



# Chapter Three

# ITS ARCHITECTURE

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## INTRODUCTION

This chapter provides a summary of the National ITS Architecture<sup>1</sup> and how it applies to the deployment of intelligent transportation systems in Clackamas County. This chapter also describes the market packages and user services selected by the ITS Technical Advisory Committee to meet the needs of the Clackamas County transportation network, and provides definitions of National ITS Architecture terminology.

Clackamas County is about to embark on the deployment of intelligent transportation system infrastructure to address transportation related needs and provide advanced traveler information services to the community. A key to the deployment of intelligent transportation systems is the identification of resource sharing, coordination with other regional agencies and the identification of information required to deliver services to the public and improve the operational and maintenance efficiency of the transportation department. The National ITS Architecture provides a common

framework that will be used to ensure compatibility with other regional agencies.

## WHY DEVELOP AN ARCHITECTURE?

Nationally, billions of dollars are being invested in ITS projects and there has been concern that these systems would not communicate with each other nor be able to share information. To address these concerns and to support and guide the development and deployment of ITS projects, the U.S. Department of Transportation has developed the National ITS Architecture. The Architecture is a framework that describes the functions of components, how these components interconnect, the organizations involved, and the type of information to be shared.

For example, if a transportation agency wants to clear incidents faster, the Architecture defines a function to monitor roadways and identifies connections to the traffic management center and emergency management center. The Architecture defines the function, interconnection and the information flows needed between the roadway, the traffic management center and the emergency management center to provide the incident responders with the incident information, but it does not define “how” this is done (e.g. what technologies and management techniques are used).

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<sup>1</sup>*The National ITS Architecture, A Framework for Integrated Transportation into the 21<sup>st</sup> Century, Version 4.0.*

The purpose for using the Architecture is to provide agencies with open, interoperable systems that allow multiple manufacturers to supply components. With multiple vendors to choose from, an agency will benefit from reduced procurement costs and an opportunity to share information and resources through integration with other agencies utilizing interoperable systems. The setup of computer networks illustrates a simple example of what can be accomplished by the Architecture. Computer networks consist of different components: servers, routers, modems, desktop computers, printers, etc. Components can be produced by different manufacturers with each offering distinctive features. However, by having standard inputs, outputs, and connecting cables, one can mix components and manufacturers without worrying if they are compatible.

In addition to the benefits of the Architecture ensuring compatibility with other systems, FHWA published a rule/policy<sup>2</sup> that states that all agencies seeking federal funding for ITS projects must create an ITS Implementation Plan that is compliant with the National ITS Architecture.

The following sections of this chapter discuss the approach used to create the Clackamas County ITS architecture and present the following task results:

- List of stakeholders
- Mapping user services to user needs
- Selection of market packages
- Definition of interconnects and information flows

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<sup>2</sup> *Federal-Aid Policy Guide*, Section 23 Part 940 Intelligent Transportation System Architecture and Standards.

## ARCHITECTURE DEVELOPMENT PROCESS

Prior to beginning this project, ODOT Region 1 led and completed a multi-agency effort to create a Regional Architecture for the Portland metropolitan region called TransPort Regional Architecture. Clackamas County was involved in this effort and is included in the TransPort Regional Architecture document. The existing Regional Architecture is maintained by ODOT and was created in *Turbo Architecture*<sup>3</sup>. For this project, updates were made to the TransPort Regional Architecture based on a review of the existing Regional Architecture document, the interview process, and the needs assessment. Appendix H includes a list of the updates made to the Regional Architecture based on input from stakeholders in Clackamas County. The *Turbo Architecture* file was reviewed and components were added to reflect the proposed ITS improvements identified in this Clackamas County ITS Plan. All updates to the Regional Architecture have been coordinated with ODOT.

The Clackamas County Architecture has been developed based upon the transportation needs and services identified through the interviews, questionnaires, and user needs workshop. The Clackamas County ITS Architecture development process used is based on the Regional ITS Architecture Guidance<sup>4</sup> and *Turbo Architecture* and has been used as a tool to map the Clackamas County Architecture to the Regional Architecture. Figure 3-1 illustrates the process used to develop the ITS Architecture for Clackamas County.

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<sup>3</sup> *Turbo Architecture*, version 2.0 by Iteris.

<sup>4</sup> *Regional ITS Architecture Guidance, Developing, Using and Maintaining an ITS Architecture for Your Region*, National ITS Architecture Team, October 12, 2001.

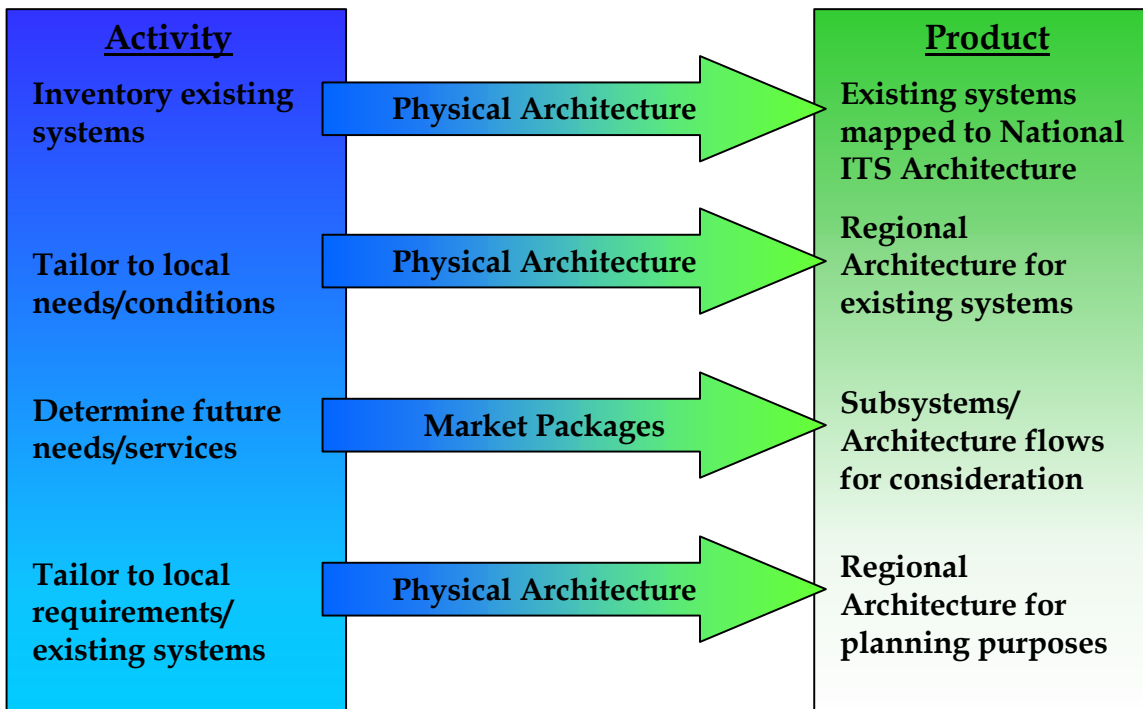


Figure 3-1: Clackamas ITS Architecture Development Process

## STAKEHOLDERS

Clackamas County includes interfaces with numerous regional agencies including the following:

- Clackamas County (Department of Transportation and Development)
- ODOT Region 1
- City of Gladstone
- City of Happy Valley
- City of Lake Oswego
- City of Milwaukie
- City of Oregon City
- City of Portland
- City of West Linn
- City of Wilsonville
- SMART
- TriMet
- Clackamas County 911 (C-COM)
- Lake Oswego Communications (LOCOM)
- Gladstone 911

- Clackamas County Sheriff's Office
- Clackamas County Fire District 1

Appendix H includes a list of all Stakeholders in the TransPort Regional Architecture including those in Clackamas County.

## ITS SERVICES

This section describes the desired transportation services that have been selected by the Clackamas County Technical Advisory Committee to address the transportation system needs in Clackamas County. The needs have been identified through stakeholder input (interviews, questionnaires and a user needs workshop) and are summarized in Chapter Two. Within the National ITS Architecture, the most common list of ITS services are the "user services" and

“market packages”. A brief description of these terms is provided below.

### **User Services**

The term user services describes what functions the intelligent transportation system has to perform. A user service is a functional requirement of the system and it does not describe where the components will go or how the service will be implemented. An example of how user services can be applied is this: An agency may have a goal to minimize vehicle delay or to minimize environmental impacts due to traffic. These goals are described within the “Traffic Control” user service and therefore this user service would be selected to lead towards traffic control projects to meet these goals. The important point is that the concept of user services allows the process of project definition to begin by thinking about what high level services will be provided to address identified problems and needs.

The 32 nationally defined user services are shown in Table 3-1 and include the user services selected by the Technical Advisory Committee. Table H-1 in the Appendix illustrates the user needs mapped to the user services. These user services have been grouped into bundles for convenience. The list of user services defined currently is by no means a final list. New or updated user services may be added to the National ITS Architecture over time.

### **Market Packages**

Some of the 32 user services are too broad in scope to be convenient in planning actual deployments. In order to address this and provide a more deployment-oriented set of ITS building blocks, “market packages” were defined from the original user services.

The National ITS Architecture market packages are a categorization of ITS technologies distributed into individual packages for guiding the design and deployment of ITS projects. A total of 75 market packages provide guidelines to the design of almost every type of ITS project imaginable. The market packages were selected early in the ITS Plan development process to stimulate ideas of regional needs that may not have been previous thought of.

The market packages are particularly useful in ITS planning because they are linked directly to ITS elements, allowing for a quicker progression from concepts to projects. The 75 market packages are divided into the following categories:

- Archived Data Management (AD) – 3 market packages
- Public Transportation (APTS) - 8 market packages
- Traveler Information (ATIS) - 9 market packages
- Traffic Management (ATMS) - 20 market packages
- Vehicle Safety (AVSS) - 11 market packages
- Commercial Vehicle Operations (CVO) - 10 market packages
- Emergency Management (EM) - 4 market packages
- Maintenance and Construction Management (MC) – 10 market packages

Table 3-2 shows the market packages selected by the Technical Advisory Committee. A description of each of the market packages may be found on the National ITS Architecture website<sup>5</sup>.

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<sup>5</sup> <http://itsarch.iteris.com/itsarch/index.htm>

Table 3-1: User Services

Selected User Services	<b>USER SERVICES</b>
	<b>TRAVEL AND TRAFFIC MANAGEMENT</b>
X	Pre-Trip Travel Information
X	En-Route Driver Information
X	Route Guidance
X	Ride Matching and Reservation
X	Traveler Services Information
X	Traffic Control
X	Incident Management
X	Travel Demand Management
X	Emissions Testing and Mitigation
X	Highway-Rail Intersection
	<b>PUBLIC TRANSPORTATION MANAGEMENT</b>
X	Public Transportation Management
X	En-Route Transit Information
X	Personalized Public Transit
X	Public Travel Security
	<b>ELECTRONIC PAYMENT</b>
X	Electronic Payment Services
	<b>COMMERCIAL VEHICLE OPERATIONS</b>
X	Commercial Vehicle Electronic Clearance
X	Automated Roadside Safety Inspection
X	On-Board Safety Monitoring
	Commercial Vehicle Administrative Processes
X	Hazardous Materials Incident Response
X	Commercial Fleet Management
	<b>EMERGENCY MANAGEMENT</b>
X	Emergency Notification and Personal Security
X	Emergency Vehicle Management
	<b>ADVANCED VEHICLE SAFETY SYSTEMS</b>
	Longitudinal Collision Avoidance
	Lateral Collision Avoidance
	Intersection Collision Avoidance
	Vision Enhancement for Crash Avoidance
	Safety Readiness
	Pre-Crash Restraint Deployment
	Automated Vehicle Operation
	<b>INFORMATION MANAGEMENT</b>
X	Archived Data Function
	<b>MAINTENANCE AND CONSTRUCTION MANAGEMENT</b>
X	Maintenance and Construction Operations

**Table 3-2: Market Packages**

Selected Market Packages	<b>MARKET PACKAGES</b>
	<b>ARCHIVED DATA MANAGEMENT</b>
<b>X</b>	ITS Data Mart
<b>X</b>	ITS Data Warehouse
	ITS Virtual Data Warehouse
	<b>PUBLIC TRANSPORTATION</b>
	Transit Vehicle Tracking
	Transit Fixed-Route Operations
	Demand Response Transit Operations
	Transit Passenger and Fare Management
	Transit Security
	Transit Maintenance
<b>X</b>	Multi-Modal Coordination
	Transit Traveler Information
	<b>TRAVELER INFORMATION</b>
<b>X</b>	Broadcast Traveler Information
	Interactive Traveler Information
	Autonomous Route Guidance
	Dynamic Route Guidance
	ISP Based Route Guidance
	Integrated Transportation Management/Route Guidance
	Yellow Pages and Reservation
	Dynamic Ridesharing
	In Vehicle Signing
	<b>TRAFFIC MANAGEMENT</b>
<b>X</b>	Network Surveillance
<b>X</b>	Probe Surveillance
<b>X</b>	Surface Street Control
<b>X</b>	Freeway Control
	HOV Lane Management
<b>X</b>	Traffic Information Dissemination
<b>X</b>	Regional Traffic Control
<b>X</b>	Incident Management System
<b>X</b>	Traffic Forecast and Demand Management
	Electronic Toll Collection
	Emissions Monitoring and Management
	Virtual TMC and Smart Probe Data
<b>X</b>	Standard Railroad Grade Crossing
<b>X</b>	Advanced Railroad Grade Crossing
	Railroad Operations Coordination
<b>X</b>	Parking Facility Management
<b>X</b>	Regional Parking Management

Selected Market Packages	<b>MARKET PACKAGES</b>
	Reversible Lane Management
	Speed Monitoring
	Drawbridge Management
	<b>VEHICLE SAFETY</b>
	Vehicle Safety Monitoring
	Driver Safety Monitoring
	Longitudinal Safety Warning
	Lateral Safety Warning
	Intersection Safety Warning
	Pre-Crash Restraint Deployment
	Driver Visibility Improvement
	Advanced Vehicle Longitudinal Control
	Advanced Vehicle Lateral Control
	Intersection Collision Avoidance
	Automated Highway System
	<b>COMMERCIAL VEHICLE OPERATIONS</b>
	Fleet Administration
	Freight Administration
	Electronic Clearance
	CV Administrative Processes
	International Border Electronic Clearance
	Weigh-In-Motion
	Roadside CVO Safety
	On-Board CVO Safety
	CVO Fleet Maintenance
X	HAZMAT Management
	<b>EMERGENCY MANAGEMENT</b>
X	Emergency Response
	Emergency Routing
	Mayday Support
	Roadway Service Patrols
	<b>MAINTENANCE &amp; CONSTRUCTION MANAGEMENT</b>
X	Maintenance and Construction Vehicle Tracking
	Maintenance and Construction Vehicle Maintenance
X	Road Weather Data Collection
X	Weather Information Processing and Distribution
	Roadway Automated Treatment
X	Winter Maintenance
X	Roadway Maintenance and Construction
X	Work Zone Management
	Work Zone Safety Monitoring
X	Maintenance and Construction Activity Coordination

## **INFORMATION FLOWS AND INTERCONNECTS**

After the existing and planned ITS systems in the region were identified, physical connections (existing and planned) between these systems and the information that flows between them was identified. First, the existing and planned high-level interconnects between systems were identified and are shown in Figure 3-2. Only the interconnects have been depicted because there are numerous information flows for each interconnect and so this diagram provides a more high-level view of the Clackamas County Architecture. The figure provides a graphical depiction of the physical connections between stakeholder agencies and roadside/vehicle devices. The interconnects in this figure do not include existing voice communications connections but rather focuses on the technical integration requirements to support the exchange of data.

In addition to this graphic of the high-level interconnects, a description of the interconnects for each stakeholder is provided below. The complete list of information flows between elements may be found in the TransPort Regional Architecture file.

### **Existing and Planned Clackamas County ITS Elements**

Based on the interviews, questionnaires, existing conditions assessment and the resulting proposed project list, an inventory of the existing and planned ITS elements has been defined within Clackamas County. This section summarizes the existing and planned ITS elements for Clackamas County in the format of the National ITS Architecture. Figure 3-3 provides a graphical representation of the proposed ITS

Architecture for Clackamas County. Appendix H includes a list of all ITS elements in the TransPort Regional Architecture.

#### **City of Wilsonville SMART**

*Status:* Existing

*Associated Stakeholder:* City of Wilsonville

*Mapped to Entity:* Transit Management

#### **City of Wilsonville SMART Vehicles**

*Status:* Existing

*Associated Stakeholder:* City of Wilsonville

*Mapped to Entity:* Transit Vehicle Subsystem

#### **Clackamas County 911-EMC**

*Status:* Existing

*Associated Stakeholder:* C-COM

*Mapped to Entity:* Emergency Management

#### **Clackamas County Fire Vehicles**

*Status:* Existing

*Associated Stakeholder:* C-COM

*Mapped to Entity:* Emergency Vehicle Subsystem

#### **Clackamas County Sheriff Vehicles**

*Status:* Existing

*Associated Stakeholder:* C-COM

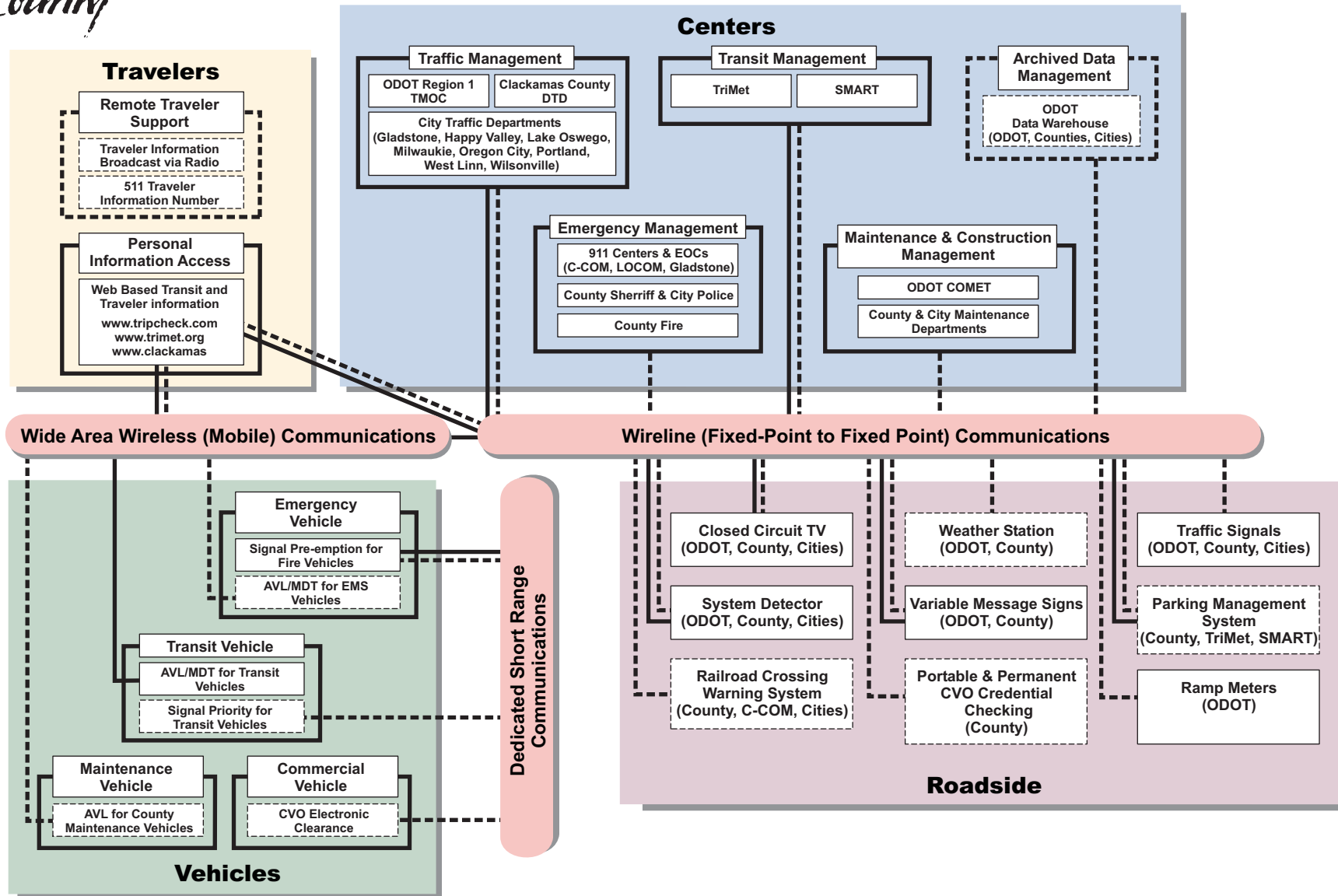
*Mapped to Entity:* Emergency Vehicle Subsystem

#### **Clackamas County TMC**

*Status:* Planned

*Associated Stakeholder:* Clackamas County

*Mapped to Entity:* Traffic Management



— Existing  
 - - - - Planned

**Figure 3-2**  
**CLACKAMAS COUNTY HIGH-LEVEL**  
**ITS ARCHITECTURE INTERCONNECT DIAGRAM**

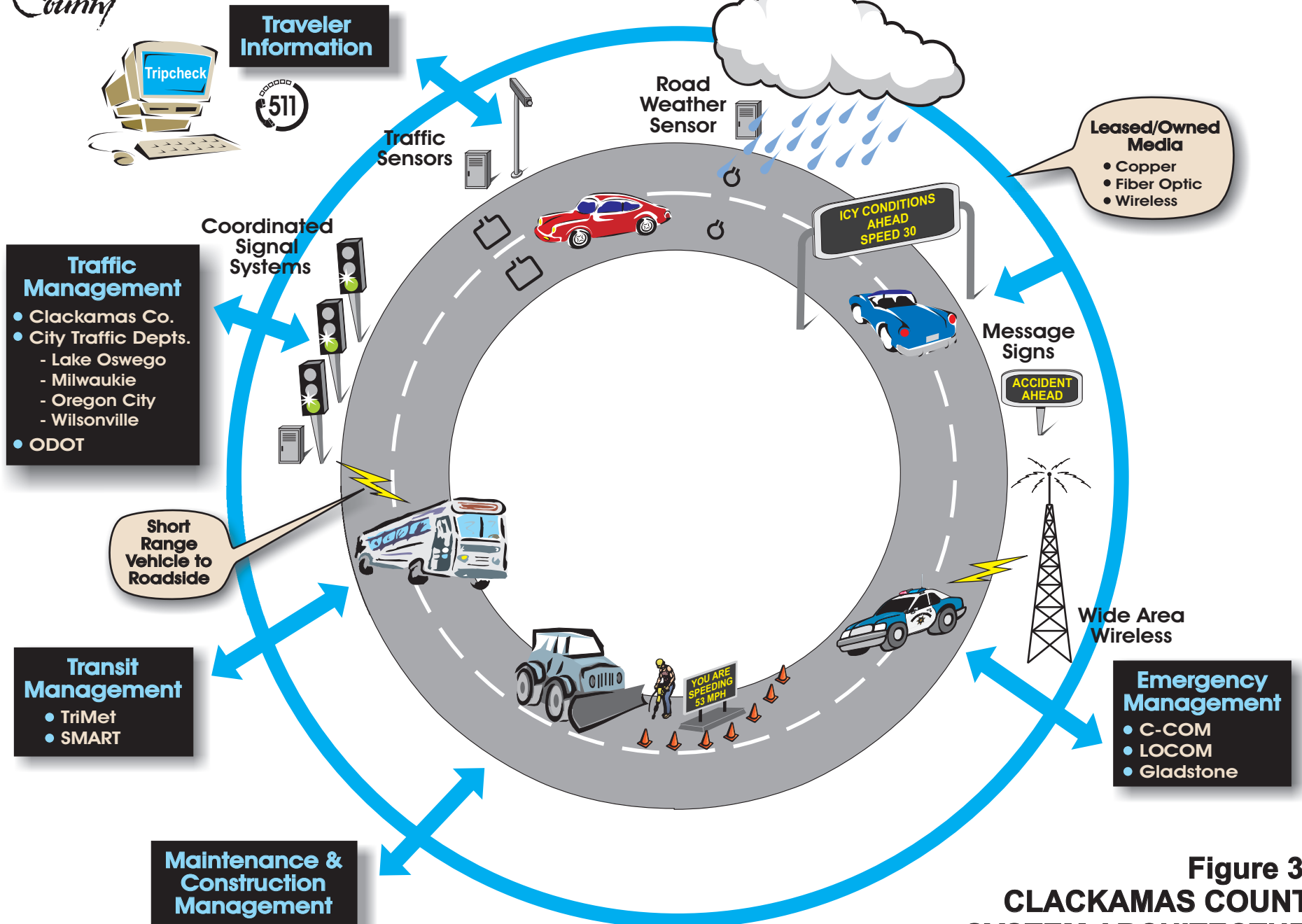


Figure 3-3  
CLACKAMAS COUNTY  
SYSTEM ARCHITECTURE

**Clackamas County TMC Traffic Signals and Roadside Devices**

*Status:* Existing

*Associated Stakeholder:* Clackamas County

*Mapped to Entity:* Roadway Subsystem

**Clackamas County Traveler Information Web Page**

*Status:* Planned

*Associated Stakeholder:* Clackamas County

*Mapped to Entity:* Personal Information Access

**Clackamas County Maintenance**

*Status:* Existing

*Associated Stakeholder:* Clackamas County

*Mapped to Entity:* Maintenance and Construction Management

**Clackamas County Maintenance Vehicles**

*Status:* Existing

*Associated Stakeholder:* Clackamas County

*Mapped to Entity:* Maintenance Vehicle Subsystem

**Other Cities in Clackamas TOC**

*Status:* Existing

*Associated Stakeholder:* Other Cities in Clackamas County

*Mapped to Entity:* Traffic Management

**Other Cities in Clackamas Field Equipment**

*Status:* Existing

*Associated Stakeholder:* Other Cities in Clackamas County

*Mapped to Entity:* Roadway Subsystem

**ODOT TMOC (Traffic Management and Emergency Management)**

*Status:* Existing

*Associated Stakeholder:* Oregon DOT  
*Mapped to Entity:* Traffic Management and Emergency Management

**ODOT TMOC Traffic Signals and Roadside Devices**

*Status:* Existing

*Associated Stakeholder:* Oregon DOT  
*Mapped to Entity:* Roadway Subsystem

**COMET (Freeway Service Patrol)**

*Status:* Existing

*Associated Stakeholder:* Oregon DOT  
*Mapped to Entity:* Maintenance Vehicle Subsystem

**TriMet Central Dispatch and Operations**

*Status:* Existing

*Associated Stakeholder:* TriMet  
*Mapped to Entity:* Transit Management

**TriMet Transit Tracker Displays**

*Status:* Planned

*Associated Stakeholder:* TriMet  
*Mapped to Entity:* Remote Traveler Support

**TriMet Transit Vehicles**

*Status:* Existing

*Associated Stakeholder:* TriMet  
*Mapped to Entity:* Transit Vehicle Subsystem