler information. In the future it is likely that vehicles will have a direct interface to traveler information.	• Develop the Open Trip Planner to include Shared Use Mobility (SUM) partners such as Lyft or Uber (see Public Transportation section) • Improve traveler information associated with the Port of Portland terminals such as rail blockages and truck queuing at Terminal 6. • Improve traveler information for freight drivers.

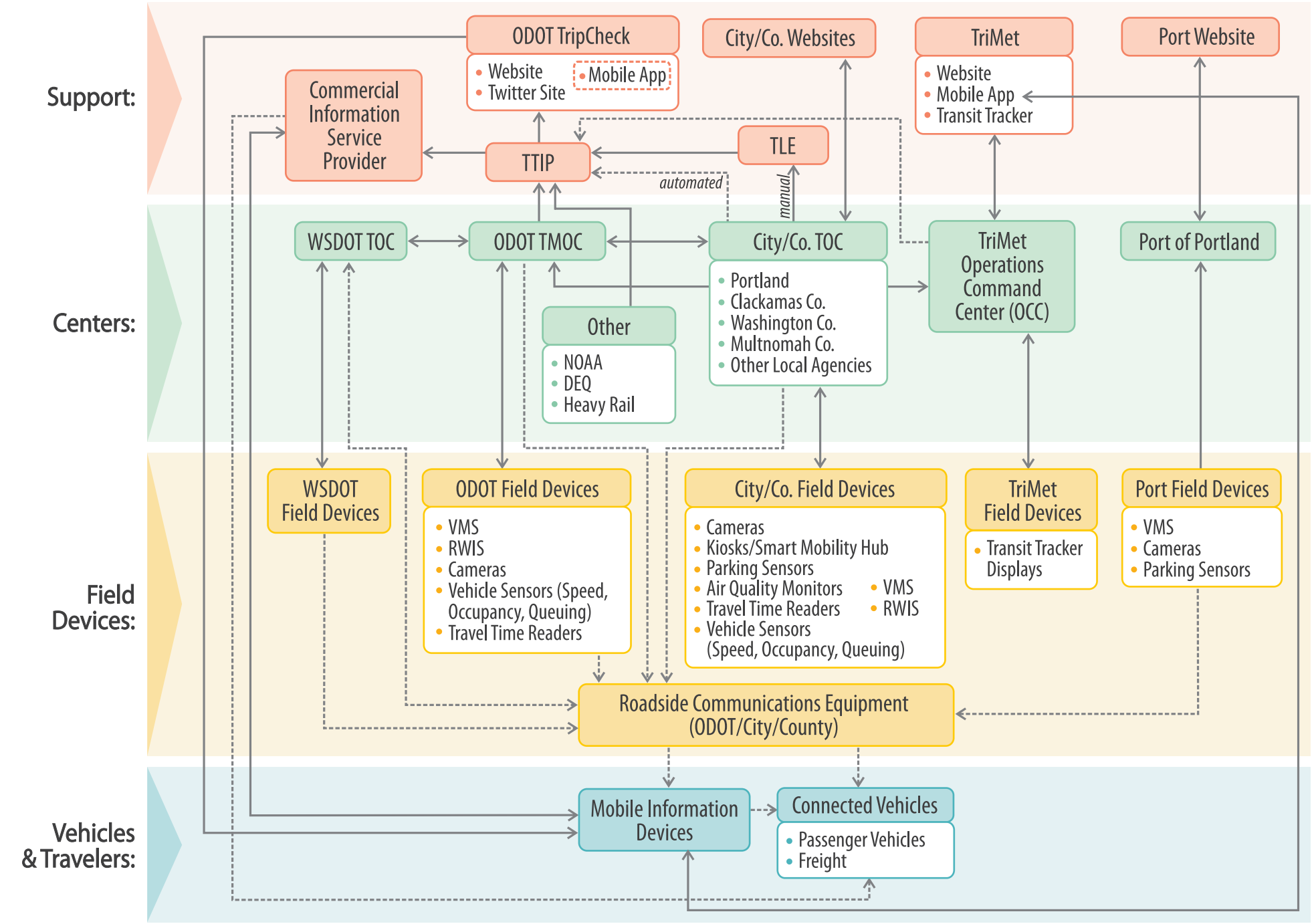
5.3.1 Potential Connected Vehicle Applications

The CVRIA lists several applications that apply to traveler information. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Advanced Traveler Information Systems** – This application includes a broad range of collecting, aggregating, and disseminating transportation information from traffic, transit, road weather, work zones, and connected vehicle related data.
- **Traveler Information-Smart Parking** – Provide drivers with real-time parking space availability through use of connected vehicle technology and roadside detection.
- **Curve Speed Warning** – Use connected vehicle technology to warn the driver of the appropriate speed for the upcoming curve. This may also include additional warning actions if the actual speed through the curve exceeds the recommended speed.
- **Dynamic Eco-Routing** (Eco-based) – Use connected vehicle technology to determine the most eco-friendly route to minimize fuel and emissions.

5.3.2 Operational Concept Graphic

The flow of traveler information is shown in Figure 9. For simplicity, the city and county field devices and traffic management centers have been grouped together because they perform similar functions. Some of the flows depicted in the graphic are existing (solid lines) and others are planned or future (dashed lines).



DKS

Existing Information Flow

Future Information Flow

Traveler Information
Operational Concept

9 *figure*

5.3.4 Stakeholders Roles and Responsibilities

The key responsibility of regional agencies that provide traveler information is to operate and maintain user interfaces that are easily accessible and provide current, up-to-date traveler information. Removing outdated information when it is no longer applicable is an equally important responsibility. For example, lane closure and delay information on TripCheck and VMS should be removed as soon as the incident is clear and traffic flow has returned to normal conditions. It is also the responsibility of regional agencies to coordinate their information dissemination. Stakeholder roles and responsibilities are shown in Table 10 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Key stakeholders include:

- City of Portland
- Clackamas County
- Commercial Information Service Provider
- Multnomah County
- ODOT
- Other local agencies (Beaverton, Gresham, Hillsboro, Lake Oswego, Wilsonville)
- Port of Portland
- TriMet
- Washington County
- WSDOT

Table 10: Traveler Information Roles and Responsibilities

Roles and Responsibilities	Stakeholders									
	ODOT	City of Portland	Clackamas County	Washington County	Port of Portland	TriMet	Multnomah County	Other local agencies*	WSDOT	Commercial Information Service Provider
PLAN										
Participate in developing interagency agreements among agencies that provide traveler information in the Portland-Vancouver region.										
Monitor direction of traveler information industry and tailor traveler information for devices most commonly used by the public.										
DESIGN										
Design traveler information projects.										
Provide information in design of region-wide traveler information projects.										
CONSTRUCT										
Construct/install new ITS equipment (e.g. cameras, dynamic message signs, count stations, communications infrastructure) to support traveler information.										
MAINTAIN/OPERATE										
Maintain and operate the TripCheck system (cameras, travel times, weather, construction, etc.)										
Maintain and operate agency-owned ITS equipment that supports traveler information.										
Update information on traveler information systems in a timely manner.	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	
Maintain and operate transit devices/systems that provide real-time transit information										
Maintain and operate real-time parking information.										
Maintain and operate real-time bridge lift										

Roles and Responsibilities	Stakeholders									
	ODOT	City of Portland	Clackamas County	Washington County	Port of Portland	TriMet	Multnomah County	Other local agencies*	WSDOT	Commercial Information Service Provider
information systems.										
INTEGRATE AND DEVELOP										
Improve the TripCheck Local Entry (TLE) tool for local agencies to interface with TripCheck.	P/F									
Work with a third party vendor to process and distribute real-time traveler information.										
Develop and expand the Open Trip Planner to include Shared Use Mobility (SUM) partners such as Lyft and Uber.	P/F	P/F				P/F				P/F
Create an open data platform for public and private entities to share traveler information data.										

*Local agencies include: City of Beaverton, City of Gresham, City of Hillsboro, City of Lake Oswego, and Wilsonville

5.4 Incident Management

Incident management is key to the safe and efficient management of traffic on Portland area roadways. Studies show that 25 percent of congestion on US roadways is caused by traffic incidents, and for every minute that a freeway travel lane is blocked during a peak travel period, four minutes of travel delay results after the incident is cleared[15]. Traffic incidents are safety hazards for both responders and the traveling public, and their economic impact can be significant, which is why traffic incident management is a critical component of the transportation management system.

Incident management includes all of the roadway subsystems, communications, and agency coordination required to quickly and accurately identify incidents and implement a response that safely minimizes incident-related impacts such as delay to people and freight and negative environmental effects. The scenarios covered by this program area are broad in scope and include minor incidents on local streets to major region-wide emergencies that cross jurisdictional boundaries. Coordination is needed for both planned and unplanned events to increase agency awareness and work towards a common goal of improving the safety of the public and minimizing effects on traffic flow. Emergency agencies, traffic agencies, tow companies, and transit management agencies all contribute to the regional success of incident management.

INCIDENT MANAGEMENT
Current ITS Applications
• ODOT incident responders (previously called COMET) routinely patrol freeways in the Portland metropolitan region including I-5, I-405, I-205, I-84, US 26, and OR 217. The incident response vehicles are equipped with flat tire repair gear, gasoline, jumper cables, water, and other essentials for rescuing disabled vehicles and getting them on the road again. The vehicles are tracked with automated vehicle locators (AVL) and also have dynamic message signs mounted on them that can be used to display messages about an incident ahead. • Operators at the ODOT TMOC monitor state roadways using cameras and system detectors to detect when and where incidents occur or they use these devices to verify incidents reported by outside sources. • The Portland Traffic Incident Management (TIM) team meets regularly (began meeting in 2015). • Instant towing actively operates in the Portland region. Instant towing is when a tow is dispatched to a lane blocking incident as soon as dispatch is notified instead of waiting for on-scene confirmation. If the tow is cancelled within 10 minutes, the tow company is not paid and returns to the top of the tow rotation list. If the tow arrives on scene and a tow is not needed, the tow company still gets compensated for the tow. • Staged towing is implemented during weather events as needed. Staged towing places tow trucks at predetermined locations (near on-ramps and areas with frequent incidents during weather events) during severe weather events. The tow company is paid for their time, whether idle or responding to calls.

[15] *Benefits of Traffic Incident Management*. National Traffic Incident Management Coalition. 2006.

INCIDENT MANAGEMENT

- ODOT and Oregon State Police (OSP) signed a Mutual Assistance Agreement in 2008
- Corridor specific incident management plan developed for I-5/Barbur Blvd. As part of the plan, incident coordinated signal timing plans were developed for each of the scenarios and arterial dynamic message signs were installed at key locations along Barbur Boulevard to alert drivers of detours or locations where diverted vehicles could re-enter I-5 past the incident or once the incident is clear. However, the plan was not automated so execution is challenging.
- The Portland Dispatch Center Consortium (PDCC), which includes the seven regional 911 centers in the Portland-Vancouver area, developed a message broker that allows the exchange of emergency and incident information between agencies as well as integrates the computer-aided dispatch (CAD) systems used by the dispatch centers.

Statewide Initiatives:

- Updated the Oregon Traffic Incident Management Strategic Plan in 2015[16]
- Implementing a 90-minute clearance goals for all incidents
- Coordinating with the Oregon State Police (ODOT and OSP signed a Mutual Assistance Agreement in 2008).
- Tracking performance measures (roadway clearance time, incident clearance time, and roadway closure time)
- Implementing the Push, Pull, and Drag Program which teaches responders how to quickly and safety move a vehicle that is blocking traffic.
- Implemented National TIM responder training and trained almost 3,000 responders as of December 2015.

Current Issues/Needs

- Need to track secondary incidents
- Need to improve communication of on-scene information to tow companies
- Need to improve surveillance for some areas to better coordinate incident response

Future Applications and Visions

Improve safety	Monitor performance	Inform responders and travelers and coordinate between agencies
• Institute connected vehicle applications to improve the safety of emergency responders and the traveling public. • Implement situational software to improve management of incident scenes.	• Add performance measures: secondary crashes, incident responder struck-bys, and incident responder fatalities (see Oregon Statewide TIM Strategic Plan for additional performance measures to consider) • Improve incident record	• Improve photo sharing system so responders arrive at scene better informed and tow companies arrive with correct equipment. • Implement connected vehicle applications that alert drivers in time to use alternate routes

[16] Oregon Traffic Incident Management Strategic Plan. Prepared by DKS Associates with ODOT and OSP. December 23, 2015.

INCIDENT MANAGEMENT		
• Continue Portland TIM team meetings and incorporate after action reviews. • Improve interoperable communication procedures before, during, and after an incident. • Create interagency coordination agreements or integrated corridor management strategies *Note – the I-84 ICM project is currently underway.*	database • Evaluate incentivized towing. • Implement automated incident management plans that adjust signal timing as necessary during incidents.	• Provide incident information and transportation system impacts to travelers in a timely manner.

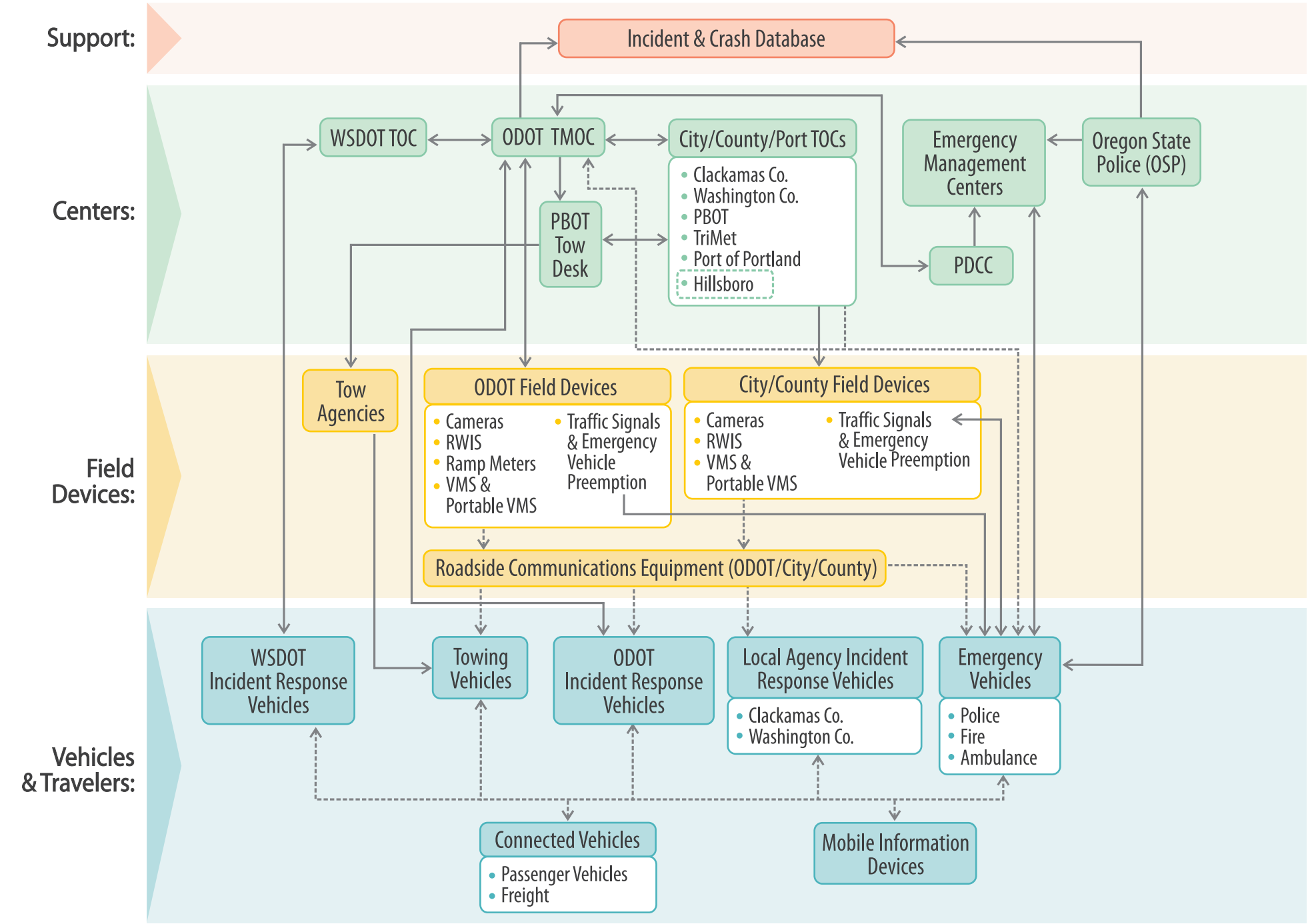
5.4.1 Potential Connected Vehicle Applications

The CVRIA lists several applications that apply to incident management. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Emergency Vehicle Preemption** – Advance the current use of emergency vehicle preemption to proactively clear queues as an emergency vehicle approaches and provides advance preemption notification to downstream signals. It also advances the transition back to normal traffic signal operations.
- **Incident Scene Work Zone Alerts for Drivers and Workers** – Provide incident related warnings, alerts, and guidance to drivers as they approach incidents (such as guidance on speed and merging). The application also provides notification to responders about approaching vehicles.
- **Vehicle Emergency Response** – Provide information to response vehicles from the vehicles involved in a crash such as whether seat belts were in use, air bag deployment, and information about the vehicle's engine that could affect the response.

5.4.2 Operational Concept Graphic

Figure 10 shows the operational concept and information flows for traffic incident management. For simplicity, the city and county field devices and traffic management centers have been grouped together because they perform similar functions. Some of the flows depicted in the graphic are existing (solid lines) and others are planned or future (dashed lines).



DKS

Existing Information Flow

Future Information Flow

Incident Management
Operational Concept

10 *figure*

5.4.4 Stakeholder Roles and Responsibilities

Incident management requires a broad range of agency coordination at many different levels. Each agency has the responsibility to install, operate and maintain individual systems that will contribute to the overall management of the regional traffic system and also to coordinate with other appropriate agencies by sharing information and controlling field devices and systems as appropriate. Detailed roles and responsibilities for key stakeholders are included in
Table 11 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Key stakeholders include:

- City of Portland
- Clackamas County
- Multnomah County
- ODOT
- Oregon State Police
- Other local agencies (Beaverton, Gresham, Hillsboro, Lake Oswego, Wilsonville)
- Port of Portland
- Portland Dispatch Center Consortium
- Tow Operators
- TriMet
- Washington County
- WSDOT

Table 11: Incident Management Roles and Responsibilities

Roles and Responsibilities	Stakeholders										
	OSP	ODOT	Wash. & Clack. Co	Mult. Co	City of Portland	TriMet	WSDOT	Port of Portland	Tow Agencies	Other local agencies*	Portland Dispatch Center Consortium
PLAN											
Participate in regional incident management planning and the development of interagency agreements for coordinated incident response.											
DESIGN											
Design field devices that support incident management (signal preemption, network surveillance).											
Design communications that facilitate sharing video and other necessary data to effectively respond to an incident.											
Design fleet devices/systems (bus probes, video) that support incident management.						P/F					
CONSTRUCT											
Construct field devices to support incident management.											
Construct communications to support center-to-center communications.											
Construct field equipment in key locations to support detours and alternate route notifications.											
MAINTAIN/OPERATE											
Maintain traffic signal preemption for emergency vehicles.											
Maintain field equipment providing video and data that can assist in traffic incident management.											
Participate in incident response as needed and as defined by interagency agreements.											
Operate systems and ITS field devices that alert travelers of detours or alternate routes.											

Roles and Responsibilities	Stakeholders										
	OSP	ODOT	Wash. & Clack. Co	Mult. Co	City of Portland	TriMet	WSDOT	Port of Portland	Tow Agencies	Other local agencies*	Portland Dispatch Center Consortium
Develop incident management signal timing plans.											
Maintain center-to-center connections required for coordination with local emergency management.											
Maintain and operate incident response vehicles.											
Maintain dedicated incident response staff.											
INTEGRATE AND DEVELOP											
Develop alternate evacuation routes.											
Develop ways to integrate connected vehicle technology with incident response.											
Develop ways to add incident-related performance measures to the crash database system (secondary crashes, incident responder struck-bys, incident responder fatalities).											
Integrate situational software with incident response.											
Develop methods to share photos of an incident scene with responders prior to arrival.											
Integrate connected vehicle applications to improve traveler and responder safety during incident response.											

*Other local agencies include: City of Beaverton, City of Gresham, City of Hillsboro, City of Lake Oswego, and Wilsonville

5.5 Maintenance and Construction Management

Motor vehicle crashes in work zones declined in recent years, but still hover around 70,000 per year. About one quarter of the crashes result in injuries, while less than one percent result in fatalities. In 2013 there were 579 fatalities due to work zone crashes, out of which 47 percent occurred on urban arterials and interstates.[17] The use of ITS applications will help make work zones safer for maintenance staff and travelers as well as improve system efficiencies.

The maintenance and construction management program area includes the integration and coordination of roadways, associated infrastructure, and available resources for the purpose of monitoring, operating, maintaining, improving, and managing the physical condition of the roadway. Key components of this program area include roadway maintenance management, maintenance vehicle fleet management, and work zone management and safety.

MAINTENANCE AND CONSTRUCTION MANAGEMENT
Current ITS Applications
• TripCheck Local Entry provides a portal for local agencies to enter information about construction and maintenance activities. • RWIS stations collect road weather information to support resource allocation decisions. • Road weather advisories are posted through TripCheck. • Traffic signals and ITS field devices connected to the central signal system can produce an alarm with equipment fails. • Some maintenance fleet vehicles have GPS tracking capabilities. • Some equipment sends automated alarms to operators when the equipment fails • Construction activities are typically performed by private contractors based on public agency-approved design plans, specifications, and special provisions.
Current Issues/Needs
• Implement fleet telematics. • Implement automated asset management techniques. • Implement work zone safety improvements. • Automate monitoring of field equipment for failures or malfunctioning equipment. • Improve process for informing public about upcoming and ongoing construction and maintenance activities. • Provide increased monitoring of work zones and address safety and enforcement issues such as speeding. • Coordinate between agencies during construction or maintenance activities to achieve the “dig once” philosophy. • Need to improve TLE system that allows agencies to post information to TripCheck (project is underway). • Challenging to coordinate utility related construction activities.

[17] Facts and Statistics. US DOT Federal Highway Administration. Website accessed August 24, 2016: http://www.ops.fhwa.dot.gov/wz/resources/facts_stats/safety.htm.

MAINTENANCE AND CONSTRUCTION MANAGEMENT		
Future Applications and Vision		
Institute enhanced and connected work zones	**Automate asset management**	**Coordinate between agencies and inform travelers**
• Improve safety for travelers and maintenance staff through work zones with connected vehicle applications such as intrusion detectors to alert workers of vehicles entering prohibited areas • Implement queue warning approaching work zones • Implement automated speed enforcement through work zones • Implement variable speeds through work zones • Use data to manage work zone impacts	• Equip fleet vehicles with telematics and automatic vehicle location (AVL) devices. Telematics can monitor both vehicle maintenance and vehicle activities (such as snow plow, pesticide spray, sanding, etc.). Maintenance vehicles can also be equipped with weather monitoring devices. • Expand automated notification to maintenance staff when equipment fails.	• Inform travelers of anticipated travel times through and around work zones. • Improve communication between agencies to ensure a "dig once" philosophy when work is required. • Improve coordination between agencies to adjust signal timing and traffic operations when construction or maintenance impacts a nearby facility belonging to another agency.

Clackamas County and Multnomah County have also expressed an interest in the possible deployment of flood/slide monitoring systems in areas that persistently call for the closure of roads. For example, such systems may alert the County of a flood or slide and post messages on dynamic message signs routing vehicles onto detour routes.

5.5.1 Potential Connected Vehicle Applications

The CVRIA lists several applications that apply to maintenance and construction management. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Warnings about Hazards in a Work Zone** – Warn workers in a work zone if equipment is operating in unsafe conditions.
- **Warnings about Upcoming Work Zone** – Provide information to drivers approaching a work zone about conditions that affect safe travel such as obstructions in the lane, lane shifts, speed changes, or other activity that requires a vehicle or driver to react.
- **Infrastructure Management** – Monitors the performance of the connected vehicle infrastructure.
- **Incident Scene Work Zone Alerts for Drivers and Workers** (see Incident Management section)

5.5.2 Operational Concept Graphic

Figure 11 illustrates the operational concept for maintenance and construction management within the Portland metropolitan area. For simplicity, the city and county field devices and traffic management centers have been grouped together because they perform similar functions. Some of the flows depicted in the graphic are existing (solid lines) and others are planned or future (dashed lines).

5.5.3 Stakeholder Roles and Responsibilities

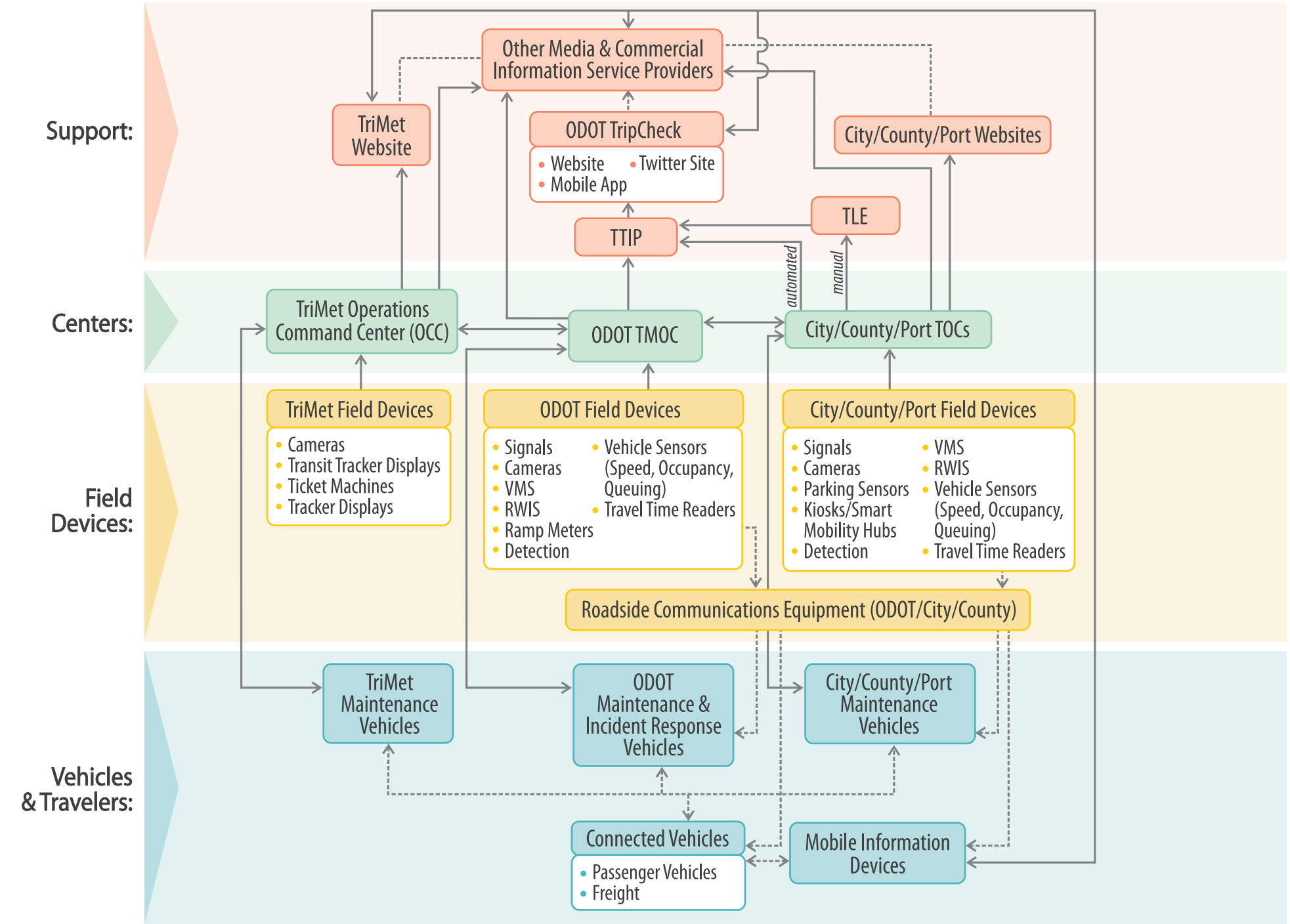
Maintenance and construction management demands a coordinated effort between traffic/transit management agencies, utility companies, and private contractors. Local agencies can provide information to travelers about planned maintenance and construction activities on ODOT's TripCheck website through the use of the TripCheck Local Entry (TLE) tool and TripCheck Traveler Information Portal (TTIP). TTIP is currently in the process of being enhanced to make it easier for local agencies to upload information to TripCheck.

State, county, and city public works departments will also be responsible for installing, operating and maintaining field devices and on-board equipment that will enhance maintenance and construction operations. Detailed roles and responsibilities for key stakeholders are shown in Table 12 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Key stakeholders include:

- City of Portland
- Clackamas County
- Multnomah County
- ODOT
- Other local agencies (Beaverton, Gresham, Hillsboro, Lake Oswego, Wilsonville)
- Port of Portland
- TriMet
- Washington County
- WSDOT



DKS

Existing Information Flow

Future Information Flow

Maintenance & Construction Management
Operational Concept

11 *figure*

Table 12: Maintenance and Construction Management Roles and Responsibilities

Roles and Responsibilities	Stakeholders								
	ODOT	City of Portland	Clackamas Co	Wash Co	Multnomah Co.	Port of Portland	TriMet	WSDOT	Other local agencies*
PLAN									
Participate in regional and statewide planning to provide construction related information (existing and planned) accessible to the public and operations personnel.									
DESIGN									
Design work zone safety system and requirements.									
Design field equipment that supports and improves maintenance and construction activities (road weather monitoring, pavement sensors, etc.).									
Design/implement automated asset management tools.									
CONSTRUCT									
Install agency field devices that support and improve maintenance and construction activities (road weather stations, pavement surface condition detection, vehicle detection status, traffic signal monitoring, etc.)									
Install AVL systems on agency maintenance vehicles.									
Install telematics on agency maintenance vehicles.									
MAINTAIN/OPERATE									
Maintain agency maintenance vehicles.									
Maintain agency field equipment related to maintenance and construction activities.									
Maintain information to travelers about planned and ongoing maintenance and construction activities.									
Manage work zone operations to enhance safety for all roadway users and maintenance personnel.									
Maintain access for local agencies to post maintenance and construction activities to TripCheck.									
Maintain ITS devices through an asset management database.									
INTEGRATE AND DEVELOP									
Integrate an automated method for local agencies to post maintenance and construction traveler information on TripCheck.	P/F								

Integrate connected vehicle applications with work zones to improve safety for all roadway users and workers.									

*Other local agencies include: City of Beaverton, City of Gresham, City of Hillsboro, City of Lake Oswego, and Wilsonville

5.6 Public Transportation Management

The public transportation management service area focuses on automating the operations, planning, and management functions of public transit systems. It monitors transit vehicle locations, identifies schedule deviations, interfaces with traffic signals, tracks passenger activities, manages personnel, monitors security, and provides traveler transit information to name a few functions.

PUBLIC TRANSPORTATION

Current ITS Applications

Key transit service providers include: TriMet (bus, paratransit, MAX, and WES), City of Portland (streetcar, and Aerial Tram), City of Wilsonvill SMART (bus)

TriMet

- TriMet incorporates advanced ITS technologies including:
  - communication systems
  - computer-aided dispatch (CAD) system and real-time transit tracking (automated vehicle location (AVL) capabilities)
  - security systems (cameras and alarms) - used at substations operations/dispatch centers, garages, transit centers, light rail platforms, and key transit stops for security surveillance.
  - connection to 911 CAD system
  - automated stop announcements
  - automated passenger counting (APC)
  - transit signal priority (TSP)
  - signal detection for light rail trains
  - data collection
  - electronic fare collection
  - trespasser detection camera on the Orange Line on the bridge from Naito Parkway to the South Waterfront
- Transit tracker displays are used at transit centers and key transit stops to display real-time arrival information. Ticket vending machines are used at light rail stops and transit centers for electronic fare purchases. These machines are outfitted with security alarms as are other transit facilities.
- TriMet utilizes a Maintenance Management Information System (MMIS) for their light rail trains and fixed-route buses, which is currently being overhauled, in part to advance communications with mobile devices. The MMIS currently tracks vehicle and equipment data. The system is used to identify both necessary preventative maintenance for equipment and vehicles as well as to identify equipment that may be failing but showing no outward signs. That data is regularly uploaded to the MMIS (not live streamed). The data is then analyzed and an operator is notified if maintenance is recommended or if the data shows equipment may be failing. Then the maintenance staff determines the appropriate action. The MMIS works with tablets that are used in the field by maintenance staff and the system is being upgraded to improve interaction with mobile devices.

PUBLIC TRANSPORTATION

- TriMet provides a bike storage options to for ease of combining transit and bicycle trips.

Streetcar

- Portland streetcar vehicles are GPS equipped and provide real time arrival information
- The City of Portland owns and operates the Streetcar system in downtown Portland. This system crosses paths with TriMet light rail lines and bus routes. The City utilizes one center in northwest Portland for operations and maintenance and employs a number of TriMet operators to run the Streetcar. NextBus, Incorporated uses GPS units on the Streetcar to predict arrival times and posts this information to dynamic message signs at Streetcar stops, the Streetcar website, the TriMet website, and mobile devices. TriMet's website provides both real-time streetcar arrival information as well as a link to the Streetcar's website under the transit tracker section of their website.

Trip Planning Resources

- Both TriMet and City of Portland Streetcar recently adopted mobile apps that allow users to buy transit fares on smartphones. The TriMet mobile fare app also includes a feature that allows users to see nearby Lyft and car2go vehicles in real-time.
- TriMet provides real-time multi-modal trip planning information on its website and mobile app, including bus, train, streetcar, bicycle, and walk. The TriMet trip planner website is integrated with streetcar information.

SMART

- The City of Wilsonville owns and operates the South Metro Area Rapid Transit (SMART) system that provides service within and to/from the City of Wilsonville using fixed-route buses and paratransit vehicles. SMART's services connect to TriMet in Portland (Commerce Circle, Tualatin Park and Ride, Barbur Boulevard Transit Center), to Cherriots in Salem (Salem Transit Center), and Canby Area Transit in Canby (Canby Transit Center). The SMART system recently introduced a mobile app (Spatial Positioning on Transit – SPOT) that provides riders with real-time arrival predictions for all buses, automated onboard announcements, and system alerts from the transit agency.

C-TRAN

- C-TRAN provides bus transit service within Clark County and provides commuter services between Clark County and downtown Portland, Lloyd District, and Marquam Hill.
- A bus rapid transit service (the VINE) will open in January 2017.
- C-TRAN is investigating shoulder running on I-205

Current Issues/Needs

- Need more multi-modal performance measure data
- Trip planning between TriMet and SMART not fully integrated
- Need to improve safety at transit stops
- Need to reduce conflict between transit vehicles and pedestrians/bicyclists

PUBLIC TRANSPORTATION		
Future Applications and Visions		
Enhance security* and implement connected vehicle and advanced technologies	**Support mobility on demand applications**	**Enhance Traveler Experience**
• Enable video streaming from on-board transit vehicle cameras during emergency situations. • Enhance security and monitoring at transit stations/stops. • Automate transit performance measurement and reports. • Coordinate cross route services and transfer times (in real-time). • Install sensors on transit vehicles to detect pedestrians and bicyclists.	• Expand the OpenTripPlanner (OTP) platform with shared use mobility modes and real time information. • Provide real-time comparisons of trip modes based on multiple measures. • Provide real-time bike share availability. • Support Transportation Network Companies (TNCs) for vehicle trip segments • Support enhanced. pedestrian and wheelchair accessibility information.	• Integrate the TriMet website and trip planner with SMART and C-TRAN. • Implement a one card or single mobile app payment system for all area transit and parking providers (note that the hop fastpass will begin in 2017 and work with TriMet, C-TRAN, and Portland Streetcar). • Develop a statewide Regional Trip Planner website that allows travelers to plan transit trips on a small-scale in metropolitan areas or on a larger scale by planning trips throughout the state that involve the use of a number of transit services.

* Note - TriMet is in the process of overhauling its CCTV system, replacing its current two vendor system with one vendor, Milestone. The upgrade will expand the functionality of the system and allow for live streaming of video via Wi-Fi or cellular communications during an emergency situation. The intent is to only use the streaming capabilities with law enforcement or other emergency responders. TriMet is also pursuing advanced video detection capabilities that could detect when packages or items were left unattended for a certain period of time and notify authorities.

5.6.1 Potential Connected Vehicle Applications

The CVRIA lists several applications that apply to public transportation management. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Transit Pedestrian Indication** – Use a pedestrian's mobile device to communicate with transit vehicles both alerting the transit diver about the presence of a pedestrian, as well as alerting the pedestrian about the incoming transit vehicle.
- **Integrated Multi-Modal Electronic Payment** – Use a common electronic payment system for transit, parking, road user charges (charges, taxes, tolls, fees, and fares), and other services requiring electronic payment. Note that both TriMet and City of Portland have mobile apps to buy transit tickets.

- **Transit Connection Protection** – Allow travelers to request a connection to another transit vehicle while en route and receive confirmation indicating whether the request is accepted.

Note: One connected vehicle application that is already partially implemented is Dynamic Transit Operations. This application allows travelers to request trips and obtain itineraries using mobile devices. The options provided to the traveler under the CVRIA application include multiple transportation modes. The TriMet Trip Planner currently incorporates transit, bicycle, and pedestrian modes.

5.6.2 Operational Concept Graphic

Figure 12 illustrates the operational concept and information flows for public transportation services within the Portland metropolitan area. For simplicity, the city and county field devices and traffic management centers have been grouped together because they perform similar functions. Some of the flows depicted in the graphic are existing (solid lines) and others are planned or future (dashed lines).

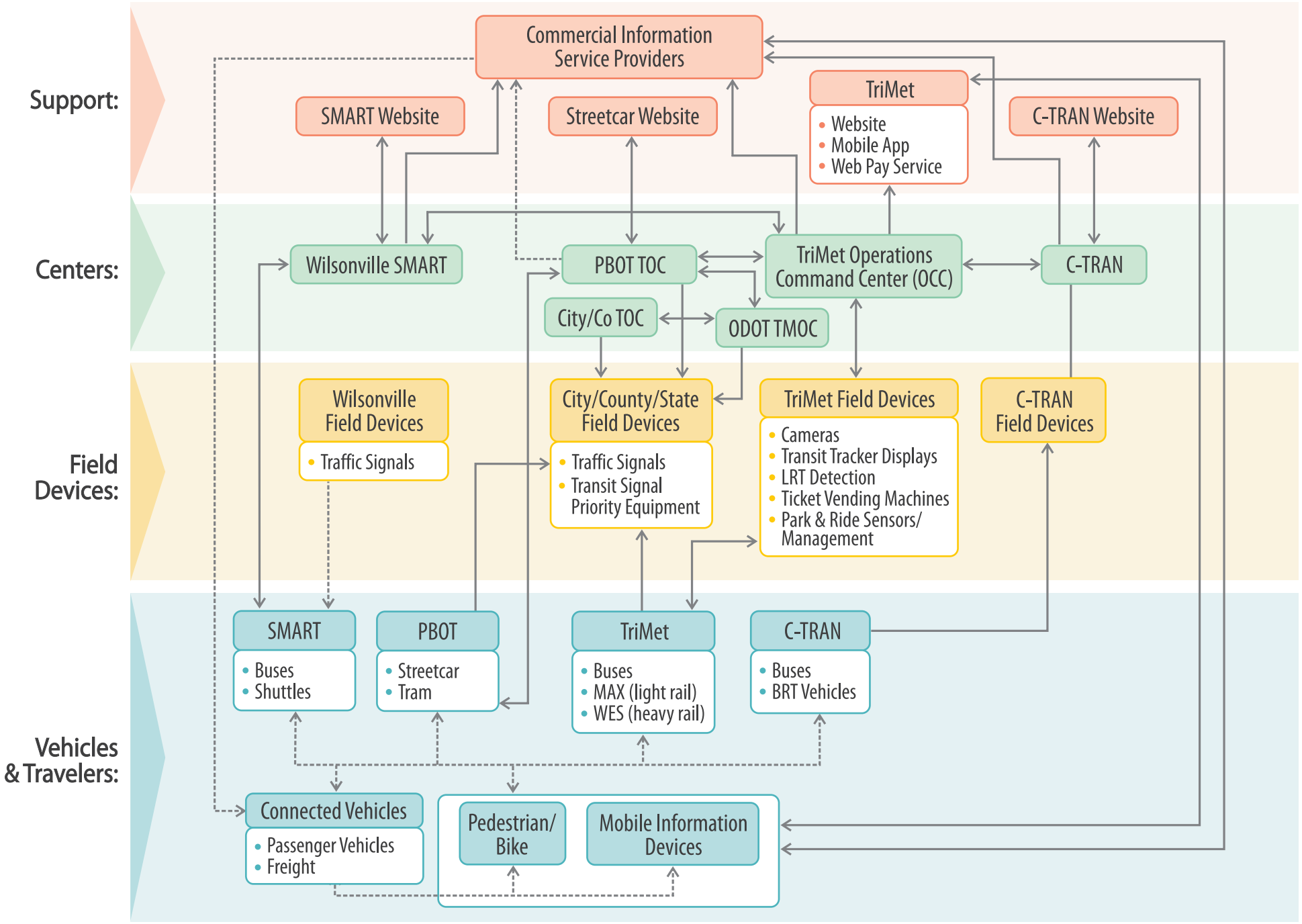
5.6.3 Stakeholder Roles and Responsibilities

TriMet, the City of Portland, and the City of Wilsonville are primarily responsible for the daily operation, maintenance, design and implementation of field devices and systems used to support their agencies' services. Additional coordination between TriMet and the traffic management agencies is required for the operations, maintenance, design and installation of transit signal priority devices and the exchange of roadway information that may influence the transit services, such as incidents, construction or weather information. Detailed roles and responsibilities for key stakeholders are shown in Table 13 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Key stakeholders include:

- City of Portland
- Clackamas County
- C-TRAN
- Multnomah County/City of Gresham
- ODOT
- TriMet
- WSDOT
- Wilsonville



DKS

Existing Information Flow

Future Information Flow

Public Transportation Management
Operational Concept

12 *figure*

Table 13: Public Transportation Roles and Responsibilities

Roles and Responsibilities	Stakeholders							
	TriMet	City of Portland	Clackamas Co	Multnomah Co/Gresham	ODOT	Washington Co	C-TRAN	Wilsonville
PLAN								
Coordinate with TriMet to plan future TSP routes and upgrades to add functionality to the TSP system.	■	■	■	■	■	■		
DESIGN								
Design ITS transit systems (e.g. surveillance, traveler information, electronic payment, on-board systems).	■	■					■	■
Design transit signal priority detection equipment for agency traffic signals.		■	■	■	■	■		■
CONSTRUCT								
Construct and implement ITS transit improvements on transit fleet and equipment including: video surveillance cameras, automated maintenance applications, electronic payment services, and traveler information systems.	■	■					■	■
Construct and implement transit signal priority installations on agency facilities.		■	■	■	■	■	■	■
Install video surveillance equipment on public transportation vehicles with the capability of live streaming.	P/F							
MAINTAIN/OPERATE								
Maintain and operate transit fleet vehicles and ITS devices (vehicles, TSP emitters, cameras, GPS, AVL, data collection devices, and other on-board ITS devices) .	■	■					■	■
Coordinate to identify potential improvements to operate and manage transit signal priority.	■	■	■	■	■	■		
Operate/manage dispatch for transit routes throughout the Portland metropolitan region.	■							
Operate/maintain dispatch for transit routes in the Wilsonville area.								■
Operate/manage dispatch for City of Portland streetcar and aerial tram.	■							
Monitor performance of transit signal priority inputs at traffic signals. Coordinate with TriMet on TSP performance evaluation.	■	■	■	■	■	■		

Roles and Responsibilities	Stakeholders							
	TriMet	City of Portland	Clackamas Co	Multnomah Co/Gresham	ODOT	Washington Co	C-TRAN	Wilsonville
Maintain and operate websites and/or apps that provide real-time transit information.	■	■					■	■
INTEGRATE AND DEVELOP								
Expand transit signal priority interfaces between TriMet buses and regional traffic signals.	■	■	■	■	■	■		
Participate in traffic signal system upgrades to support automated TSP performance monitoring.	■	■	■	■	■	■		
Implement interfaces between agency field devices and/or systems and transit equipment.	■				■		■	
Develop a single card or single app payment option.	■	■						
Integrate the TriMet system with SMART.	■							■
Develop and automate transit performance measurement reports.	■	■						■
Integrate technology on transit vehicles to detect pedestrians and bicyclists.	■							

5.7 Archived Data Management

The purpose of the data warehouse service area is to provide a centralized, electronic database that facilitates the collection, archiving, and sharing of information/data for public agencies within the region. This is used by many agencies in areas such as planning, design, safety, operations, and research.

ARCHIVED DATA MANAGEMENT
Current ITS Applications
Portland State University (PSU) houses the Portal[18], which serves as the regional data warehouse for the Portland-Vancouver metropolitan area. Portal data is accessible via the Internet. The Portal system currently archives the following information: Freeways (ODOT) • volume, speed, occupancy (ODOT, WSDOT) • Travel time (calculated based on speed) • Incident data (ODOT) • Vehicle length via ramp meters (ODOT) • Weigh-in-motion (WIM) (ODOT) • VMS and variable advisory speed (VAS) messages (ODOT) • Advanced Transportation Management System (ATMS) (ODOT) Arterials (ODOT, City of Portland, Washington County, and Clark County) • Travel times • Volumes • Traffic signals – detectors, volumes • Bicycle counts and pedestrian pushbutton activations (City of Portland) • TransSuite connection – viewing capabilities of all signals connected to TransSuite (measures of effectiveness and volumes) • VMS and VAS messages Transit (TriMet) • Ridership and on-time performance data including segment load, utilized capacity, and stop activity • General Transit Feed Specification (GTFS) schedule data • Note C-TRAN is also linked to Portal and provides similar data Other • National Oceanic and Atmospheric Administration (NOAA) and Oregon Department of Environmental Quality (DEQ) air quality data
Current Issues/Needs

- Need a data retention policy (what data to retain and for how long)
- Need data validation tools
- Need to expand data collection beyond City of Portland, ODOT, and Washington Co. facilities in the Portland metro region (note – Clark County, C-TRAN, and WSDOT both provide some data to Portal)

Future Applications and Vision

Expand data collection	*Automate data processing and develop advanced analytic tools*
• Expand Portal data collection beyond fixed sensors. • Expand data collection for bicycles and pedestrians. • Link RWIS data, crash data, bridge lift data, and construction data to Portal, which can be used to help understand anomalies in data and provide insight on how to improve operations during special conditions and events (note ODOT incident data is already linked to Portal). • Expand the system to include information from agencies beyond City of Portland, ODOT, Washington County, Clark County, WSDOT, and C-TRAN. • Expand Portal connections to outlying agencies not yet connected to the ODOT central system or TransSuite (once an agency is connected to either the ODOT system or TransSuite, they are linked to Portal). • Develop the capability to merge data sets	• Develop a data validation tool or algorithm to help verify the data is accurate and identify potential failed or malfunctioning detectors. • Develop and advance automated analytical planning tools for performance measurement, operational evaluation, asset management, regional planning activities, and financial decision making. • Integrate Portal data to produce automated performance measure reports that could meet new federal requirement such as MAP-21 • Integrate data from across modes and agencies (transit, arterial, freeway, etc.) and develop advanced analytics to improve the equity and safety of the road network. Examples include: integrating congestion data with transit arrival data; map intersections with higher rates of pedestrian crashes or safety concerns

5.7.1 Potential Connected Vehicle Applications

The CVRIA lists several applications that apply to archived data management. A non-exhaustive list of applications for the Portland region to consider as connected vehicle technology advances include:

- **Performance Monitoring and Planning** – Collect information from connected vehicles to support performance monitoring and data analysis for transportation planning, safety analysis, research, and other archived data uses.

5.7.2 Operational Concept Graphic

Figure 13 illustrates the operational concept and information flows for archived data management in the Portland metropolitan area. Unlike the other service areas, data flows are mainly from centers to Portal, and then out to Portal users, such as researchers and planners. The intent of Portal is for data archive purposes, not using data for real-time traffic operation decisions or traveler information, so there are no data flows to travelers or websites.

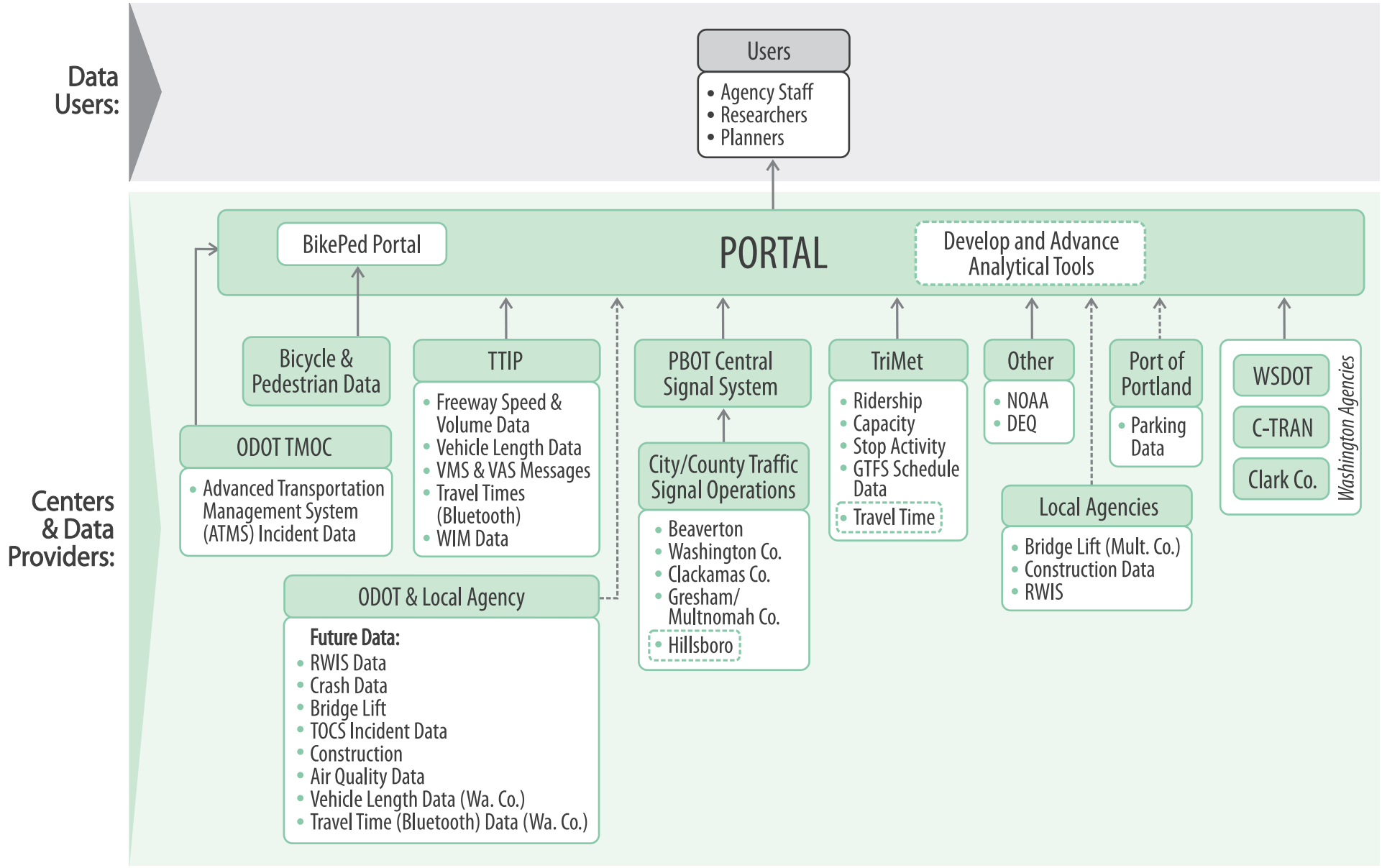
5.7.3 Stakeholder Roles and Responsibilities

Portland State University will lead the operations, maintenance, and expansion of the Portal regional data warehouse within the Portland metropolitan area. Each agency will participate in data exchange to/from the warehouse and create their corresponding user interface for sharing information. Detailed roles and responsibilities for key stakeholders are shown in Table 14 using the key shown below.

Status	Key	Description
Existing		Agency currently supports the identified responsibility and may expand services.
Planned/Funded	P/F	Agency does not currently support the identified responsibility, but there is a planned and funded project in the near-term that will be implemented.
Future		Agency does not currently support the identified responsibility, but is interested in pursuing projects in the area in the future. No funding identified.

Portland State University is the stakeholder that maintains the Portal database. Other stakeholders include:

- City of Beaverton
- City of Gresham
- City of Hillsboro
- City of Lake Oswego
- City of Portland
- Clackamas County
- Clark County
- C-Tran
- Multnomah County
- ODOT
- Other government agencies (NOAA, DEQ)
- Portland State University
- Port of Portland
- TriMet
- Washington County
- WSDOT



DKS

← Existing Information Flow
<----- Future Information Flow

Archived Data Management
Operational Concept

Table 14: Archived Data Management Roles and Responsibilities

Roles and Responsibilities	Stakeholders				
	Portland State University	ODOT	TriMet	Port of Portland	Other Local Agencies*
PLAN					
Participate in future plans for upgrades and expansions to the data warehouse interface and data input.	■	■	■	■	■
DESIGN					
Design projects that support automated data collection (system detectors, etc.) on agency facilities.		■	■	■	■
CONSTRUCT					
Construct communications network infrastructure to support data transfer to the data warehouse.		■	■	■	■
MAINTAIN/OPERATE					
Maintain and operate the Portal database.	■				
Maintain and operate agency devices and communication network infrastructure that provide data to Portal database.		■	■	■	■
Maintain and operate agency devices and communication network infrastructure that provide data to the agency data mart.			■	■	
INTEGRATE AND DEVELOP					
Integrate Portal data to produce automated performance measure reports.	■				
Provide ongoing input and recommendations to PSU on system interface from user perspective.		■	■	■	■
Develop ways to collect data beyond fixed point sensors.	■				
Expand data collected by Portal to include: RWIS data, crash data, incident data, bridge lift data (ODOT and Multnomah County), and construction data.	■				
Develop a data validation tool.	■				
Integrate data from across modes and agencies (transit, arterial, freeway, etc.) and develop advanced analytics to improve the equity and safety of the road network.	■				
Develop and automate advance analytical planning tools for data validation, performance measurement, operational evaluation, asset management, regional planning activities, and financial decision making.	■				

*Local agencies include: City of Portland, Clackamas County, Clark County, Multnomah County, Washington County, WSDOT, City of Gresham, City of Lake Oswego, City of Beaverton, City of Hillsboro, C-TRAN

APPENDIX A: GLOSSARY OF ACRONYMS

December 2016

Glossary of Acronyms

AAA	American Automobile Association
ACC	Airport Communications Center
AD	Archived Data
AHS	Automated Highway System
APTS	Advanced Public Transportation Systems
AQI	Air Quality Index
ATIS	Advanced Traveler Information Systems
ATMS	Advanced Traffic Management Systems
AVI	Automated Vehicle Identification
AVL	Automated Vehicle Location
AVSS	Advanced Vehicle Safety Systems
BNSF	Burlington Northern Santa Fe
BOEC	Bureau of Emergency Communications
BRT	Bus Rapid Transit
C911	Columbia 911 Communications District
CAD	Computer-Aided Dispatch
CCOM	Clackamas County Central Communications
CCTV	Closed-Circuit Television
CVO	Commercial Vehicle Operations
DEQ	Department of Environmental Quality
DFD	Data Flow Diagram
DMS	Dynamic Message Sign
EAS	Emergency Alert System
EM	Emergency Management
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographical Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
HazMat	Hazardous Material
HRI	Highway-Rail Intersection
HTCRS	Highway Traffic Conditions Reporting System
HOV	High Occupancy Vehicle
ID	Identification
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
MAX	Metropolitan Area Express
MC	Maintenance and Construction
JPACT	Joint Policy Advisory Committee on Transportation

MPO	Metropolitan Planning Organization
MTIP	Metropolitan Transportation Improvement Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
ODOT	Oregon Department of Transportation
OEM	Office of Emergency Management
OERS	Oregon Emergency Response System
OHSU	Oregon Health Sciences University
ORS	Oregon Revised Statute
OSP	Oregon State Police
OTA	Oregon Trucking Association
PDA	Personal Digital Assistant
PDCC	Portland Dispatch Center Consortium
PDX	Portland International Airport
PNWR	Portland and Western Railroad
PSpecs	Process Specifications
PSU	Portland State University
PVMS	Portable Variable Message Sign
RLIS	Regional Land Information System
RR	Railroad
RTC	Southwest Washington Regional Transportation Council
RWIS	Roadway Weather Information System
SCATS	Sydney Coordinated Adaptive Traffic System
SMART	South Metro Area Rapid Transit
TDM	Traffic Demand Management
TMC	Traffic Management Center
TMOC	Traffic Management Operation Center
TOC	Traffic Operations Center
TOCS	Traffic Operations Center Software
TPAC	Transportation Policy Alternatives Committee
TransPort	Transportation Portland
TSP	Transit Signal Priority
TSP	Transportation System Plan
UP	Union Pacific
U.S. DOT	United States Department of Transportation
VAST	Vancouver Area Smart Trek
VIP	Vehicle Inspection Program
WCCCA	Washington County Consolidated Communications Agency
WSDOT	Washington State Department of Transportation
Xing	Crossing

APPENDIX B: SUMMARY OF CHANGES TO NATIONAL ITS ARCHITECTURE

December 2016

Conversion Summary

5/3/2016 1:06:52PM

Original File Information

Original File	X:\Projects\2012\P12016-019 (ODOT Regional ITS Communications Plan and ITS Architecture)\Task 2.1_ITS Architecture\Turbo Architecture\TransPort Regional Architecture- Ver 4.10-28-05.tbo
Turbo Architecture	3.1.8 - 5/12/2005 3:55:16 PM
Physical Architecture	5.1.0 - 4/7/2005 8:28:35 AM
Market Packages	5.1.0 - 3/28/2005 11:15:05 AM
SDOMAP	5.1.1 - 5/6/2005 11:00:24 AM

Converted File Information

Converted File	X:\Projects\2012\P12016-019 (ODOT Regional ITS Communications Plan and ITS Architecture)\Task 2.1_ITS Architecture\Turbo Architecture\Version 7.1 conversion_TransPort Arch_2016-05-03.tbo
Turbo Architecture	7.1.0 - 4/28/2015 8:31:20 PM
Physical Architecture	7.1.0 - 3/7/2015 8:48:46 AM
Service Packages	7.1.0 - 3/5/2015 2:36:20 PM
SDOMAP	7.1.0 - 4/28/2015

Architectures Converted

Regional Architecture	TransPort Regional ITS Architecture
Project Architecture	Arterial Signal System
Project Architecture	ATIS Release 1
Project Architecture	ATMS Release 2
Project Architecture	Tri-Met 5 Year Plan

Version 7.1 Service Package Changes

5/3/2016 1:08:11PM

SP	SP Name	Change	Old SP	Old SP Name
APTS09	Transit Signal Priority	New		

Description: This service package determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations. The signal priority may result from limited local coordination between the transit vehicle and the individual intersection for signal priority or may result from coordination between transit management and traffic management centers. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network.

APTS10 Transit Passenger Counting New

Description: 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.

APTS11 Multimodal Connection Protection New

Description: This service package supports the coordination of multimodal services to optimize the travel time of travelers as they move from mode to mode (or to different routes within a single mode). A near term function supported by this service package would be for a single transit agency to coordinate crossing routes so that passengers on one route would have the opportunity to transfer with minimum wait time to another route within the same transit system. The next level of complexity of this service package would be for this coordination to occur across transit agencies, or between transit agencies and other modes of transportation. The most advanced functions of this service package would be to track the route of an individual traveler and ensure that connections are properly scheduled on an individual basis. This final capability represents a long-term functionality, which could be managed either through an Information Serviced Provider or through a Transit Management subsystem

ATIS06 Transportation Operations Data Sharing New

Description: This service package makes real-time transportation operations data available to transportation system operators. The Information Service Provider collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes this information available to transportation system operators, facilitating the exchange of qualified, real-time information between agencies. Using the provided information, transportation system operators can manage their individual systems based on an overall view of the regional transportation system. The regional transportation operations data resource represented by the Information Service Provider may be implemented as a web application that provides a web-based access to system operators, an enterprise database that provides a network interface to remote center applications, or any implementation that supports regional sharing of real-time transportation operations data.

ATIS10 Short Range Communications Traveler Information New

Description: This service package provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility applications 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 DSRC 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.

ATMS12 Roadside Lighting System Control New

Description: This service package includes systems that manage electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside. These systems allow a center to control lights based on traffic conditions, time-of-day, and the occurrence of incidents. Such systems can increase the safety of a roadway segment by increasing lighting and conserve energy at times when conditions warrant a reduction in the amount of lighting.

SP	SP Name	Change	Old SP	Old SP Name

ATMS22 Variable Speed Limits New

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

This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the ATMS19-Automated Speed Warning and Enforcement service package.

Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS23-Dynamic Lane Management and Shoulder Use and ATMS24-Dynamic Roadway Warning).

ATMS23 Dynamic Lane Management and Shoulder Use New

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

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

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS24-Dynamic Roadway Warning).

ATMS24 Dynamic Roadway Warning New

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

Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the ATMS19 – Speed Warning and Enforcement service package.

Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS23-Dynamic Lane Management and Shoulder Use).

SP	SP Name	Change	Old SP	Old SP Name

ATMS25 VMT Road User Payment New

Description: This service package facilitates charging fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner). Vehicle owners need only register with a single payment entity of their choice (a participating state, municipal, or regional DOT, an authority, or a private entity), and payments are reconciled by the entity receiving payment (and travel history) with all roadway owners that participate in the VMT payment scheme, which may also include the Federal government. Vehicle owners would pay nothing for distances traveled where there are no payments required (e.g. in jurisdictions that have not implemented a distance based payment or for roadway operators that collect payment using traditional tolls), although a Federal payment rate might cover some or all roadway operations (a Federal policy decision). Basic operation depends on the vehicle tracking its own location, and periodically reporting its travel history to the registered entity receiving payment using C-V communications. Roadway VMT Payment can duplicate the functions of current toll road payment schemes based on F-V communications, parking payment functions, as well as augment and/or replace federal and state gasoline taxes (which are otherwise ineffective for vehicles that don't use gasoline).

The payments per distance traveled can be structured to provide some amount of demand management by motivating vehicle owner travel choices to minimize payments. The use of this service package for demand management is a local policy decision by each roadway owner.

Alternatively, for vehicle owners that prefer a strictly odometer ("high privacy") based payment approach (that does not need to record and report specific locations and times of travel), then the payment amount may assume a payment rate corresponding to the most expensive roads at the most expensive times. Specific payment rates for this option are a local policy decision.

Odometer readings (from vehicle registration and periodic safety inspection events stored at the state DOT where the vehicle is registered) can be used as a back-office audit to detect gross vehicle equipment failures and fraud (e.g. disabling or dismounting vehicle equipment). In addition, vehicle equipment can be read by fixed or mobile roadside equipment using F-V communications for a more immediate audit of in-vehicle equipment and enforcement (for vehicle owners that have not chosen the odometer-only method of payment).

Payment can be made periodically through a normal bill/payment cycle that is part of the registration process a vehicle owner chooses, or using a vehicle mounted or entered payment instrument/information with vehicle operator or owner initiated payment points. This facilitates payment by vehicle operators (instead of owners) for various commercial operations such as rental vehicles, taxi operators.

ATMS26 Mixed Use Warning Systems New

Description: This service package supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. These systems could allow automated warning or active protection for this class of users.

AVSS12 Cooperative Vehicle Safety Systems New

Description: This service package enhances the on-board longitudinal and lateral warning stand-alone systems by exchanging messages with other surrounding vehicles and roadside equipment. Vehicles send out information concerning their location, speed, and direction to surrounding vehicles. The roadside equipment provides information about potential safety hazards in the vehicle path such as stalled (unequipped) vehicles, wrong-way drivers, debris, or water hazards. The on-board systems can then process this information and present warnings to the driver including headway warnings, merge warnings, unsafe passing warnings, and warnings about hazards detected in the vehicle path. Special messages from approaching emergency vehicles may also be received and processed.

MC11 Environmental Probe Surveillance New

Description: This service package 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. It includes the on-board vehicle systems that collect and report environmental probe data, the infrastructure equipment that collects the probe data and the centers that aggregate and share the collected probe data.

MC12 Infrastructure Monitoring New

Description: 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.

SP	SP Name	Change	Old SP	Old SP Name
APTS01	Transit Vehicle Tracking	Modified	APTS1	Transit Vehicle Tracking

Description: 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. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

APTS02	Transit Fixed-Route Operations	Modified	APTS2	Transit Fixed-Route Operations

Description: 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 determines the transit vehicle trip performance against the schedule using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

APTS03	Demand Response Transit Operations	Modified	APTS3	Demand Response Transit Operations

Description: This service package performs automated dispatch and system monitoring for demand responsive transit services. This service performs scheduling activities as well as operator assignment. In addition, this service package performs similar functions to support dynamic features of flexible-route transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific paratransit service. In the second scenario, a third party service provider determines that the paratransit service is a viable means of satisfying a traveler request and makes a reservation for the traveler.

APTS04	Transit Fare Collection Management	Modified	APTS4	Transit Passenger and Fare Management

Description: 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. 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 Subsystem. Two other service packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management, also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

APTS05	Transit Security	Modified	APTS5	Transit Security

Description: This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment is deployed to perform surveillance and sensor monitoring in order to warn of 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).

The surveillance and sensor information is transmitted to the Emergency Management Subsystem, as are transit user activated alarms in public secure areas. On-board alarms, activated by transit users or transit vehicle operators are transmitted to both the Emergency Management Subsystem and the Transit Management Subsystem, indicating two possible approaches to implementing this service package.

In addition the service package supports remote transit vehicle disabling by the Transit Management Subsystem and transit vehicle operator authentication.

SP	SP Name	Change	Old SP	Old SP Name
APTS06	Transit Fleet Management	Modified	APTS6	Transit Maintenance

Description: 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 Subsystem. Hardware and software in the Transit Management Subsystem 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.

APTS07	Multi-modal Coordination	Modified	APTS7	Multi-modal Coordination

Description: 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. Transit transfer information is shared between Multimodal Transportation Service Providers and Transit Agencies.

APTS08	Transit Traveler Information	Modified	APTS8	Transit Traveler Information

Description: 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.

ATIS01	Broadcast Traveler Information	Modified	ATIS1	Broadcast Traveler Information

Description: This service package 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 web casts. The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the service package ATMS06 - Traffic Information Dissemination, which provides localized HAR and DMS information capabilities, ATIS01 provides a wide area digital broadcast service. Successful deployment of this service package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

ATIS02	Interactive Traveler Information	Modified	ATIS2	Interactive Traveler Information

Description: 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 between the traveler and Information Service Provider. 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 kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. This service package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this service package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a “traveler card” that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

ATIS03	Autonomous Route Guidance	Modified	ATIS3	Autonomous Route Guidance

Description: This service package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.

ATIS04	Dynamic Route Guidance	Modified	ATIS4	Dynamic Route Guidance

Description: This service package offers advanced route planning and guidance that is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is considered by the user equipment in provision of route guidance.

SP	SP Name	Change	Old SP	Old SP Name
ATIS05	ISP Based Trip Planning and Route Guidance	Modified	ATIS5	ISP Based Trip Planning and Route Guidance

Description: 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 ATIS3 and ATIS4, where the user equipment determines the route, the route determination functions are performed in the Information Service Provider Subsystem 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 (e.g., parking reservations) 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.

ATIS07	Travel Services Information and Reservation	Modified	ATIS7	Yellow Pages and Reservation

Description: This service package provides travel information and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This service package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.

ATIS08	Dynamic Ridesharing	Modified	ATIS8	Dynamic Ridesharing

Description: This service package provides dynamic ridesharing/ride matching services to travelers. This service could allow near real time ridesharing reservations to be made through the same basic user equipment used for Interactive Traveler Information. This ridesharing/ride matching capability also includes arranging connections to transit or other multimodal services.

ATIS09	In Vehicle Signing	Modified	ATIS9	In Vehicle Signing

Description: 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). It includes short range communications between field equipment and the vehicle and connections to the Traffic Management Subsystem for monitoring and control. This service package also includes the capability for maintenance and construction, transit, and emergency vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in work zones, around incidents, and in areas where transit operations impacts traffic.

ATMS02	Traffic Probe Surveillance	Modified	ATMS02	Probe Surveillance

Description: This service package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this service package: 1) wide-area wireless communications between the vehicle and center is used to communicate vehicle operational information and status directly to the center, and 2) dedicated short range communications between passing vehicles and the roadside is used to provide equivalent information to the center. The first approach leverages wide area communications equipment that may already be in the vehicle to support personal safety and advanced traveler information services. The second approach utilizes vehicle equipment that supports toll collection, in-vehicle signing, and other short range communications applications identified within the architecture. The service package enables transportation operators and traveler information providers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, on-board equipment, data reduction software, and fixed-point to fixed-point links between centers to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required, such as the ability to identify and filter out-of-bounds or extreme data reports.

ATMS03	Traffic Signal Control	Modified	ATMS03	Surface Street Control

Description: 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 ATMS07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.

SP	SP Name	Change	Old SP	Old SP Name
ATMS04	Traffic Metering	Modified	ATMS04	Freeway Control

Description: 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 Network Surveillance 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.

SP	SP Name	Change	Old SP	Old SP Name
ATMS07	Regional Traffic Management	Modified	ATMS07	Regional Traffic Control

Description: This service package provides for the sharing of traffic 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 ATMS03-Traffic Signal Control and ATMS04-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 to 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 control between traffic management centers.

SP	SP Name	Change	Old SP	Old SP Name
ATMS09	Transportation Decision Support and Demand Management	Modified	ATMS09	Traffic Forecast and Demand Management

Description: This service package recommends courses of action to traffic operations personnel based on an assessment of current and forecast road network performance. Recommendations may include predefined incident response plans and regional surface street and freeway control strategies that correct network imbalances. Where applicable, this service package also recommends transit, parking, and toll strategies to influence traveler route and mode choices to support travel demand management (TDM) programs and policies managing both traffic and the environment. TDM recommendations are coordinated with transit, parking, and toll administration centers to support regional implementation of TDM strategies. Incident response and congestion management recommendations are implemented by the local traffic management center and coordinated with other regional centers by other service packages (see ATMS07-Regional Traffic Management and ATMS08-Traffic Incident Management). All recommendations are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. Traffic data is collected from sensors and surveillance equipment as well as other transportation management centers (see ATIS06-Transportation Operations Data Sharing). Forecasted traffic loads are derived from historical data and route plans supplied by the Information Service Provider Subsystem. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support TDM, where applicable.

SP	SP Name	Change	Old SP	Old SP Name
ATMS19	Speed Warning and Enforcement	Modified	ATMS19	Speed Monitoring

Description: 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 ATMS22-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.

SP	SP Name	Change	Old SP	Old SP Name
AVSS11	Automated Vehicle Operations	Modified	AVSS11	Automated Highway System

Description: This service package enables “hands-off” operation of the vehicle on automated portions of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control. 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 as the driver resumes control of the vehicle.

SP	SP Name	Change	Old SP	Old SP Name
CVO01	Carrier Operations and Fleet Management	Modified	CVO01	Fleet Administration

Description: This service package provides the capabilities to manage a fleet of commercial vehicles. The Fleet and Freight Management subsystem provides the route for a commercial vehicle by either utilizing an in-house routing software package or an Information Service Provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). Any such restricted areas are determined by the Commercial Vehicle Administration. A route would be 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 subsystem and routing changes can be made depending on current road network conditions. Once a route has been assigned, changes must be coordinated between the Fleet and Freight Management subsystem and the Commercial Vehicle. Commercial Vehicle Drivers would be 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 subsystem. The Fleet and Freight Management subsystem can also notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried), by sending an alarm to the Emergency Management subsystem.

CVO08	On-board CVO Safety	Modified	CVO08	On-board CVO and Freight Safety & Security

Description: This service package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Service Package and includes support for collecting on-board safety data via transceivers or other means. The on-board safety data are assessed by an off-board system. In some cases the monitoring and safety assessment may occur remotely (i.e., not at a roadside site). Following the assessment, safety warnings are provided to the driver, the Commercial Vehicle Check roadside elements, and carrier. This service package allows for the Fleet and Freight Management subsystem to have access to the on-board safety data.

ATIS6	Integrated Transportation Management/Route Guidance	Discontinued		

Description: This market package provides advanced route planning and guidance which is responsive to current conditions, and supports collection of near-real time information on intended routes for a proportion of the vehicles in the network. This comprehensive road network probe information can be used by the Traffic Management Subsystem to optimize the traffic control strategy based on anticipated vehicle routes. The Traffic Management Subsystem would utilize the individual and ISP route planning information to optimize signal timing while at the same time providing updated signal timing information to allow optimized route plans. The predictive link times used by this market package are provided by the market package ATMS9--Traffic Forecast and Demand Management--at the traffic management center.

ATMS12	Virtual TMC and Smart Probe Data	Discontinued		

Description: This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing equipment is capable of autonomous operation). In-vehicle signing is used to inform drivers of detected road conditions.

Version 7.1 Subsystems and Terminator Changes

5/3/2016 1:07:18PM

Entity Name	Entity Kind	Entity Class	Entity Type	Old Entity Name
New				
Border Inspection Systems	Terminator	Field	System	
Driver Identification Card	Terminator	Traveler	System	
Public Health System	Terminator	Center	System	
Modified				
Archived Data Management	Subsystem	Center	System	Archived Data Management Subsystem
Commercial Vehicle	Subsystem	Vehicle	System	Commercial Vehicle Subsystem
Emergency Vehicle	Subsystem	Vehicle	System	Emergency Vehicle Subsystem
Payment Administration	Subsystem	Center	System	Toll Administration
Roadway	Subsystem	Field	System	Roadway Subsystem
Roadway Payment	Subsystem	Field	System	Toll Collection
Security Monitoring	Subsystem	Field	System	Security Monitoring Subsystem
Transit Vehicle	Subsystem	Vehicle	System	Transit Vehicle Subsystem
Border Inspection Administration	Terminator	Center	System	Trade Regulatory Agencies
Other Payment Administration	Terminator	Center	Other System	Other Toll Administration
Payment Administrator	Terminator	Center	Human	Toll Administrator
Transit Operations Personnel	Terminator	Center	Human	Transit System Operators
Travel Services Provider	Terminator	Center	System	Yellow Pages Service Providers

Version 7.1 Standard Changes

5/3/2016 1:08:21PM

Change		SDO	Standard Name	Document ID
New *		CEN	Intelligent transport systems	CEN SIRI
New *		OASIS	Emergency Management TC	OASIS CAP
New		IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS)	IEEE 1609.11-2010
New		IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Identifier Allocations	IEEE 1609.12-2012
New		IEEE	Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification	IEEE 802.11-2012
New		IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Architecture	IEEE P1609.0-2013
New		AASHTO/ITE/NEMA	Object Definitions for Electrical and Lighting Management Systems (ELMS)	NTCIP 1213
New		AASHTO/ITE/NEMA	Object Definitions for Conflict Monitor Units (CMU)	NTCIP 1214
Modified *	Old:	CEN	Intelligent transport systems	CEN SIRI
	New:	CEN	Intelligent transport systems	CEN SIRI
Modified *	Old:	ASTM/IEEE/SAE	Dedicated Short Range Communication at 5.9 GHz Standards Group	DSRC 5GHz
	New:	ASTM/IEEE/SAE	Dedicated Short Range Communication at 5.9 GHz Standards Group	DSRC 5GHz
Modified *	Old:	SAE/IEEE	DSRC 5GHz	DSRC 5GHz
	New:	ASTM/IEEE/SAE	Dedicated Short Range Communication at 5.9 GHz Standards Group	DSRC 5GHz
Modified *	Old:	ASTM	Dedicated Short Range Communication at 915 MHz Standards Group	DSRC 915MHz
	New:	ASTM	Dedicated Short Range Communication at 915 MHz Standards Group	DSRC 915MHz
Modified *	Old:	AASHTO/ITE/NEMA	NTCIP Center-to-Center Standards Group	NTCIP C2C
	New:	AASHTO/ITE/NEMA	NTCIP Center-to-Center Standards Group	NTCIP C2C
Modified *	Old:	AASHTO/ITE/NEMA	NTCIP Center-to-Field Standards Group	NTCIP C2F
	New:	AASHTO/ITE/NEMA	NTCIP Center-to-Field Standards Group	NTCIP C2F
Modified *	Old:	OASIS	Emergency Management TC	OASIS CAP
	New:	OASIS	Emergency Management TC	OASIS CAP
Modified	Old:	ASTM	Standard Guide for Archiving and Retrieving ITS-Generated Data	ASTM E2259-03
	New:	ASTM	Standard Guide for Archiving and Retrieving ITS-Generated Data	ASTM E2259-03a(2011)
Modified	Old:	ASTM	Standard Specification for Metadata to Support Archived Data Management Systems	ASTM E2259-xx
	New:	ASTM	Standard Practice for Metadata to Support Archived Data Management Systems	ASTM E2468-05
Modified	Old:	ASTM	Standard Specification for Archiving ITS Generated Travel Monitoring Data	ASTM E2259-yy
	New:	ASTM	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	ASTM E2665-08

Change		SDO	Standard Name	Document ID
Modified	Old:	IEEE	Standard for Traffic Incident Management Message Sets for Use by EMCs	IEEE 1512.1-2003
	New:	IEEE	Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers	IEEE 1512.1-2006
Modified	Old:	IEEE	Standard for Public Safety IMMS for use by EMCs	IEEE 1512.2-2004
	New:	IEEE	Standard for Public Safety Traffic Incident Management Message Sets for Use by Emergency Management Centers	IEEE 1512.2-2004
Modified	Old:	IEEE	Standard for Hazardous Material IMMS	IEEE 1512.3-2002
	New:	IEEE	Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers	IEEE 1512.3-2006
Modified	Old:	IEEE	Standard for Common Incident Management Message Sets (IMMS) for use by EMCs	IEEE 1512-2000
	New:	IEEE	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	IEEE 1512 -2006
Modified	Old:	IEEE	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	IEEE 1570-2002
	New:	IEEE	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	IEEE 1570-2002
Modified	Old:	IEEE	Application Services (Layers 6,7) for DSRC 5.9 GHz	IEEE 1609.2
	New:	IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Security Services for Applications and Management Messages	IEEE 1609.2-2013
Modified	Old:	IEEE	Communications Services (Layers 4,5) for DSRC 5.9 GHz (Future Standard)	IEEE 1609.3
	New:	IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services	IEEE 1609.3-2010
Modified	Old:	IEEE	Medium Access Control (MAC) Extension & the MAC Extension Management Entity for DSRC 5.9 GHz	IEEE 1609.4
	New:	IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Multi-Channel Operation	IEEE 1609.4-2010
Modified	Old:	IEEE	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems - 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IEEE 802.11
	New:	ASTM	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems - 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications	ASTM E2213-03
Modified	Old:	IEEE	Standard for Message Sets for Vehicle/Roadside Communications	IEEE Std 1455-1999
	New:	IEEE	Standard for Message Sets for Vehicle/Roadside Communications	IEEE 1455-1999
Modified	Old:	ITE	ATC Application Program Interface (API)	ITE 9603-1
	New:	NEMA/AASHTO/ITE	Application Programming Interface (API) Standard for the Advanced Transportation Controller (ATC)	ITE ATC API
Modified	Old:	ITE	ATC Cabinet	ITE 9603-2
	New:	NEMA/AASHTO/ITE	ITS Standard Specification for Roadside Cabinets	ITE ITS Cabinet
Modified	Old:	ITE	Advanced Transportation Controller (ATC)	ITE 9603-3
	New:	NEMA/AASHTO/ITE	Advanced Transportation Controller (ATC)	ITE ATC Controller 5.2

Change		SDO	Standard Name	Document ID
Modified	Old:	ITE	Standard for Functional Level Traffic Management Data Dictionary (TMDD)	ITE TM 1.03
	New:	AASHTO/ITE	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	ITE TMDD
Modified	Old:	ITE	Message Sets for External TMC Communication (MS/ETMCC)	ITE TM 2.01
	New:	AASHTO/ITE	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	ITE TMDD
Modified	Old:	ITE	TMDD & MS/ETMCC Guide Standard for Functional Level Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications	ITE TMDD Guide
	New:	AASHTO/ITE	TMDD and MS/ETMCC Guide Standard for Functional Level Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications	ITE TMDD Guide
Modified	Old:	AASHTO/ITE/NEMA	Object Definitions for Actuated Traffic Signal Controller Units	NTCIP 1202
	New:	AASHTO/ITE/NEMA	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	NTCIP 1202
Modified	Old:	AASHTO/ITE/NEMA	Environmental Sensor Station (ESS) Interface Standard	NTCIP 1204
	New:	AASHTO/ITE/NEMA	Object Definitions for Environmental Sensor Stations (ESS)	NTCIP 1204
Modified	Old:	AASHTO/ITE/NEMA	Field Management Stations - Part 1: Object Definitions for Signal System Masters	NTCIP 1210
	New:	AASHTO/ITE/NEMA	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	NTCIP 1210
Modified	Old:	AASHTO/ITE/NEMA	Object Definitions for Signal Control and Prioritization	NTCIP 1211
	New:	AASHTO/ITE/NEMA	Object Definitions for Signal Control and Prioritization (SCP)	NTCIP 1211
Modified	Old:	AASHTO/ITE/NEMA	TCIP Framework Standard	NTCIP 1400
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Common Public Transportation (CPT) Objects	NTCIP 1401
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Incident Management (IM) Objects	NTCIP 1402
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Passenger Information (PI) Objects	NTCIP 1403
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Scheduling/Runcutting (SCH) Objects	NTCIP 1404
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Spatial Representation (SP) Objects	NTCIP 1405
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP On-Board (OB) Objects	NTCIP 1406

Change		SDO	Standard Name	Document ID
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Control Center (CC) Objects	NTCIP 1407
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	TCIP Fare Collection (FC) Business Area Objects	NTCIP 1408
	New:	APTA	Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.4
Modified	Old:	AASHTO/ITE/NEMA	Application Profile for XML Message Encoding and Transport in ITS C2C Communications	NTCIP 2306
	New:	AASHTO/ITE/NEMA	Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications (C2C XML)	NTCIP 2306
Modified	Old:	SAE	RDS (Radio Data System) Phrase Lists	SAE J2540-1
	New:	SAE	RDS (Radio Data System) Phrase Lists	SAE J2540/1
Modified	Old:	SAE	ITIS (International Traveler Information Systems) Phrase Lists	SAE J2540-2
	New:	SAE	ITIS (International Traveler Information Systems) Phrase Lists	SAE J2540/2
Modified	Old:	SAE	National Names Phrase List	SAE J2540-3
	New:	SAE	National Names Phrase List	SAE J2540/3
Modified	Old:	SAE	Data Dictionary and Message Sets for DSRC 5.9 GHz (Future Standard)	SAE JXXXX
	New:	SAE	Dedicated Short Range Communications (DSRC) Message Set Dictionary	SAE J2735
Discontinued		ANSI	Commercial Vehicle Safety Reports	ANSI TS284
Discontinued		ANSI	Commercial Vehicle Safety and Credentials Information Exchange	ANSI TS285
Discontinued		ANSI	Commercial Vehicle Credentials	ANSI TS286
Discontinued		ASTM	Standard Provisional Specification for Dedicated Short Range Communication (DSRC) Data Link Layer	ASTM PS 105-99
Discontinued		IEEE	Resource Manager for DSRC 5.9 GHz	IEEE 1609.1
Discontinued		IEEE	Logical Link (Layer 2) for DSRC 5.9 GHz	IEEE 802.2
Discontinued		IEEE	Trial-Use Standard for Message Set Template for Intelligent Transportation Systems	IEEE Std 1488-2000
Discontinued		IEEE	Standard for Data Dictionaries for Intelligent Transportation Systems	IEEE Std 1489-1999
Discontinued		ISO	Networking Services (Layer 3) for DSRC 5.9 GHz	ISO 21210

Change	SDO	Standard Name	Document ID
Discontinued	AASHTO/ITE/NEMA	Simple Transportation Management Framework (STMF)	NTCIP 1101
Discontinued	AASHTO/ITE/NEMA	CORBA Security Service Specification	NTCIP 1105
Discontinued	AASHTO/ITE/NEMA	CORBA Near-Real Time Data Service Specification	NTCIP 1106
Discontinued	AASHTO/ITE/NEMA	Weather Report Message Set for Environmental Sensor Stations (Future Standard)	NTCIP 1301
Discontinued	AASHTO/ITE/NEMA	Application Profile for CORBA (AP-CORBA)	NTCIP 2305
Discontinued	AASHTO/ITE/NEMA	Information Profile for DATEX	NTCIP 2501
Discontinued	AASHTO/ITE/NEMA	Information Profile for CORBA	NTCIP 2502
Discontinued	SAE	ITS Data Bus - Data Security Services	SAE J1760
Discontinued	SAE	ITS Data Bus Architecture Reference Model Information Report	SAE J2355
Discontinued	SAE	ITS Data Bus - lDB-C Physical Layer	SAE J2366-1
Discontinued	SAE	ITS Data Bus - Link Layer	SAE J2366-2
Discontinued	SAE	ITS Data Bus - Thin Transport Layer	SAE J2366-4
Discontinued	SAE	ITS Data Bus - Application Message Layer	SAE J2366-7
Discontinued	SAE	ITS Data Bus Vehicle Gateway Reference Design Recommended Practice	SAE J2367

Change	SDO	Standard Name	Document ID

*** The standards included in the group have changed as identified below:**

Dedicated Short Range Communication at 5.9 GHz Standards Group

SDO	Standard Name	Document ID	Change
ISO	Networking Services (Layer 3) for DSRC 5.9 GHz	ISO 21210	Removed
IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS)	IEEE 1609.11-2010	Added
IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Identifier Allocations	IEEE 1609.12-2012	Added
IEEE	Standard for Wireless Access in Vehicular Environments (WAVE) - Architecture	IEEE P1609.0-2013	Added
IEEE	Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification	IEEE 802.11-2012	Added
IEEE	Logical Link (Layer 2) for DSRC 5.9 GHz	IEEE 802.2	Removed

Dedicated Short Range Communication at 915 MHz Standards Group

SDO	Standard Name	Document ID	Change
ASTM	Standard Provisional Specification for Dedicated Short Range Communication (DSRC) Data Link Layer	ASTM PS 105-99	Removed

Emergency Management TC

SDO	Standard Name	Document ID	Change
			Added

Intelligent transport systems

SDO	Standard Name	Document ID	Change
			Added

NTCIP Center-to-Center Standards Group

SDO	Standard Name	Document ID	Change
AASHTO/ITE/NEMA	Information Profile for DATEX	NTCIP 2501	Removed
AASHTO/ITE/NEMA	Information Profile for CORBA	NTCIP 2502	Removed
AASHTO/ITE/NEMA	CORBA Security Service Specification	NTCIP 1105	Removed
AASHTO/ITE/NEMA	CORBA Near-Real Time Data Service Specification	NTCIP 1106	Removed
AASHTO/ITE/NEMA	Application Profile for CORBA (AP-CORBA)	NTCIP 2305	Removed

NTCIP Center-to-Field Standards Group

SDO	Standard Name	Document ID	Change
AASHTO/ITE/NEMA	Simple Transportation Management Framework (STMF)	NTCIP 1101	Removed

Element Mapping Conversion Details

5/3/2016 1:04:32PM

Change	Element Name	Old Mapping	New Mapping
Replaced			
	Ambulances	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Amtrak Trains	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	City Fire Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	City of Beaverton Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	City of Gresham Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	City of Hillsboro Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	City of Lake Oswego Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	City of Portland Aerial Tram	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	City of Portland Streetcar Vehicles	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	City of Portland Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	City of Wilsonville SMART Fixed-Route Buses	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	City of Wilsonville SMART Paratransit Vehicles	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	City Police Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Clackamas County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Commercial Salvage and Towing Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Commercial Vehicles	Commercial Vehicle Subsystem (Subsystem)	Commercial Vehicle (Subsystem)
	County Fire Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	County Sheriff Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Maintenance and Construction Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Multnomah County Bridge Operations Centers	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Multnomah County Bridge Operations Centers	Security Monitoring Subsystem (Subsystem)	Security Monitoring (Subsystem)
	Multnomah County Incident Response Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Multnomah County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	ODOT COMET Freeway Service Patrol Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	ODOT HazMat Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	ODOT Interstate 5 Bridge Operations Center	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	ODOT Interstate 5 Bridge Operations Center	Security Monitoring Subsystem (Subsystem)	Security Monitoring (Subsystem)
	ODOT Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Oregon State Police Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Other Cities in Clackamas County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)

Change	Element Name	Old Mapping	New Mapping
	Other Cities in Multnomah County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Other Cities in Washington County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Port of Portland Airport Emergency Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Port of Portland Airport Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Port of Portland Airport Parking Shuttle Buses	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	Port of Portland Data Mart	Archived Data Management Subsystem (Subsystem)	Archived Data Management (Subsystem)
	Portland State University PORTAL Data Warehouse	Archived Data Management Subsystem (Subsystem)	Archived Data Management (Subsystem)
	Toll Administration	Other Toll Administration (Terminator)	Other Payment Administration (Terminator)
	Toll Administration	Toll Administration (Subsystem)	Payment Administration (Subsystem)
	Toll Plazas	Toll Collection (Subsystem)	Roadway Payment (Subsystem)
	TriMet Commuter Rail	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	TriMet Enterprise Data Mart	Archived Data Management Subsystem (Subsystem)	Archived Data Management (Subsystem)
	TriMet Fixed-Route Buses	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	TriMet LIFT/ATP Paratransit Vehicles	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	TriMet MAX Trains	Transit Vehicle Subsystem (Subsystem)	Transit Vehicle (Subsystem)
	TriMet Security Surveillance	Security Monitoring Subsystem (Subsystem)	Security Monitoring (Subsystem)
	TriMet Supervisory Vehicles	Emergency Vehicle Subsystem (Subsystem)	Emergency Vehicle (Subsystem)
	Washington County Traffic Signals and Field Devices	Roadway Subsystem (Subsystem)	Roadway (Subsystem)
	Yellow Pages Service Providers	Yellow Pages Service Providers (Terminator)	Travel Services Provider (Terminator)

Discontinued Flows

5/3/2016 1:06:06PM

Source Element	Destination Element	Flow Name	Flow Kind
Project Architecture: Arterial Signal System			
City of Beaverton Traffic Signals and Field Devices	ODOT Traffic Management Operations Center	environmental probe data*	Discontinued
Other Cities in Washington County Traffic Signals and Field Devices	Washington County Traffic Operations Center	environmental probe data*	Discontinued
Project Architecture: ATIS Release 1			
City of Portland Traffic Operations Center	TripCheck	ISP coordination*	Discontinued
City of Portland Traffic Operations Center	TripCheck	request fare and price information*	Discontinued
ODOT Traffic Management Operations Center	TripCheck	ISP coordination*	Discontinued
ODOT Traffic Management Operations Center	TripCheck	request fare and price information*	Discontinued
Port of Portland Airport Communications Center	TripCheck	request fare and price information*	Discontinued
TripCheck	City of Portland Traffic Operations Center	ISP coordination*	Discontinued
TripCheck	ODOT Traffic Management Operations Center	ISP coordination*	Discontinued
Regional Architecture: TransPort Regional ITS Architecture			
Broadcast Media for Portland/Vancouver Area	TATII Message Broker	media information request*	Discontinued
City of Gresham Traffic Signals and Field Devices	Multnomah County Traffic Operations Center	environmental probe data*	Discontinued
City of Portland Traffic Signals and Field Devices	City of Portland Traffic Operations Center	environmental probe data*	Discontinued
County Emergency Operations Centers	City of Beaverton Traffic Operations Center	road network probe information*	Discontinued
County Emergency Operations Centers	City of Gresham Traffic Operations Center	road network probe information*	Discontinued
County Emergency Operations Centers	City of Portland Traffic Operations Center	road network probe information*	Discontinued
County Emergency Operations Centers	Clackamas County Traffic Operations Center	road network probe information*	Discontinued
County Emergency Operations Centers	Multnomah County Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	City of Beaverton Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	City of Gresham Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	City of Portland Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	Clackamas County Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	Maintenance and Construction Management	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	Multnomah County Traffic Operations Center	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	ODOT Transportation Operations Centers	road network probe information*	Discontinued
ODOT Traffic Management Operations Center	Port of Portland Airport Communications Center	road network probe information*	Discontinued

Source Element	Destination Element	Flow Name	Flow Kind
ODOT Traffic Signals and Field Devices	ODOT Traffic Management Operations Center	environmental probe data*	Discontinued
ODOT Traffic Signals and Field Devices	ODOT Transportation Operations Centers	environmental probe data*	Discontinued
Port of Portland Airport Communications Center	ODOT Traffic Management Operations Center	road network probe information*	Discontinued
Port of Portland Airport Communications Center	ODOT Transportation Operations Centers	road network probe information*	Discontinued
Port of Portland Airport Field Devices	Port of Portland Airport Communications Center	environmental probe data*	Discontinued

The asterisk (*) indicates that this flow has been discontinued and is no longer included in the National ITS Architecture.

APPENDIX C: STAKEHOLDER LIST

December 2016

Stakeholders Report

12/13/2016 2:14:22PM

Stakeholders for Region TransPort Regional ITS Architecture

Stakeholder

Amtrak

Description: Amtrak provides two north-south routes (Amtrak Cascades and Coast Starlight) and one east-west route (Empire Builder) that pass through or terminate in the Portland metropolitan area. Amtrak is also included in the Oregon Statewide Architecture.

Associated Element: Amtrak Operations

Associated Element: Amtrak Trains

Broadcast Media Companies

Description: Media outlets (news, websites, etc.) that provide traveler information.

Associated Element: Broadcast Media for Portland/Vancouver Area

City Fire Departments

Description: This stakeholder includes the following City Fire Departments: Cornelius, Forest Grove, Gladstone, Gresham, Hillsboro, Lake Oswego, Portland, and West Linn.

Associated Element: City Fire Vehicles

City of Beaverton

Description: The City of Beaverton operates and maintains most of its own traffic signals and field devices.

Associated Element: City of Beaverton Traffic Signals and Field Devices

Associated Element: City of Beaverton Traffic Operations Center

City of Gresham

Description: The City of Gresham operates and maintains most of the traffic signals and field devices within its jurisdiction. The City of Gresham also maintains the signals and field devices in the cities of Fairview, Wood Village, and Troutdale and for unincorporated Multnomah County near those cities.

Associated Element: City of Gresham Traffic Signals and Field Devices

Associated Element: City of Gresham Traffic Operations Center

City of Hillsboro

Description: The City operates and maintains thirty signals within the city. The City currently has a fiber network running along many primary roads within the city, and is investigating options to connect these signals to the network and establish a central monitoring system. The City is in the process of completing an ITS Plan which will look at project options for completing these connections and establishing additional network rings throughout the City.

Associated Element: City of Hillsboro Traffic Signals and Field Devices

Associated Element: City of Hillsboro Traffic Operations Center

City of Lake Oswego

Description: The City of Lake Oswego operates and maintains most of its own traffic signals and field devices.

Associated Element: City of Lake Oswego Traffic Signals and Field Devices

City of Portland

Description: The City of Portland operates and maintains most of its own traffic signals and field devices.

Associated Element: City of Portland Traffic Operations Center

Associated Element: City of Portland Traffic Signals and Field Devices

Associated Element: City of Portland Parking Management

Associated Element: City of Portland Streetcar Vehicles

Associated Element: City of Portland Transit Operations and Dispatch Center

Associated Element: City of Portland Aerial Tram

City of Wilsonville

Description: Wilsonville is included as a stakeholder since they own and operate the SMART transit service. They are also included under the "Other Cities in Clackamas County" stakeholder since all of the City's traffic signals and field devices are operated and maintained by Clackamas County.

Associated Element: City of Wilsonville SMART Transit Operations and Dispatch Center

Associated Element: City of Wilsonville SMART Fixed-Route Buses

Associated Element: City of Wilsonville SMART Paratransit Vehicles

Stakeholder

City Police Departments

Description: This stakeholder includes the following City Police Departments: Beaverton, Cornelius, Fairview, Forest Grove, Gladstone, Gresham, Hillsboro, King City, Lake Oswego, Milwaukie, Oregon City, Portland, Sherwood, Tigard, Troutdale, Tualatin, and West Linn.

Associated Element: City Police Vehicles

Clackamas County

Description: Clackamas County operates and maintains the traffic signals and roadside devices for the following cities: Damascus, Gladstone, Happy Valley, Johnson City, Milwaukie, Oregon City, Rivergrove, West Linn, and Wilsonville.

Associated Element: Clackamas County Traffic Operations Center

Associated Element: Clackamas County Traffic Signals and Field Devices

Commercial Information Service Providers

Description: Companies such as Waze, Google, Intrix that provide on demand information to travelers.

Commercial Salvage and Towing Operators

Description: This stakeholder includes any commercial operators that provide salvage or towing operations for roadway incidents. This stakeholder is also included in the Oregon Statewide Architecture.

Associated Element: Commercial Salvage and Towing Vehicles

County Fire Districts

Description: This stakeholder includes Clackamas County Fire Districts, Multnomah County Rural Protection Fire Districts, Tualatin Valley Fire & Rescue Districts.

Associated Element: County Fire Vehicles

County Offices of Emergency Management

Description: This stakeholder includes Clackamas County Emergency Management, Multnomah County Emergency Management, and the Washington County Office of Consolidated Emergency Management (this includes Beaverton, Banks, Cornelius, Forest Grove, Hillsboro, King City, North Plains, Sherwood, Tigard, Tualatin and Washington County).

Associated Element: County Emergency Operations Centers

County Sheriff Offices

Description: This includes the sheriff's offices for Clackamas County, Multnomah County, and Washington County.

Associated Element: County Sheriff Vehicles

C-TRAN

Description: C-TRAN provides transit service in southwest Washington and also transports riders across the Columbia River into Oregon where they can transfer to the TriMet transit service. Although the C-TRAN architecture will be maintained with the VAST architecture, information flows between C-TRAN and TriMet are included in this architecture.

Associated Element: C-TRAN Transit Operations and Dispatch Center

Emergency Medical Service Providers

Description: This stakeholder includes local companies/agencies that provide ambulance and medical response services in the Portland metropolitan area.

Associated Element: Ambulances

Heavy Rail Operators

Description: This includes Burlington Northern Santa Fe (BNSF) Railway, Union Pacific (UP) Railroad, Portland and Western Railroad (PNWR), and any other heavy rail companies in the Portland metropolitan area.

Associated Element: Heavy Rail Operations

Associated Element: Heavy Rail Wayside Equipment

Local Agencies for roles and responsibilities grouping

Description:

Stakeholder

Stakeholders in this group:

City of Gresham
City of Beaverton
City of Wilsonville
City of Hillsboro
City of Lake Oswego

Local Public Agency Traveler Information Providers

Description: This stakeholder group includes the counties, cities, and the Port of Portland who all provide or plan to provide jurisdiction specific traveler information. This does not include ODOT or TriMet who both provide traveler information that spans the entire Portland metropolitan region.

Stakeholders in this group:

City of Portland
Multnomah County
Clackamas County
Washington County
Port of Portland
Other Cities in Multnomah County
City of Gresham
Other Cities in Clackamas County
City of Beaverton
Other Cities in Washington County
City of Hillsboro
City of Lake Oswego

Associated Element: Local Agency Websites

Mayday Service Provider

Description: Mayday service providers (e.g. GM's OnStar, ATX, AAA, RESCU) provide traveler assistance through an interface in personal vehicles.

Associated Element: Mayday Service Centers

Metro

Description: Metro, the local metropolitan planning organization (MPO), is the directly elected regional government that serves more than 1.3 million residents in Clackamas, Multnomah and Washington counties, and the 25 cities in the Portland, Oregon, metropolitan area.

Associated Element: Toll Administration

Associated Element: Toll Plazas

Multnomah County

Description: Multnomah County operates signals and field devices in unincorporated areas and within the cities of Fairview, Wood Village, and Troutdale. Those signals are maintained by ODOT, the City of Gresham, or the City of Portland. Multnomah County also operates five bridges over the Willamette River in Portland: Broadway, Burnside, Hawthorne, Sellwood and Morrison. The County currently provides notifications of openings of the four drawbridges with their Bridge Alerts app.

Associated Element: Multnomah County Traffic Operations Center

Associated Element: Multnomah County Traffic Signals and Field Devices

Associated Element: Multnomah County Bridge Operations Centers

Associated Element: Multnomah County Incident Response Vehicles

National Oceanographic and Atmospheric Administration

Description: The National Oceanographic and Atmospheric Administration (NOAA) National Weather Service plays a key role in weather reporting and forecasting events that impact surface transportation.

Associated Element: NOAA National Weather Service

Oregon Department of Environmental Quality

Description: The Oregon Department of Environmental Quality (DEQ) is a regulatory agency whose job is to protect the quality of Oregon's environment. DEQ is responsible for protecting and enhancing Oregon's water and air quality, for cleaning up spills and releases of hazardous materials, and for managing the proper disposal of hazardous and solid wastes. In the transportation arena, DEQ monitors vehicle emissions and cleans up hazmat spills on the roadway resulting from incidents.

Associated Element: Emissions Management

Oregon Department of Transportation

Description: In the Portland metro area ODOT Region 1 is the local ODOT office. ODOT Region 1 operates and maintains traffic signals and field devices on ODOT facilities as well as some PBOT facilities. It also operates the TMOC 24 hours a day, seven days a week, managing recurring and non-recurring events.

Associated Element: ODOT Traffic Management Operations Center

Associated Element: ODOT Traffic Signals and Field Devices

Associated Element: TripCheck

Associated Element: ODOT Incident Response

Associated Element: ODOT HazMat Vehicles

Associated Element: ODOT Interstate 5 Bridge Operations Center

Associated Element: 511 Traveler Information Phone Number

Associated Element: ODOT Transportation Operations Centers

Associated Element: ODOT TripCheck

Oregon Office of Emergency Management

Description: The purpose of the Office of Emergency Management (OEM) is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in ORS 401 by planning, preparing and providing for the prevention, mitigation and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the State of Oregon.

Associated Element: Statewide Emergency Services System

Oregon State Police

Description: Oregon State Police work closely with ODOT during incident response or other events on state facilities. OSP uses computer aided dispatch (CAD) systems to dispatch responders.

Associated Element: Oregon State Police Dispatch Center

Associated Element: Oregon State Police Vehicles

Other Cities in Clackamas County

Description: In the Portland metropolitan area, Clackamas County operates and maintains the traffic signals and roadside devices for the following cities: Damascus, Gladstone, Happy Valley, Johnson City, Milwaukie, Oregon City, Rivergrove, West Linn, and Wilsonville. The City of Lake Oswego operates and maintains their own traffic signals and field devices.

Associated Element: Other Cities in Clackamas County Traffic Signals and Field Devices

Associated Element: Other Cities in Clackamas County Traffic Operations Centers

Other Cities in Multnomah County

Description: In the Portland metropolitan area, Multnomah County operates the traffic signals and roadside devices in unincorporated areas and in the following cities: Fairview, Troutdale, and Wood Village. The City of Portland and City of Gresham operate and maintain their own traffic signals and field devices. The City of Gresham maintains Multnomah County's signals and devices within Fairview, Troutdale, and Wood Village and nearby unincorporated areas.

Associated Element: Other Cities in Multnomah County Traffic Signals and Field Devices

Associated Element: Other Cities in Multnomah County Traffic Operations Centers

Other Cities in Washington County

Description: In the Portland metropolitan area, Washington County operates and maintains the traffic signals and roadside devices for the following cities: Cornelius, Durham, Forest Grove, King City, Sherwood, Tigard, and Tualatin. The City of Beaverton and the City of Hillsboro operate and maintain the majority of their own traffic signals and field devices.

Associated Element: Other Cities in Washington County Traffic Signals and Field Devices

Associated Element: Other Cities in Washington County Traffic Operations Centers

Other Emergency Management Agencies

Stakeholder

Description: This stakeholder includes other agencies or companies that contribute to emergency management in the Portland metropolitan area. Examples include hospitals, the Red Cross, and emergency shelter sites (e.g. schools and churches). Regional hospitals include Doernbecher Children's Hospital, Eastmoreland Hospital, Kaiser Sunnyside Medical Center, Legacy Emanuel Hospital, Legacy Meridian Park Hospital, Legacy Mount Hood Medical Center, Oregon Health Sciences University and Hospital, Providence Milwaukie Hospital, Providence Portland Medical Center, Providence Saint Vincent Hospital, Tuality Community Hospital, Willamette Falls Hospital, and Woodland Park Hospital.

Associated Element: Other Emergency Management Operations

Port of Portland

Description: The Port manages the Portland International Airport (PDX) and the water terminals along the Willamette River in Portland as well as the cargo/shipping that travels through these facilities.

Associated Element: Port of Portland Airport Parking Management

Associated Element: Port of Portland Airport Emergency Vehicles

Associated Element: Port of Portland Airport Communications Center

Associated Element: Port of Portland Airport Field Devices

Associated Element: Port of Portland Airport Parking Shuttle Buses

Associated Element: Port of Portland Data Mart

Portland Dispatch Center Consortium

Description: The PDCC includes the following 911 public safety dispatch centers: City of Portland's Bureau of Emergency Communications (BOEC), Port of Portland's Airport Communications Center (ACC), Clackamas County Central Communications (CCOM), Washington County Consolidated Communications Agency (WCCCA), Lake Oswego Communications (LOCOM), Clark Regional Emergency Services Agency (CRESA), and Columbia 911 Communications District (C911). The PDCC expects to become a legal entity in the Fall of 2005.

Associated Element: PDCC Message Broker

Associated Element: 911 Dispatch Centers

Associated Element: PDCC Mobile Dispatch Center

Portland State University

Description: Portland State University manages and maintains Portal, the official Archived Data User Service (ADUS) for the Portland Metropolitan region.

Associated Element: Portland State University PORTAL Data Warehouse

Regional Travel Options (RTO) program

Description: Metro's RTO program supports increasing awareness of non-single occupancy vehicle travel options such as biking, walking, transit, and ridesharing.

Special Event Promoters

Description: Includes the Rose Quarter, Portland International Raceway and Expo Center. These event venues regularly hold large events that impact traffic and are locations that currently share or could potentially use ITS and share infrastructure. Examples include ODOT posting advisory messages on dynamic message signs for the Rose Quarter. The Rose Quarter has access to ODOT and City of Portland cameras and also has a dynamic message sign that they use to post arrival times of TriMet MAX trains.

Associated Element: Special Event Promoters

Associated Element: Special Event Promoters Field Devices

TransPort Committee

Description: The Transportation Portland (TransPort) Committee is a consortium of transportation agencies with the following mission: "To provide safe, efficient multi-modal travel in the Portland-Vancouver metropolitan area by using technology and public/private cooperation to integrate the operation of regional transportation facilities." TransPort partners include DOT's (ODOT, WSDOT, FHWA), Metro, TriMet, PSU, counties (Clackamas, Multnomah, and Washington), the City of Portland, and numerous other cities in the metropolitan area. The TransPort Committee was initially formed in 1993 and representatives from member agencies currently meet monthly to reach consensus on ITS deployment throughout the region. The TransPort Committee is also an official subcommittee of Metro's Transportation Policy Alternatives Committee (TPAC). The TransPort Architecture Subcommittee maintains this regional architecture.

Associated Element: TTIP Message Broker

Stakeholder

Transportation Maintenance and Construction Agencies

Description: This stakeholder group includes all public transportation management agencies who provide maintenance and construction services on roadways.

Stakeholders in this group:

- Oregon Department of Transportation
- City of Portland
- Multnomah County
- TriMet
- Clackamas County
- Washington County
- Port of Portland
- Other Cities in Multnomah County
- City of Gresham
- Other Cities in Clackamas County
- City of Beaverton
- Other Cities in Washington County
- City of Hillsboro
- City of Lake Oswego

Associated Element: Maintenance and Construction Management
Associated Element: Maintenance and Construction Vehicles

Transportation Network Companies (TNCs), Rideshare, or Bikeshare companies

Description: A TNC connects paying passengers with drivers who provide transportation with their own vehicles. Examples: Uber, Lyft, Zipcar. A car or bike share companie provides a vehicle or bicycle to a paying customer to use for a specified time period. Examples: Zipcar, Car to Go, BIKETOWN

TriMet

Description: Local Transit and Rail Authority.
Associated Element: TriMet Website
Associated Element: TriMet Fixed-Route Buses
Associated Element: TriMet Enterprise Data Mart
Associated Element: TriMet MAX Trains
Associated Element: TriMet Parking Management
Associated Element: TriMet LIFT/ATP Paratransit Vehicles
Associated Element: TriMet Supervisory Vehicles
Associated Element: TriMet Commuter Rail
Associated Element: TriMet Security Surveillance
Associated Element: TriMet Field Devices
Associated Element: TriMet Transit Operations and Dispatch Centers

Trucking Firms and Public Fleets

Description: This stakeholder is also included in the Oregon Statewide Architecture. Movement of freight in the Portland region is important to the economy. Portland State University is currently researching freight movement and ODOT is trying to limit freight delay to 90 minutes from border to border. This stakeholder includes the Oregon Trucking Associations (OTA), who has been serving the needs of the state's trucking industry for more than 50 years.
Associated Element: Commercial Vehicles

U.S. Coast Guard

Description: The U.S. Coast Guard plays an active role in bridge security along the Willamette and Columbia Rivers. This stakeholder is also included in the Oregon Statewide Architecture.
Associated Element: U.S. Coast Guard

Users

Description: This includes any member of the traveling public that uses the transportation system.
Associated Element: Mobile Information Devices
Associated Element: Personal Vehicles (Public at Large)

Washington County

Stakeholder

Description: Washington County operates and maintains the traffic signals and roadside devices for the following cities: Cornelius, Durham, Forest Grove, King City, Sherwood, Tigard, and Tualatin.

Associated Element: Washington County Traffic Operations Center

Associated Element: Washington County Traffic Signals and Field Devices

Washington State Department of Transportation

Description: WSDOT. The link between ODOT and WSDOT connects the Portland metro area to the Vancouver metro area.

Associated Element: WSDOT Regional Traffic Operations Center

APPENDIX D: CHANGE LOG - STAKEHOLERS

DKS IBI

December 2016

Note: Rows that are highlighted indicate changes since 2005

Stakeholder	Description	2016 Updates
Amtrak	Amtrak provides two north-south routes (Amtrak Cascades and Coast Starlight) and one east-west route (Empire Builder) that pass through or terminate in the Portland metropolitan area. Amtrak is also included in the Oregon Statewide Architecture.	
Broadcast Media Companies	Media outlets (news, websites, etc.) that provide traveler information.	
City Fire Departments	This stakeholder includes the following City Fire Departments: Cornelius, Forest Grove, Gladstone, Gresham, Hillsboro, Lake Oswego, Portland, and West Linn.	
City of Beaverton	The City of Beaverton operates and maintains most of its own traffic signals and field devices.	New description
City of Gresham	The City of Gresham operates and maintains most of its own traffic signals and field devices.	The City of Gresham operates and maintains most of the traffic signals and field devices within its jurisdiction. The City of Gresham also maintains the signals and field devices in the cities of Fairview, Wood Village, and Troutdale and for unincorporated Multnomah County near those cities.
City of Hillsboro	The City of Hillsboro operates and maintains most of its own traffic signals and field devices.	The City operates and maintains thirty signals within the city. The City currently has a fiber network running along many primary roads within the city, and is investigating options to connect these signals to the network and establish a central monitoring system. The City is in the process of completing an ITS Plan which will look at project options for completing these connections and establishing additional network rings throughout the City.
City of Lake Oswego	The City of Lake Oswego operates and maintains most of its own traffic signals and field devices.	New description
City of Portland	The City of Portland operates and maintains most of its own traffic signals and field devices.	New description
City of Wilsonville	Wilsonville is included as a stakeholder since they own and operate the SMART transit service. They are also included under the "Other Cities in Clackamas County" stakeholder since all of the City's traffic signals and field devices are operated and maintained by Clackamas County.	
Clackamas County	Clackamas County operates and maintains the traffic signals and roadside devices for the following cities: Damascus, Gladstone, Happy Valley, Johnson City, Milwaukie, Oregon City, Rivergrove, West Linn, and Wilsonville.	New description
Commercial Information Service Providers	Companies such as Waze, Google, Intrix that provide on demand information to travelers.	added
Commercial Salvage and Towing Operators	This stakeholder includes any commercial operators that provide salvage or towing operations for roadway incidents. This stakeholder is also included in the Oregon Statewide Architecture.	
County Fire Districts	This stakeholder includes Clackamas County Fire Districts, Multnomah County Rural Protection Fire Districts, Tualatin Valley Fire & Rescue Districts. This stakeholder includes Clackamas County Fire Districts, Multnomah County Rural Protection Fire	
County Offices of Emergency Management	This stakeholder includes Clackamas County Emergency Management, Multnomah County Emergency Management, and the Washington County Office of Consolidated Emergency Management (this includes Beaverton, Banks, Cornelius, Forest Grove, Hillsboro, King City, North Plains, Sherwood, Tigard, Tualatin and Washington County).	
County Sheriff Offices	This includes the sheriff's offices for Clackamas County, Multnomah County, and Washington County.	
C-TRAN	C-TRAN provides transit service in southwest Washington and also transports riders across the Columbia River into Oregon where they can transfer to the TriMet transit service. Although the C-TRAN architecture will be maintained with the VAST architecture, information flows between C-TRAN and TriMet are included in this architecture.	
Emergency Medical Service Providers	This stakeholder includes local companies/agencies that provide ambulance and medical response services in the Portland metropolitan area.	
Heavy Rail Operators	This includes Burlington Northern Santa Fe (BNSF) Railway, Union Pacific (UP) Railroad, Portland and Western Railroad (PNWR), and any other heavy rail companies in the Portland metropolitan area.	
Local Public Agency Traveler Information Providers	This stakeholder group includes the counties, cities, and the Port of Portland who all provide or plan to provide jurisdiction specific traveler information. This does not include ODOT or TriMet who both provide traveler information that spans the entire Portland metropolitan region.	
Mayday Service Provider	Mayday service providers (e.g. GM's OnStar, ATX, AAA, RESCU) provide traveler assistance through an interface in personal vehicles.	
Metro	Metro, the local metropolitan planning organization (MPO), is the directly elected regional government that serves more than 1.3 million residents in Clackamas, Multnomah and Washington counties, and the 25 cities in the Portland, Oregon, metropolitan area.	
Multnomah County		Multnomah County operates signals and field devices in unincorporated areas and within the cities of Fairview, Wood Village, and Troutdale. Those signals are maintained by ODOT, the City of Gresham, or the City of Portland. Multnomah County also operates five bridges over the Willamette River in Portland: Broadway, Burnside, Hawthorne, Sellwood and Morrison. The County currently provides notifications of openings of the four drawbridges with their Bridge Alerts app.
National Oceanographic and Atmospheric Administration	The National Oceanographic and Atmospheric Administration (NOAA) National Weather Service plays a key role in weather reporting and forecasting events that impact surface transportation.	

Note: Rows that are highlighted indicate changes since 2005

Stakeholder	Description	2016 Updates
Oregon Department of Environmental Quality	The Oregon Department of Environmental Quality (DEQ) is a regulatory agency whose job is to protect the quality of Oregon's environment. DEQ is responsible for protecting and enhancing Oregon's water and air quality, for cleaning up spills and releases of hazardous materials, and for managing the proper disposal of hazardous and solid wastes. In the transportation arena, DEQ monitors vehicle emissions and cleans up hazmat spills on the roadway resulting from incidents.	
Oregon Department of Transportation	In the Portland metro area ODOT Region 1 is the local ODOT office. ODOT Region 1 operates and maintains traffic signals and field devices on ODOT facilities as well as some PBOT facilities. It also operates the TMOC 24 hours a day, seven days a week, managing recurring and non-recurring events.	New description
Oregon Office of Emergency Management	The purpose of the Office of Emergency Management (OEM) is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in ORS 401 by planning, preparing and providing for the prevention, mitigation and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the State of Oregon.	
Oregon State Police	Oregon State Police work closely with ODOT during incident response or other events on state facilities. OSP uses computer aided dispatch (CAD) systems to dispatch responders.	New description
Other Cities in Clackamas County	In the Portland metropolitan area, Clackamas County operates and maintains the traffic signals and roadside devices for the following cities: Damascus, Gladstone, Happy Valley, Johnson City, Milwaukie, Oregon City, Rivergrove, West Linn, and Wilsonville. The City of Lake Oswego operates and maintains their own traffic signals and field devices.	
Other Cities in Multnomah County	In the Portland metropolitan area, Multnomah County operates and maintains the traffic signals and roadside devices for the following cities: Gresham, Fairview, Maywood Park, Troutdale, Springwater, and Wood Village. The City of Portland operates and maintains their own traffic signals and field devices.	In the Portland metropolitan area, Multnomah County operates the traffic signals and roadside devices in unincorporated areas and in the following cities: Fairview, Troutdale, and Wood Village. The City of Portland and City of Gresham operate and maintain their own traffic signals and field devices. The City of Gresham maintains Multnomah County's signals and devices within Fairview, Troutdale, and Wood Village and nearby unincorporated areas.
Other Cities in Washington County	In the Portland metropolitan area, Washington County operates and maintains the traffic signals and roadside devices for the following cities: Cornelius, Durham, Forest Grove, King City, Sherwood, Tigard, and Tualatin. The City of Beaverton and the City of Hillsboro operate and maintain the majority of their own traffic signals and field devices.	
Other Emergency Management Agencies	This stakeholder includes other agencies or companies that contribute to emergency management in the Portland metropolitan area. Examples include hospitals, the Red Cross, and emergency shelter sites (e.g. schools and churches). Regional hospitals include Doernbecher Children's Hospital, Eastmoreland Hospital, Kaiser Sunnyside Medical Center, Legacy Emanuel Hospital, Legacy Meridian Park Hospital, Legacy Mount Hood Medical Center, Oregon Health Sciences University and Hospital, Providence Milwaukie Hospital, Providence Portland Medical Center, Providence Saint Vincent Hospital, Tuality Community Hospital, Willamette Falls Hospital, and Woodland Park Hospital.	
Port of Portland	The Port manages the Portland International Airport (PDX) and the water terminals along the Willamette River in Portland as well as the cargo/shipping that travels through these facilities.	
Portland Dispatch Center Consortium	The PDCC includes the following 911 public safety dispatch centers: City of Portland's Bureau of Emergency Communications (BOEC), Port of Portland's Airport Communications Center (ACC), Clackamas County Central Communications (CCOM), Washington County Consolidated Communications Agency (WCCCA), Lake Oswego Communications (LOCOM), Clark Regional Emergency Services Agency (CRESA), and Columbia 911 Communications District (C911). The PDCC expects to become a legal entity in the Fall of 2005.	
Portland State University	Portland State University manages and maintains Portal, the official Archived Data User Service (ADUS) for the Portland Metropolitan region	New description
Regional Travel Options (RTO) Program	Metro's RTO program supports increasing awareness of non-single occupancy vehicle travel options such as biking, walking, transit, and ridesharing.	New description
Special Event Promoters	Includes the Rose Quarter, Portland International Raceway and Expo Center. These event venues regularly hold large events that impact traffic and are locations that currently share or could potentially use ITS and share infrastructure. Examples include ODOT posting advisory messages on dynamic message signs for the Rose Quarter. The Rose Quarter has access to ODOT and City of Portland cameras and also has a dynamic message sign that they use to post arrival times of TriMet MAX trains.	

Note: Rows that are highlighted indicate changes since 2005

Stakeholder	Description	2016 Updates
TransPort Committee	The Transportation Portland (TransPort) Committee is a consortium of transportation agencies with the following mission: "To provide safe, efficient multi-modal travel in the Portland-Vancouver metropolitan area by using technology and public/private cooperation to integrate the operation of regional transportation facilities." TransPort partners include DOT's (ODOT, WSDOT, FHWA), Metro, TriMet, PSU, counties (Clackamas, Multnomah, and Washington), the City of Portland, and numerous other cities in the metropolitan area. The TransPort Committee was initially formed in 1993 and representatives from member agencies currently meet monthly to reach consensus on ITS deployment throughout the region. The TransPort Committee is also an official subcommittee of Metro's Transportation Policy Alternatives Committee (TPAC). The TransPort Architecture Subcommittee maintains this regional architecture.	
Transportation Maintenance and Construction Agencies	This stakeholder group includes all public transportation management agencies who provide maintenance and construction services on roadways.	
Transportation Network Companies (TNCs), Rideshare or Bikeshare companies	A TNC connects paying passengers with drivers who provide transportation with their own vehicles. Examples: Uber, Lyft, Zipcar. A car or bike share companie provides a vehicle or bicycle to a paying customer to use for a specified time period. Examples: Zipcar, Car to Go, BIKETOWN	added
TriMet	Local Transit and Rail Authority.	
Trucking Firms and Public Fleets	This stakeholder is also included in the Oregon Statewide Architecture. Movement of freight in the Portland region is important to the economy. Portland State University is currently researching freight movement and ODOT is trying to limit freight delay to 90 minutes from border to border. This stakeholder includes the Oregon Trucking Associations (OTA), who has been serving the needs of the state's trucking industry for more than 50 years.	
U.S. Coast Guard	The U.S. Coast Guard plays an active role in bridge security along the Willamette and Columbia Rivers. This stakeholder is also included in the Oregon Statewide Architecture.	
Users	This includes any member of the traveling public that uses the transportation system.	
Washington County	Washington County operates and maintains the traffic signals and roadside devices for the following cities: Cornelius, Durham, Forest Grove, King City, Sherwood, Tigard, and Tualatin.	New description
Washington State Department of Transportation	WSDOT. The link between ODOT and WSDOT connects the Portland metro area to the Vancouver metro area.	

APPENDIX E: SYSTEM INVENTORY

DKS IBI

December 2016

Stakeholder Inventory for Region TransPort Regional ITS Architecture

Element: Yellow Pages Service Providers *Status:* Existing

Description: This element represents the individual organizations that provide any service oriented towards the traveler. Example services that could be included are gas, food, lodging, vehicle repair, points of interest, and recreation areas. Also included are services specifically directed toward bicyclists and pedestrians such as bicycle shops and parking locations and bicycle and pedestrian rest areas. The service providers may pay a fee to have their services advertised to travelers. The interface with the service provider is necessary so that accurate, up-to-date service information can be provided to the traveler and to support electronic reservation capabilities included in the ITS user services. This element is included in the Oregon Statewide Architecture.

Mapped to Entity: Information Service Provider

Mapped to Entity: Travel Services Provider

Amtrak

Element: Amtrak Operations *Status:* Existing

Description: This element supports transit rail operations of Amtrak trains that travel through the Portland metropolitan region.

Mapped to Entity: Transit Management

Element: Amtrak Trains *Status:* Existing

Description: Amtrak trains carry passengers between metropolitan areas around the country. Amtrak lines connect Portland to Vancouver, B.C., Los Angeles, and Chicago.

Mapped to Entity: Transit Vehicle

Broadcast Media Companies

Element: Broadcast Media for Portland/Vancouver Area *Status:* Existing

Description: This element represents systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media.

Mapped to Entity: Media

City Fire Departments

Element: City Fire Vehicles *Status:* Existing

Description: This includes fire vehicles for the following City Fire Departments: Cornelius, Forest Grove, Gladstone, Gresham, Hillsboro, Lake Oswego, Portland, and West Linn. Most city fire vehicles are equipped with emitters for traffic signal preemption and mobile data terminals.

Mapped to Entity: Emergency Vehicle

City of Beaverton

Element: City of Beaverton Traffic Operations Center *Status:* Planned

Description: A virtual TOC will be implemented at the City of Beaverton that provides desktop access to the City's traffic signals and field devices and the main TOC located at Washington County.

Mapped to Entity: Traffic Management

Element: City of Beaverton Traffic Signals and Field Devices *Status:* Existing/Planned

Description: The City of Beaverton currently operates traffic signals, coordinated traffic signal systems, video detection, and red light photo enforcement cameras. Per the Washington County ITS Plan the City plans to add system detectors and CCTV cameras.

Mapped to Entity: Roadway

City of Gresham

Element: City of Gresham Traffic Operations Center *Status:* Existing/Planned

Description: The City of Gresham maintains a virtual TOC that provides desktop access to the City's and Multnomah County's traffic signals, the City's SCATS adaptive signal server, and field devices.

Mapped to Entity: Traffic Management

Element: City of Gresham Traffic Signals and Field Devices *Status:* Existing/Planned
Description: The City currently operates traffic signals, coordinated traffic signal systems, and SCATS adaptive signal systems. The City is constructing an arterial dynamic message sign that will be operated and maintained by ODOT. The future may include the installation of CCTV cameras and weather/air quality stations.
Mapped to Entity: Roadway

City of Hillsboro

Element: City of Hillsboro Traffic Operations Center *Status:* Planned
Description: A virtual TOC will be implemented at the City of Hillsboro that provides desktop access to the City's traffic signals and field devices and the main TOC located at Washington County.
Mapped to Entity: Traffic Management

Element: City of Hillsboro Traffic Signals and Field Devices *Status:* Existing
Description: The City of Hillsboro currently operates a number of traffic signals and coordinated traffic signal systems.
Mapped to Entity: Roadway

City of Lake Oswego

Element: City of Lake Oswego Traffic Signals and Field Devices *Status:* Existing
Description: The City of Lake Oswego currenty maintains and operates all traffic signals and coordinated traffic signal systems on non-state roadways in the City.
Mapped to Entity: Roadway

City of Portland

Element: City of Portland Aerial Tram *Status:* Existing
Description: An aerial tram connects OHSU to the South Waterfront area. This is a short fixed line that requires fare payment.
Mapped to Entity: Transit Vehicle

Element: City of Portland Parking Management *Status:* Existing/Future
Description: The City of Portland currently manages on-street metered parking facilities and seven Smart Park parking garages. Payment for on-street parking is collected electronically and payment at Smart Park garages is collected manually by gate operators or electronically for monthly pass holders. In the future a regional smart card may allow system users to electronically pay for parking and transit services anywhere in the metropolitan area.
Mapped to Entity: Parking Management

Element: City of Portland Streetcar Vehicles *Status:* Existing
Description: The Streetcar provides service in downtown Portland, extending down to the South Waterfront Area, and looping to the east side via the Tilikum Crossing and the Broadway Bridge. Streetcar vehicles are equipped with GPS units used to automatically track the vehicle's location for traveler information dissemination and transit management.
Mapped to Entity: Transit Vehicle

Element: City of Portland Traffic Operations Center *Status:* Existing
Description: The TOC includes two workstations, five wall-mounted television displays, and the TranSuite central signal system server. It is operated during normal weekday business hours and is used to monitor/manage traffic signal operations and incidents or citizen complaints as they arise.
Mapped to Entity: Traffic Management

Element: City of Portland Traffic Signals and Field Devices *Status:* Existing
Description: The City of Portland operates traffic signals, SCATS, coordinated traffic signal systems, video detection, system detectors, CCTV cameras, and arterial dynamic message signs. They also own NextBus dynamic message signs that are used at Streetcar stops to display arrival times.
Mapped to Entity: Roadway

Element: City of Portland Transit Operations and Dispatch Center *Status:* Existing
Description: The City of Portland operates a maintenance and dispatch center to support its Streetcar services.
Mapped to Entity: Transit Management

City of Wilsonville

Element: City of Wilsonville SMART Fixed-Route Buses *Status:* Existing
Description: SMART operates several fixed bus routes that serve Wilsonville and make connections to TriMet in Portland, Cherriots in Salem, and Canby Area Transit. The main transfer locations are: Commerce Circle, Tualatin Park and Ride, Barbur Boulevard Transit Center, Salem Transit Center, and Canby Transit Center.
Mapped to Entity: Transit Vehicle

Element: City of Wilsonville SMART Paratransit Vehicles *Status:* Existing
Description: SMART operates a dial-a-ride service in addition to its fixed-route bus services.
Mapped to Entity: Transit Vehicle

Element: City of Wilsonville SMART Transit Operations and Dispatch Cente *Status:* Existing
Description: SMART manages the operations and provides the dispatch for its fixed-route bus and parantransit services.
Mapped to Entity: Transit Management

City Police Departments

Element: City Police Vehicles *Status:* Existing
Description: This includes police vehicles for the following City Police Departments: Beaverton, Cornelius, Fairview, Forest Grove, Gladstone, Gresham, Hillsboro, King City, Lake Oswego, Milwaukie, Oregon City, Portland, Sherwood, Tigard, Troutdale, Tualatin, and West Linn. Many police vehicles are equipped with mobile data terminals.
Mapped to Entity: Emergency Vehicle

Clackamas County

Element: Clackamas County Traffic Operations Center *Status:* Existing
Description: The Clackamas County TOC currently consists of two workstations used by traffic engineering staff during normal weekday business hours to monitor/manage traffic as incidents or citizen complaints arise. The workstations include an interface to the ODOT TMOC and include connections to CCTV cameras and many of the traffic signals operated by the County.
Mapped to Entity: Traffic Management

Element: Clackamas County Traffic Signals and Field Devices *Status:* Existing/Programmed
Description: Clackamas County currently operates traffic signals, coordinated traffic signal systems, video detection, weather stations, and CCTV cameras. Per their ITS Plan they plan to install arterial dynamic message signs, system detectors, and railroad warning systems. In the future they may also add flood/slide monitoring/warning systems.
Mapped to Entity: Roadway

Commercial Salvage and Towing Operators

Element: Commercial Salvage and Towing Vehicles *Status:* Existing
Description: This includes any vehicle used for salvage or towing operations for roadway incident management.
Mapped to Entity: Emergency Vehicle

County Fire Districts

Element: County Fire Vehicles *Status:* Existing
Description: This includes the fire vehicles for the fire districts in Clackamas County, Multnomah County, and Washington County. Most county fire vehicles are equipped with emitters for traffic signal preemption and mobile data terminals.
Mapped to Entity: Emergency Vehicle

County Offices of Emergency Management

Element: County Emergency Operations Centers *Status:* Existing
Description: This element includes emergency operations centers (EOC's) in Clackamas County, Multnomah County, and Washington County, which are co-located with the County 911 Dispatch Centers. This also includes alternate or back-up EOC's.
Mapped to Entity: Emergency Management

County Sheriff Offices

Element: County Sheriff Vehicles *Status:* Existing
Description: This includes the sheriff vehicles for the Sheriff's Offices in Clackamas County, Multnomah County, and Washington County. Many sheriff vehicles are equipped with mobile data terminals.

Element: County Sheriff Vehicles *Status:* Existing
Description: This includes the sheriff vehicles for the Sheriff's Offices in Clackamas County, Multnomah County, and Washington County. Many sheriff vehicles are equipped with mobile data terminals.
Mapped to Entity: Emergency Vehicle

C-TRAN

Element: C-TRAN Transit Operations and Dispatch Center *Status:* Existing
Description: Flows between C-TRAN Transit Operations and Dispatch and TriMet Operations and Dispatch provide the transit management link between the Portland (TransPort) and Vancouver (VAST) regional architectures.
Mapped to Entity: Transit Management

Emergency Medical Service Providers

Element: Ambulances *Status:* Existing
Description: This element includes ambulances operated by both public agencies (e.g. fire departments) and private companies (e.g. American Medical Response).
Mapped to Entity: Emergency Vehicle

Heavy Rail Operators

Element: Heavy Rail Operations *Status:* Existing
Description: This element is roughly the equivalent to a traffic operations center and is the source and destination of information that can be used to coordinate rail and highway traffic management and maintenance operations.
Mapped to Entity: Rail Operations

Element: Heavy Rail Wayside Equipment *Status:* Existing
Description: This element represents train interface equipment (usually) maintained and operated by the railroad and (usually) physically located at or near a grade crossing. This is the source and destination for highway-rail intersection (HRI) information for, or about, approaching trains and their crews (e.g. the time at which the train will arrive and the time it will take to clear a crossing, crossing status or warnings, etc.). Generally one wayside equipment interface would be associated with one highway rail intersection. However, multiple crossings may be controlled using information based on data from one wayside equipment interface.
Mapped to Entity: Wayside Equipment

Local Public Agency Traveler Information Providers

Stakeholders in this group:

City of Portland
Multnomah County
Clackamas County
Washington County
Port of Portland
Other Cities in Multnomah County
City of Gresham
Other Cities in Clackamas County
City of Beaverton
Other Cities in Washington County
City of Hillsboro
City of Lake Oswego

Element: Local Agency Websites *Status:* Existing
Description: This includes any public agency website that includes traveler information that mostly pertains to a single geographic area within the region. Ideally these websites include links to regional traveler information websites (TripCheck and TriMet) and may possibly include links to other local agencies.
Mapped to Entity: Information Service Provider

Mayday Service Provider

Element: Mayday Service Centers *Status:* Existing
Description: Mayday services (e.g. GM's OnStar, AAA, ATX, RESCU) provide traveler assistance via communications between a service center and a vehicle.
Mapped to Entity: Emergency Management

Metro

Element: Toll Administration *Status:* Future
Description: Tolling may be added to some regional roadways in the future for transportation demand management purposes.
Mapped to Entity: Payment Administration

Element: Toll Plazas *Status:* Future
Description: Tolling may be added to some regional roadways in the future for transportation demand management purposes.
Mapped to Entity: Roadway Payment

Multnomah County

Element: Multnomah County Bridge Operations Centers *Status:* Existing
Description: Multnomah County operates and maintains all of the Willamette River bridges within the county. Some of the bridges include lift systems, gates, security surveillance, and bridge operators.
Mapped to Entity: Roadway
Mapped to Entity: Security Monitoring
Mapped to Entity: Traffic Management

Element: Multnomah County Incident Response Vehicles *Status:* Existing
Description: Multnomah County has three vehicles available for incident response. They are only used as needed and are not used to continuously patrol County roadways.
Mapped to Entity: Emergency Vehicle

Element: Multnomah County Traffic Operations Center *Status:* Programmed
Description: A virtual TOC will be implemented at Multnomah County that provides desktop access to the County's traffic signals and field devices and central signal system servers (City of Portland's TranSuite, City of Gresham's SCATS Adaptive).
Mapped to Entity: Traffic Management

Element: Multnomah County Traffic Signals and Field Devices *Status:* Existing/Planned
Description: Multnomah County currently operates traffic signals and coordinated traffic signal systems. The future may include CCTV cameras, flood/slide monitoring systems, and weather stations.
Mapped to Entity: Roadway

National Oceanographic and Atmospheric Administration

Element: NOAA National Weather Service *Status:* Existing
Description: The National Weather Service provides current weather conditions, forecasts, and warnings throughout the entire country and has a field office in Portland.
Mapped to Entity: Archived Data Management
Mapped to Entity: Weather Service

Oregon Department of Environmental Quality

Element: Emissions Management *Status:* Existing
Description: DEQ operates a Vehicle Inspection Program (VIP) in the Portland area. Vehicles are the number one source of air pollution in Oregon. Emissions lead to high smog and carbon monoxide levels, which can have a variety of effects on Oregonians. The VIP is a successful, cost-effective way to reduce air pollution and maintain the quality of Oregon's air. DEQ also issues Clean Air Action Days to encourage people to reduce air pollution such as driving less or taking public transportation.
Mapped to Entity: Emissions Management

Oregon Department of Transportation

Element: 511 Traveler Information Phone Number *Status:* Existing
Description: 511 has been designated by the Federal Communications Commission as the state-by-state, three-digit traveler information phone number. The old ODOT toll-free telephone traveler information number (1-800-977-6368) was converted to 511 in late 2003. The conversion allows travelers who have access to a touchtone phone anywhere within Oregon to dial 511 and obtain current road conditions throughout the state.
Mapped to Entity: Information Service Provider

Element: ODOT HazMat Vehicles *Status:* Existing
Description: These vehicles are used for HazMat clean-up when needed for a roadway incident.

Element: ODOT HazMat Vehicles *Status:* Existing
Description: These vehicles are used for HazMat clean-up when needed for a roadway incident.
Mapped to Entity: Emergency Vehicle

Element: ODOT Incident Response *Status:* Existing
Description: ODOT incident response vehicles are equipped with flat tire repair gear, gasoline, jumper cables, water, and other essentials for rescuing disabled vehicles and getting them on the road again. They are also equipped with automated vehicle locators. ODOT IR vehicles currently patrol I-5, I-405, I-205, I-84, US 26, and OR 217. They are also available for use on state arterial highways.
Mapped to Entity: Emergency Vehicle

Element: ODOT Interstate 5 Bridge Operations Center *Status:* Existing
Description: The I-5 Bridge spans the Columbia River between Portland and Vancouver. Equipment on the bridge (recently upgraded in 2004/2005) includes a lift system, gates, cameras for traffic management and security surveillance, intrusion detectors, and a fiber optic connection between ODOT and WSDOT. The bridge also houses a small operations center solely dedicated to bridge operations.
Mapped to Entity: Roadway
Mapped to Entity: Security Monitoring
Mapped to Entity: Traffic Management

Element: ODOT Traffic Management Operations Center *Status:* Existing
Description: The TMOC operates 24 hours a day, seven days a week and provides traffic management for recurring and non-recurring events on the ODOT Region 1 roadways throughout the Portland metropolitan region and is the primary ODOT contact point when incidents occur. Operators at the TMOC provide a multitude of tasks in the areas of monitoring, traffic control, dispatching, coordination, and documentation. Operators monitor CCTV cameras, system detectors, and radios (ODOT, OSP, Portland Police Bureau, and other emergency services) for abnormal events/incidents. They activate traffic control/information devices such as dynamic message signs and ramp meters. They may eventually implement coordinated traffic signal timing plans designed for incident conditions. Operators dispatch the ODOT COMET incident responders, ODOT HazMat responders, and the ODOT District 2B Maintenance Crew. They advise and coordinate with ODOT personnel, other transportation management agencies, emergency management agencies, and the media. Operators also log/supplement reports of incidents in the TransPort ATMS software.
Mapped to Entity: Emergency Management
Mapped to Entity: Traffic Management

Element: ODOT Traffic Signals and Field Devices *Status:* Existing/Programmed
Description: This element includes all of ODOT's ITS existing and planned field devices. This includes, but is not limited to, traffic signals, ramp meters, CCTV cameras, dynamic message signs, road weather information systems (aka weather stations), vehicle detection (e.g. loops, radar, Bluetooth), highway advisory radio, curve warning signs, variable speed signs, downhill speed warning systems (Motor Carrier), wind warning systems, flood warning systems, remote snow zone signs (drum signs), pavement sensors that keep the road clear of snow and ice, automatic ramp closure gates, and bridge sensors. In the future this list may include permanent tolling devices, travel time dynamic message signs, and lane control signs.
Mapped to Entity: Roadway

Element: ODOT Transportation Operations Centers *Status:* Existing
Description: ODOT has other regional TOC's throughout Oregon in Salem, Bend, and Medford. ODOT is currently working on a Traffic Operations Center Software (TOCS) project that will standardize the software used at each TOC and provide interoperability between the centers.
Mapped to Entity: Archived Data Management
Mapped to Entity: Traffic Management

Element: ODOT TripCheck *Status:* Existing
Description: The TripCheck website provides real-time traveler information to roadway users.
Mapped to Entity: Archived Data Management
Mapped to Entity: Remote Traveler Support
Mapped to Entity: Traffic Management

Element: TripCheck *Status:* Existing

Element: TripCheck *Status:* Existing
Description: The statewide TripCheck website (www.tripcheck.com) is the central location for obtaining traveler information in the Portland metropolitan area. Additional links to other agencies' information, cameras, and websites will be added in the future.
Mapped to Entity: Remote Traveler Support

Oregon Office of Emergency Management

Element: Statewide Emergency Services System *Status:* Existing
Description: This system includes emergency planning, preparedness, response and recovery and involves numerous state and local emergency services agencies and organizations.
Mapped to Entity: Emergency Management

Oregon State Police

Element: Oregon State Police Dispatch Center *Status:* Existing
Description:
Mapped to Entity: Emergency Management

Element: Oregon State Police Vehicles *Status:* Existing
Description:
Mapped to Entity: Emergency Vehicle

Other Cities in Clackamas County

Element: Other Cities in Clackamas County Traffic Operations Centers *Status:* Planned
Description: Virtual TOC's will be implemented at cities within Clackamas County that provide desktop access to the field devices connected to the main TOC located at the County.
Mapped to Entity: Traffic Management

Element: Other Cities in Clackamas County Traffic Signals and Field Device *Status:* Existing/Planned
Description: Clackamas County currently operates City-owned traffic signals, coordinated traffic signal systems, and video detection for this stakeholder. Per the Clackamas County ITS Plan, CCTV cameras are also planned for installation at key locations within the cities.
Mapped to Entity: Roadway

Other Cities in Multnomah County

Element: Other Cities in Multnomah County Traffic Operations Centers *Status:* Planned
Description: Virtual TOC's will be implemented at cities within Multnomah County that provide desktop access to the field devices connected to the main TOC located at the County.
Mapped to Entity: Traffic Management

Element: Other Cities in Multnomah County Traffic Signals and Field Devic *Status:* Existing
Description: Multnomah County currently operates City-owned traffic signals and coordinated traffic signal systems for this stakeholder.
Mapped to Entity: Roadway

Other Cities in Washington County

Element: Other Cities in Washington County Traffic Operations Centers *Status:* Planned
Description: Virtual TOC's will be implemented at cities within Washington County that provide desktop access to the field devices connected to the main TOC located at the County.
Mapped to Entity: Traffic Management

Element: Other Cities in Washington County Traffic Signals and Field Devic *Status:* Existing
Description: Washington County currently operates City-owned traffic signals and coordinated traffic signal systems for this stakeholder.
Mapped to Entity: Roadway

Other Emergency Management Agencies

Element: Other Emergency Management Operations *Status:* Existing

Element: Other Emergency Management Operations *Status:* Existing
Description: This element supports emergency operations not typically covered by 911 centers, EOC's, police, fire, and ambulances. It supports projects that integrate information sharing between ambulances en-route to hospitals. It supports coordination with the Red Cross and emergency shelters during regional emergencies or evacuations.
Mapped to Entity: Other Emergency Management

Port of Portland

Element: Port of Portland Airport Communications Center *Status:* Existing
Description: The ACC includes four workstations (each with approximately 10 monitors) as well as several overhead television monitors. It operates 24 hours a day, seven days a week and is typically staffed by two to three personnel. Primary responsibilities include emergency and non-emergency call-taking, dispatching (police, fire, medical, maintenance, and operations personnel), and monitoring of the CCTV camera system, fire alarm system, and the access control system. When the Port installs new roadway dynamic message signs the ACC will likely operate the signs.
Mapped to Entity: Emergency Management
Mapped to Entity: Traffic Management

Element: Port of Portland Airport Emergency Vehicles *Status:* Existing
Description: The Port has its own fire department (dispatched by Portland BOEC 911) and police (dispatched by the Port). Port of Portland dispatches everything for aircraft.
Mapped to Entity: Emergency Vehicle

Element: Port of Portland Airport Field Devices *Status:* Existing/Planned
Description: The Port currently operates CCTV cameras, count stations, and highway advisory radio. Although the Port also currently operates one dynamic message sign it is only used for general customer information. The Port plans to install a number of dynamic message signs along the roadway within the next five years. The Port may install "next bus" signs to provide parking shuttle bus arrival information. The Port also may include weather sensors and automated deicing equipment on the ramps of its planned long-term parking garage (P2). The Port plans to install information kiosks with links to real-time information sources such as TripCheck.
Mapped to Entity: Information Service Provider
Mapped to Entity: Remote Traveler Support
Mapped to Entity: Roadway

Element: Port of Portland Airport Parking Management *Status:* Existing/Programmed
Description: The Port manages their parking lots (short-term, long-term, and economy) with an electronic system that allows payment by credit in-credit out or by pay-on-foot (cash or credit). This system provides paid tickets that are used by drivers at the exit toll plazas. The Port currently has a parking wayfinding system for the short-term parking garage that indicates if each parking level is full or open. They plan to expand this system to provide wayfinding to individual spaces on each level. They also plan to install dynamic message signs along the roadway that specifically indicate how many spaces are available in each parking lot/garage.
Mapped to Entity: Parking Management

Element: Port of Portland Airport Parking Shuttle Buses *Status:* Existing
Description: The Port operates shuttle buses between the main terminal and several parking lots (economy red and blue, long-term, and employee). These buses may be equipped with GPS in the future to provide next bus arrival information to travelers and to help manage the fixed space at the terminal for bus pick-up.
Mapped to Entity: Transit Vehicle

Element: Port of Portland Data Mart *Status:* Existing
Description: The Port currently archives their data from field device/systems (e.g. count stations, parking systems) on a server at the Port.
Mapped to Entity: Archived Data Management

Portland Dispatch Center Consortium

Element: 911 Dispatch Centers *Status:* Existing
Description: The seven main 911 public safety dispatch centers include: City of Portland's Bureau of Emergency Communications (BOEC), Port of Portland's Airport Communications Center (ACC), Clackamas County Central Communications (CCOM), Washington County Consolidated Communications Agency (WCCCA), Lake Oswego Communications (LOCOM), Clark Regional Emergency Services Agency (CRESA), and Columbia 911 Communications District (C911).
Mapped to Entity: Emergency Management

Element: PDCC Message Broker *Status:* Programmed

Description: The main purpose of the message broker is to provide CAD system interoperability and an interface between the seven main dispatch centers that make up the PDCC. This system will also provide system interfaces with other regional agencies such as ODOT and OSP for the purpose of managing roadway incidents. This message broker will be a push only system that allows information to flow from one agency to other pre-designated agencies depending on the information type. Subscribers will not be able to extract information from the broker.

Mapped to Entity: Emergency Management

Element: PDCC Mobile Dispatch Center *Status:* Programmed

Description: The mobile dispatch center will provide a means for conducting emergency operations and management from a remote location.

Mapped to Entity: Emergency Management

Portland State University

Element: Portland State University PORTAL Data Warehouse *Status:* Existing/Programmed

Description: Portal is the official Archived Data User Service (ADUS) for the Portland Metropolitan region as specified in the Regional ITS Architecture. Portal provides a centralized, electronic database that facilitates the collection, archiving, and sharing of data and information for public agencies within the region. Portal data is intended to be used for research and transportation planning purposes, not real-time operation decision making. The data stored in Portal includes 20-second granularity loop detector data from freeways in the Portland metropolitan region, arterial signal data, travel time data, weather data, incident data, VAS/VMS message data, truck volumes, transit data and arterial signal data. Many of these data feeds are received by Portal in real time or on a daily basis and for most, the retrieval and archiving process is fully automated. The 20-second volume, occupancy and count data for Portland and Vancouver, WA-area freeways from ODOT is received in real-time and has been archived since July 2004. Weather data is retrieved from NOAA and is archived automatically. The collection and archival process for the arterial signal, travel time data and VAS/VMS message sign data is also automated.
The Portal project is a multi-modal transportation data archive that aims to support Metro's Regional Transportation Plan, the production of regional performance measures, support for regional transportation agencies and their consultants and researchers at PSU and elsewhere. Project objectives include producing tools and performance measures useful to local transportation professionals, exploring new and innovative uses of the data, and making the Portal data and system more accessible to agency personnel. Portal is developed in collaboration with partners at the Southwest Washington Regional Transportation Council (RTC), the Transportation and Research Consortium (TREC) at PSU.

Mapped to Entity: Archived Data Management

Mapped to Entity: Traffic Management

Special Event Promoters

Element: Special Event Promoters *Status:* Existing

Description: This element represents events that may impact travel on roadways or other modal means. Examples include sporting events, conventions, motorcades/parades, and public/political events. These promoters interface to the ITS to provide event information such as date, time, estimated duration, location, and any other information pertinent to traffic movement in the surrounding area.

Mapped to Entity: Event Promoters

Element: Special Event Promoters Field Devices *Status:* Existing

Description: This element includes any field devices (e.g. dynamic message signs, CCTV cameras) that can be used to manage travelers or provide traveler information. The Rose Garden currently has a dynamic message sign outside the arena that is used to post information about TriMet MAX train arrivals and departures.

Mapped to Entity: Remote Traveler Support

TransPort Committee

Element: TTIP Message Broker *Status:* Programmed

Description: The TripCheck Traveler Information Portal (TTIP) will collect, process, store, and disseminate transportation information to regional agencies and private information service providers. This system will allow agencies to post information to the broker about roadways, construction, parking, special events, road closures, etc. and will allow subscribers to retrieve information from the broker. Some public agency information will not be accessible to private information service providers for security reasons.

Mapped to Entity: Information Service Provider

Transportation Maintenance and Construction Agencies

Stakeholders in this group:

Oregon Department of Transportation
City of Portland
Multnomah County
TriMet
Clackamas County
Washington County
Port of Portland
Other Cities in Multnomah County
City of Gresham
Other Cities in Clackamas County
City of Beaverton
Other Cities in Washington County
City of Hillsboro
City of Lake Oswego

Element: Maintenance and Construction Management *Status:* Existing

Description: This element includes all management of roadway maintenance and construction activities in the Portland metropolitan area by ODOT, the counties, the cities, the Port, and TriMet.

Mapped to Entity: Maintenance and Construction Management

Mapped to Entity: Traffic Management

Element: Maintenance and Construction Vehicles *Status:* Existing/Planned

Description: This element includes all maintenance and construction vehicles owned and operated by ODOT, the counties, the cities, the Port, and TriMet. These vehicles are not currently outfitted with any intelligent transportation systems but it is very likely in the next 10 years that these vehicles will be equipped with GPS or automated vehicle location tracking devices.

Mapped to Entity: Emergency Vehicle

Mapped to Entity: Maintenance and Construction Vehicle

TriMet

Element: TriMet Commuter Rail *Status:* Programmed

Description: A 15-mile commuter rail line is currently under design and will run between Beaverton and Wilsonville. Service will be operated by P&W Operators and the Operations Center will be located in Utah. Automated vehicle locators are not currently planned to be installed on the trains.

Mapped to Entity: Transit Vehicle

Element: TriMet Enterprise Data Mart *Status:* Existing

Description: This system archives bus and rail operations and dispatch data.

Mapped to Entity: Archived Data Management

Element: TriMet Field Devices *Status:* Existing

Description: This element includes train sensors (these are used to request preempt at traffic signals and provide schedule adherance information), transit tracker real-time customer information displays (these provide static and real-time information), transit tracker phone system (provides static and real-time information), transit tracker PDA system, CCTV cameras, ticket vending machines, and customer information kiosks (these may eventually be phased out).

Mapped to Entity: Remote Traveler Support

Mapped to Entity: Wayside Equipment

Element: TriMet Fixed-Route Buses *Status:* Existing

Description: Fixed-route buses provide service throughout the Portland metropolitan area, except for the City of Wilsonville where SMART provides service. A typical bus includes a number of systems: radio, voice, wi-fi 802.11, automated vehicle location devices, video surveillance, passenger counting, automated stop announcements, silent alarms, other data collection, and communications to wayside devices (transit signal priority). These systems collect, manage, and disseminate transit-related information to the driver, operations and maintenance personnel, and transit system patrons.

Mapped to Entity: Transit Vehicle

Mapped to Entity: Vehicle

Element: TriMet LIFT/ATP Paratransit Vehicles *Status:* Existing

Element: TriMet LIFT/ATP Paratransit Vehicles *Status:* Existing
Description: TriMet's LIFT Program is a shared-ride public transportation service for people who are unable to use buses or MAX due to a disability or disabling health condition. Paratransit vehicles are equipped with automated vehicle locators that include functionality such as silent alarms.
Mapped to Entity: Transit Vehicle

Element: TriMet MAX Trains *Status:* Existing/Programmed
Description: TriMet currently has three MAX lines: Blue (Hillsboro/City Center/Gresham), Red (Beaverton/City Center/Airport), and Yellow (City Center/Expo Center). Two new lines are programmed and expected to be operational by 2009: downtown Portland transit mall and I-205. An additional line from downtown Portland to Milwaukie is planned after the completion of the downtown and I-205 lines.
Mapped to Entity: Transit Vehicle

Element: TriMet Parking Management *Status:* Planned
Description: TriMet plans to provide wayfinding and traveler information for their park and ride facilities.
Mapped to Entity: Parking Management

Element: TriMet Security Surveillance *Status:* Existing
Description: TriMet uses a number of cameras to monitor security on buses and MAX trains and at transit centers, MAX stations, and park and rides. TriMet also uses intrusion detectors/alarms in their tunnel, at substations, and other facilities.
Mapped to Entity: Security Monitoring

Element: TriMet Supervisory Vehicles *Status:* Existing
Description: This element includes both bus and rail supervisory vehicles. These vehicles respond to incidents or equipment failures involving TriMet buses (fixed-route or paratransit) and MAX trains.
Mapped to Entity: Emergency Vehicle

Element: TriMet Transit Operations and Dispatch Centers *Status:* Existing
Description: TriMet operates a number of dispatch and operations centers to support their rail, fixed-route bus, and paratransit services. There are three rail operations centers: Ruby Junction (main center), Elmonica (no dispatch), and Washington Park (emergency center). The fixed route buses are dispatched from Ruby Junction and all three garages have separate operations centers: Powell, Merlo, and Center. Paratransit has three operations centers: Nela (main center), Powell, and Merlo.
Mapped to Entity: Archived Data Management
Mapped to Entity: Emergency Management
Mapped to Entity: Transit Management

Element: TriMet Website *Status:* Existing
Description: The website (www.trimet.org) includes both static and real-time traveler information. Static information includes maps, schedules, fares, park and ride locations, etc. Real-time information includes transit arrival times by route and stop location. The website also features an interactive trip planner.
Mapped to Entity: Information Service Provider

Trucking Firms and Public Fleets

Element: Commercial Vehicles *Status:* Existing
Description: This element may provide two-way communications between the commercial vehicle drivers, their fleet managers, attached freight equipment, and roadside officials, and provides HazMat response teams with timely and accurate cargo contents information after a vehicle incident. It may provide the capability to collect and process vehicle and cargo information from the attached freight equipment, and driver safety data and status and alert the driver whenever there is a potential safety or security problem. Basic identification, security and safety status data are may be supplied to inspection facilities at mainline speeds. In addition, this element may automatically collect and record mileage, fuel usage, and border crossings.
Mapped to Entity: Commercial Vehicle

U.S. Coast Guard

Element: U.S. Coast Guard *Status:* Existing
Description: The U.S. Coast Guard is responsible for handling emergency management on the Willamette and Columbia Rivers. This is critical to the surface transportation system when bridges are involved.
Mapped to Entity: Other Emergency Management

Users

Element: Mobile Information Devices *Status:* Existing

Description: User devices refer to equipment an individual owns and can personalize with their choices for information about transportation networks. Examples include smart phones, tablets, and laptops.

Mapped to Entity: Driver

Mapped to Entity: Pedestrians

Mapped to Entity: Personal Information Access

Mapped to Entity: Traveler

Element: Personal Vehicles (Public at Large) *Status:* Existing

Description: A general element that represents personal automobiles and fleet vehicles that include ITS safety, navigation and traveler information systems that may be applicable to any highway vehicle.

Mapped to Entity: Vehicle

Washington County

Element: Washington County Traffic Operations Center *Status:* Programmed

Description: Washington County has a dedicated room they are planning to convert to a TOC that will initially consist of one or two workstations and a central signal system server with real-time access to field devices. The TOC will be operated during normal weekday business hours and will provide traffic engineers/technicians the capability to monitor/manage traffic signal operations and incidents or citizen complaints as they arise.

Mapped to Entity: Traffic Management

Element: Washington County Traffic Signals and Field Devices *Status:* Existing/Planned

Description: Washington County currently operates traffic signals, SCATS, coordinated traffic signal systems, video detection, and CCTV cameras. The County's ITS Plan includes the addition of weather stations and dynamic warning systems in the future.

Mapped to Entity: Roadway

Washington State Department of Transportation

Element: WSDOT Regional Traffic Operations Center *Status:* Existing

Description: Flows between the WSDOT Regional TOC and the ODOT TMOC provide the transportation management link between the Portland (TransPort) and Vancouver (VAST) regional architectures.

Mapped to Entity: Traffic Management

Status Value Legend

Name	Description
Existing	An entity that currently exists.
Existing/Programmed	Some entities currently exist and others are planned and funded.
Existing/Planned	Some entities currently exist and others are planned but unfunded.
Existing/Future	Some entities currently exist and others are likely to occur in the future as technology advances or funding becomes available.
Programmed	Funding has been obtained for a planned entity.
Planned	An entity has been identified as planned within the next 10 years, but funding has not yet been obtained.
Future	An entity that is likely to occur in the future as technology develops or as other projects are completed but is not currently planned or funded.
Not Planned	

APPENDIX F: CHANGE LOG – SYSTEM INVENTORY

DKS IBI

December 2016

Inventory Element	previous description/problem	updated description	updated status
City of Gresham Traffic Operations Center	none	Multnomah County's traffic signals, the City's SCATS adaptive signal server, and field devices.	Existing/Planned
City of Gresham Traffic Signals and Field Devices	none	The City currently operates traffic signals, coordinated traffic signal systems, and SCATS adaptive signal systems. The City is constructing an arterial dynamic message sign that will be operated and maintained by ODOT. The future may include the installation of CCTV cameras and weather/air quality stations.	Existing/Programmed/Planned
Portal		Portal is the official Archived Data User Service (ADUS) for the Portland Metropolitan region as specified in the Regional ITS Architecture. Portal provides a centralized, electronic database that facilitates the collection, archiving, and sharing of data and information for public agencies within the region. Portal data is intended to be used for research and transportation planning purposes, not real-time operation decision making. The data stored in Portal includes 20-second granularity loop detector data from freeways in the Portland metropolitan region, arterial signal data, travel time data, weather data, incident data, VAS/VMS message data, truck volumes, transit data and arterial signal data. Many of these data feeds are received by Portal in real time or on a daily basis and for most, the retrieval and archiving process is fully automated. The 20-second volume, occupancy and count data for Portland and Vancouver, WA-area freeways from ODOT is received in real-time and has been archived since July 2004. Weather data is retrieved from NOAA and is archived automatically. The collection and archival process for the arterial signal, travel time data and VAS/VMS message sign data is also automated. The Portal project is a multi-modal transportation data archive that aims to support Metro's Regional Transportation Plan, the production of regional performance measures, support for regional transportation agencies and their consultants and researchers at PSU and elsewhere. Project objectives include producing tools and performance measures useful to local transportation professionals, exploring new and innovative uses of the data, and making the Portal data and system more accessible to agency personnel. Portal is developed in collaboration with partners at the Southwest Washington Regional Transportation Council (RTC), the Transportation and Research Consortium (TREC) at PSU.	
RTO related element	none		
City of Portland Aerial Tram	An aerial tram line is currently being designed to connect OHSU to the South Waterfront area. Although this will be a short, fixed line that may not be suited for ITS devices/systems, the fare payment for the system may eventually be tied in to a regional smart card.	An aerial tram connects OHSU to the South Waterfront area. This is a short fixed line that requires fare payment.	existing

Inventory Element	previous description/problem	updated description	updated status
City of Portland Streetcar Vehicles	The Streetcar provides service in downtown Portland and an extension to the South Waterfront Area is planned in the near future. Streetcar vehicles are equipped with GPS units used to automatically track the vehicle's location for traveler information dissemination and transit management.	The Streetcar provides service in downtown Portland, extending down to the South Waterfront Area, and looping to the east side via the Tilikum Crossing and the Broadway Bridge. Streetcar vehicles are equipped with GPS units used to automatically track the vehicle's location for traveler information dissemination and transit management.	existing
User Devices - renamed "Mobile Information Device"			

APPENDIX G: SERVICE PACKAGES

DKS IBI

December 2016

Service Packages (Transportation Services)

12/13/2016 11:21:14AM

Service Packages for Region TransPort Regional ITS Architecture

ITS Data Mart (AD1) -- Existing

This service package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.

ITS Data Warehouse (AD2) -- Existing/Planned

This service package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this service package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

Expansion of the existing program is programmed.

ITS Virtual Data Warehouse (AD3) -- Existing/Planned

This service package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse service package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

Transit Vehicle Tracking (APTS01) -- Existing

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. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

Fixed-route buses, paratransit vehicles, and Streetcar are tracked by devices on the actual vehicles whereas the operations center tracks MAX trains through the use of sensors in the tracks. The City of Wilsonville currently does not have plans to track their vehicles.

Transit Fixed-Route Operations (APTS02) -- Existing

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 determines the transit vehicle trip performance against the schedule using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

Demand Response Transit Operations (APTS03) -- Existing

This service package performs automated dispatch and system monitoring for demand responsive transit services. This service performs scheduling activities as well as operator assignment. In addition, this service package performs similar functions to support dynamic features of flexible-route transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific paratransit service. In the second scenario, a third party service provider determines that the paratransit service is a viable means of satisfying a traveler request and makes a reservation for the traveler.

Transit Fare Collection Management (APTS04) -- Existing

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. 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 Subsystem. Two other service packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management, also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.
Although TriMet collects electronic fares through ticket vending machines at platforms/stops, electronic fare collection is not currently available on-board the vehicle. The development of a smart card in the future may make it possible to pay fares on-board for any transit service or pay fares at parking facilities throughout the Portland area. The development of such a system/smart card will likely follow successful deployments in other parts of the country.

Transit Security (APTS05) -- Existing

This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment is deployed to perform surveillance and sensor monitoring in order to warn of 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).

The surveillance and sensor information is transmitted to the Emergency Management Subsystem, as are transit user activated alarms in public secure areas. On-board alarms, activated by transit users or transit vehicle operators are transmitted to both the Emergency Management Subsystem and the Transit Management Subsystem, indicating two possible approaches to implementing this service package.

In addition the service package supports remote transit vehicle disabling by the Transit Management Subsystem and transit vehicle operator authentication.

Transit Fleet Management (APTS06) -- Future

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 Subsystem. Hardware and software in the Transit Management Subsystem 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.
Although TriMet manually monitors their fleet today, affordable technology to monitor on-board systems and automatically schedule maintenance has not occurred. This is definitely a system TriMet would like to utilize in the future once it is available.

Multi-modal Coordination (APTS07) -- Existing/Planned

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. Transit transfer information is shared between Multimodal Transportation Service Providers and Transit Agencies.

This market package includes transit signal priority (TSP), which TriMet and the City of Portland have implemented at a number of traffic signals. TriMet plans to expand TSP to other traffic signals throughout the region. MAX trains, Streetcar, and Commuter Rail all directly interface with traffic signals through sensors in the tracks.

Transit Traveler Information (APTS08) -- Existing

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.

In addition to transit agency-owned infrastructure, the Port of Portland displays real-time MAX train information in the baggage claim area and the Rose Garden displays real-time MAX train information outside the Rose Garden.

Transit Signal Priority (APTS09) -- Existing/Planned

This service package determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations. The signal priority may result from limited local coordination between the transit vehicle and the individual intersection for signal priority or may result from coordination between transit management and traffic management centers. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network.

Transit Passenger Counting (APTS10) -- Existing

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.

Multimodal Connection Protection (APTS11) -- Planned

This service package supports the coordination of multimodal services to optimize the travel time of travelers as they move from mode to mode (or to different routes within a single mode). A near term function supported by this service package would be for a single transit agency to coordinate crossing routes so that passengers on one route would have the opportunity to transfer with minimum wait time to another route within the same transit system. The next level of complexity of this service package would be for this coordination to occur across transit agencies, or between transit agencies and other modes of transportation. The most advanced functions of this service package would be to track the route of an individual traveler and ensure that connections are properly scheduled on an individual basis. This final capability represents a long-term functionality, which could be managed either through an Information Serviced Provider or through a Transit Management subsystem.

Broadcast Traveler Information (ATIS01) -- Existing

This service package 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 web casts. The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the service package ATMS06 - Traffic Information Dissemination, which provides localized HAR and DMS information capabilities, ATIS01 provides a wide area digital broadcast service. Successful deployment of this service package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

Interactive Traveler Information (ATIS02) -- Existing

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 between the traveler and Information Service Provider. 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 kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. This service package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this service package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a “traveler card” that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

Autonomous Route Guidance (ATIS03) -- Existing

This service package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.

Most automobile manufacturers offer interactive navigational systems as optional equipment on most personal vehicles. A number of fire and police vehicles are currently equipped with mobile data terminals that provide static route guidance to a specified address.

Dynamic Route Guidance (ATIS04) -- Planned

This service package offers advanced route planning and guidance that is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is considered by the user equipment in provision of route guidance.

When the technology and communications are available to support dynamic route guidance, the TATII Message Broker will be the medium through which real-time traveler information will be funneled to navigation systems.

ISP Based Trip Planning and Route Guidance (ATIS05) -- Existing

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 ATIS3 and ATIS4, where the user equipment determines the route, the route determination functions are performed in the Information Service Provider Subsystem 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 (e.g., parking reservations) 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.

Transportation Operations Data Sharing (ATIS06) -- Existing

This service package makes real-time transportation operations data available to transportation system operators. The Information Service Provider collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes this information available to transportation system operators, facilitating the exchange of qualified, real-time information between agencies. Using the provided information, transportation system operators can manage their individual systems based on an overall view of the regional transportation system. The regional transportation operations data resource represented by the Information Service Provider may be implemented as a web application that provides a web-based access to system operators, an enterprise database that provides a network interface to remote center applications, or any implementation that supports regional sharing of real-time transportation operations data.

Travel Services Information and Reservation (ATIS07) -- Existing

This service package provides travel information and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This service package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.

Dynamic Ridesharing (ATIS08) -- Existing/Planned

This service package provides dynamic ridesharing/ride matching services to travelers. This service could allow near real time ridesharing reservations to be made through the same basic user equipment used for Interactive Traveler Information. This ridesharing/ride matching capability also includes arranging connections to transit or other multimodal services.

In Vehicle Signing (ATIS09) -- Future

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). It includes short range communications between field equipment and the vehicle and connections to the Traffic Management Subsystem for monitoring and control. This service package also includes the capability for maintenance and construction, transit, and emergency vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in work zones, around incidents, and in areas where transit operations impacts traffic.

This market package will be added in the future when the technology is available and affordable.

Short Range Communications Traveler Information (ATIS10) -- Future

This service package provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility applications 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 DSRC 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.

Network Surveillance (ATMS01) -- Existing

This service package includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. 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 Subsystem). 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 Information Service Provider Subsystem.

Traffic Probe Surveillance (ATMS02) -- Existing/Planned

This service package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this service package: 1) wide-area wireless communications between the vehicle and center is used to communicate vehicle operational information and status directly to the center, and 2) dedicated short range communications between passing vehicles and the roadside is used to provide equivalent information to the center. The first approach leverages wide area communications equipment that may already be in the vehicle to support personal safety and advanced traveler information services. The second approach utilizes vehicle equipment that supports toll collection, in-vehicle signing, and other short range communications applications identified within the architecture. The service package enables transportation operators and traveler information providers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, on-board equipment, data reduction software, and fixed-point to fixed-point links between centers to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required, such as the ability to identify and filter out-of-bounds or extreme data reports.

The City of Portland and TriMet currently use TriMet fixed-route buses as probes to detect congestion/incidents along arterial roadways. Other transportation agencies plan to work with TriMet to implement a probe system on their roadways.

Traffic Signal Control (ATMS03) -- Existing

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 ATMS07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.

Traffic Metering (ATMS04) -- Existing

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 Network Surveillance 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.

HOV Lane Management (ATMS05) -- Future

This service package manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.

ODOT currently has HOV lanes on I-5 between downtown Portland and Vancouver. They may consider using ITS to manage these HOV lanes in the future.

Traffic Information Dissemination (ATMS06) -- Existing

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 Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated. The sharing of transportation operations data described in this service package also supports other services like ATMS09- Traffic Decision Support and Demand Management.

ODOT, WSDOT, and the City of Portland own and operate roadway dynamic message signs today and the Port of Portland owns and operates a highway advisory radio system. Other agencies in the Portland area plan to deploy dynamic message signs at key points on busy corridors.

Regional Traffic Management (ATMS07) -- Existing/Planned

This service package provides for the sharing of traffic 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 ATMS03-Traffic Signal Control and ATMS04-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 to 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 control between traffic management centers.

A small number of TOC's in the region are currently connected through communications links and more are planned to be linked. Control of CCTV camera images is most often shared. ODOT and the City of Portland also share control of a number of traffic signals and field devices along the I-5/Barbur Boulevard corridor. Other sharing will likely be added as more incident management detour routes and operational plans are developed.

Traffic Incident Management System (ATMS08) -- Existing

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 center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

Transportation Decision Support and Demand Management (ATMS09) -- Existing

This service package recommends courses of action to traffic operations personnel based on an assessment of current and forecast road network performance. Recommendations may include predefined incident response plans and regional surface street and freeway control strategies that correct network imbalances. Where applicable, this service package also recommends transit, parking, and toll strategies to influence traveler route and mode choices to support travel demand management (TDM) programs and policies managing both traffic and the environment. TDM recommendations are coordinated with transit, parking, and toll administration centers to support regional implementation of TDM strategies. Incident response and congestion management recommendations are implemented by the local traffic management center and coordinated with other regional centers by other service packages (see ATMS07-Regional Traffic Management and ATMS08-Traffic Incident Management). All recommendations are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. Traffic data is collected from sensors and surveillance equipment as well as other transportation management centers (see ATIS06-Transportation Operations Data Sharing). Forecasted traffic loads are derived from historical data and route plans supplied by the Information Service Provider Subsystem. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support TDM, where applicable.

Electronic Toll Collection (ATMS10) -- Future

This service package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Field-Vehicle Communication between the roadway equipment and the vehicle is required as well as Fixed Point-Fixed Point interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Toll violations are identified and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. Two other service packages, APTS04: Transit Fare Collection Management and ATMS16: Parking Facility Management also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

The vehicle equipment and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.
The future will include road user charging applications within the Portland area. Example applications include congestion pricing, parking pricing, or a Columbia River Bridge toll. The TransPort Regional ITS Architecture will be updated when road user charging applications are implemented. The architecture will follow the open system model used in the Oregon Statewide ITS Architecture and use ITS standards that allow for interoperability between road user charging systems used throughout the state.

Emissions Monitoring and Management (ATMS11) -- Existing

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 subsystem 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 TDM programs, policies, and regulations.

The Oregon DEQ currently performs emissions testing on personal vehicles every two years. They also monitor the air quality using an Air Quality Index (AQI) and issue Clean Air Action Day Smog Advisories in the summertime when they predict the AQI will exceed acceptable levels.

Roadside Lighting System Control (ATMS12) -- Existing/Planned

This service package includes systems that manage electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside. These systems allow a center to control lights based on traffic conditions, time-of-day, and the occurrence of incidents. Such systems can increase the safety of a roadway segment by increasing lighting and conserve energy at times when conditions warrant a reduction in the amount of lighting.

Standard Railroad Grade Crossing (ATMS13) -- Existing

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 roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. 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 subsystem.

Wayside equipment is used for heavy rail vehicles and TriMet MAX trains and is planned for TriMet Commuter Rail trains. This equipment interacts with flashing lights and gates at crossings. This market package also includes agency-owned passive warning devices (e.g. crossbuck or RR warning signs).

Advanced Railroad Grade Crossing (ATMS14) -- Planned

This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This service package includes all capabilities from the Standard Railroad Grade Crossing service package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this service package include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this service package, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This service package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Clackamas County is actively seeking funding to deploy train detection equipment at rail crossings in downtown Milwaukie and downtown Oregon City to provide advanced train activity information to travelers and emergency management personnel. Once a model deployment has been completed, the concepts of the project will be applied to other at-grade rail crossings in Clackamas County based on the successfulness of the project.

Railroad Operations Coordination (ATMS15) -- Planned

This service package provides an additional level of strategic coordination between freight rail operations and traffic management 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.

Once the TATII Message Broker is operational, information that affects at-grade rail intersections can be fed into TATII by heavy rail operators (e.g. train schedules, crossing maintenance) and transportation agencies (e.g. crossing maintenance).

Parking Facility Management (ATMS16) -- Existing/Planned

This service package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This service package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment. Two other service packages, APTS04: Transit Fare Collection Management and ATMS10: Electronic Toll Collection also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

The Port of Portland has a parking management system in place that includes electronic payment for all facilities and wayfinding by level in the short-term parking garage. They plan to expand the wayfinding system in the garage to include individual parking spaces. The City of Portland uses electronic payment at its parking meters and for monthly pass holders in their Smart Park garages. TriMet plans to monitor their park and ride facilities in the future and provide parking availability information to travelers.

Regional Parking Management (ATMS17) -- Future

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 systems and information service providers to support multimodal travel planning, including parking reservation capabilities. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.

The potential development of a smart card in the future will allow travelers to electronically pay for parking at any publicly-owned facility in the area regardless of which agency owns the facility.

Speed Warning and Enforcement (ATMS19) -- Existing/Planned

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 ATMS22-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.

A few agencies within the region currently use driver feedback signs to display a vehicle's speed compared to the posted speed. Other agencies plan to add speed monitoring in additional locations.

Drawbridge Management (ATMS20) -- Existing

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 tha are used to keep travelers apprised of current and forecasted drawbridge status.

ODOT manages the I-5 bridge over the Columbia River and Multnomah County manages the bridges over the Willamette River.

Roadway Closure Management (ATMS21) -- Future

This service package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The service package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates tc be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this service package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This service package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other ATMS service packages.

Clackamas County and Multnomah County both have flood and/or slide areas where they may deploy roadway closure systems in the future.

Variable Speed Limits (ATMS22) -- Existing/Planned

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

This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the ATMS19-Automated Speed Warning and Enforcement service package.

Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS23-Dynamic Lane Management and Shoulder Use and ATMS24-Dynamic Roadway Warning).

Dynamic Lane Management and Shoulder Use (ATMS23) -- Planned

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

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

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS24-Dynamic Roadway Warning).

Dynamic Roadway Warning (ATMS24) -- Existing/Planned

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

Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the ATMS19 – Speed Warning and Enforcement service package.

Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS23-Dynamic Lane Management and Shoulder Use).

VMT Road User Payment (ATMS25) -- Planned

This service package facilitates charging fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner). Vehicle owners need only register with a single payment entity of their choice (a participating state, municipal, or regional DOT, an authority, or a private entity), and payments are reconciled by the entity receiving payment (and travel history) with all roadway owners that participate in the VMT payment scheme, which may also include the Federal government. Vehicle owners would pay nothing for distances traveled where there are no payments required (e.g. in jurisdictions that have not implemented a distance based payment or for roadway operators that collect payment using traditional tolls), although a Federal payment rate might cover some or all roadway operations (a Federal policy decision). Basic operation depends on the vehicle tracking its own location, and periodically reporting its travel history to the registered entity receiving payment using C-V communications. Roadway VMT Payment can duplicate the functions of current toll road payment schemes based on F-V communications, parking payment functions, as well as augment and/or replace federal and state gasoline taxes (which are otherwise ineffective for vehicles that don't use gasoline).

The payments per distance traveled can be structured to provide some amount of demand management by motivating vehicle owner travel choices to minimize payments. The use of this service package for demand management is a local policy decision by each roadway owner.

Alternatively, for vehicle owners that prefer a strictly odometer ("high privacy") based payment approach (that does not need to record and report specific locations and times of travel), then the payment amount may assume a payment rate corresponding to the most expensive roads at the most expensive times. Specific payment rates for this option are a local policy decision.

Odometer readings (from vehicle registration and periodic safety inspection events stored at the state DOT where the vehicle is registered) can be used as a back-office audit to detect gross vehicle equipment failures and fraud (e.g. disabling or dismounting vehicle equipment). In addition, vehicle equipment can be read by fixed or mobile roadside equipment using F-V communications for a more immediate audit of in-vehicle equipment and enforcement (for vehicle owners that have not chosen the odometer-only method of payment).

Payment can be made periodically through a normal bill/payment cycle that is part of the registration process a vehicle owner chooses, or using a vehicle mounted or entered payment instrument/information with vehicle operator or owner initiated payment points. This facilitates payment by vehicle operators (instead of owners) for various commercial operations such as rental vehicles, taxi operators.

Mixed Use Warning Systems (ATMS26) -- Planned

This service package supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. These systems could allow automated warning or active protection for this class of users.

Vehicle Safety Monitoring (AVSS01) -- Existing/Future

This service package will diagnose critical components of the vehicle and warn the driver of potential dangers. On-board sensors will determine the vehicle's condition, performance, on-board safety data, and display information.
Most vehicles include a basic system to alert the driver of potential dangers (e.g. "Check Engine" light). These systems are private initiatives that will be developed by the automotive industry and will continue to advance with new technological developments.

Longitudinal Safety Warning (AVSS03) -- Planned

This service package allows for longitudinal warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.
This market package is being pursued by the automotive industry.

Lateral Safety Warning (AVSS04) -- Planned

This service package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.
This market package is being pursued by the automotive industry.

Intersection Safety Warning (AVSS05) -- Future

This service package monitors vehicles approaching an intersection and warns drivers when hazardous conditions are detected. The service package detects impending violations (e.g., red-light violations) and potential conflicts between vehicles occupying or approaching the intersection (e.g., situations where a left turn would be unsafe because of approaching traffic). When a potentially hazardous condition is detected, a warning is communicated to the involved vehicles using short range communications and/or signs/signals in the intersection.

This market package may be deployed within the next 10 years and will involve public agencies installing field devices at traffic signals that can communicate to warning systems in vehicles that alert drivers of potential safety hazards.

Advanced Vehicle Longitudinal Control (AVSS08) -- Future

This service package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.

If pursued, this market package will be deployed by the automobile industry.

Advanced Vehicle Lateral Control (AVSS09) -- Future

This service package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.

If pursued, this market package will be deployed by the automobile industry.

Intersection Collision Avoidance (AVSS10) -- Future

This service package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This service package builds on the Intersection Safety Warning field and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle to avoid intersection violations and potential collisions. The same sensors and communications equipment in the roadway infrastructure are used to assess vehicle locations and speeds near an intersection. This information is determined and communicated to the approaching vehicle using a short range communications system. The vehicle uses this information to develop control actions which alter the vehicle's speed and steering control and potentially activate its pre-crash safety system.

This market package may be deployed within the next 10 years and will involve public agencies installing field devices at traffic signals that can communicate to warning systems in vehicles that alert drivers of potential safety hazards.

Automated Vehicle Operations (AVSS11) -- Future

This service package enables "hands-off" operation of the vehicle on automated portions of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control. 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 as the driver resumes control of the vehicle.

This market package would involve a massive deployment of field devices along the roadway and would require communications between these devices and on-board vehicle systems. No agencies within the Portland area foresee this occurring within the next 10 years.

Cooperative Vehicle Safety Systems (AVSS12) -- Future

This service package enhances the on-board longitudinal and lateral warning stand-alone systems by exchanging messages with other surrounding vehicles and roadside equipment. Vehicles send out information concerning their location, speed, and direction to surrounding vehicles. The roadside equipment provides information about potential safety hazards in the vehicle path such as stalled (unequipped) vehicles, wrong-way drivers, debris, or water hazards. The on-board systems can then process this information and present warnings to the driver including headway warnings, merge warnings, unsafe passing warnings, and warnings about hazards detected in the vehicle path. Special messages from approaching emergency vehicles may also be received and processed.

HAZMAT Management (CVO10) -- Existing

This service package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates 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 Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

Emergency Call-Taking and Dispatch (EM01) -- Existing

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 Subsystems supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystem and an Emergency Vehicle supports dispatch and provision of information to responding personnel.

Emergency Routing (EM02) -- Existing/Planned

This service package supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions, and suggested routing information are provided to enhance emergency vehicle routing. Special priority or other specific emergency traffic control strategies can be coordinated to improve the safety and time-efficiency of responding vehicle travel on the selected route(s). The Emergency Management Subsystem provides the routing for the emergency fleet based on real-time conditions and has the option of requesting a route from the Traffic Management subsystem. The Emergency Vehicle may also be equipped with dedicated short range communications for local signal preemption and the transmission of alerts to surrounding vehicles. The service provides for information exchange between care facilities and both the Emergency Management Subsystem and emergency vehicles.

Most traffic signals currently include signal preemption for fire vehicles, which is included in this market package. Dynamic routing will be possible as technology advances and transportation infrastructure provides the information to support it.

Mayday and Alarms Support (EM03) -- Existing/Planned

This service package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user, gather information about the incident, and determine the appropriate response. The request for assistance may be manually initiated or automated and linked to vehicle sensors. This service package also includes general surveillance capabilities that enable the Emergency Management Subsystem to remotely monitor public areas (e.g., rest stops parking lots) to improve security in these areas. The Emergency Management Subsystem may be operated by the public sector or by a private sector telematics service provider.

Private companies already provide mayday services to people who purchase vehicles with mayday systems and subscribe to the system. Call-takers at mayday service centers facilitate emergency response by calling 911 and passing along information (communications with driver, location of vehicle determined by GPS, etc.). ODOT is currently working on a project to integrate private mayday service systems with emergency and incident management agencies. The PDCC message broker may be used as the interface between system users.

Roadway Service Patrols (EM04) -- Existing

This service package supports roadway service patrol vehicles that monitor roads that 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.

Transportation Infrastructure Protection (EM05) -- Existing

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 by Traffic Management Subsystems 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.

TriMet monitors most of their infrastructure, including substations and the tunnel. ODOT uses intrusion alarms on the I-5 bridge.

Wide-Area Alert (EM06) -- Existing

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

Early Warning System (EM07) -- Existing

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.
Several monitoring and warning systems are currently used: flood and severe weather watches (National Weather Service), earthquake warning system (National Earthquake Information Center), tsunami warning system (U.S. West Coast and Alaska Tsunami Warning Center), and debris flow early warning system (Oregon Department of Forestry). The Oregon Emergency Response System (OERS) is the primary point of contact for state notification of an emergency or disaster.

Disaster Response and Recovery (EM08) -- Existing/Planned

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 subsystem 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 Subsystem and the other center subsystems 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 ATMS08, 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 the National ITS Architecture will want to consider both ATMS08 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 EM10, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.
A number of plans and systems are currently in place to support this market package. The PDCC Message Broker currently under development will help enhance information sharing and integrate CAD systems. Planned communications links between a number of centers will also allow for shared control and monitoring of existing and planned ITS devices and systems.

Evacuation and Reentry Management (EM09) -- Existing/Planned

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 EM10, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.
Local emergency management agencies already have evacuation plans in place. Existing and planned ITS devices and systems may be used to supplement evacuations and reentry. For example, coordinated traffic signal timing plans may be used to flush traffic in a single direction. Additional planning may be required to develop operational plans that include the use of ITS.

Disaster Traveler Information (EM10) -- Planned

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 ATIS 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.

Maintenance and Construction Vehicle and Equipment Tracking (MC01) -- Existing/Planned

This service package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. These activities can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.
Automated systems are not in use today because of the large cost and limited benefits. These systems support emergency management operations more than the day-to-day operations. As technology advances and becomes more affordable automated systems will likely be added to many maintenance and construction vehicles.

Maintenance and Construction Vehicle Maintenance (MC02) -- Existing/Planned

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 maintenance.
Agencies will consider the use of this market package in the future when the technology has been developed and provides a high benefit-to-cost ratio.

Road Weather Data Collection (MC03) -- Existing/Planned

This service package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles. 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.
Road weather data is currently collected by a limited number of agencies, but many agencies plan to add weather stations at key locations within the next 10 years.

Weather Information Processing and Distribution (MC04) -- Existing

This service package processes and distributes the environmental information collected from the Road 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 system operators 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 by system operators 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.

Roadway Automated Treatment (MC05) -- Existing/Future

This service package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The service package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatmen system is activated.
ODOT has this system deployed at the Court Creek crossing. Multnomah County may deploy these systems on their bridges in the future

Winter Maintenance (MC06) -- Existing/Planned

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.
This market package will be utilized in the future after more weather stations have been deployed and after more affordable technology has been developed to support this market package.

Roadway Maintenance and Construction (MC07) -- Existing/Future

This service package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would 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.
Some existing systems currently provide limited automated notification of non-routine maintenance needs. For example, a traffic signal controller may communicate through a central signal system that a detector loop is not working. Most agencies will wait to deploy maintenance scheduling systems until the technology is readily available.

Work Zone Management (MC08) -- Existing/Planned

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., ISP, 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.

ITS is used in a number of ways today in work zones: posting of delay messages on permanent or portable dynamic message signs, variable speed signs, CCTV camera monitoring, posting of information online at TripCheck or local agency websites, etc. As new construction projects are budgeted, planned and designed, ITS should be built into the project to support the management of the work zone.

Work Zone Safety Monitoring (MC09) -- Existing/Future

This service package includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. This service package detects vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment or other potential safety hazards. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone. The service package supports both stationary and mobile work zones. The intrusion detection and alarm systems may be collocated or distributed, allowing systems that detect safety issues far upstream from a work zone (e.g., detection of over dimension vehicles before they enter the work zone).

ODOT has utilized overheight vehicle warning systems to alert work zone crews of potential safety hazards. Regional transportation agencies should plan to use safety monitoring systems in future construction projects.

Maintenance and Construction Activity Coordination (MC10) -- Existing/Programmed

This service package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.

Maintenance and construction information is already disseminated through traveler information systems today to some degree. The regional vision for coordinating activities between agencies and utility companies is to use the TATII Message Broker.

Environmental Probe Surveillance (MC11) -- Existing/Planned

This service package 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. It includes the on-board vehicle systems that collect and report environmental probe data, the infrastructure equipment that collects the probe data and the centers that aggregate and share the collected probe data.

Infrastructure Monitoring (MC12) -- Future

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.

APPENDIX H: CHANGE LOG – SERVICE PACKAGES

DKS IBI

December 2016

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
ARCHIVED DATA MANAGEMENT						
	AD1	ITS Data Mart	Yes		same	
	AD2	ITS Data Warehouse	Yes		existing/planned	
	AD3	ITS Virtual Data Warehouse	No	Yes	existing/planned	This service package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse service package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.
PUBLIC TRANSPORTATION						
	APTS01	Transit Vehicle Tracking	Yes			
	APTS02	Transit Fixed-Route Operations	Yes			
	APTS03	Demand Response Transit Operations	Yes			
	APTS04	Transit Fare Collection Management	Yes			
	APTS05	Transit Security	Yes			
	APTS06	Transit Fleet Management	Yes		existing	
	APTS07	Multi-modal Coordination	Yes			
	APTS08	Transit Traveler Information	Yes			
	APTS09	Transit Signal Priority	Yes		existing/planned	
	APTS10	Transit Passenger Counting	Yes		existing	
	APTS11	Multimodal Connection Protection	No	Yes	planned	This service package supports the coordination of multimodal services to optimize the travel time of travelers as they move from mode to mode (or to different routes within a single mode). A near term function supported by this service package would be for a single transit agency to coordinate crossing routes so that passengers on one route would have the opportunity to transfer with minimum wait time to another route within the same transit system. The next level of complexity of this service package would be for this coordination to occur across transit agencies, or between transit agencies and other modes of transportation. The most advanced functions of this service package would be to track the route of an individual traveler and ensure that connections are properly scheduled on an individual basis. This final capability represents a long-term functionality, which could be managed either through an Information Serviced Provider or through a Transit Management subsystem.
TRAVELER INFORMATION						
	ATIS01	Broadcast Traveler Information	Yes		Existing	
	ATIS02	Interactive Traveler Information	Yes			
	ATIS03	Autonomous Route Guidance	Yes			
	ATIS04	Dynamic Route Guidance	Yes		Existing	
	ATIS05	ISP Based Trip Planning and Route Guidance	Yes			
	ATIS06	Transportation Operations Data Sharing	Yes			
	ATIS07	Travel Services Information and Reservation	Yes			
	ATIS08	Dynamic Ridesharing	Yes			
	ATIS09	In Vehicle Signing	Yes			

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
	ATIS10	Short Range Communications Traveler Information	Yes			
TRAFFIC MANAGEMENT						
	ATMS01	Network Surveillance	Yes			
	ATMS02	Traffic Probe Surveillance	Yes			
	ATMS03	Traffic Signal Control	Yes			
	ATMS04	Traffic Metering	Yes			
	ATMS05	HOV Lane Management	Yes			
	ATMS06	Traffic Information Dissemination	Yes		existing	
	ATMS07	Regional Traffic Management	Yes			
	ATMS08	Traffic Incident Management System	Yes			
	ATMS09	Transportation Decision Support and Demand Management	Yes			
	ATMS10	Electronic Toll Collection	Yes			
	ATMS11	Emissions Monitoring and Management	Yes			
	ATMS12	Roadside Lighting System Control	No	Yes	existing/planned	This service package includes systems that manage electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside. These systems allow a center to control lights based on traffic conditions, time-of-day, and the occurrence of incidents. Such systems can increase the safety of a roadway segment by increasing lighting and conserve energy at times when conditions warrant a reduction in the amount of lighting.
	ATMS13	Standard Railroad Grade Crossing	Yes			
	ATMS14	Advanced Railroad Grade Crossing	Yes			
	ATMS15	Railroad Operations Coordination	Yes			
	ATMS16	Parking Facility Management	Yes			
	ATMS17	Regional Parking Management	Yes			
	ATMS18	Reversible Lane Management	No	NO (No interest from TransPort - June mtg)		This service package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this service package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This service package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.
	ATMS19	Speed Warning and Enforcement	Yes			
	ATMS20	Drawbridge Management	Yes			
	ATMS21	Roadway Closure Management	Yes			
	ATMS22	Variable Speed Limits	Yes			
	ATMS23	Dynamic Lane Management and Shoulder Use	Yes			
	ATMS24	Dynamic Roadway Warning	Yes			

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
	ATMS25	VMT Road User Payment	No	Yes	Planned	This service package facilitates charging fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner). Vehicle owners need only register with a single payment entity of their choice (a participating state, municipal, or regional DOT, an authority, or a private entity), and payments are reconciled by the entity receiving payment (and travel history) with all roadway owners that participate in the VMT payment scheme, which may also include the Federal government. more text...
	ATMS26	Mixed Use Warning Systems	No	Yes (future)	Planned	This service package supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. These systems could allow automated warning or active protection for this class of users.
VEHICLE SAFETY						
	AVSS01	Vehicle Safety Monitoring	Yes			
	AVSS02	Driver Safety Monitoring	No	No		This service package will determine the driver's condition, and warn the driver of potential dangers. On-board sensors will determine the driver's condition, performance, on-board safety data, and display information.
	AVSS03	Longitudinal Safety Warning	Yes			
	AVSS04	Lateral Safety Warning	Yes			
	AVSS05	Intersection Safety Warning	Yes			
	AVSS06	Pre-Crash Restraint Deployment	No	No		This service package provides in-vehicle sensors and on-board communications to monitor the vehicle's local environment, determine collision probability and deploy a pre-crash safety system. It will include on-board sensors to measure lateral and longitudinal gaps and together with weather and roadway conditions will determine lateral and longitudinal collision probability. It will exchange messages with other equipped vehicles to determine the precise location of surrounding vehicles. It will deploy a pre-crash safety system when a crash is imminent.
	AVSS07	Driver Visibility Improvement	No	No		This service package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed
	AVSS08	Advanced Vehicle Longitudinal Control	No	Yes (future)		This service package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.
	AVSS09	Advanced Vehicle Lateral Control	No	Yes (future)		This service package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.
	AVSS10	Intersection Collision Avoidance	Yes			
	AVSS11	Automated Vehicle Operations	No	Yes (future)		This service package enables "hands-off" operation of the vehicle on automated portions of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control. 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 as the driver resumes control of the vehicle.
	AVSS12	Cooperative Vehicle Safety Systems	Yes			

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
COMMERCIAL VEHICLE OPERATIONS	CVO01	Carrier Operations and Fleet Management	No	No		This service package provides the capabilities to manage a fleet of commercial vehicles. The Fleet and Freight Management subsystem provides the route for a commercial vehicle by either utilizing an in-house routing software package or an Information Service Provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). Any such restricted areas are determined by the Commercial Vehicle Administration. A route would be 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 subsystem and routing changes can be made depending on current road network conditions. Once a route has been assigned, changes must be coordinated between the Fleet and Freight Management subsystem and the Commercial Vehicle. Commercial Vehicle Drivers would be 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 subsystem. The Fleet and Freight Management subsystem can also notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried), by sending an alarm to the Emergency Management subsystem.
	CVO02	Freight Administration	No	No		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 source to destination. In addition to the usual cargo monitoring required to insure that cargo gets from origin to destination, the Fleet and Freight Management subsystem monitors shipments to make sure that no tampering or breach of security occurs to the cargo on commercial vehicles. Any such tampering will be reported to the Fleet and Freight Management subsystem. In addition to exceptions (e.g., alerts) that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management subsystem. The commercial vehicle driver is also alerted of any tampering or breach of cargo security. 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 subsystem may notify the Emergency Management subsystem. Commercial vehicle and freight security breaches may also be sent to the Commercial Vehicle Check subsystem.
	CVO03	Electronic Clearance	No	No		This service package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and Field-Vehicle Communications to the roadside. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, transponder read/write devices and computer workstations.

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
	CVO04	CV Administrative Processes	No	No		This service package supports program administration and enrollment and provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in a variety of programs including electronic clearance and wireless inspection programs which allow commercial vehicles to be screened at mainline speeds. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration subsystem and snapshots of this data are made available to the roadside check facilities. Current program status is maintained and made available to carriers, drivers, and other authorized users of the data. Enrolled carriers are provided the option to review and challenge the collected data.
	CVO05	International Border Electronic Clearance	No	No		This service package provides for automated clearance at international border crossings. It augments the Electronic Clearance service package by allowing interface with border administration and border inspection related functions. This service package processes the entry documentation for vehicle, cargo, and driver, checks compliance with import/export and immigration regulations, handles duty fee processing, and reports the results of the crossing event to manage release of commercial vehicle, cargo, and driver across an international border. It interfaces with administrative systems used by customs and border protection, immigration, carriers, and service providers (e.g., brokers) and inspection systems at international border crossings to generate, process, and store entry documentation.
	CVO06	Weigh-In-Motion	Yes	Take out?		
	CVO07	Roadside CVO Safety	No	No/maybe DISCUSS		This service package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the roadside check locations. The capabilities for performing the safety inspection are shared between this service package and the On-board CVO and Freight Safety & Security (CVO08) service package which enables a variety of implementation options. The basic option, directly supported by this service package, facilitates safety inspection of vehicles that have been pulled off the highway, perhaps as a result of the automated screening process provided by the Electronic Clearance (CVO03) service package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations, supported by the On-board CVO and Freight Safety & Security (CVO08) service package, utilize additional on-board vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.
	CVO08	On-board CVO Safety	No	No		This service package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Service Package and includes support for collecting on-board safety data via transceivers or other means. The on-board safety data are assessed by an off-board system. In some cases the monitoring and safety assessment may occur remotely (i.e., not at a roadside site). Following the assessment, safety warnings are provided to the driver, the Commercial Vehicle Check roadside elements, and carrier. This service package allows for the Fleet and Freight Management subsystem to have access to the on-board safety data.

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
	CVO09	CVO Fleet Maintenance	No	No		This service package supports maintenance of CVO fleet vehicles with on-board monitoring equipment and Automated Vehicle Location (AVL) capabilities within the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.
	CVO10	HAZMAT Management	Yes			
	CVO11	Roadside HAZMAT Security Detection and Mitigation	No	No		This service package provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT. If the credentials analysis and sensed HAZMAT information do not agree, the vehicle can be signaled to pull off the highway, and if required, an alarm can be sent to Emergency Management to request they monitor, traffic stop or disable the vehicle.
	CVO12	CV Driver Security Authentication	No	No		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.
	CVO13	Freight Assignment Tracking	No	No		This service package 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 subsystem and then the appropriate people and subsystems are notified. Data collected by the On-board CV and Freight Safety & Security and the On-board Driver Authentication equipment packages used in other service packages are also used to monitor the three aspects of assignment for this service package. In addition to this service package, Fleet and Freight Managers may also monitor routes and itineraries and this capability is included in Fleet Administration.
EMERGENCY MANAGEMENT						
	EM01	Emergency Call-Taking and Dispatch	Yes			
	EM02	Emergency Routing	Yes			
	EM03	Mayday and Alarms Support	Yes			
	EM04	Roadway Service Patrols	Yes			
	EM05	Transportation Infrastructure Protection	Yes			
	EM06	Wide-Area Alert	Yes			
	EM07	Early Warning System	Yes			
	EM08	Disaster Response and Recovery	Yes			
	EM09	Evacuation and Reentry Management	Yes			
	EM10	Disaster Traveler Information	Yes			
N MANAGEMENT						
	MC01	Maintenance and Construction Vehicle and Equipment Tracking	Yes		existing/planned	
	MC02	Maintenance and Construction Vehicle Maintenance	Yes		existing/planned	

Key:	light green highlight = service package added to Turbo Architecture since 2005 dark green highlight = change to Regional Architecture

Service Area	Service Package	Service Package Name	Currently included in Regional Arch?	Include in 2016 update?	updated status	Description
MAINTENANCE & CONSTRUCTION	MC03	Road Weather Data Collection	Yes			
	MC04	Weather Information Processing and Distribution	Yes			
	MC05	Roadway Automated Treatment	Yes			
	MC06	Winter Maintenance	Yes			
	MC07	Roadway Maintenance and Construction	Yes			
	MC08	Work Zone Management	Yes			
	MC09	Work Zone Safety Monitoring	Yes			
	MC10	Maintenance and Construction Activity Coordination	Yes			
	MC11	Environmental Probe Surveillance	No	Yes	existing/planned	This service package 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. It includes the on-board vehicle systems that collect and report environmental probe data, the infrastructure equipment that collects the probe data and the centers that aggregate and share the collected probe data.
	MC12	Infrastructure Monitoring	Yes		future	

APPENDIX I: SAMPLE OF ODOT ITS ARCHITECTURE COMPLIANCE CHECKLIST AND THE ITS ARCHITECTURE CHANGE REQUEST FORMS

DKS IBI

December 2016

TransPort Regional ITS Architecture Change Request Form

To be Filled Out by Change Originator	
Date of Request:	
Title of Change:	Project Name
Type of Change:	☐ Stakeholder ☐ Inventory (Subsystems and Terminators) ☐ Services Packages ☐ Operational Concept ☐ Interfaces (Interconnects/Flows Between Elements) ☐ Standards ☐ Agreements ☐ Project Architecture
Description of Change:	
Reason for Change:	
Originator Information	
Name:	
Agency:	
Telephone:	
E-Mail:	
To be Filled Out by TransPort	
Change #:	
Change Status:	☐ Approved ☐ Denied
Date of Status Decision:	
Comments:	
Documents Affected:	
Date Architecture Updated:	

Oregon Department of Transportation

ITS Projects – Systems Engineering and Architecture Compliance (Rule 940) Checklist

For all ITS projects, a Systems Engineering Checklist must be submitted to the Federal Highway Administration (FHWA) for review and approval. The checklist needs to be completed and submitted to the FHWA for review and approval prior to preliminary engineering authorization.

SECTION 1 – Project Information	
1.1 NAME OF PERSON FILING CHECKLIST	**1.2 DATE**
1.3 PROJECT TITLE	**1.4 KEY NUMBER**

1.5 PROJECT PURPOSE
Is there a project prospectus that defines the problem? ☒ Yes ☐ No
If "No", please provide information:

Is there a project prospectus that defines the proposed solution? ☒ Yes ☐ No
If "No", please provide information:

1.6 HOW WERE THESE NEEDS IDENTIFIED? (Check appropriate box)
☒ Internal Assessment ☐ Stakeholder Involvement ☒ Regional ITS Plan ☐ Other
Please provide details on how needs were identified – If other documentation was used as a reference, please identify it here:

-

1.7 CONTACT PERSON/GROUP	**1.8 PROJECT LOCATION**	**1.9 BUDGET**
	☒ See Project Prospectus (if available) Other: •	☒State ☒Federal ☐Other Amount

1.10 NATURE OF WORK (Check appropriate box)
☒ Software/Integration ☒ Construction ☒ Operations ☐ Evaluations ☐ Planning
☐ Maintenance (Equipment Replacement) ☐ Others (Please Specify)

1.11 RELATIONSHIP TO OTHER PROJECTS AND PHASES

Current and Future Projects:

Past and Completed Projects:

-

SECTION 2 – Regional Architecture Assessment

2.1 PORTIONS OF REGIONAL ARCHITECTURE BEING IMPLEMENTED

☒ Archived Data Management
☐ Public Transportation
☐ Traveler Information
☒ Traffic Management
☐ Vehicle Safety
☐ Commercial Vehicle Operations
☐ Emergency Management
☐ Maintenance & Construction Management

2.2 INVENTORY ELEMENTS IN ODOT REGIONAL ARCHITECTURE INCLUDED BY PROJECT

•

2.3 INTERFACE IMPACTS (I.E. DATA EXCHANGES) DUE TO PROJECT

2.4 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?

☒ No ☐ Yes
If "Yes", please specify what ITS Standards are being used:
If "No", explain why:

•

2.5 CHANGES RECOMMENDED TO ODOT and/or REGIONAL ARCHITECTURES

☒ No ☐ Yes
If "Yes", please specify and provide detail:

SECTION 3 – Project Matrix

3.1 PROJECT MATRIX - DOCUMENTATION

	Existing	Existing To Be Modified	To Be Developed	Not Applicable	Comments/Document Reference
Alternatives Analysis	☐	☐	☐	☒	
Concept of Operations	☐	☐	☒	☐	
Requirements	☐	☐	☒	☐	
Design	☐	☐	☒	☐	
System Test Plan	☐	☐	☒	☐	

SECTION 4 – Procurement

4.1 PROCUREMENT METHODS (Check all that apply)

☒ Construction Contract
☐ Request for Proposal
☐ Invitation to Bid
☐ State Price Agreement Contract
☐ Flexible Service Contract
☐ Other:

Comments:

4.2 EQUIPMENT TO BE PURCHASED WITH PROJECT FUNDING

Field equipment:

Software Development:

-

SECTION 5 – Operations and Maintenance

5.1 PROCEDURES AND RESOURCES NEEDED FOR OPERATION

5.2 ESTIMATED ANNUAL OPERATIONS AND MAINTENANCE COSTS

SECTION 6 – Schedule

6.1 EXPECTED COMPLETION DATE

-

SECTION 7 – Agreements

7.1 IS AN INTERSTATE OR INTERGOVERNMENTAL AGREEMENT NEEDED FOR THIS PROJECT?

☒ Existing ☐ To be Developed ☐ No

Please describe: