CLACKAMAS COUNTY INTELLIGENT TRANSPORTATION SYSTEMS PLAN

2021

PREPARED FOR:

CLACKAMAS COUNTY

DKS

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INTRODUCTION

Clackamas County's Intelligent Transportation System (ITS) Program leverages technology and support systems to help achieve a safer and more effective, equitable, and multimodal transportation system for the mobility of people, goods, and services. The ITS program has a tradition of cutting-edge innovation through treatments such as high-speed fiber optic communication (benefitting transportation, schools, public utilities, etc.), smart traffic signal sensors for pedestrians and bikes, adaptive traffic signals, and transit priority systems.

This plan outlines the ITS program's next generation of planned technology treatments to build upon this successful tradition of excellence in providing value to Clackamas County's roadway users.

Clackamas County's first ITS Plan was developed in 2003 and updated in 2010. The 2021 ITS Plan provides an Executive Summary and the following chapters:

- Chapter 1 - Existing Conditions
- Chapter 2 - User Needs
- Chapter 3 - Deployment Plan

Chapter 1 includes a summary of systems, technologies, and Intelligent Transportation System (ITS) practices already in place. Chapter 2 includes a summary of transportation system ITS-related user needs gathered from stakeholders. Chapter 3 includes the proposed projects along with high-level cost estimates, descriptions, and maps.

This effort is consistent with plans put together in other regions statewide that ensure that the ITS strategies used are integrated, complimentary, and conform with National ITS Architecture and applicable standards.[1] This plan will be used by agencies and partners for local and regional planning, project funding, and implementation.

INTELLIGENT TRANSPORTATION SYSTEMS (ITS) IN CLACKAMAS COUNTY

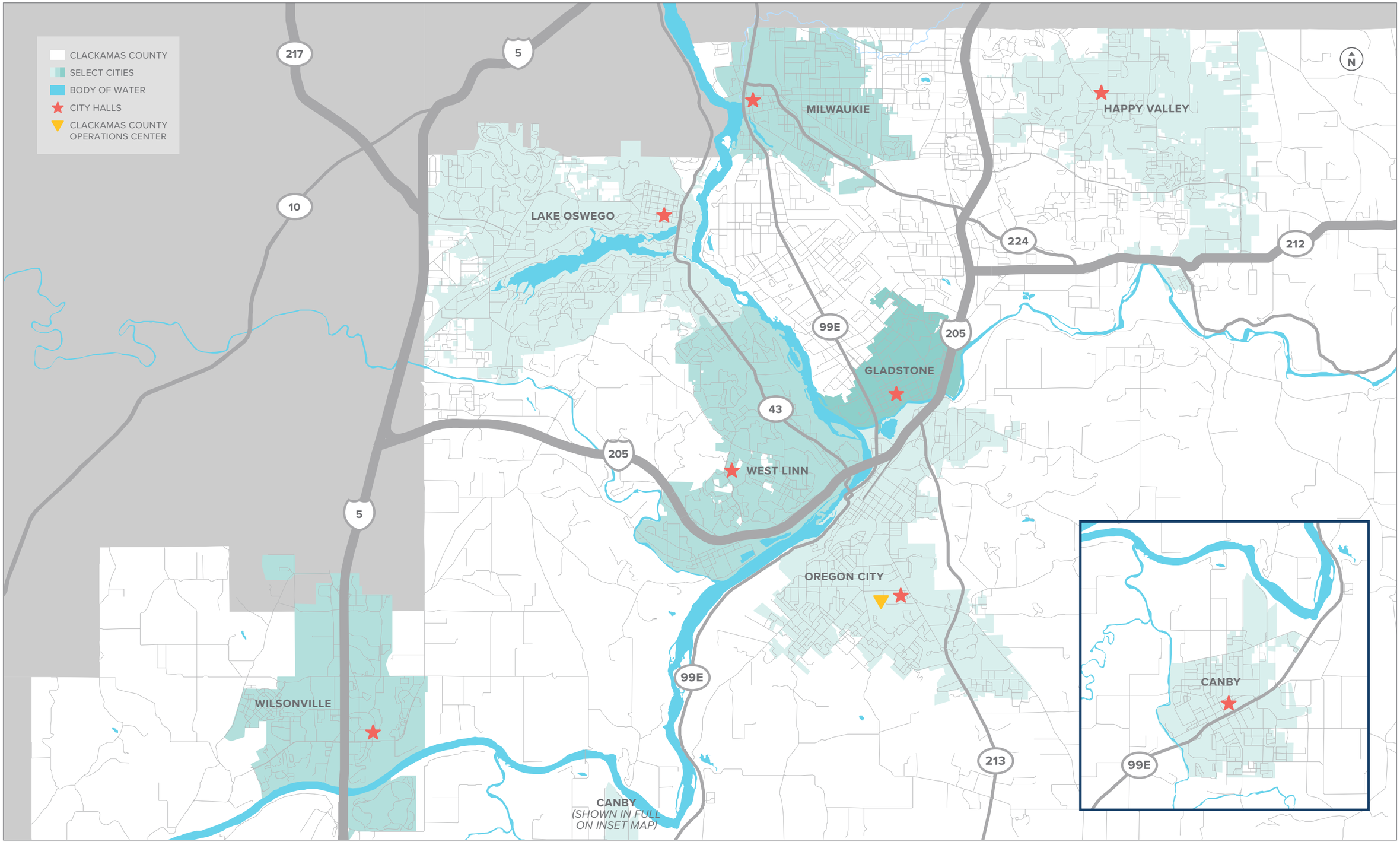
ITS applications leverage technology and support systems to improve the safety and mobility of the transportation system in Clackamas County at a lower impact and cost than adding more lanes. ITS employs technology, processes, and systems to achieve these goals. Clackamas County and its partner agencies have successfully employed ITS for many years, regionally collaborating on effective management of the transportation system.

The 2021 ITS Plan was developed with the participation and input from the Cities of Canby, Gladstone, Happy Valley, Lake Oswego, Milwaukie, Oregon City, West Linn, and Wilsonville.

STUDY AREA

The ITS plan covers all county and city roads in Clackamas County, including rural and urban corridors (see Figure ES-1). Additionally, the plan includes signals that are owned by the cities and maintained by the county.

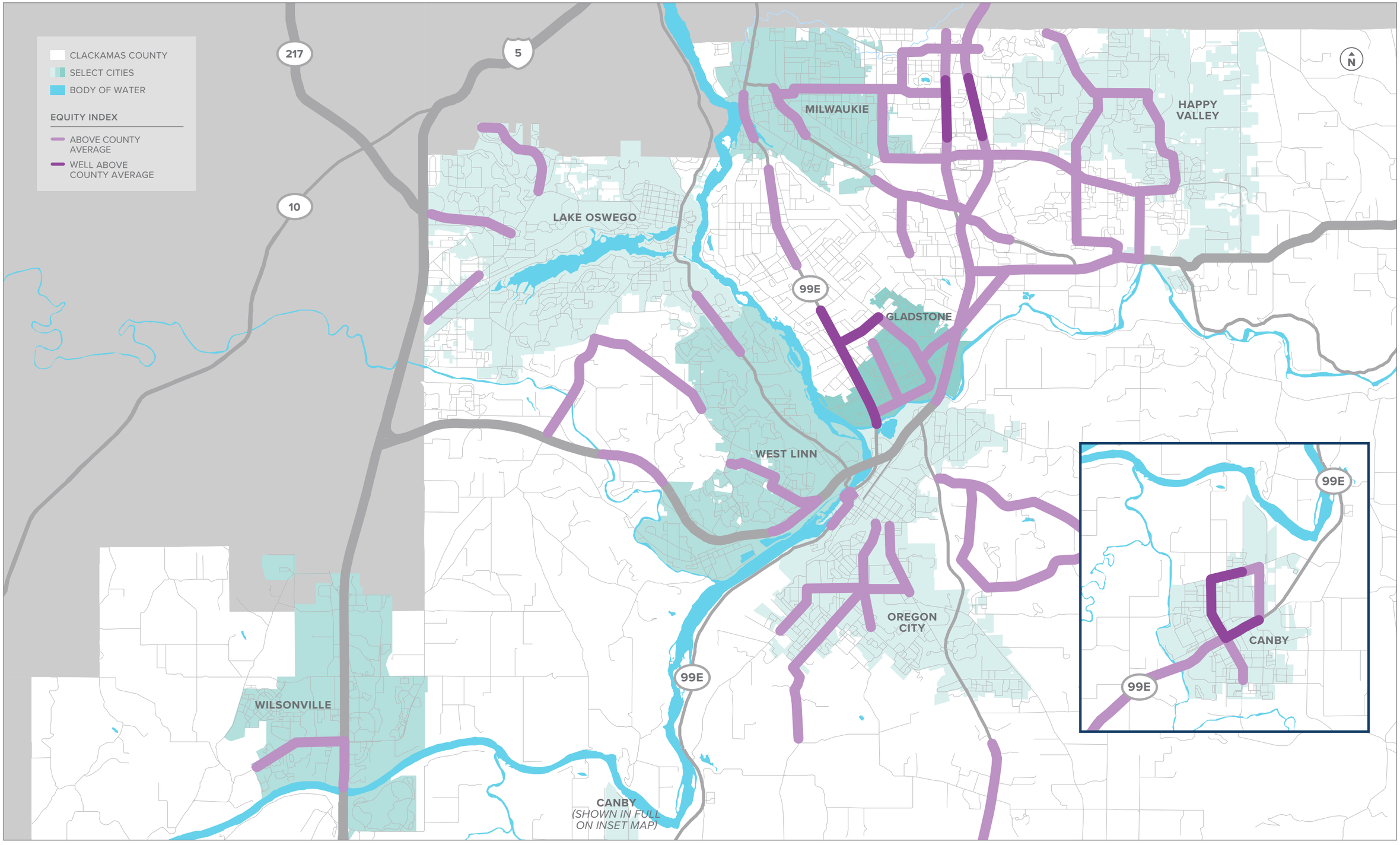
FIGURE ES-1: CLACKAMAS COUNTY ITS PLAN STUDY AREA



ADDRESSING DIVERSITY, EQUITY, AND INCLUSION WITH THE ITS PLAN

Clackamas County conducted a review of methodology to identify geospatial distribution patterns of vulnerable populations and transportation equity indicators. This was developed to guide equitable outcomes in county programs, budgets, decision-making, and service delivery. More information is included in Chapter 3 – Deployment Plan and the Appendix. The 2021 ITS Plan Update advances the county's initiative by recommending projects that improve transportation mobility and safety in corridors that serve vulnerable populations as shown in Figure ES-2.

FIGURE ES-2: CLACKAMAS COUNTY TRANSPORTATION EQUITY CORRIDORS



ITS STRATEGIES INCLUDED IN THE ITS PLAN

This plan identifies projects and practices that build on well-established partnerships, and encourages expansion to new opportunities, ensuring that the Clackamas County transportation system is prepared for increased traffic and meeting customer expectations of safety, mobility, wide varieties of mode choice, the ability to address equity, and to provide and receive transportation related information. The ITS projects and practices fall under the six categories described in Table ES-1 below.

TABLE ES-1: CATEGORIES OF ITS PROJECTS/PRACTICES

CATEGORY OF PROJECT/PRACTICE	PROJECT/PRACTICE
TRAFFIC MANAGEMENT AND OPERATIONS	• Advanced Transportation Controller (ATC) upgrades • Automated Signal Performance Measures (ATSPMs) • Adaptive, responsive signal timing • Signal Phase and Timing (SPaT) data shared with TripCheck • Enhanced detection at signalized intersections • Intersection safety analytics system • Bicycle detection and counting • Bicycle signal timing • Enhanced pedestrian signal timings • Accessible pedestrian signals (APS) • RRFB passive detection • Detour route management
MULTIMODAL OPERATIONS	• Transit signal priority • Remote trail counters • Pedestrian and bicycle detection • Countdown timers • School zone flasher upgrade - communication • Passive detection at RRFB locations
TRAVELER INFORMATION	• Variable message signs • Regional parking information systems • Communication via social media • County traveler information website • Publish county cameras for TV and radio broadcasting • Arterial travel times • Rail crossings

CATEGORY OF PROJECT/PRACTICE	PROJECT/PRACTICE
DATA COLLECTION AND MANAGEMENT	• Automated data collection • Automated performance reporting • Travel time monitoring system integrate county arterial data with PORTAL • Improve pedestrian counts - RRFBs, push buttons, signals • Explore connections and applications with RITIS • Implement ATSPMs • Dashboard • Traffic monitoring video sharing with other agencies
INCIDENT AND EMERGENCY MANAGEMENT	• Predictive gauges for flooding • Closed Circuit Television (CCTV) cameras • Portable ITS devices to reroute traffic • En-route electronic detour guidance • Variable message signs • Need real time communication to the public about emergency situations • Automatically populate TripCheck website
MAINTENANCE AND CONSTRUCTION MANAGEMENT	• Smart work zone system (en-route warnings) • Infrastructure monitoring technology • Enhanced snowplow operations • Winter road status and work zone status information sharing system • Road Weather Information Systems (RWIS) • Need an asset management system - track ITS equipment in a Geographic Information System (GIS) type format, including county owned and county maintained • Variable speed limits • Variable message signs • Collect speed and volume data in construction zones

WORKFORCE DEVELOPMENT TO DELIVER AND MAINTAIN ITS

Transportation systems are rapidly evolving due to advances in technology. Clackamas County must hire, train, and retain specialized staff to deliver and maintain ITS investments.

PROJECT RECOMMENDATIONS

A total of forty-six ITS projects were identified by the stakeholders to improve safety and traffic operations in Clackamas County. Detailed project descriptions, locations, and costs are summarized in the 2021 ITS Plan.

PROPOSED PROJECTS

Projects are distributed across Clackamas County based on need and application. Responsibility for project funding is assigned to the lead agency; however, a variety of funding tools and partnerships are likely to create the resources to implement these projects. The cost estimates of the projects by each ITS category and region are given in Table ES-2 and Figure ES-3. Project descriptions are provided in the Deployment Plan, and a map showing project locations are provided in Figure ES-4 and Figure ES-5.

TABLE ES-2: ITS COST ESTIMATES BY REGION

COST BY GEOGRAPHIC AREA	CAPITAL COST	ANNUAL OPERATIONS AND MAINTENANCE COST
COUNTYWIDE	$5,690,000	$149,100
CANBY AREA	$80,000	$2,400
GLADSTONE AREA	$160,000	$4,800
HAPPY VALLEY AREA	$2,960,000	$88,000
LAKE OSWEGO AREA	$2,800,000	$84,000
MILWAUKIE AREA	$4,740,000	$142,000
OREGON CITY AREA	$7,400,000	$222,000
WEST LINN AREA	$300,000	$9,000
WILSONVILLE AREA	$3,620,000	$88,800

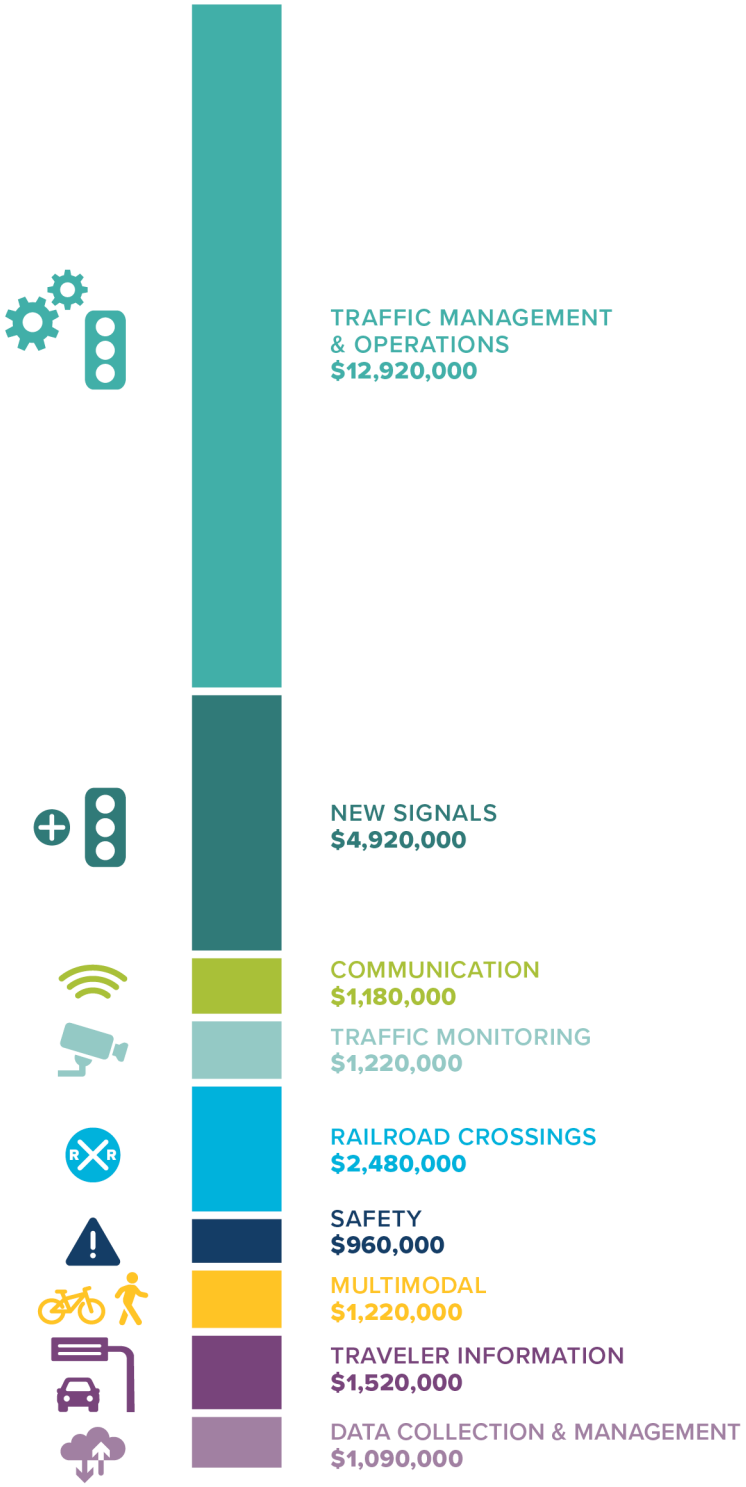


FIGURE ES-3. ITS COST ESTIMATES BY CATEGORY

FIGURE ES-4: DEPLOYMENT PLAN ITS EQUIPMENT

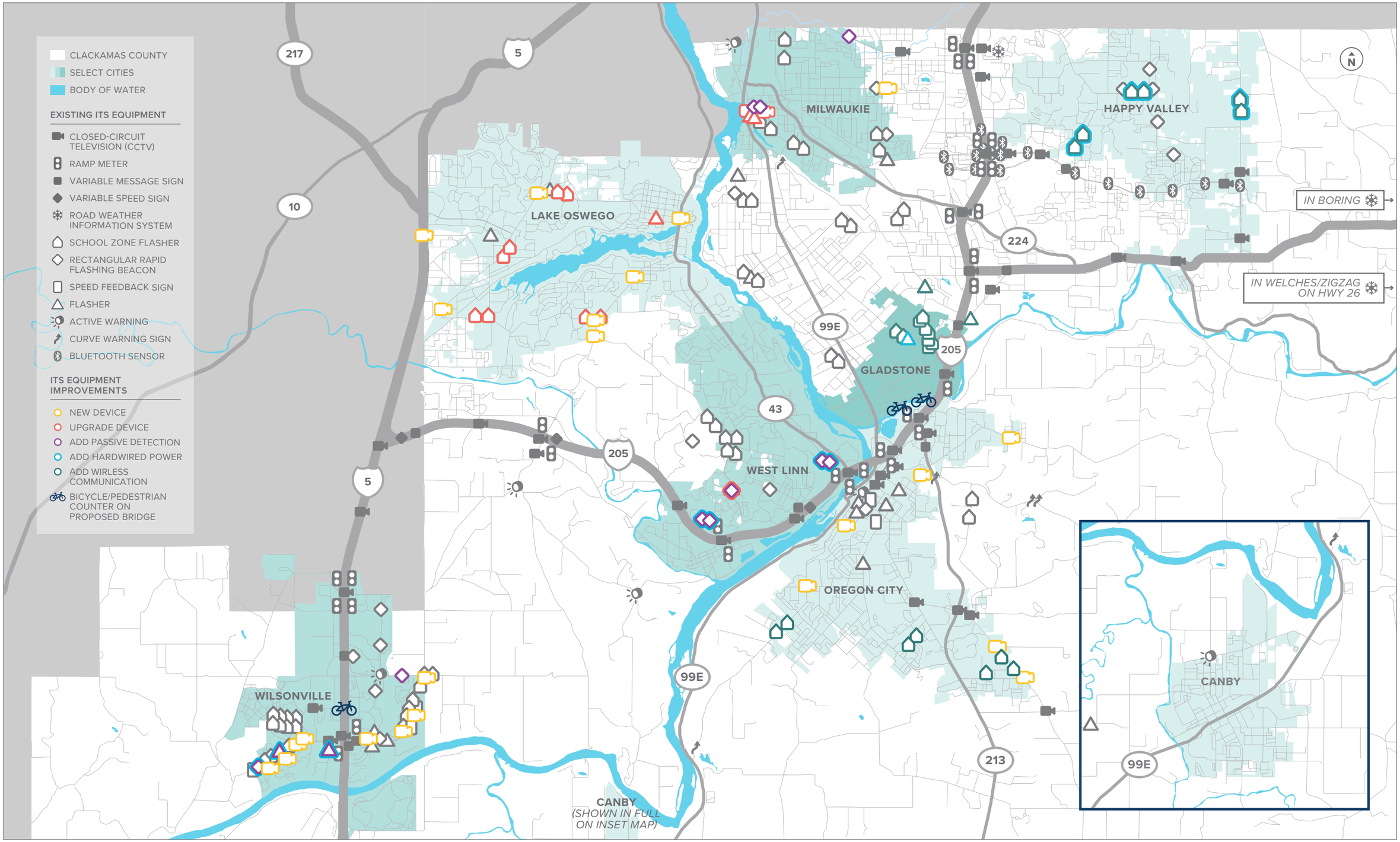
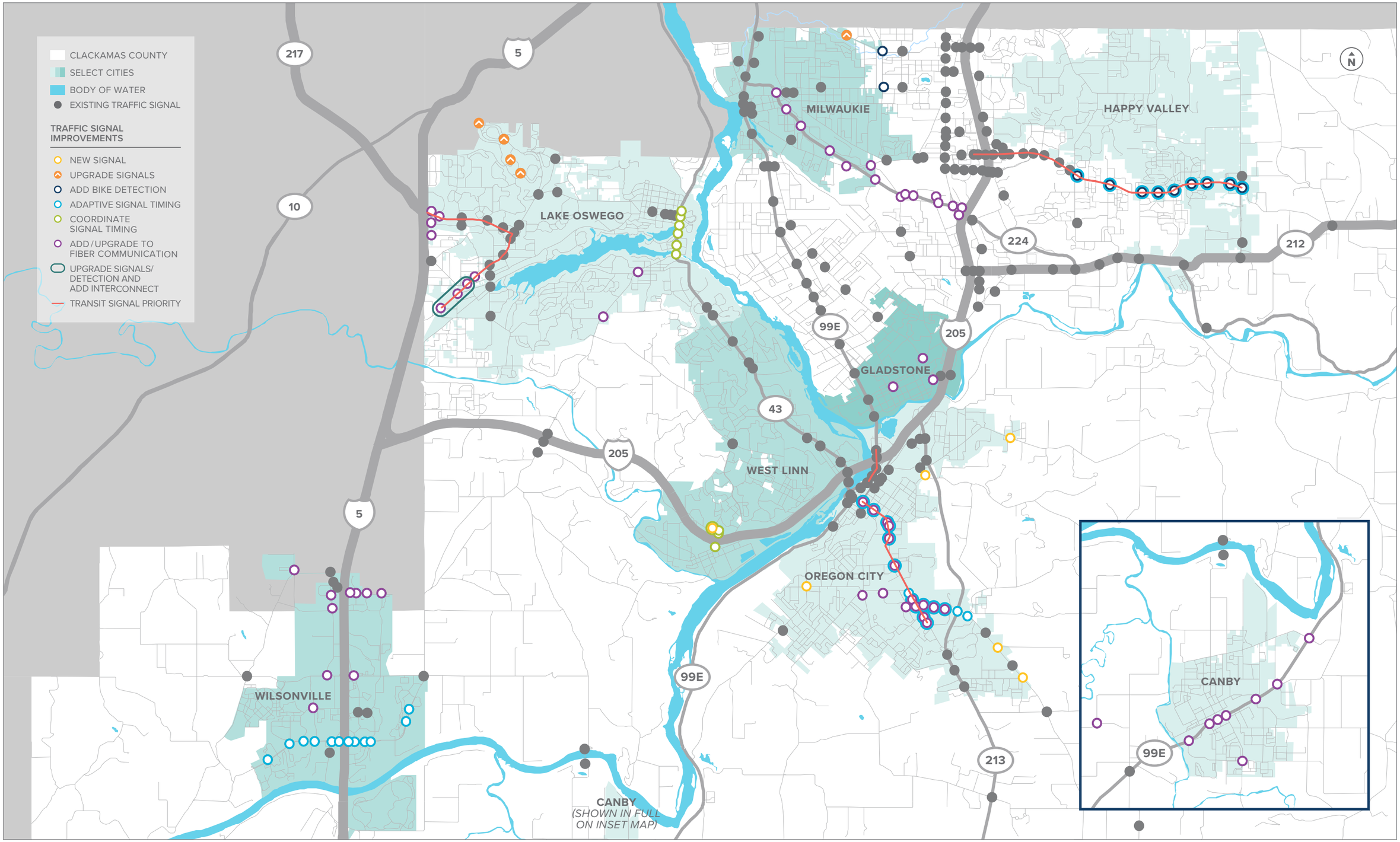
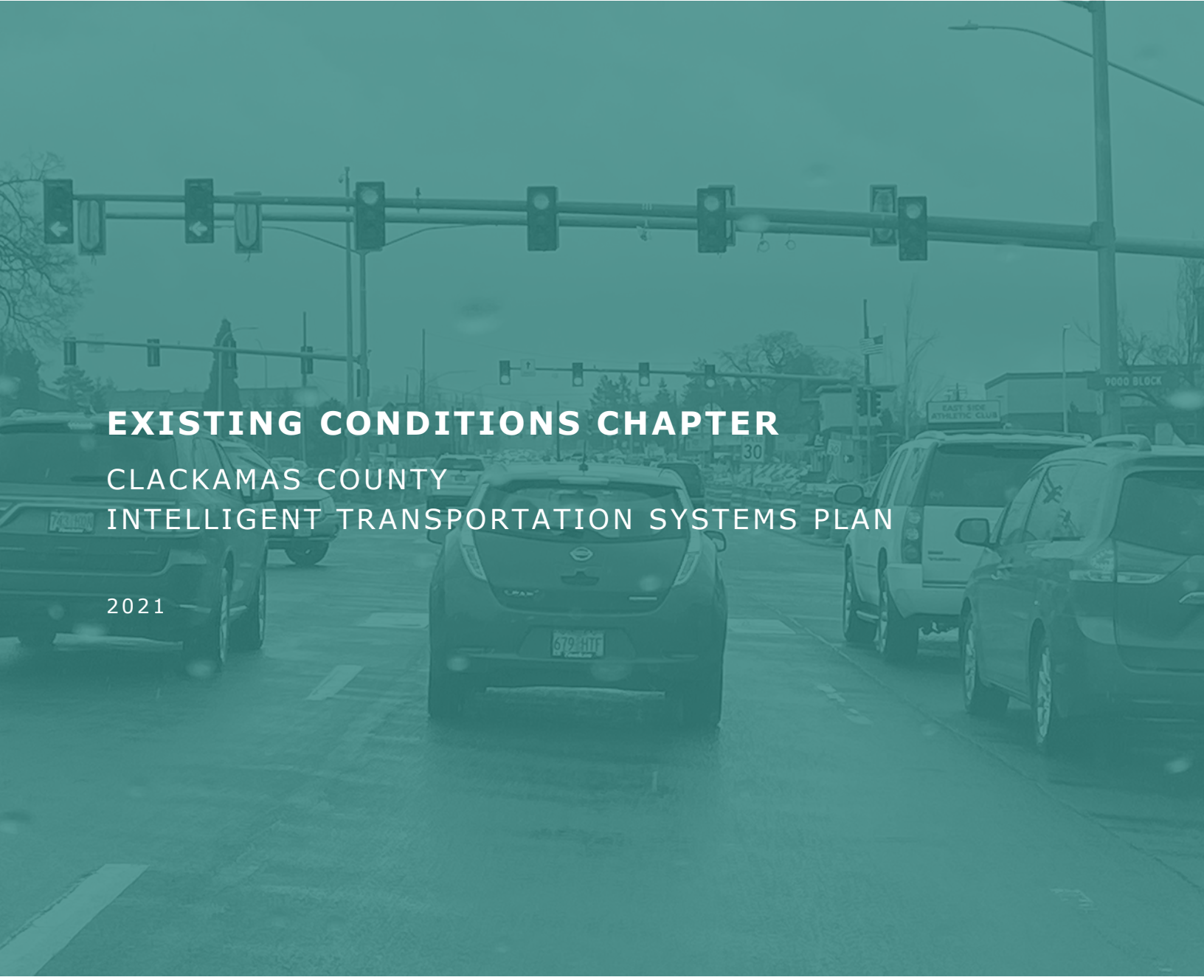


FIGURE ES-5: DEPLOYMENT PLAN TRAFFIC SIGNAL PROJECTS





EXISTING CONDITIONS CHAPTER

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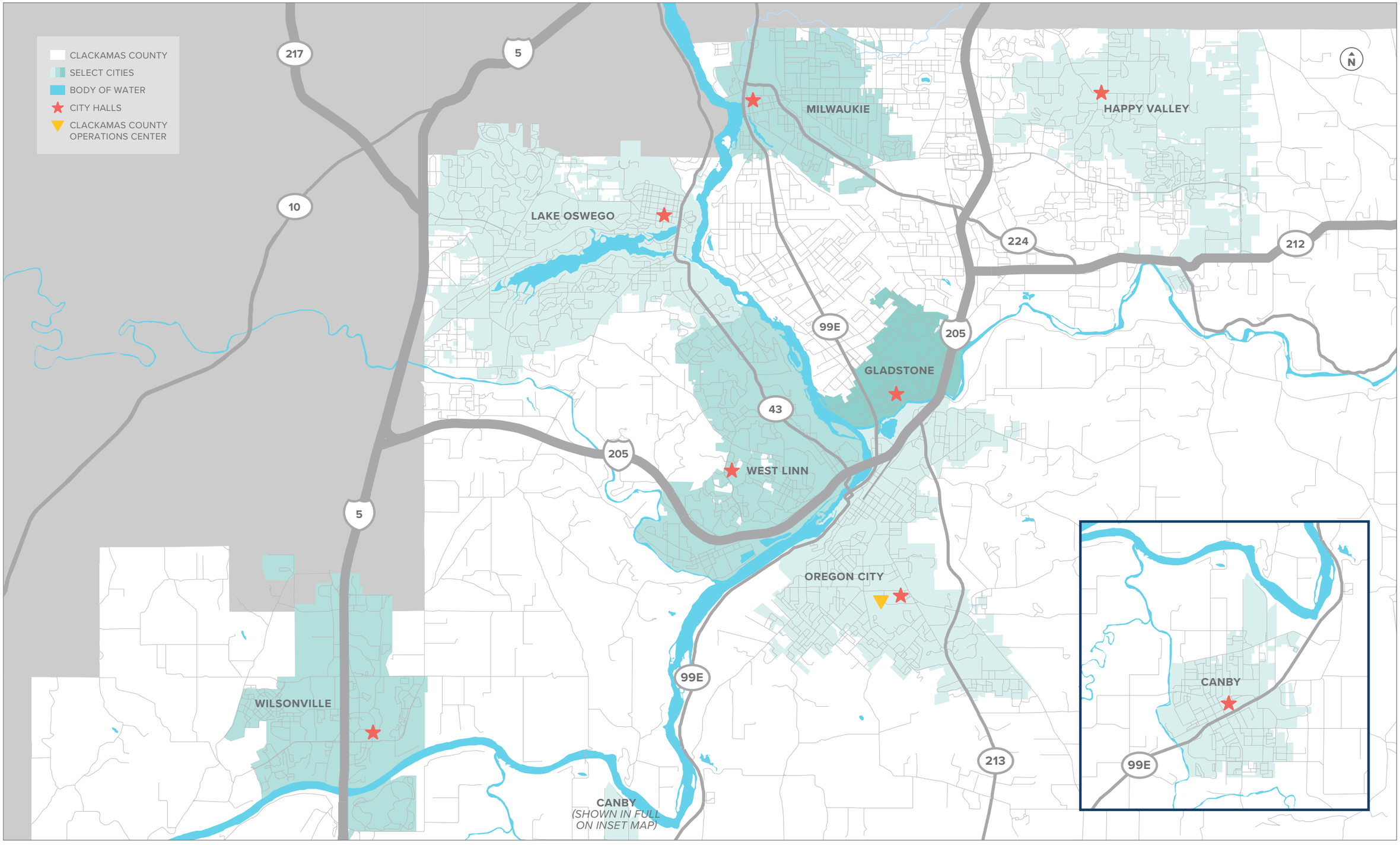
INTRODUCTION

This chapter provides an update from the 2011 Clackamas County Intelligent Transportation Systems (ITS) Plan. In this chapter, the existing ITS-related infrastructure and systems are documented and described, including traffic signals, the Transportation Operations Center (TOC), communications infrastructure, transit, emergency and incident management, regional systems, and previous and planned projects. Understanding the existing ITS infrastructure sets the foundation for updating ITS needs and developing a project list for the County and included cities. Shared needs and solutions present opportunities for partnerships that could result in cost savings for the next phase of projects. The study area, shown in Figure 1, includes the Cities of Canby, Gladstone, Happy Valley, Lake Oswego, Milwaukie, Oregon City, West Linn, Wilsonville, and other unincorporated areas within Clackamas County.

FIGURE 1: STUDY AREA



TRAFFIC SIGNALS

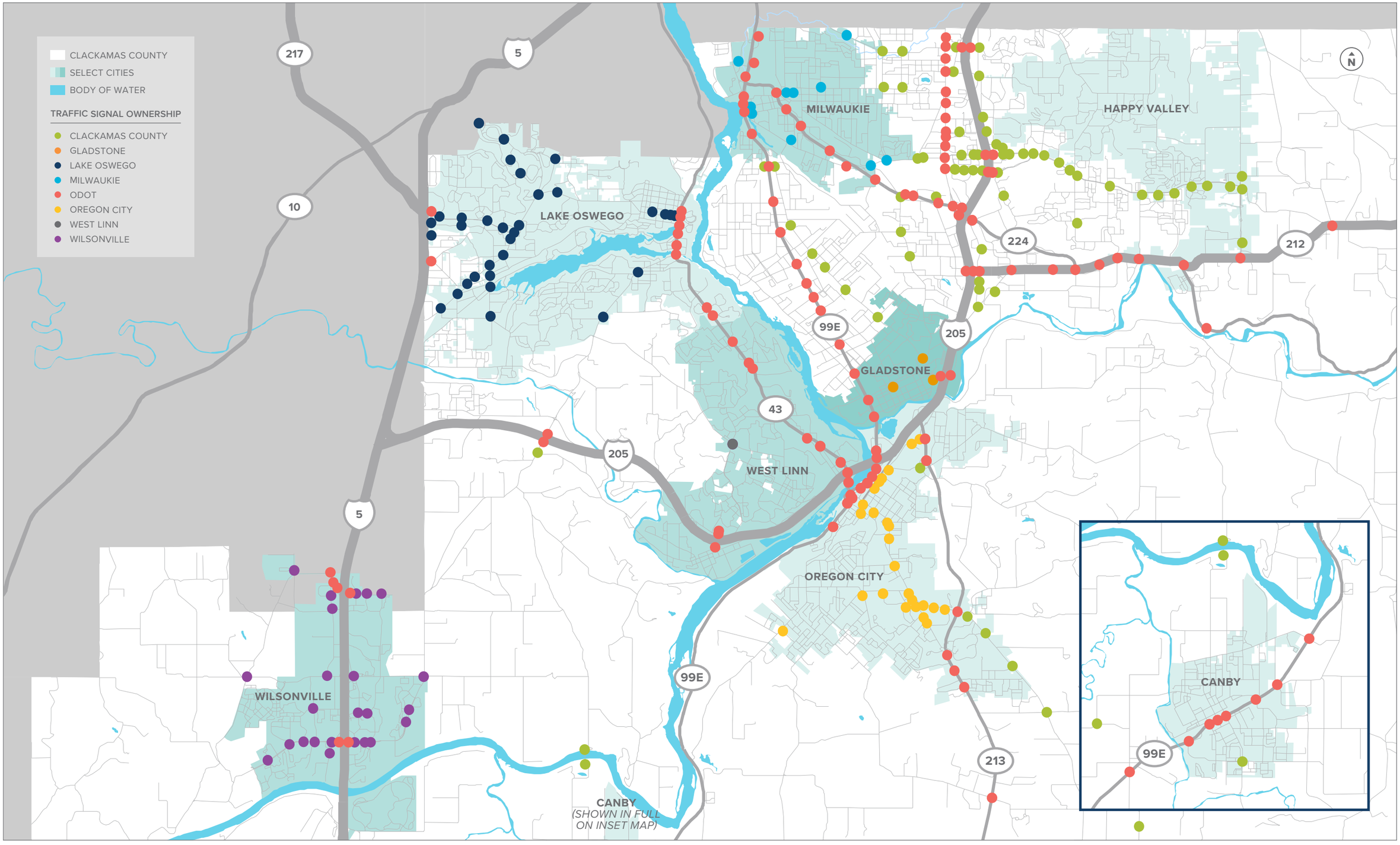
Traffic signals are the primary traffic control device on arterial roadways. This section describes the regional traffic signal system, the current traffic signal controllers, pedestrian, bicycle, and vehicle detection, flashing yellow arrow, countdown pedestrian signal head timers, coordination, and emergency vehicle preemption equipment. Clackamas County currently deploys new ATC controllers for all new signal construction, while the existing signals contain a mix of model 170, 2070 and ATC signal controllers, running various signal control software, including Trafficware, Voyage, Intellight, and the older Wapati. Figure 2 shows the existing traffic signals within the study area.

Within the County, the Oregon Department of Transportation (ODOT) maintains traffic signals located on the state highway system and Clackamas County maintains all other traffic signals.

REGIONAL TRAFFIC SIGNAL SYSTEM SERVER

In the early 1990's ODOT convened a regional group, called TransPort, to coordinate and partner with other public agencies for transportation operations projects. One outcome of the partnership is a regional traffic signal system central server that is shared by the City of Portland, Clackamas County, ODOT, City of Gresham, Multnomah County, City of Beaverton, and Washington County. The physical host server resides at the City of Portland, with a remote TransCore TransSuite server that resides in Clackamas County. The traffic signals communicate directly with the remote TransSuite server, and County personnel accesses the signals via the host TransSuite server. All signals using Voyage software and Intelight MaxTime with Ethernet communication are connected to the regional traffic signal system. Signals using Trafficware SynchroGreen and Intellight Maxtime software have their own prospective central software. Figure 3 shows the regional traffic signal system network diagram.

FIGURE 2: TRAFFIC SIGNALS



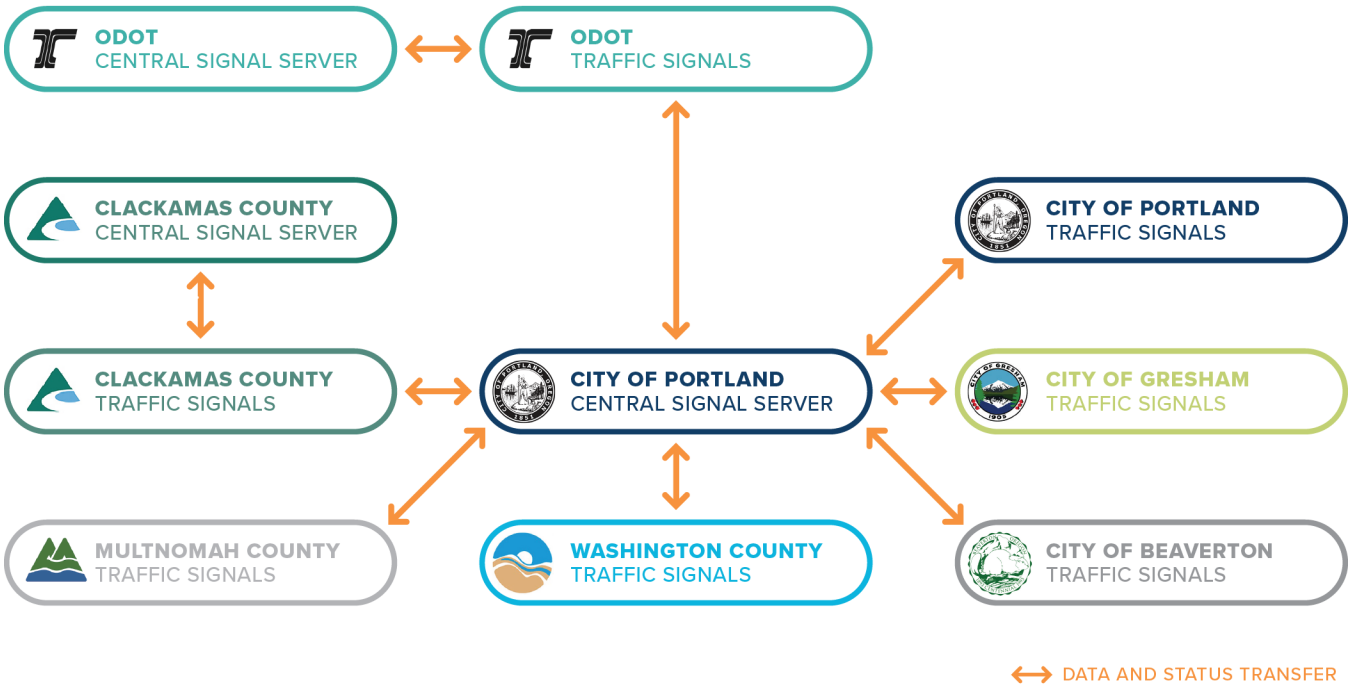


FIGURE 3: REGIONAL TRAFFIC SIGNAL SYSTEM NETWORK DIAGRAM

The regional traffic signal system provides remote access and monitoring to traffic signals and enables Clackamas County to make timing adjustments, collect and archive traffic signal phase and detector data, and receive alerts about system failures. The City of Portland is currently evaluating either upgrading or replacing the current central signal system. Clackamas County is continually adding new intersections to the traffic signal system as projects and funding allows.

TRAFFIC SIGNAL CONTROLLERS

The majority of traffic signals operated and maintained by Clackamas County are using model 2070 controllers running Voyage software. The County also operates Intelight Maxtime software and Trafficware SynchroGreen traffic adaptive using ATC signal controllers. The SynchroGreen traffic adaptive system is currently deployed on the Sunnyside Road corridor stretching between Clackamas Town Center, the I-205 freeway interchange, Sunnyside Medical Hospital, and major intersections in Happy Valley. The Intelight Maxtime software is deployed at various locations throughout the County.

PEDESTRIAN, BICYCLE, AND VEHICLE DETECTION

Clackamas County has been installing Accessible Pedestrian Signal (APS) buttons for all pedestrian actuation signals and flashers. The county is also testing passive (infrared camera) pedestrian detection system for touch-less pedestrian actuation. As the County and local cities implement American with Disabilities Act (ADA) ramp upgrades, pedestrian push buttons are being converted to APS buttons.

The County has been using combination of loops and infrared cameras to detect bicycles.

Vehicle detection at intersections provides data input to the signal controller and to engineers managing the TOC. Clackamas County uses a combination of inductive loops, radar, and at some locations infrared cameras, or a combination of these depending on the characteristics of an intersection and/or approach. Inductive loops are used for vehicle detection at the majority of traffic signals in Clackamas County. Approximately 25% of County signals have advanced detections that can provide Signal Performance Measures (SPM). Due to the limitation of inputs using loops, the county has been adding noninvasive detection for additional SPM inputs using Synchronous Data Link Control (SDLC). The County currently plans to upgrade the detection capability of the remaining signals.

FLASHING YELLOW ARROW

Flashing yellow arrow (FYA) signal indications gained popularity in the last 10 to 15 years because they allow permissive left turns and can significantly reduce delay for left turning vehicles. The majority of County maintained signals have been converted to FYA. There are only a small number of intersections that need to be converted (doghouse to FYA). The County has also been converting right turn overlaps to FYA right turn overlaps. The County typically runs FYA left and right turns with "pedestrian friendly" mode. This means that FYA is suppressed during pedestrian walk and pedestrian clearance mode. Depending on detection type, they also run what is called "gap dependent" FYA mode.

PEDESTRIAN COUNTDOWN SIGNAL HEADS

Countdown timers provide an indication of walking time left before a crossing movement changes to “Don’t Walk”. The County is actively installing new countdown times as budget allows and is including this technology on new signal construction.

COORDINATED SIGNAL SYSTEMS

Clackamas County has installed new time-of-day coordinated timings on several corridors including Sunnybrook Boulevard, Wilsonville Road, Boones Ferry Road, and Molalla Avenue. In addition to coordinated corridor signal operation, the County also uses adaptive signal operation. The traffic adaptive system analyzes measured traffic conditions on the roadway and implements timing plans based on real time traffic conditions. The County has installed a Synchro Green traffic adaptive signal system on Sunnyside Road.

Currently, the County monitors and makes coordinated timing adjustments to respond to changes in traffic conditions or citizen comments to improve traffic operations.

EMERGENCY VEHICLE PREEMPTION

The majority of the traffic signals in Clackamas County have full emergency vehicle preemption capabilities for fire district vehicles on all legs of each intersection. Police vehicles and ambulances

are not equipped with preemption devices. However, many of the existing preemption detectors are older models that do not support the low priority required for transit signal priority (TSP). The next generation of TSP technology, which employs Center-to-Center communication between the bus dispatch system and the signal central server, may negate the need to install or upgrade legacy preemption detectors at the intersection level.

TRAFFIC MANAGEMENT

Clackamas County uses several tools and systems to actively manage traffic on their corridors. The following section describes the County's operation center and system, emergency and incident management systems and tools, and the integration of ODOT systems and incident management.

TRAFFIC OPERATIONS CENTER

In 2008, Clackamas County constructed a Traffic Operations Center (TOC) in the Development Services Building in Oregon City. From the TOC, as shown in Figure 4, County traffic engineers view and control cameras, traffic signals and weather stations. The TOC provides a working space for engineers and can support active management of County traffic control and management field devices. The TOC is connected to a battery backup system and has dedicated workstations that have connectivity to systems, including the central signal system and the CCTV video management system. This room is also used to bench test new signal timing with 2070 and ATC controllers.

FIGURE 4: CLACKAMAS COUNTY TRAFFIC OPERATIONS CENTER (TOC)

ODOT TRANSPORTATION OPERATIONS CENTER SYSTEM (TOCS)

ODOT has developed the Transportation Operations Center System (TOCS) to provide a common, integrated system for use at all ODOT Transportation Operations Centers (TOCs) statewide. The system supports all of the following functional areas: traffic management, incident management, emergency management, resource management, maintenance operations, winter operations, device management, traveler information, data archival and reporting, and connection with external agencies. The TOCS is made available for local agencies including Clackamas County for incident and traffic information sharing between TOCs.

EMERGENCY/INCIDENT MANAGEMENT

Clackamas County 911 (CCOM) provides dispatch services for a majority of the police, fire, and medical agencies within Clackamas County. After an emergency call is processed by dispatch, the appropriate agency is radioed and provided with an address to respond to and the nature of the call. Police vehicles are currently outfitted with mobile data terminals that use a computer-aided dispatch (CAD) system to map addresses and provide other information. These terminals operate on a separate system from dispatch.

The Clackamas County's Office of Emergency Management uses an all-hazard, county-wide approach to minimize the impact of natural and human-caused incidents. During a state of emergency, the Emergency Operations Center (EOC), which is located at Clackamas County Central Communications (CCOM), is activated. The Clackamas County Department of Transportation and Development works with the EOC to keep the road system operating to every extent practical, focusing on Emergency Transportation Routes (ETR) and access routes to shelters.

PORTLAND DISPATCH CENTER CONSORTIUM

The Portland Dispatch Center Consortium (PDCC) includes seven regional 911 centers in the Portland-Vancouver area. The PDCC developed a message broker to exchange real-time emergency and incident information between dispatch centers. The main purpose of the message broker is to provide computer aided dispatch (CAD) system interoperability and an interface between the seven main dispatch centers that make up the PDCC. This system also provides interfaces with ODOT and OSP for managing roadway incidents. The message broker is a push only system that allows information to flow one agency to other pre-designed agencies depending on the information type. 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 Center (CCOM), Washington County Consolidated Communications Agency (WCCCA), Lake Oswego Communications (LOCOM), Clark Regional Emergency Services Agency (CRESA), and Columbia 911 Communications District (C911). It's important for Clackamas County transportation department to be aware of the system, but there are no likely direct interfaces between the message broker and the transportation systems. Ultimately, some of the incident information may be available to transportation agencies through the TripCheck Traveler Information Portal.

INCIDENT RESPONSE

ODOT currently operates an incident response program to address traffic congestion and delays caused by incidents on highways within the Portland metropolitan region. Region 1 Incident Response (IR) consists of incident response vehicles, which are equipped with flat tire repair gear, gasoline, jumper cables, water, and other essentials for rescuing disabled vehicles and getting them on the move again. IR vehicles patrol major corridors to remove major obstructions, provide emergency motorist assistance and improve on-scene incident management. Each IR vehicle is equipped with automatic vehicle location (AVL). Clackamas County also has incident response vehicles.

IR vehicles currently patrol I-5, I-84, I-205, and I-405 freeways as well as ORE 217 and US 26 (Sunset Highway) daily. IR vehicles do not currently patrol State arterials such as 99E or Highway 212/224, but IR is in constant communication with the ODOT Traffic Management Operations Center (TMOC). If an incident occurs on a State arterial roadway, IR vehicles are available to respond if they are free.

Depending on the situation, the Clackamas County Fire District and Sheriff's Office may be dispatched to an incident for assistance. They help provide traffic control near the incident, when necessary, and also perform emergency services.

USE CASE – SEPTEMBER 2020 WILDFIRE EMERGENCY EVENT

In September 2020, a series of wildfires burned in both the rural and urban parts of Clackamas County. The ITS infrastructure and systems put in place by the County, ODOT, and local agencies allowed each agency the ability to respond to the event and prioritize public safety. Three significant functionalities of the ITS network contributed to the health and well-being of Clackamas County residents during this emergency event:

- The County was able to make signal timing changes in real time to facilitate the evacuation of traffic. These changes were completed remotely, ensuring the safety of County maintenance staff and enabling the County operations staff to make changes quickly at multiple locations.
- Widespread availability of traffic cameras also contributed to the County's ability to respond to the needs of evacuation routes by providing a real time picture of congested locations. The benefits of having traffic monitoring cameras along evacuation routes also benefited other agencies and the public because of their availability on the region-wide traveler information website, TripCheck.
- In addition to camera availability for the public, ODOT TripCheck provided local agencies the ability to list road closures and fire lines to give travelers the information they needed to evacuate. In the month of September, 233 events were added by local agencies (up over 400% from September 2019).[1] Google analytics recorded over 644,000 views of locally entered events

[1] Robertson, Rachel. "Road hazard app designed at Oregon State University played a big role during wildfires," OSU College of Engineering Newsroom, October 2020.

in September, highlighting the significant usage of the traveler information website. ODOT's TripCheck will be described in greater detail under the *Traveler Information* section below.

This emergency evacuation event is just one example of how critical traveler information and the ability to monitor and make changes in real time is to the public's safety. This use case highlights the effective coordination and implementation of the ITS network on behalf of Clackamas County and its partners. Figure 5 shows a screenshot of the TripCheck interface during the wildfire emergency event.

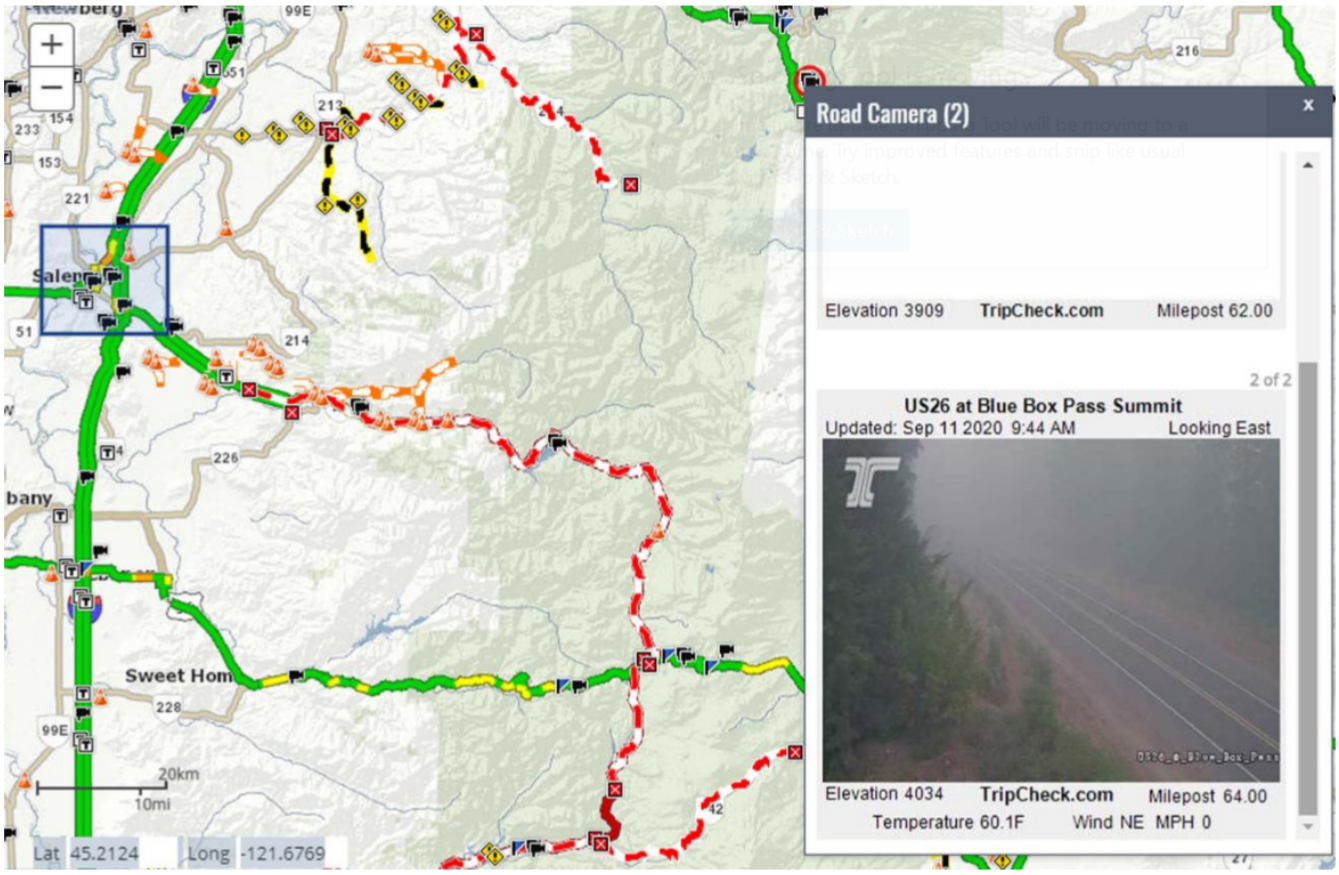


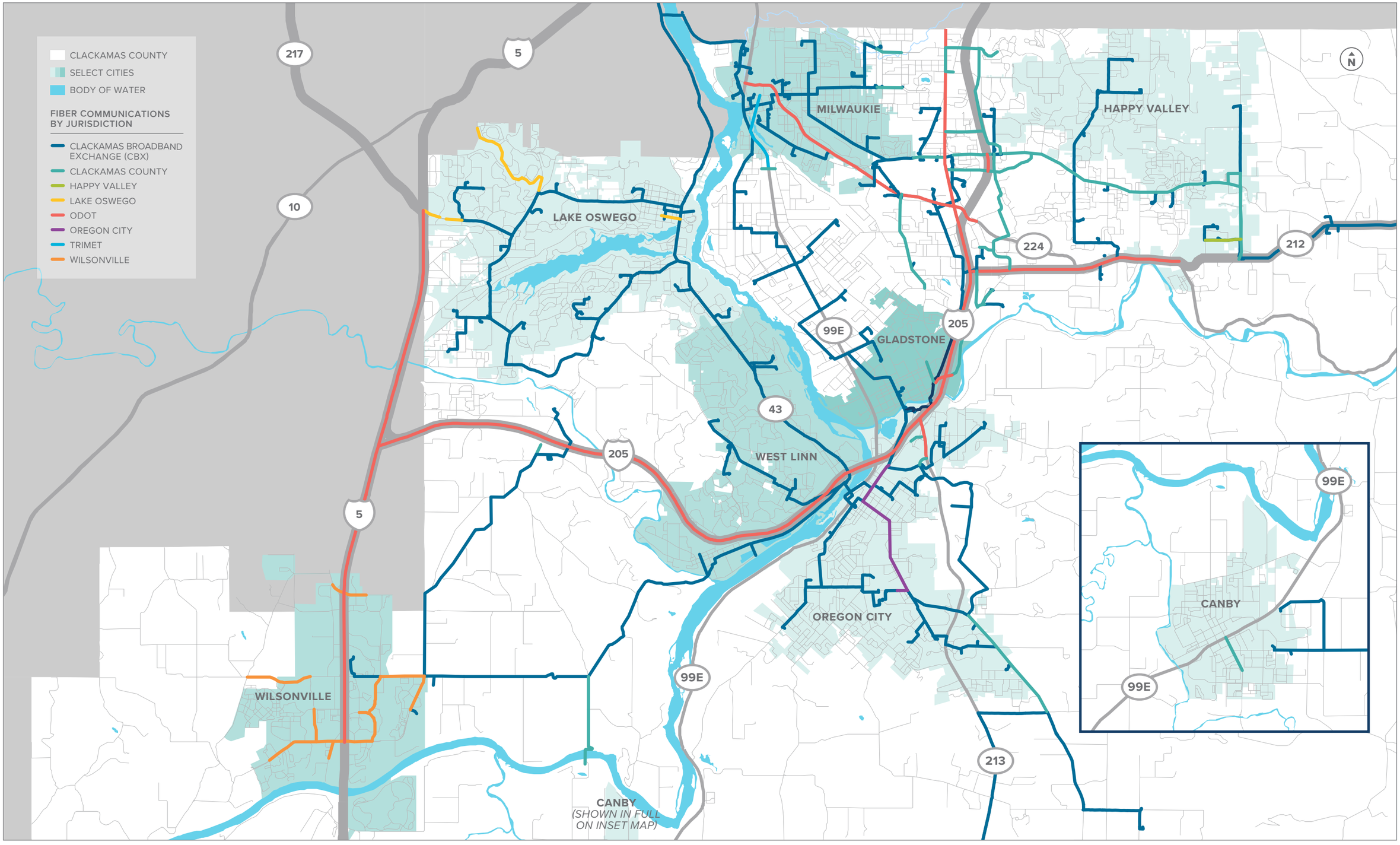
FIGURE 5: TRIPCHECK SCREENSHOT FROM SEPTEMBER 2020 WILDFIRE EMERGENCY EVENT

COMMUNICATIONS INFRASTRUCTURE

The communications network enables communications between field devices and the TOC, between devices in the field, and supports information sharing with the public and agency partners. In 2013, the County launched the Clackamas Broadband Exchange (CBX), a broadband exchange program that has allowed the County to greatly expand its communications infrastructure at a reduced cost. The County Transportation Department has several miles of fiber in addition to CBX. Currently, the County has over 325 miles of fiber optic cable connecting multiple public agency buildings. This fiber provides access points for existing and planned field devices, and connections to cities such as Wilsonville, West Linn, and Lake Oswego. In addition, local agencies have fiber of their own connecting signals to the fiber backbone. Fiber connects traffic signals with County offices located in Oregon City over a high-speed ethernet network. With CBX, the cost of connecting future field traffic management devices back to the traffic management center is significantly reduced.

All new communications infrastructure installed in the County uses fiber optic cable with Ethernet communications. Figure 6 illustrates the communications infrastructure in Clackamas County.

FIGURE 6: COMMUNICATIONS NETWORK



REGIONAL SYSTEMS

Many agencies in the Portland-Vancouver area are developing and have developed communications networks and systems that the County could benefit from. This section presents some of the regional networks and systems that may benefit transportation management and operations in Clackamas County.

One example of a regional network that has been created with partnerships between local municipalities, state DOT's, and Tri-Met is called the Cooperative Telecom infrastructure Committee (CTIC). CTIC members can have access to communication infrastructures owned by other members, in an effort to maximize the use of resources. Clackamas County is a current member and cities within the county may be able to gain access to the fiber infrastructure though the county.

ITS NETWORK

Within the CTIC network mentioned above is the ITS network, shown in Figure 7. It supports the inter-agency transportation communication needs. The network originated as a partnership amongst public agencies that owned fiber optic cable including ODOT, TriMet, Port of Portland, City of Portland, and Portland State University. The network has since expanded to include Clackamas County, Washington County, City of Gresham, City of Beaverton, Washington State Department of Transportation (WSDOT), Vancouver, Clark County in Washington, and Clark County Public Benefit Area Authority (C-TRAN). The network exists to cooperatively design, build, and operate a communications network for sharing transportation related video and data. The network benefits Clackamas County because it provides a communications path to the regional traffic signal system server, to Portal, and to ODOT traffic management systems including video cameras. While the network provides communication between agencies, it also allows the County the ability to utilize the existing communication infrastructures within the network to provide communications to the County's equipment, where existing County owned infrastructure does not exist. This provides substantial savings in capital improvement costs for the county.

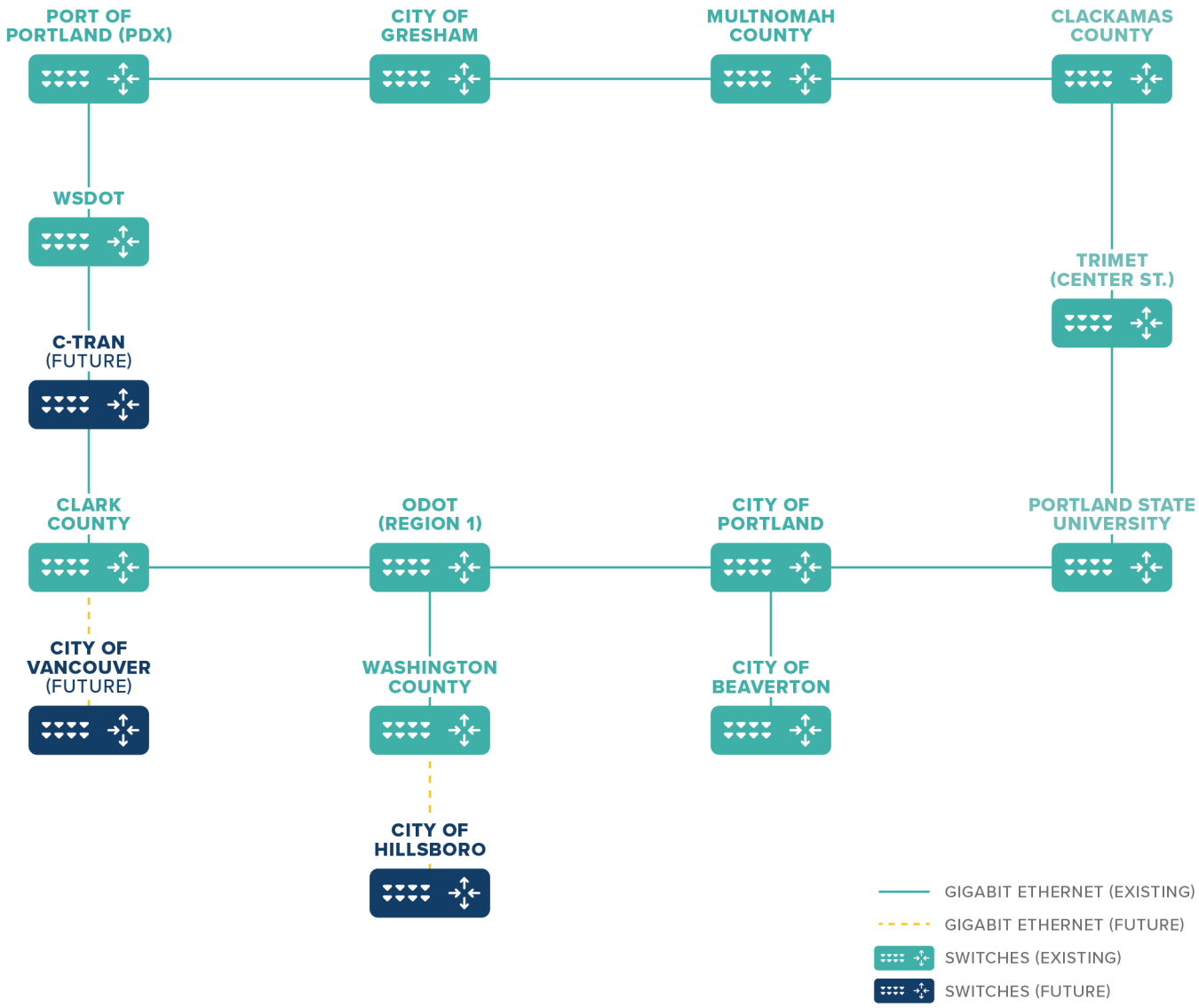


FIGURE 7: REGIONAL ITS NETWORK

TRAVELER INFORMATION

Clackamas County works closely with ODOT and other jurisdictions to provide traveler information. Clackamas County uses their own website as well as ODOT's TripCheck to provide traveler information.. Both tools are described in greater detail below. In addition to these tools, both the County and ODOT use social media accounts to spread traveler information.

CLACKAMAS COUNTY WEBSITE

Clackamas County has a link on their website (https://www.clackamas.us/engineering/closures.html) to share the latest information on construction related roadway closures. They also use social media for outreach related to road conditions and construction projects. Additionally, traffic camera images on County facilities are shared on ODOT's traveler website, TripCheck. County and cities' personnel also provide roadway closures to TripCheck using the Local Entry Tool, which will be described in greater detail below.

TRIPCHECK

ODOT's TripCheck is a collection of traveler information systems that provide central locations for distribution of traveler information. TripCheck includes the ODOT website (www.tripcheck.com), the 511-telephone system, TripCheck Traveler Information Portal and TripCheck Local Entry.

TripCheck Website

TripCheck.com includes camera images, road conditions, weather information, incident maps, travel times, and construction activity for the state. ODOT continues to add information to TripCheck as new equipment is deployed, and the system is currently serving as a central site for accessing local city and County roadway information. A screenshot of the TripCheck landing page available to the public is shown in Figure 8.

ODOT also uses cameras for traffic monitoring at all interchanges along I-5 and I-205. ODOT has migrated to a digital video system that enables region-wide video sharing. Clackamas County shares video feeds with ODOT to be posted on the TripCheck websites, enabling users to access one website for camera monitoring of the County. A screenshot of a Clackamas County operated camera on the TripCheck website is shown in Figure 9.

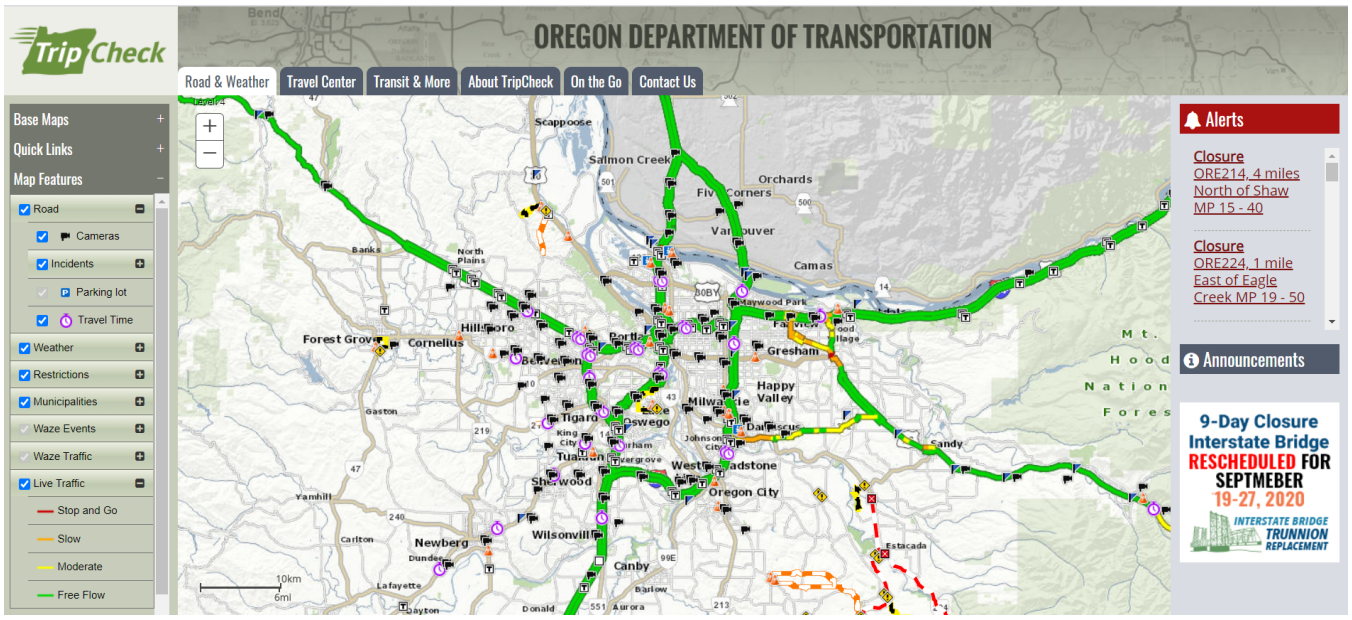


FIGURE 8: ODOT TRIPCHECK LANDING PAGE

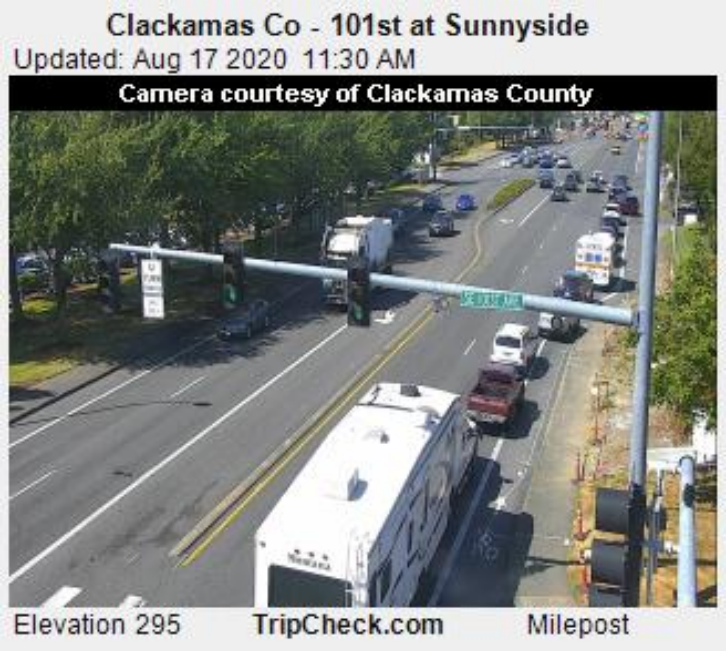


FIGURE 9: ODOT TRIPCHECK CAMERA FEED FROM CLACKAMAS COUNTY CAMERA

TripCheck Traveler Information Portal

TripCheck Traveler Information Portal (TTIP) is a data exchange system that collects traveler information from multiple sources and provides a data portal to subscribers, formatting the consolidated data as standardized traveler information messages. TTIP enables the sharing of real-time information from multiple sources to any subscriber who is interested in the current status of the roadway system. Multiple providers (public and private) can access the information free of charge and can tailor it for their uses. Local agencies can make their traveler information data available through TTIP using the proper data standards.

TripCheck Local Entry (TLE)

TripCheck Local Entry (TLE) is a website that allows Clackamas County and other local jurisdictions to enter information about events such as incidents or construction activities in their area that might affect traffic flow. TLE provides direct access to TripCheck.com for posting real-time information on the TripCheck website. An example of what the TripCheck LTE website looks like is shown in Figure 10.

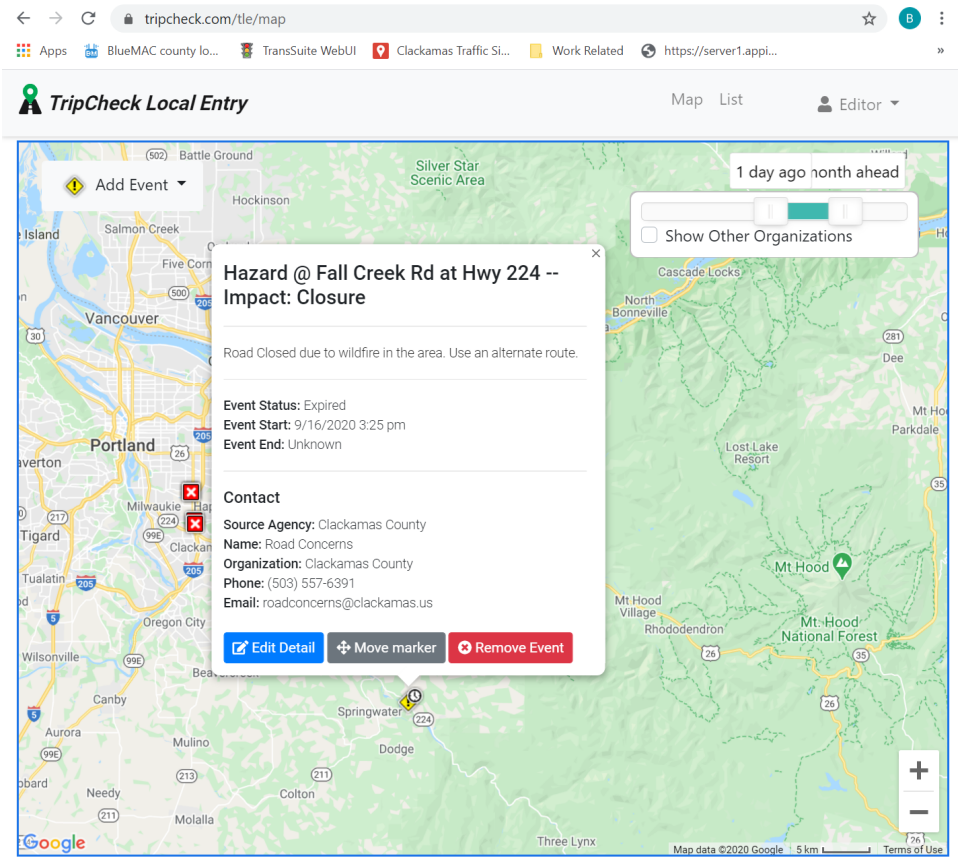


FIGURE 10: TRIPCHECK LOCAL ENTRY TOOL SAMPLE ENTRY

INTELLIGENT TRANSPORTATION SYSTEM DEVICES

Clackamas County has numerous existing intelligent transportation devices out in the field. The following sections describe existing ITS devices that are shown in Figure 11.

CCTV

Where there is fiber communication, the County has been deploying Closed Circuit Television (CCTV) Pan Tilt Zoom (PTZ) cameras. Some locations include supplemental quad (nesting) cameras along with the PTZ cameras. All of these cameras are integrated into the County video management system. The quad cameras are installed at some intersection approaches and provide the county real time traffic conditions at the intersection. Furthermore, the CCTV's give county personnel the ability to monitor signal performance. The cameras are managed using Genetec Security desk.

RAMP METERS

ODOT currently operates over a hundred and fifty ramp meters in the Portland metropolitan region. Numerous ramp meters have been installed on I-205 and I-5 ramps within Clackamas County. ODOT implemented System Wide Adaptive Ramp Meter (SWARM) on all Portland area freeways. SWARM provides the ramp meters with the capability to adapt to local conditions, predict the onset of recurring congestion and respond system wide by automatically adjusting the metering rate.

VARIABLE MESSAGE SIGNS (VMS)

Currently, ODOT operates and maintains variable message signs (VMS) on I-5, I-205, OR224, OR99E, and OR213 in the Clackamas County study area. See Figure 11 for locations of existing variable message signs.

VARIABLE SPEED SIGN (VSS)

Variable Speed Signs (VSS) enable speed limits to be changed dynamically in response to traffic conditions. These indications can warn drivers that congestion is ahead to allow for better preparation as they approach the slow down. Several VSS are owned and operated by ODOT on I-205 and I-5 in Clackamas County.

ROAD WEATHER INFORMATION SYSTEM (RWIS)

A Road Weather Information System (RWIS) is placed in the field to collect field data from numerous environmental sensors and communicate the data back to the County and ODOT. Measurements from these stations include atmospheric, pavement, and/or water level conditions. The County has three existing systems and has plans to deploy more on roadways near various County maintenance yard facilities.

SCHOOL ZONE FLASHER

School zone flashers are added to school speed limit signs to indicate when the school speed limit is in effect. Several jurisdictions throughout the County use school zone flashers. The County maintains all school zone flashers within the County. The majority of these flashers are programed/monitored/controlled with wireless cellular communication using AI Glance Cloud based system.

RECTANGULAR RAPID FLASHING BEACON (RRFB)

Rectangular Rapid-Flashing Beacons (RRFBs) are warning lights that are used at marked crosswalks to draw attention to pedestrians entering the intersection. RRFBs can also be installed mid-block away from intersections. They blink in varying patterns to increase driver awareness. Several jurisdictions throughout the County use RRFBs. The flashers are commonly pedestrian-actuated, but more recent advancements in technology use passive detection of pedestrians to activate the beacons. Some of the existing RRFBs have the ability for passive detection. The County is testing supplemental detection systems using a passive detection system (Flir cameras for touch-less pedestrian detection).

DRIVER SPEED FEEDBACK SIGN

Speed feedback signs are interactive signs that are used in conjunction with posted speed signs to measure driver speed while passing the sign. The purpose of the feedback is to encourage drivers to reduce vehicle speeds to match the posted speeds, and often the interactive sign will flash or display a targeted message such as "SLOW DOWN" if a driver is traveling over a certain speed threshold. Several jurisdictions throughout the County use speed feedback signs.

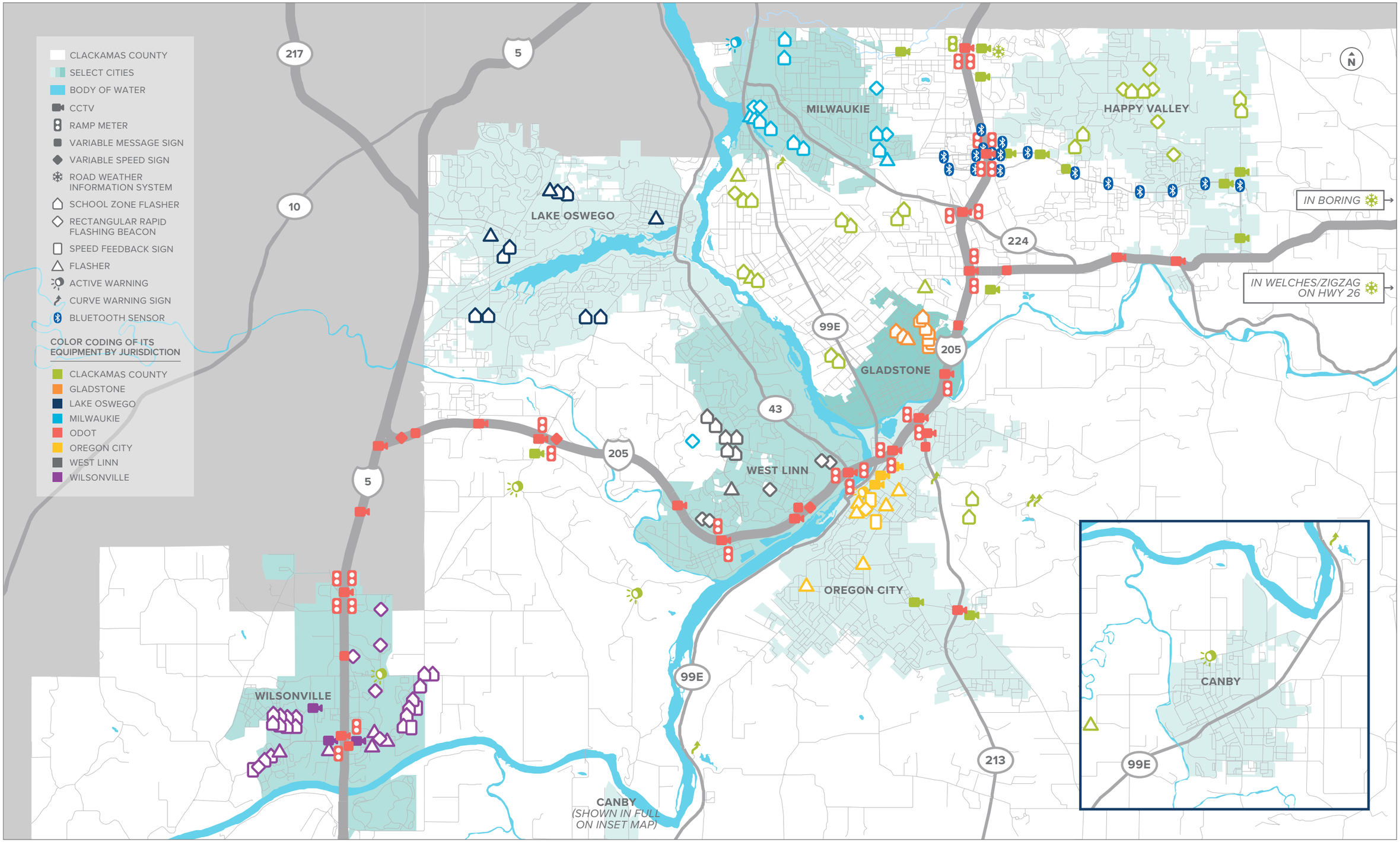
CURVE WARNING SIGN

Similar to a speed feedback sign, a curve warning sign notifies drivers of upcoming curves in the roadway that require modified speeds and special attention. Several curve warning signs are placed throughout the County.

BLUETOOTH SENSOR

With the rise in Bluetooth-equipped devices in cell phones and in-car systems, Bluetooth sensor systems can be used to measure traffic presence, density, flow, and long term comparative traffic analysis. The system typically includes monitoring of Bluetooth probe devices within radio proximity which is stored for future analysis and use. The County uses Bluetooth sensors at several intersections throughout their jurisdiction.

FIGURE 11: INTELLIGENT TRANSPORTATION SYSTEM DEVICES



TRANSIT

The Tri-County Metropolitan Transportation District of Oregon (TriMet) provides layered bus service on nearly every major arterial in the Clackamas County urban area. The cities of Wilsonville and Canby provide their own transit service. Transit centers (TC) are located at Clackamas Town Center, Oregon City, and Lake Oswego, and 15 Park and Ride lots are located within the study area. The TriMet bus routes, transit centers, and Park and Ride lots in the study area can be found at TriMet's website (www.trimet.org).

Transit signal priority (TSP) can reduce and provide more reliable transit travel times while having little impact on general traffic. Currently TSP is not being implemented within the county, however TriMet has expressed interest in doing so. For TriMet buses, TSP can be provided with traditional Opticom equipment, and in the near future using cloud-based technology. New traffic signals in Clackamas County are being constructed with Opticom detector equipment that can support transit signal priority, but many existing intersections require upgraded detection equipment to support TSP.

Several rail projects were implemented in Oregon City, Wilsonville, Milwaukie, and Clackamas County since the 2011 ITS Plan. Amtrak opened a station in Oregon City along its Cascades Route, a north-south route between Eugene, Oregon, and Vancouver B.C., Canada, in April 2004. TriMet opened the 15-mile Westside Express Service (WES) commuter rail line between Beaverton and Wilsonville in February 2009. The WES includes a rail station and Park and Ride in Wilsonville with connections for SMART (Wilsonville), CAT (Canby Area Transit), and Cherriots (Salem-Keizer Transit) transit routes. In Beaverton, the Commuter Rail provides connections to TriMet's light rail line, which provides service to Hillsboro, Portland, and Gresham.

Another rail project was completed in September 2009. The I-205/Portland Mall TriMet Green Line is 8 miles long with 20 new stations. The termini are located in downtown Portland at Portland State University and in Clackamas County at the Clackamas Town Center. The Green Line connects to the existing Banfield/I-84 light rail line and provides transfers to bus service along the corridor, including 10 bus lines at Clackamas Town Center.

The most recent project completed since the 2011 ITS Plan is the Portland to Milwaukie Light Rail (PMLR) project (TriMet Orange Line). The PMLR travels 7.3 miles between Portland State University and North Clackamas County. The PMLR includes two stations in Clackamas County: one in Milwaukie (SE Lake Ave/Se 21st Ave) and one in Oak Grove (Park Ave Station and Park & Ride).

SUPPLEMENTAL THIRD-PARTY DATA SOURCES

In addition to data collected by ITS devices owned and operated by the County, several regional data sources are also available for use by the County. The two most well-known and available third-party data sources for Clackamas County will be discussed in greater detail below.

PORTAL DATA WAREHOUSE

The Portland Oregon Regional Transportation Archive Listing (Portal), constructed and hosted by Portland State University, is the official transportation archive for the Portland-Vancouver metropolitan area. Portal provides a central archive that combines data from multiple sources and makes it available for planning and analysis purposes. Current data sources include ODOT freeway and incident data, traffic signal data from the PBOT server, travel time data, TriMet transit data, Port of Portland parking information, weather data, bicycle counts, and freight data. The region is actively enhancing the system to provide ongoing system performance measures for arterials and freeways. A screenshot of the platform is shown in Figure 12.

PSU has created a range of web interfaces and reports that the user may access in addition to providing access to raw data for off-line analysis. Portal 2.0 may be accessed at the following site.

http://portal.its.pdx.edu/

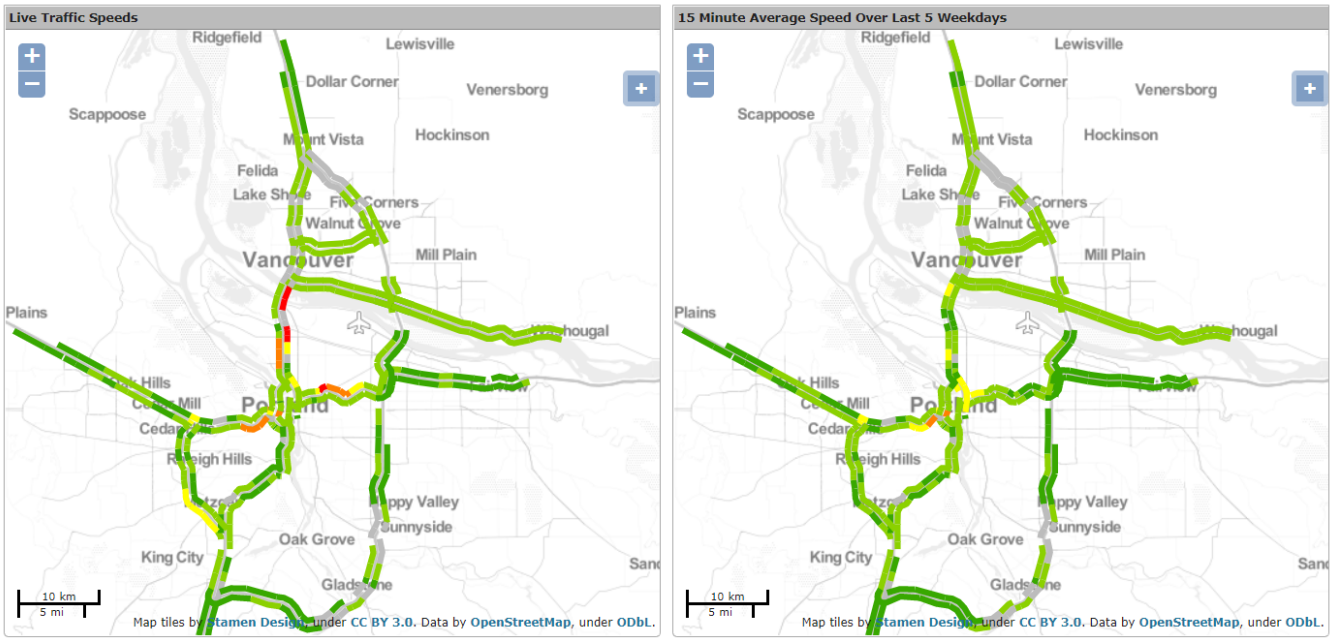


FIGURE 12: SCREENSHOT OF PORTAL LANDING PAGE

RITIS

RITIS is a situational awareness, data archiving, and analytics platform often used by transportation officials, first responders, planners, researchers, and more. It fuses data from many agencies, including public and private partners, to enable effective decision making for incident response and planning. In 2020, ODOT purchased access to the RITIS platform for the entire state of Oregon, including Clackamas County. With ODOT's access, the County and local agencies may also use the platform.

PREVIOUS AND PLANNED PROJECTS

There are several current and planned projects that relate to ITS in Clackamas County. Some of these projects demonstrate the benefits of regional partnerships and resource sharing, while others provide future opportunities that could significantly reduce the cost of implementing ITS.

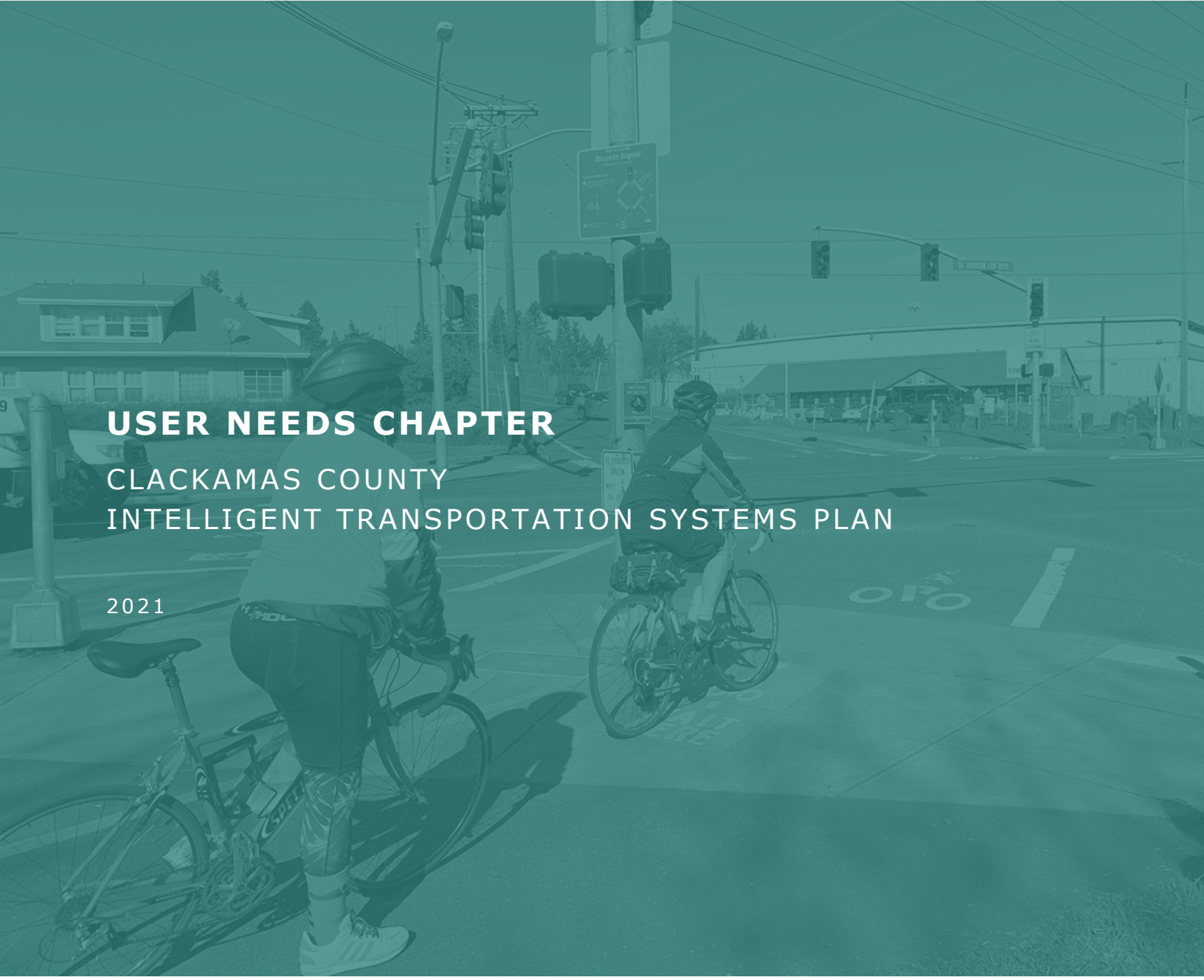
A few key current and planned projects are described below.

OREGON DEPARTMENT OF TRANSPORTATION (ODOT) ITS EXPANSION

ODOT annually invests in ITS improvements on Region 1 corridors. For the past several years, the investments have included communications and field devices (cameras, message signs, weather stations) on the region's highways. Lately, ODOT has been investing in more rural applications. The County has benefited by sharing fiber optic cable with ODOT that has enabled the County to connect facilities with field devices at a significant cost savings.

MTIP TSMO ALLOCATION PROGRAMMING

The TransPort group currently has set aside funds from MTIP that they allocate to regional operations projects. The TransPort group has identified arterial traffic management as a priority and the latest project will allow Clackamas County to upgrade the remaining signalized intersections to ATC controller.



USER NEEDS CHAPTER

CLACKAMAS COUNTY
INTELLIGENT TRANSPORTATION SYSTEMS PLAN

2021

PREPARED FOR:

CLACKAMAS COUNTY

DKS

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INTRODUCTION

This chapter provides a summary of Intelligent Transportation System (ITS) related user needs for Clackamas County gathered from project stakeholders through a workshop and personal interviews. In addition, this chapter includes a summary of the ITS strategies that were identified by stakeholders for consideration in the Deployment Plan. The assessment of current and future transportation user needs provides a basis for the development and evaluation of potential ITS projects.

The *Stakeholders and System Users* section identifies the stakeholder and key system users for the Clackamas County ITS plan. These users participated in the stakeholder workshop and individual interviews to identify and confirm key user needs. The *Summary of User Needs* section summarizes these user needs, organized by the following areas of interest:

- Traffic Operations and Management
- Multimodal Operations
- Traveler Information
- Data Collection and Management
- Incident and Emergency Management
- Maintenance and Construction Management

STAKEHOLDER AND SYSTEM USERS

To ensure the success of the Regional ITS Plan for Clackamas County, a coalition of stakeholders and system users was created to gather input and build consensus on regional needs. A workshop was held in June 2020 to gather big-picture user needs and to facilitate discussion between the Plan's stakeholders. The workshop was followed by personal interviews with key stakeholders to discuss and verify the transportation needs that had been identified and to determine any additional needs.

Stakeholders include:

- Clackamas County
- City of Canby
- City of Gladstone
- City of Happy Valley
- City of Lake Oswego
- City of Milwaukie
- City of Oregon City
- City of West Linn
- City of Wilsonville

USER NEEDS ASSESSMENTS WORKSHOP

A user needs assessment workshop was conducted with key regional stakeholders to review user needs established in the previous ITS Plan, confirm those needs that still applied, and discuss new needs that should be reflected in the current plan update. The focus of the workshop was to reach consensus from all stakeholders regarding the countywide transportation user needs.

The workshop included a short presentation that provided project background information, an overview of the plan process, and general ITS uses.

VISION, GOALS, AND STRATEGIES

To guide the development and ultimate deployment of intelligent transportation systems in Clackamas County, strategies were developed that support the County's Transportation System Plan (TSP) vision and goals.

POLICY VISION

The policy vision for this plan mirrors the TSP Policy Vision.

Building on the foundation of our existing assets, we envision a well-maintained and designed transportation system that provides safety, flexibility, mobility, accessibility and connectivity for people, goods and services; is tailored to our diverse geographies; and supports future needs and land use plans.

GOALS AND OBJECTIVES

The following graphic details the goals from the County TSP and how ITS strategies can influence those goals.

TSP GOALS		APPLICABLE ITS STRATEGIES
 SUSTAINABLE	**GOAL 1:** PROVIDE A TRANSPORTATION SYSTEM THAT OPTIMIZES BENEFITS TO THE ENVIRONMENT, THE ECONOMY AND THE COMMUNITY.	TRAFFIC MANAGEMENT AND OPERATIONS MULTIMODAL OPERATIONS DATA COLLECTION AND MANAGEMENT
 LIVABLE AND LOCAL	**GOAL 2:** PLAN THE TRANSPORTATION SYSTEM TO CREATE A PROSPEROUS AND ADAPTABLE ECONOMY AND FURTHER THE ECONOMIC WELL-BEING OF BUSINESSES AND RESIDENTS OF THE COUNTY.	TRAFFIC MANAGEMENT AND OPERATIONS MULTIMODAL OPERATIONS TRAVELER INFORMATION
 LOCAL DIVERSITY	**GOAL 3:** TAILOR TRANSPORTATION SOLUTIONS TO SUIT THE DIVERSITY OF LOCAL COMMUNITIES.	TRAFFIC MANAGEMENT AND OPERATIONS MAINTENANCE AND CONSTRUCTION MANAGEMENT
 HEALTH AND SAFETY	**GOAL 4:** PROMOTE A TRANSPORTATION SYSTEM THAT MAINTAINS OR IMPROVES OUR SAFETY, HEALTH, AND SECURITY.	TRAFFIC MANAGEMENT AND OPERATIONS MULTIMODAL OPERATIONS INCIDENT AND EMERGENCY MANAGEMENT MAINTENANCE AND CONSTRUCTION MANAGEMENT
 EQUITY	**GOAL 5:** PROVIDE AN EQUITABLE TRANSPORTATION SYSTEM.	MULTIMODAL OPERATIONS TRAVELER INFORMATION
 FISCALLY RESPONSIBLE	**GOAL 6:** PROMOTE A FISCALLY RESPONSIBLE APPROACH TO PROTECT AND IMPROVE THE EXISTING TRANSPORTATION SYSTEM AND IMPLEMENT A COST-EFFECTIVE SYSTEM TO MEET FUTURE NEED.	TRAFFIC MANAGEMENT AND OPERATIONS INCIDENT AND EMERGENCY MANAGEMENT

SUMMARY OF USER NEEDS

This section contains a summary of transportation system user needs for Clackamas County based on input gathered from the user needs workshop and individual stakeholder interviews.

User needs are grouped into the following six categories:

1. Traffic Management and Operations
2. Multimodal Operations
3. Traveler Information
4. Data Collection and Management
5. Incident and Emergency Management
6. Maintenance and Construction Management

Some needs may apply to multiple categories and any similar user need statements are likely the result of comments from separate stakeholders. The user needs in each category may also be split into several subcategories that summarize comments with similar themes.

TRAFFIC OPERATIONS AND MANAGEMENT

Stakeholders identified the following traffic operations and management needs:

Arterial Management and Traffic Signal Control

- Need to provide signal retiming and optimization
- Need to deploy adaptive, responsive and optimized time of day (TOD) signal timing on major corridors
- Need to upgrade signals to flashing yellow arrow left/right turn where warranted
- Need to upgrade all controllers to Advanced Transportation Controller (ATC), or latest system
- Need to install cameras at all arterial signalized intersections
- Need to install smarter bicycle detection system and implement special timing strategies
- Need to upgrade pedestrian actuated push buttons to Accessible Pedestrian Signal (APS) push buttons
- Need to evaluate upgrading individual Rectangular Rapid Flashing Beacons (RRFBs) to include passive pedestrian detection such as infrared
- Need better communication to County about signal timing - being able to change things on the fly

Coordinated Operations

- Need to minimize the number of different systems
- Need to continue to explore integration with other systems (Washington County, Oregon Department of Transportation (ODOT), etc)

- Need to create and share a dashboard of the central signal system between County and cities
- Need to expand Variable Message Signs (VMS) usage beyond highway system - onto other County roads to inform travelers approaching the interstates
- Need to provide travel times to freeways, arterials, etc
- Need more multipurpose detection and counting systems (permanent location)
- Need vehicle detection equipment for volumes, speeds, classification, and travel times - add signal performance measures, high resolution data
- Need an automatic train location system (advanced warning) with VMS

Special Events Management

- Explore event management for recurring events (County fair (99E), Tulip farm) - signal timing plans, automating traffic control
- Need to deploy portable ITS systems to monitor and make changes in real time for special events, construction, etc

MULTIMODAL OPERATIONS

Stakeholders identified the following multimodal operational needs:

Operational Performance

- Need to provide traffic signal system and detector upgrades for Transit Signal Priority (TSP)
- Need to explore deploying TSP on City and County corridors - support the technology (integrate with a central system)

Pedestrian/Bicycle

- Need to provide American Disability Act (ADA) improvements
- Need pedestrian and bicycle detection
- Need countdown timers
- Need pedestrian detection upgrades (push button with active feedback)
- Need school zone flasher update (continue to connect to cloud - to access information, data)
- Need to explore passive detection at RRFB locations to improve compliance at midblock crossings
- Need to explore counting capabilities with RRFBs
- Need to increase safety at intersections for bikes/peds - split signals, Leading Pedestrian Intervals (LPI), differentiating between vehicles/other modes and modifying timings
- Need to explore providing feedback for bicycles that they've been detected at bike signals
- Need automated remote trail count stations for bikes/peds to capture the need (Springwater, Trolley Trail, and others)
- Need remote trail counters connected to communications infrastructure

Infrastructure

- Need to work with Tri-Met to provide info about number of parking spaces available
- Need to provide parking occupancy information for heavily used park and rides - advance warning (coordinate with TriMet, ODOT)
- Need to explore connected vehicle applications for RRFBs (and connections from vehicles to the RRFB)
- Need to add fiber when possible for new projects

TRAVELER INFORMATION

Stakeholders identified the following needs related to traveler information:

Broadcast Traveler Information

- Need to continue to improve communication via social media (Twitter, Facebook, etc)
- Need to provide information through TripCheck
- Need to enhance County traveler information website - communicate road impacts
- Need to coordinate with cities to create a one stop shop website for road activity
- Need to provide one consistent message for routing travelers
- Need to publish county cameras for news media

Travel Time

- Need to provide arterial travel times
- Need to provide arterial congestion maps

Infrastructure

- Need to provide travel time variable message signs on arterial roadways
- Need to use field devices to automatically populate website
- Need to provide information about rail crossings, similar to Multnomah County and bridge raises

DATA COLLECTION & MANAGEMENT

Stakeholders identified the following needs related to data management and performance measurement.

Data Management

- Need to integrate county arterial data with regional archive center Portal
- Need to automate turn movement counts and 24-hour counts
- Need to use every signal with communication as a permanent count location (including Average Daily Traffic and Turning Movement Counts) throughout county
- Need to improve pedestrian counts - RRFBs, push buttons, signals
- Need bike detection at trails (see Multimodal Operations)

- Need to explore connections and applications with RITIS
- Explore the sources for origin destination data (including third-party providers) to compliment and replace BlueMac systems, ensuring consistency or sharing of data between local agencies and the County

Performance Monitoring

- Need to implement Automated Traffic Signal Performance Measures (ATSPMs)
- Need a system to aggregate and make data usable, accessible for varying levels of depth
- Need a customizable dashboard for varying levels of workforce and for each agency
- Need to collect instances of yellow and red light running

INCIDENT & EMERGENCY MANAGEMENT

Stakeholders identified the following needs related to incident and emergency management.

Detect and Verify

- Need to use predictive gauges for flooding
- Need to tie road closures or alerts to stream gauges
- Need to automate systems and/or cameras to confirm flooding and activate warning signs

Respond

- Need portable ITS devices to reroute traffic in emergency situations
- Need police department access to cameras, emergency information - to benefit their response to a crash
- Need to automate weather related ITS responses
- Need signal and ramp meter adjustments
- Need integrate Computer Aided Dispatch (CAD) systems and traffic data between traffic agencies and emergency management
- Need to use systems in place for Canby ferry

Inform

- Need en-route electronic detour guidance
- Need variable message signs
- Need real time communication to the public about emergency situations
- Need to automatically populate TripCheck website

MAINTENANCE & CONSTRUCTION MANAGEMENT

Stakeholders identified the following needs related to maintenance and construction management.

Infrastructure Monitoring

- Need to improve technology for maintenance crews to assess field conditions (pavement quality, reflectivity, guardrail damage, etc)
- Need Road Weather Information Systems (RWIS)
- Need to coordinate asset management tracking with other agencies

Winter Maintenance

- Need snowplow tracking systems, slick factors, risk factors, images - communicating with public

Roadway Maintenance and Construction Coordination

- Need an asset management system - track ITS equipment in a GIS-type format, including county owned and county maintained

Work Zone Management

- Variable speed limits
- Variable message signs
- Continue to explore and deploy automatic flagging stations

Work Zone Safety Monitoring

- Collect speed and volume data in construction zones
- Deploy portable radar feedback signs at construction zones that are usually used on safety corridors and at safety locations

PROPOSED STRATEGIES

Through the user needs interview process, stakeholders highlighted various strategies and areas of focus to address their needs. This section highlights the key focus areas and strategies of interest as identified by the Clackamas County ITS Plan stakeholders. These preliminary strategies, organized by functional areas, will be refined and used as a basis to define specific projects for the Deployment Plan.

TRAFFIC OPERATIONS AND MANAGEMENT

- Advanced Transportation Controller (ATC) upgrades
- Automated Signal Performance Measures (ATSPMs)
- Adaptive, responsive signal timing
- Signal Phase and Timing (SPaT) data shared with TripCheck
- Enhanced detection at signalized intersections
- Intersection safety analytics system
- Bicycle detection and counting

- Bicycle signal timing
- Enhanced pedestrian signal timings
- Accessible pedestrian signals (APS)
- RRFB passive detection
- Detour route management
- Special event traffic plans
- Communications infrastructure gap closure
- Traffic monitoring cameras
- Advanced railroad grade crossing information

MULTIMODAL OPERATIONS

- Transit signal priority
- Remote trail counters
- Pedestrian and bicycle detection
- Countdown timers
- School zone flasher upgrade - communication
- Passive detection at RRFB locations

TRAVELER INFORMATION

- Variable message signs
- Regional parking information systems
- Communication via social media
- County traveler information website
- Publish county cameras for TV and radio broadcasting
- Arterial travel times
- Rail crossings

DATA COLLECTION & MANAGEMENT

- Automated data collection
- Automated performance reporting
- Travel time monitoring system integrate county arterial data with PORTAL
- Improve pedestrian counts - RRFBs, push buttons, signals
- Explore connections and applications with RITIS
- Implement ATSPMs
- Dashboard
- Traffic monitoring video sharing with other agencies

INCIDENT & EMERGENCY MANAGEMENT

- Predictive gauges for flooding
- Closed Circuit Television (CCTV) cameras
- Portable ITS devices to reroute traffic
- En-route electronic detour guidance
- Variable message signs
- Need real time communication to the public about emergency situations
- Automatically populate TripCheck website

MAINTENANCE & CONSTRUCTION MANAGEMENT

- Smart work zone system (en-route warnings)
- Infrastructure monitoring technology
- Enhanced snowplow operations
- Winter road status and work zone status information sharing system
- Road Weather Information Systems (RWIS)
- Need an asset management system - track ITS equipment in a Geographic Information System (GIS) type format, including county owned and county maintained
- Variable speed limits
- Variable message signs
- Collect speed and volume data in construction zones

DEPLOYMENT PLAN CHAPTER

CLACKAMAS COUNTY
INTELLIGENT TRANSPORTATION SYSTEMS PLAN

2021

PREPARED FOR:

CLACKAMAS COUNTY

DKS

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INTRODUCTION

The following chapter presents the updated ITS Deployment Plan for Clackamas County and its local agency partners. The plan includes a range of ITS projects that address the needs of the region. The Deployment Plan projects are grouped into the following categories:

- Traffic Management and Operations
- Multimodal Operations
- Traveler Information
- Data Collection and Management
- Incident and Emergency Management
- Maintenance and Construction Management

The following sections summarize the County's ITS vision and goals, and provides performance measures, a toolbox of ITS strategies, priority corridors, and the Deployment Plan projects.

CLACKAMAS COUNTY VISION AND GOALS

For consistency across the County, the policy vision and goals for this plan mirror the County's Transportation System Plan (TSP). Figure 13 details the TSP vision and goals, as well as the connections to ITS strategies that can influence these goals.

TSP GOALS		APPLICABLE ITS STRATEGIES
SUSTAINABLE	**GOAL 1:** PROVIDE A TRANSPORTATION SYSTEM THAT OPTIMIZES BENEFITS TO THE ENVIRONMENT, THE ECONOMY AND THE COMMUNITY.	TRAFFIC MANAGEMENT AND OPERATIONS MULTIMODAL OPERATIONS DATA COLLECTION AND MANAGEMENT
LIVABLE AND LOCAL	**GOAL 2:** PLAN THE TRANSPORTATION SYSTEM TO CREATE A PROSPEROUS AND ADAPTABLE ECONOMY AND FURTHER THE ECONOMIC WELL-BEING OF BUSINESSES AND RESIDENTS OF THE COUNTY.	TRAFFIC MANAGEMENT AND OPERATIONS MULTIMODAL OPERATIONS TRAVELER INFORMATION
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FIGURE 13: CLACKAMAS COUNTY TSP GOALS AND APPLICABLE ITS STRATEGIES

PERFORMANCE MEASURES

Performance measures will be used to evaluate transportation system performance and prioritize investments. Table 1 presents sample performance measures that could be used to monitor the effectiveness of projects and track ongoing transportation network performance.

TABLE 1: SAMPLE PERFORMANCE MEASURES FOR GOAL ASSESSMENT

CANDIDATE PERFORMANCE MEASURES	SAMPLE MEASUREMENT	RELATED TSP GOAL
GREENHOUSE GAS EMISSIONS	Vehicle Miles Traveled Vehicle Emissions Transit Vehicle Fuel Efficiency	Sustainable Equity
TRAVEL TIME	Average Travel Time Average Speed	Livable and Local Local Business and Jobs
TRAVEL TIME RELIABILITY	90th or 95th Percentile Travel Time Frequency that congestion exceeds expected thresholds Travel Time Index Planning Time Index Buffer Time Index On-Time Transit Performance	Livable and Local Local Business and Jobs
MODAL SPLIT	Percentage of travelers using personal vehicle, carpool, transit, biking, or walking	Sustainable Livable and Local Health and Safety Equity
RECURRING DELAY	Vehicle Delay Person Delay Freight Delay	Sustainable Livable and Local Local Businesses and Jobs
NON-RECURRING DELAY	Vehicle Delay Person Delay Freight Delay	Sustainable Livable and Local Local Businesses and Jobs
THROUGHPUT (VEHICLE)	Vehicle Volume per Hour	Livable and Local Local Businesses and Jobs

CANDIDATE PERFORMANCE MEASURES	SAMPLE MEASUREMENT	RELATED TSP GOAL
THROUGHPUT (PASSENGER)	Passenger Trips per Vehicle Revenue Hour and Mile Passenger Load (Ridership/Capacity)	Livable and Local Local Businesses and Jobs Health and Safety
HOURS OF CONGESTION	Duration of Congestion	Sustainable Livable and Local Local Businesses and Jobs
CUSTOMER SATISFACTION	Percent of Population Highly Satisfied or Satisfied with Travel Conditions Complaint/Compliment Rate Number/Type of Hits on Traveler Information Website Number/Type of Interactions on Social Media	Livable and Local Health and Safety Fiscally Responsible Equity
INCIDENT RESPONSE	Number/Type of Incident Responses Incident Duration Incident Response Time Average Incident Clearance Time	Health and Safety
COLLISION RATE	Rate/Number of Collisions Rate/Number of Fatalities Rate/Number of Injuries	Health and Safety
INEQUITABLE BURDENS	Of any performance measures listed above, compare general population trends with trends of disadvantaged populations[1]	Equity

[1] Disadvantaged populations may follow the definition of the Title VI Civil Rights Act Requirements to remove barriers and conditions from the following groups from receiving access, participation, and benefits from federally assisted programs, services, and activities: Minority Populations, Households in Poverty, Elderly Populations, People with Limited English Proficiency, and People with Disabilities.

CANDIDATE PERFORMANCE MEASURES	SAMPLE MEASUREMENT	RELATED TSP GOAL
HEALTH EQUITY INDICATORS[2]	Age-Adjusted Death Rate due to Motor Vehicle Traffic Collisions Households without a Vehicle Solo Drivers with a Long Commute Households with No Car and Low Access to a Grocery Store Mean Travel Time to Work Workers Commuting by Public Transportation	Health and Safety Equity

TOOLBOX OF ITS STRATEGIES

Table 2 presents a toolbox of ITS strategies to help advance the ITS Plan and address the identified issues and needs of the County. The ITS strategies are provided for each of the six Deployment Plan project categories:

[2] Health Equity Indicators are directly pulled from Clackamas County's *Blueprint for a Health Clackamas County* website, intended to help community members and policy makers learn about the health of the County community. The website provides data and tools, including dashboards, for each of the health equity indicators described in the table on a County wide, census places, zip code, and census tract level.

TABLE 2: TOOLBOX OF ITS STRATEGIES

ITS STRATEGY	STRATEGY DESCRIPTION	EXPECTED BENEFITS	SPECIFIC APPLICATIONS
TRAFFIC MANAGEMENT AND OPERATIONS			
ENHANCED TRAFFIC SIGNAL OPERATIONS	Expand and improve traffic signal, traffic controller, and communications technology.	• Reduce travel times • Potential to improve travel time reliability • Reduces fuel consumption and vehicle emissions	• Connect signals to central signal system • Upgrade signal communications to fiber • Install fiber and connect to traffic signals • Upgrade signal technology • Signal retiming and optimization • Expand coordination of signals • Adaptive signal timing • Expand bicycle and pedestrian detection technology
TRAFFIC MONITORING	Add monitoring cameras and detection to observe key locations of the regional transportation network and assess real-time traffic flow conditions.	• Improves incident detection and verification • Provides real-time and historic system operations information • Supports the dissemination of real-time traveler information • Improved visual information for decision makers and travelers	• Arterial camera deployment • Vehicle Detection Equipment
RAILROAD CROSSING ALERT SYSTEM	Deploy driver warning systems at select railroad at-grade crossings.	• Emergency response vehicles or travelers may choose alternative routes to avoid delay at the railroad crossing • Provides vehicles with additional warning to prevent conflicts with trains	• Variable message signs • Automatic train location system • Advanced detection
ACTIVE MANAGEMENT SOFTWARE	Deploy dynamic speed warning systems on high-speed and/or high-crash corridors.	• Reduced crashes and improved safety	• Dynamic speed control • Warning signs at high accident locations

ITS STRATEGY	STRATEGY DESCRIPTION	EXPECTED BENEFITS	SPECIFIC APPLICATIONS
		MULTIMODAL OPERATIONS	
PEDESTRIAN ENHANCEMENTS	Deploy pedestrian crossing devices to improve safety at select pedestrian crossings.	• Increases safety • Encourages walking as a safe and healthy mode of transportation • Facilitates the tracking and understanding of pedestrian patterns	• Pedestrian detection upgrades (passive) • Countdown timers • School zone flasher communications and power source upgrades • Permanent pedestrian counters
BICYCLE ENHANCEMENTS	Improve bicycle travel at traffic signals to progress bicycles on major bicycle routes and increasing space for presence of bicyclists and visibility for motor vehicles.	• Reduces bicycle stops and delay • Potential to improve bicycle travel time reliability • Increases safety • Encourages bicycling as a safe and healthy mode of transportation • Facilitates the tracking and understanding of pedestrian patterns	• Bicyclist detection and signal timing • Permanent bicyclist counters
TRANSIT SIGNAL PRIORITY	Extend the green phase at traffic signals for buses that are behind schedule to reduce the frequency of bus stops at traffic signals.	• Reduces delay at traffic signals • Reduces transit travel time • Improves travel time reliability • Increases passenger throughput • Reduces system operational costs if fleet can be reduced	• Traffic signal system and detector upgrades for TSP

ITS STRATEGY	STRATEGY DESCRIPTION	EXPECTED BENEFITS	SPECIFIC APPLICATIONS
		TRAVELER INFORMATION	
REGIONAL TRAVELER INFORMATION	Provide static and real-time traveler information (e.g., incidents, construction, transit arrivals) from all regional agencies.	• Reduces delay • Reduces the number of stops and vehicle emissions • Potential to improve travel time reliability • Reduces crashes • Provides traveler information to make informed choices • Increases attractiveness of alternate modes • Increases traveler satisfaction with the transportation network	• Travel time variable message signs on arterial roadways • Continued use of TripCheck, TripCheck Traveler Information Portal (TTIP), and TripCheck Local Entry (TLE) • Arterial congestion maps • Arterial travel times
COMMUNITY OUTREACH	Provide real-time and static information to the community through multiple applications.	• Pre-trip planning capabilities that allow users to make informed travel decisions • Reduced congestion and delay	• Continued use of social networking
		DATA COLLECTION AND MANAGEMENT	
INNOVATIVE DATA COLLECTION	Collect and store data at key intersections and roadways.	• Supports regional planning efforts • Cost-effective	• Automated traffic signal performance measures • Asset management systems
		INCIDENT AND EMERGENCY MANAGEMENT	
VARIABLE SPEED LIMITS	Real time system adjustments to warn drivers of upcoming congestion or lane closures.	• Supports alternate travel routing for incident management • Reduces speed variation • Reduces stop and go driving in congested areas • Potential to improve travel time reliability • Improves safety, specifically rear-end crashes and secondary crashes	• Variable speed limits • Variable message signs

ITS STRATEGY	STRATEGY DESCRIPTION	EXPECTED BENEFITS	SPECIFIC APPLICATIONS
MAINTENANCE AND CONSTRUCTION MANAGEMENT			
WORK ZONE MANAGEMENT	Deploy variable message signs to display information or speed limits that change based on road, traffic, and weather conditions.	• Improves safety • Reduces speed variations • Reduces stop and go driving in congested areas • Reduces delay • Potential to improve travel time reliability	• Variable speed limits • Variable message signs
ROAD WEATHER MANAGEMENT	Monitor and predict roadway conditions to mitigate impacts of adverse weather conditions.	• Reduces vehicle speeds • Potential to improve travel time reliability • Reduces crashes • Provides information for decision makers and travelers • Improves maintenance resource allocation	• Road weather information systems (RWIS)
FLOOD/SLIDE WARNING SYSTEM	Monitor and predict river and stream water heights to mitigate impacts of adverse roadway conditions when water levels are high.	• Potential to improve travel time reliability • Improves safety by reducing crashes • Provides information for decision makers and travelers • Improves maintenance and resource allocation	• Warning lights • Alert flashers and signals • Roadway barriers

PRIORITIZATION USING TRANSPORTATION EQUITY INDICATORS

The outcome of this chapter is a comprehensive list of Deployment Plan projects to be implemented by the County and local agency partners in the next several years. To facilitate project selection from year to year, the project team has prioritized corridors to place emphasis on specific geographic locations that are in the most need of system management applications. A priority corridor designation does not automatically mean that all Deployment Plan projects would be implemented on the corridor, rather, that the corridor should be considered for investment prior to non-priority corridors.

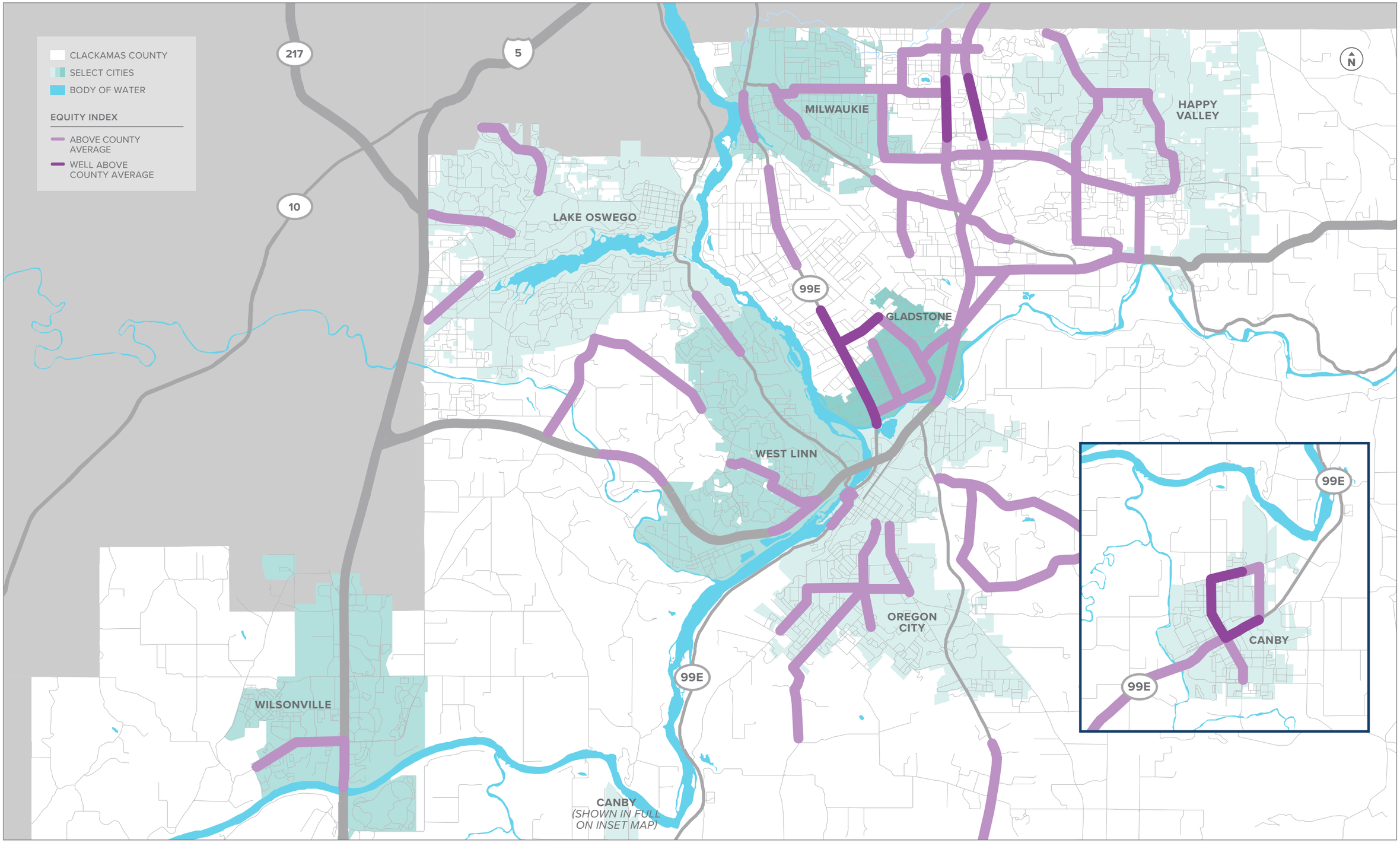
The priority corridors for this plan were selected using a social and economic justice lens. In 2019, the County conducted a review of methodology to identify geospatial distribution patterns of vulnerable populations and transportation equity indicators to incorporate into planning work.[3] As a result of this review, several indicators were proposed to best capture potential disadvantages in the County:

- Populations 65 and older
- Populations younger than 18
- Communities of Color
- Hispanic/Latino Ethnicity
- Low Income Households
- Limited English Proficiency
- Disability status

Using these indicators, Figure 14 highlights roadways that serve census tracts above County average population percentages of one or more of the indicators. Priority corridors were identified based on their proximity to the highlighted census tracts. The full methodology behind the index interpretation is included in the Appendix.

[3] Moland, Abe. *Transportation Equity Indicators – Review & Methodology*, last updated August 2020.

FIGURE 14: TRANSPORTATION EQUITY INDICATOR PRIORITIZED CORRIDORS



DEPLOYMENT PLAN PROJECTS

The following list of projects were identified to address the needs of the County as identified in the Existing Conditions and User Needs chapters of this plan. Figure 15 illustrates the proposed signal system, and Figure 16 illustrates the proposed ITS network.

The full project list is shown in Table 3. The rightmost columns indicate whether the project will influence a census tract where the population consists of either *above average* or *well above average* percentages of vulnerable populations. By equitably prioritizing these projects, the County and its local agency partners increase the potential that residents that fall under one of the population groups described in the previous section will receive the benefits of transportation investment rather than the burdens.

FIGURE 15: DEPLOYMENT PLAN SIGNAL NETWORK

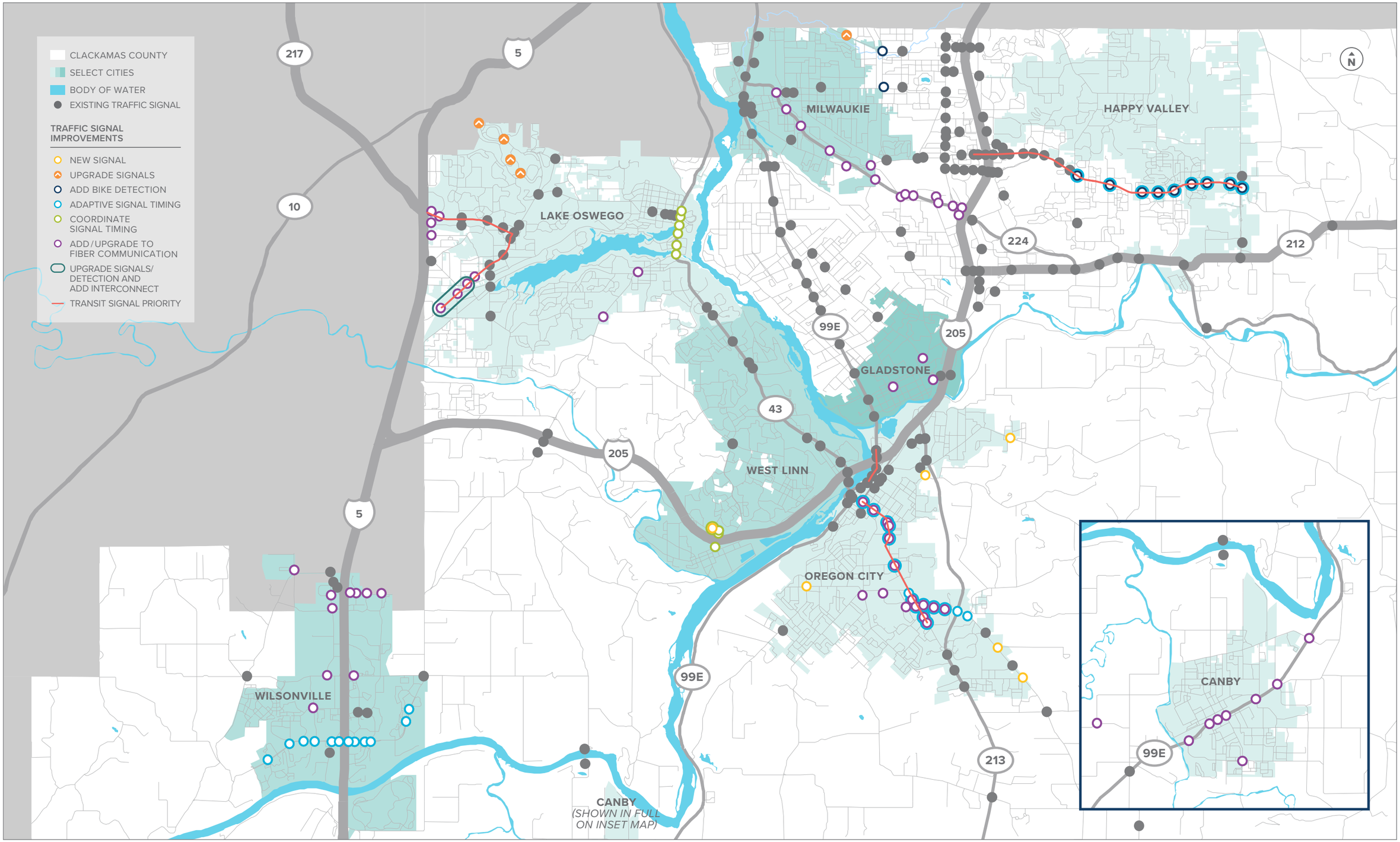


FIGURE 16: DEPLOYMENT PLAN ITS NETWORK

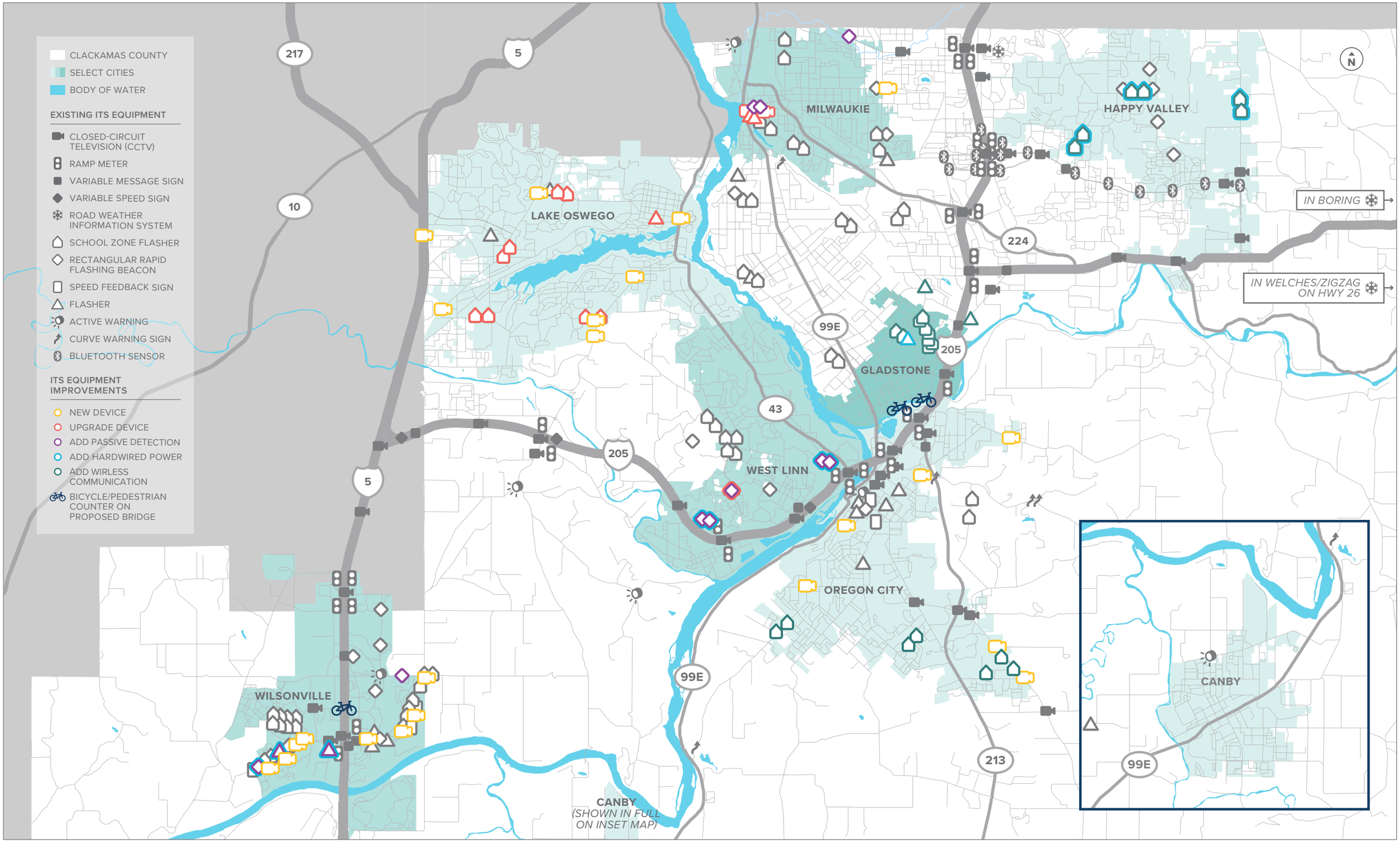


TABLE 3: CLACKAMAS COUNTY ITS PLAN PROJECT LIST

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-01	ARTERIAL CONGESTION MAP WITH TRAVEL TIMES	Using RITIS/INRIX/ODOT hybrid with Bluetooth/field devices, portable to see how people are using detours to monitor degradation of travel times from planned or unplanned events	Clackamas County	$100K	Enhanced Traffic Signal Operations	X	
CC-02	CONNECT COUNTY SIGNALS TO CENTRAL SIGNAL SYSTEM	Upgrade the following traffic signal controllers in Lake Oswego to ATC, and establish communications to the intersections from existing fiber network for central control and monitoring: • Boones Ferry • Stafford Road • Bryant Road • Bangy Road	City of Lake Oswego	$220K	Enhanced Traffic Signal Operations	X	
CC-03	UPGRADE SIGNAL COMMUNICATION TO FIBER	Connect signals to existing fiber communications on the following corridors (using wireless communication at the intersection): • Knights Bridge Rd • OR99E – Berg Rd to Territorial Ave • Extend fiber on Ivy St	Clackamas County & Canby	$80K	Enhanced Traffic Signal Operations	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-04	UPGRADE SIGNAL COMMUNICATION TO FIBER	Extend signal communications to the following signals, using fiber communication: • 82nd/Oatfield Rd • Oatfield Rd/Webster Rd • Gloucester Rd/Portland Ave	Gladstone	$40K	Enhanced Traffic Signal Operations		X
CC-05	UPGRADE SIGNAL COMMUNICATION TO FIBER	Connect signals at Kruse Way/Kruse Oaks Blvd to existing fiber communications	Lake Oswego	$60K	Enhanced Traffic Signal Operations	X	
CC-06	UPGRADE SIGNAL COMMUNICATION TO FIBER	Upgrade the following signal locations to fiber communications: • Leland Rd/Warner Milne Rd/Warner Parrot Rd • Warner Milne Rd/Beavercreek Rd • Signals on Mollala Ave (Hilda St to Washington St) (6 signals) • Signals on Beavercreek Rd (Shopping Center Driveway west of Molalla Ave to Fir Street) (5 signals)	Oregon City	$100K	Enhanced Traffic Signal Operations	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-07	UPGRADE SIGNAL COMMUNICATION TO FIBER	Connect the following signals to fiber communications network: • 95th Ave/Boeckman Rd • Parkway Ave/Boeckman Rd • Commerce Circle/95th Ave • Ridder Rd/95th Ave • Day Rd/Grahams Ferry Rd (potential for a joint effort with Washington County) • Elligsen Rd east of I-5 (3 signals) • Grahams Ferry Rd/Day Rd	Wilsonville	$100K	Enhanced Traffic Signal Operations		
CC-08	MILWAUKIE SIGNAL IMPROVEMENT	Upgrade Milwaukie city signals to communications network: • Fiber communications on OR224 (connect to City's network) • Upgrade King Rd/Linwood Rd signals to include bicycle detection and a camera (County owned) • Upgrade signal on Johnson Creek Blvd near PCC Structurals • Upgrade Linwood Ave/Johnson Creek Blvd to include bicycle detection	Milwaukie & Clackamas County	$320K	Enhanced Traffic Signal Operations	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-09	OR-213 FIBER INSTALLATION	Install fiber communications into existing conduit on OR-213 from Mollala Ave to Glen Oak Rd	Oregon City	$100K	Enhanced Traffic Signal Operations		
CC-10	WEST LINN SIGNAL COORDINATION/ COMMUNICATION UPDATE	Add future communication and coordination between the following signals: • 10th St/I-205 NB Ramps • 10th St/I-205 SB Ramps • 10th St/Blankenship Rd/Salamo Rd • Blankenship Rd/Tannler Dr (future signal)	West Linn	$160K	Enhanced Traffic Signal Operations		
CC-11	OREGON CITY ADVANCED SIGNAL UPDATE	Install new traffic signals with fiber communications, CCTVs, ATCs, and SPM capabilities at the following locations: • High St/2nd St • South End Rd/Warner Parrot Rd • Redland Rd/Anchor Way • Beavercreek Rd/Glen Oak Rd • Holcomb Blvd/Barlow Dr • Beavercreek Rd/Loder Rd	Oregon City	$3,720K	Enhanced Traffic Signal Operations	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-12	LAKE OSWEGO SIGNAL ENHANCEMENT	Enhance detection and upgrade signals as follow: • Coordinate signals on A Ave and OR 43 • Upgrade signals at Kerr Pkwy • New signals at Jean Way/Pilkington Rd	Clackamas County	$1,200K	Enhanced Traffic Signal Operations	**X** **Kerr Pkwy**	
CC-13	SIGNAL COORDINATION	Coordinate signal at Oatfield Rd/82nd Ave to ODOT signal	Gladstone	$60K	Enhanced Traffic Signal Operations		
CC-14	SUNNYSIDE ADAPTIVE SIGNAL EXPANSION	Extend adaptive signal on Sunnyside Rd from 122nd to 172nd and expand bike detection from 132nd to 172nd	Clackamas Co	$2,080K	Enhanced Traffic Signal Operations	**X**	
CC-15	JOHNSON CREEK ADAPTIVE	Installation of traffic adaptive signals on Johnson Creek Blvd, from Fuller Rd to 92nd Ave	Clackamas Co	$720K	Enhanced Traffic Signal Operations	**X**	
CC-16	WILSONVILLE RD ADAPTIVE SIGNAL	Upgrade the Wilsonville Rd corridor to adaptive signal timing (Advance Rd/Boeckman Rd to Brown Rd)	Wilsonville	$3,060K	Enhanced Traffic Signal Operations	**X** **West of I-5**	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-17	OREGON CITY ADAPTIVE SIGNALS	Deploy adaptive signal timing on the following corridors: • Molalla Ave (Washington St to Fir St) • Beavercreek Rd (Molalla Ave to Maple Lane Rd)	Oregon City	$2,420K	Enhanced Traffic Signal Operations	X	
CC-18	LAKE OSWEGO CCTV	Install PTZ cameras with fiber connection where possible at the following locations: • Kruse Way/Boones Ferry Rd • OR-43/A Ave • Boones Ferry Rd/Country Club Rd • Boones Ferry Rd/Jean Way • Bangy Rd/Bonita Rd • Stafford Rd/Overlook Dr • Stafford Rd/McVey Ave • Stafford Rd/Rosemont Rd	Lake Oswego	$200K	Traffic Monitoring	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-19	OREGON CITY CCTV AND DETECTION	Install Traffic Surveillance devices such as video monitoring cameras and vehicle detection equipment to provide turn movement counts, hourly volumes, travel times, and speed on the following corridors: • Beavercreek Rd (Molalla Ave to Maple Lane Rd) • Washington St (7th St to OR 213) • 7th Street/Molalla Avenue (Washington Street to OR 213)	Oregon City	$860K	Traffic Monitoring		
CC-20	WILSONVILLE CCTV	Add cameras at the following locations: • Kinsman Rd/Barber St • Boones Ferry Rd/Wilsonville Rd • Kinsman Rd/Wilsonville Rd • Brown Rd/Wilsonville Rd • Willamette Way East/Wilsonville Rd • Town Center Loop East/Wilsonville Rd (City Hall) • High School entrance/Wilsonville Rd • Meadows Rd (Primary School Entrance)/Wilsonville Rd • Boeckman Rd/Advance Rd/Stafford Rd	Wilsonville	$160K	Traffic Monitoring	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-21	LAKE OSWEGO RAILROAD ALERT SYSTEM	Add detection and interconnect at RR crossing on Boones Ferry Rd at Washington Ct, Pilkington Rd and Jean Way	Lake Oswego	$900K	Railroad crossing alert system		
CC-22	COUNTY WIDE ODOT RAILROAD CROSSING ALERT SYSTEM	Add railroad crossing alert system on ODOT facilities: • OR-99E (2) • 82nd Ave • Wilsonville Rd	Clackamas County	$900K	Railroad crossing alert system		
CC-23	MILWAUKIE RAILROAD CROSSING	Upgrade cameras and install blank-out signs for train warning at 21st Ave/Washington St and Harmony/Railroad & Linwood	Milwaukie	$680K	Railroad crossing alert system		
CC-24	DYNAMIC SPEED CONTROL	Add radar speed feedback signs on Westview Dr	Lake Oswego	$60K	Dynamic Speed Control		
CC-25	MILWAUKIE INTERSECTION SAFETY IMPROVEMENT	Add safety improvements (blank out sign/cameras, etc) at Harmony Rd/Linwood Ave/Lake Rd	Milwaukie	$480K	Safety Improvement	X	
CC-26	DYNAMIC SPEED FEEDBACK	Install radar feedback signs with AC power or wireless comm, with traffic counts/speed data on the following corridors: • 32nd St • 42nd St • Linwood Ave • Stanley Rd	Milwaukie	$1,040K	Dynamic Speed Control	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-27	ADVANCED PED CROSSING	Add ped/bike count stations at the following pedestrian bridges: • Existing bridge on 82nd Ave • Future bridge near Portland Ave/Clackamas Blvd/Clackamas River	Gladstone	$40K	Pedestrian/ Bicyclist Safety	X	
CC-28	GLADSTONE FLASHER UPGRADE	Upgrade flasher to AC power from solar power	Gladstone	$20K	Pedestrian/ Bicyclist Safety		X
CC-29	HAPPY VALLEY FLASHER UPGRADE	Upgrade existing school zone flashers to AC power at the following corridors: • 129th Ave • King Rd • 172nd Ave • 152nd Ave	Happy Valley	$120K	Pedestrian/ Bicyclist Safety	X	
CC-30	LAKE OSWEGO FLASHER UPGRADE	Upgrade flashers at the following locations: • Enhance ped crossing at A Ave/5th St • Add passive detection at midblock crossings throughout the City • Upgrade school flashers throughout the City	Lake Oswego	$100K	Pedestrian/ Bicyclist Safety		
CC-31	MILWAULIKE FLASHER UPGRADE	Upgrade flashers at the following locations: • Add passive detection to existing RRFB's on Johnson Creek	Milwaukie	$80K	Pedestrian/ Bicyclist Safety	X	

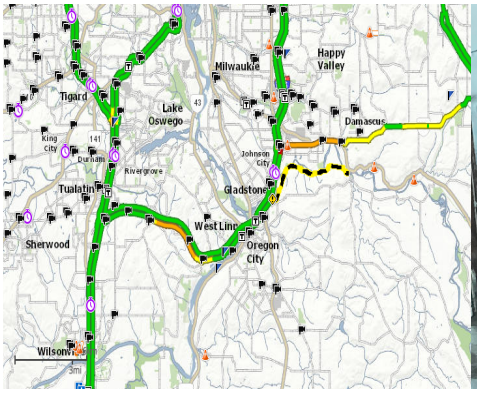
PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
		Blvd/Washington St/Milwaukie HS • Upgrade flasher on Lake Rd • Upgrade all flashers to wireless communication					
CC-32	OREGON CITY FLASHER UPGRADE	Upgrade school zone flashers at the following locations with wireless capabilities: • South End Rd near Salmonberry Dr and Filbert Dr • Gaffney Ln near Glenview Ct and Falcon Dr • Meyers Rd near High School Ln • Beavercreek Rd south of Loder Rd and north of Glen Oak Rd	Oregon City	$20K	Pedestrian/ Bicyclist Safety	**X** **South End Road**	
CC-33	WEST LINN FLASHER UPGRADE	Add hardwired power and passive detection to the following RRFB locations: • Blankenship Rd/13th St (2) • Salamo Rd/Bland Circle (upgrade to RRFB) • A St near West Linn High School (2)	West Linn	$140K	Pedestrian/ Bicyclist Safety		
CC-34	WILSONVILLE FLASHER UPGRADE	Upgrade all flashers/RRFBs to be capable of passive detection. Specific locations identified include: • Willamette Way W (Graham Oaks Nature Park)/Wilsonville Rd (needs hardwiring) • Wellington Rd/Wilsonville Rd (overhead flasher)	Wilsonville	$40K	Pedestrian/ Bicyclist Safety	**X** **Wilsonville Road**	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
		• Guiss Way/Wilsonville Rd • Boones Ferry Rd/Sonic driveway (illuminating signs) • Sherman Dr/Boeckman Rd					
CC-35	CLACKAMAS CO TRAIL CROSSINGS	Upgrade the following locations to AC power and add cellular communication: • Spring Park Natural Area • Trolley Trail	Clackamas Co	$60K	Pedestrian/ Bicyclist Safety	X	
CC-36	WILSONVILLE CITYWIDE PED TIMING AND DETECTION	Upgrade detection along a corridor (or citywide) to have bicycle timing/detection (15 locations included in cost estimate)	Wilsonville	$200K	Pedestrian/ Bicyclist Safety		
CC-37	WILSONVILLE BARBER ST BIKE-PED BRIDGE ACTIVE COUNTER	Install permanent active transportation counter on the proposed Barber Street Bike-Ped Bridge	Wilsonville	$60K	Pedestrian/ Bicyclist Safety		
CC-38	HAPPY VALLEY TSP	Upgrade the following corridors with Transit Signal Priority: • Sunnyside Rd (82nd to 172nd)	Happy Valley	$280K	Transit Signal Priority	X	
CC-39	LAKE OSWEGO TSP	Upgrade the following corridors with Transit Signal Priority: • Kruse Way (I-5 to Boones Ferry Rd) • Boones Ferry Rd (I-5 to Kerr Pkwy)	Lake Oswego	$100K	Transit Signal Priority	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
CC-40	OREGON CITY TSP	Upgrade the following corridors with Transit Signal Priority: • Molalla Avenue (Washington Street to Fir Street) • OR 99E (Dunes Drive to 10th Street)	Oregon City	$180K	Transit Signal Priority	X	
CC-41	PERMANENT DMS INSTALLATION	Capture and display travel time data for the City of Wilsonville using devices and/or third-party data collection on the following corridors: • Wilsonville Rd • Sunnyside WB • Clackamas Town Center	Clackamas County	$1,520K	Traveler Information	X	
CC-42	AUTOMATE PERFORMANCE MEASURES	Collect and store data at key intersections and roadways. Field devices should collect travel times, measure travel time reliability, and inform other performance measures.	Clackamas County	$1,000K	Innovative Data Collection		
CC-43	ASSET MANAGEMENT SYSTEM	Track ITS equipment in a GIS-based asset management system, including County owned and County maintained devices	Clackamas County	$90K	Innovative Data Collection	X	
CC-44	DYNAMIC SPEED CONTROL	Install dynamic speed control devices on the following corridors, based on weather/traffic condition: • ODOT facilities: 99E, 82nd Ave, McLoughlin Rd, and Hwy 26 to Mt Hood • Sunnyside Rd	Clackamas County	$1,300K	Variable Speed Limits	X	

PROJECT NO.	PROJECT TITLE	DESCRIPTION	JURISDICTION	COST	STRATEGY	ABOVE AVERAGE EQUITY IMPACT	WELL ABOVE AVERAGE EQUITY IMPACT
		• Stafford Rd • Wilsonville Rd – (includes driver feedback signs with advisory or regulatory speed depending on the condition)					
CC-45	CORRIDOR MANAGEMENT	Deploy Integrated Corridor Management on OR 224 from Milwaukie to 10th St	Milwaukie	$2,140K	Variable Speed Limits	X	
CC-46	HAPPY VALLEY SAFETY IMPROVEMENT	Evaluate current operations and safety for implement recommendations	Happy Valley	$480K	Variable Speed Limits	X	

The following pages provide one-page summaries of each category of projects. The one-page summaries include project objective, description, stakeholders, communications requirements, costs, operations and maintenance needs, user needs addressed, and benefits. Several projects may be described under one category, however, associated costs for each project will be separated.

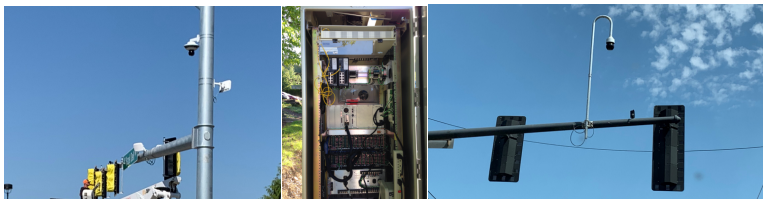
PROJECT NUMBER CC-01	ARTERIAL CONGESTION MAP, TRAVEL TIMES
OBJECTIVE	Monitor degradation of travel times from planned or unplanned events.
DESCRIPTION	Using RITIS/INRIX/ODOT hybrid with Bluetooth/field devices to observe detour use to monitor degradation of travel times from planned or unplanned events.  
STAKEHOLDER(S)	Clackamas County traffic management, ODOT Region 1 traffic management, freight, traveling public
COMMUNICATIONS REQUIREMENTS	Communications links from the Clackamas County Traffic Operations Center (TOC) to field devices for display on the website.
COST	$100,000 for project deployment/$3,000 for annual O&M
OPERATIONS & MAINTENANCE	Operations and maintenance will play a key role in the successful implementation of this project since traveler information must continually be kept up-to-date in order to provide value to website users. The use of software will allow certain types of information to be automatically uploaded to the website while other information may need to be updated manually by key personnel.
NEEDS ADDRESSED	• Need real-time traffic condition information • Need to understand travel routes during planned and unplanned events • Need to understand how travel times are affected during planned and unplanned events
BENEFITS	• Real-time or near real-time ability to monitor and evaluate to travel routes and travel time delays that result from planned or unplanned events.

PROJECT NUMBER CC-02 THROUGH CC-09	SIGNAL UPGRADE
OBJECTIVE	Provide capability to monitor traffic signals to support regional traffic management strategies
DESCRIPTION	These projects will upgrade traffic signal controllers to ATC controllers and establish communications to the intersections or upgrade connections to fiber communications for central control and monitoring. This will allow remote data collection, analysis, and real-time signal timing changes that respond to current traffic conditions. The remote access enables County signal operations engineers to efficiently make timing adjustments that reduce delays during incidents, unplanned events, and/or to respond to citizen comments. Plans may be implemented to respond to congested traffic conditions due to time of day, incidents, special events or adverse weather. 
STAKEHOLDER(S)	Clackamas County, Canby, Gladstone, Lake Oswego, Milwaukie, Oregon City, Wilsonville
COMMUNICATIONS REQUIREMENTS	Requires communication between central signal system server and traffic signals. May replace existing communications with fiber.
COST	CC-02: $220,000 for project deployment/$6,600 for annual O&M CC-03: $80,000 for project deployment/$2,400 for annual O&M CC-04: $40,000 for project deployment/$1,200 for annual O&M CC-05: $60,000 for project deployment/$1,800 for annual O&M CC-06: $100,000 for project deployment/$3,000 for annual O&M CC-07: $100,000 for project deployment/$3,000 for annual O&M CC-08: $320,000 for project deployment/$9,600 for annual O&M CC-09: $100,000 for project deployment/$3,000 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed to manage the Traffic Operations Center (TOC). Duties would include monitoring traffic signal performance and developing special signal plans in response to incidents and special events.
NEEDS ADDRESSED	• Need to be able to manage traffic operations • Need for communications to central signal system for management • Need to update communications for improved reliability and bandwidth
BENEFITS	• Improved travel times and travel time reliability will result from the ability to manage the signal system • Reduces fuel consumption and vehicle emissions

PROJECT NUMBER CC-10 CC-12, CC-13	SIGNAL COORDINATION/COMMUNICATION UPDATE
OBJECTIVE	Coordinate signal operations at closely spaced intersections or along corridors
DESCRIPTION	These projects will upgrade traffic signal controllers to ATC controllers and establish communications to the intersections or upgrade connections to fiber communications for central control and monitoring. This will provide the ability to coordinate signal operations between closely spaced intersections, along corridors, or between intersecting corridors. This will also allow remote data collection, analysis, and real-time signal timing changes that respond to current traffic conditions. The remote access enables County signal operations engineers to efficiently make timing adjustments that reduce delays during incidents, unplanned events, and/or to respond to citizen comments. Plans may be implemented to respond to congested traffic conditions due to time of day, incidents, special events or adverse weather. 
STAKEHOLDER(S)	Clackamas County, Lake Oswego, West Linn, ODOT
COMMUNICATIONS REQUIREMENTS	Requires communication between central signal system server and traffic signals. May replace existing communications with fiber.
COST	CC-10: $160,000 for project deployment/ $4,800 for annual O&M CC-12: $1,200,000 for project deployment/$36,000 for annual O&M CC-13: $60,000 for project deployment/$1,800 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed to manage the Traffic Operations Center (TOC). Duties would include monitoring traffic signal performance and developing special signal plans in response to incidents and special events.
NEEDS ADDRESSED	• Need to be able to manage traffic operations • Need for communications to central signal system for management • Need to update communications for improved reliability and bandwidth
BENEFITS	• Reduces travel times • Improve travel time reliability • Reduce fuel consumption and vehicle emissions

PROJECT NUMBER CC-11	OREGON CITY TRAFFIC SIGNAL INSTALLATION
OBJECTIVE	Install new traffic signals at multiple locations
DESCRIPTION	Install new traffic signals with fiber communications, CCTVs, ATC controllers, and signal performance measurement (SPM) capability at the following locations: • High Street/2nd Street • South End Road/Warner Parrot Road • Redland Road/Anchor Way • Beavercreek Road/Glen Oak Road • Holcomb Boulevard/Barlow Drive • Beavercreek Road/Loder Road 
STAKEHOLDER(S)	Clackamas County, Oregon City
COMMUNICATIONS REQUIREMENTS	Requires communication between central signal system server and traffic signals. Connect to existing fiber communication network.
COST	$3,720,000 for project deployment/$111,600 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours are needed to develop signal timings. County maintenance crews will be responsible for maintaining the signal equipment and communication network.
NEEDS ADDRESSED	• Need to improve safety • Need to reduce traffic congestion and delay
BENEFITS	• Reduce crash severity • Reduce travel time

PROJECT NUMBER CC-14 THROUGH CC-17	ADAPTIVE SIGNAL TIMING
OBJECTIVE	Deploy adaptive signal timing that adjusts signal timings to match real-time traffic conditions.
DESCRIPTION	Adaptive signal control technologies receive and process traffic condition information from detectors to optimize signal timings. Adaptive signal systems automatically respond to measured traffic conditions and make continual adjustments to the cycle lengths, splits, and offsets to match the traffic needs. Adaptive signal control technologies have the most benefit on corridors with variable or unpredictable traffic demand. Five corridors where adaptive signal control appears appropriate include: • Extension of existing Sunnyside Road system (adding bike detection from 132nd to 172nd) • Johnson Creek Road • Wilsonville Road • Molalla Avenue • Beavercreek Road 
STAKEHOLDER(S)	Clackamas County, Happy Valley, Wilsonville, Oregon City, ODOT
COMMUNICATIONS REQUIREMENTS	Requires a communications connection between the central signal system server and each traffic signal. In many cases, requires vehicle detection upgrades.
COST	CC-14: $2,080,000 for project deployment/$62,400 for annual O&M CC-15: $720,000 for project deployment/$21,600 for annual O&M CC-16: $3,060,000 for project deployment/$91,800 for annual O&M CC-17: $2,420,000 for project deployment/$72,600 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed to manage software. Maintenance includes keeping the software up to date, and upkeep of field devices and communications between field devices and transportation center.
NEEDS ADDRESSED	• Need updated signal timing plans • Need to reduce traffic congestion and delay
BENEFITS	• Reduction in stops, fuel consumption, and vehicle delay • Improved travel time on major arterials • Ability to monitor and control traffic control systems in real-time from a remote location • Cost effective methods

PROJECT NUMBER CC-18 THROUGH CC-20	ARTERIAL TRAFFIC SURVEILLANCE
OBJECTIVE	Develop and deploy a regional arterial surveillance and management system along several corridors within Clackamas County.
DESCRIPTION	This project will deploy additional traffic detection and closed-circuit television (CCTV) systems to provide for traffic responsive corridor management and sharing of roadside subsystems at major decision points within the corridors and provide real-time traveler information along arterial roadways. The use of strategically placed system detectors will provide the County with the capability to collect and store traffic counts and to display congestion information on the County traveler information website. The historical count information may be used for planning or to adjust signal timings based on fluctuations in traffic. CCTV camera placement at key intersections provides agency staff with the ability to monitor the roadway for congestion, trouble spots, incidents, equipment failures, and then make real-time adjustments to traffic signal timings. Images from the cameras would be broadcast on the County traveler information website for public traveler information. 
STAKEHOLDER(S)	Clackamas County, Lake Oswego, Oregon City, Wilsonville
COMMUNICATIONS REQUIREMENTS	Varies by project, but all have some new fiber connection required.
COST	CC-18: $200,000 for project deployment/ $6,000 for annual O&M CC-19: $860,000 for project deployment/$25,800 for annual O&M CC-20: $160,000 for project deployment/ $4,800 for annual O&M
OPERATIONS & MAINTENANCE	County maintenance crews will be responsible for maintaining the video monitoring cameras and vehicle detection equipment
NEEDS ADDRESSED	• Need remote video and traffic signal status/access to respond to complaints • Need video capabilities at key intersections on major arterials • Need traffic conditions information (i.e., congestion, hazards)
BENEFITS	• Improved safety and efficiency of arterial corridors, therefore reducing delay and emergency response times • More effective traffic management, incident management, and maintenance management • Increase in information available to travelers through VMS and the website

PROJECT NUMBER CC-21 THROUGH CC-23	RAILROAD CROSSING ALERT SYSTEM
OBJECTIVE	Deploy driving warning systems at select railroad at-grade crossings
DESCRIPTION	Install automatic train detection system and variable message signs to provide advance information to emergency management personnel and travelers to allow them to make informed decisions about route choice. 
STAKEHOLDER(S)	Clackamas County, Lake Oswego, Milwaukie, ODOT
COMMUNICATIONS REQUIREMENTS	Communications is needed between variable message signs, field sensors and devices and controller.
COST	CC-21: $900,000 for project deployment/$27,000 for annual O&M CC-22: $900,000 for project deployment/$27,000 for annual O&M CC-23: $680,000 for project deployment/$20,400 for annual O&M
OPERATIONS & MAINTENANCE	Requires training maintenance staff to use new electronic message signs. Maintenance duties will include upkeep of field sensors and devices.
NEEDS ADDRESSED	• Need advanced warning of train crossings
BENEFITS	• Reduces crashes and improved safety • Reduces delay • Alternate route information for travelers

PROJECT NUMBER CC-24, CC-26	DYNAMIC SPEED FEEDBACK
OBJECTIVE	Deploy variable message signs to provide real-time speed feedback to travelers. Locations for dynamic speed feedback include select school crossings, construction zones, and severe weather or congested locations.
DESCRIPTION	Dynamic speed feedback systems provide feedback to drivers based on the speed limits in real time. Feedback systems are useful in school zones and construction work zones to provide advanced feedback to drivers when they are approaching areas with vulnerable roadway users. Some components of a dynamic speed feedback system include: • Traffic and speed sensors • Variable message signs • Communications from equipment to controller 
STAKEHOLDER(S)	Clackamas County, Lake Oswego, Milwaukie
COMMUNICATIONS REQUIREMENTS	Communications is needed between variable message signs, field sensors and devices and controller.
COST	CC-24: $60,000 for project deployment/ $1,800 for annual O&M CC-26: $1,040,000 for project deployment/$31,200 for annual O&M
OPERATIONS & MAINTENANCE	Requires training maintenance staff to use new electronic message signs. Maintenance duties will include upkeep of field sensors and devices.
NEEDS ADDRESSED	• Need speed feedback through school zones and high speed areas
BENEFITS	• Improves safety • Increases compliance of speed limits

PROJECT NUMBER CC-25	MILWAUKIE INTERSECTION SAFETY IMPROVEMENT
OBJECTIVE	Deploy safety analytics system, detection, and advance warning signs
DESCRIPTION	This project will deploy additional traffic detection and closed-circuit television (CCTV) cameras as well as a safety analytics system to provide supporting traffic flow data, incident detection data, and real-time traveler information. This information helps improve the efficiency of traffic management, incident management, and operations and maintenance management, which effectively helps improve roadway safety and efficiency. It will also include advance dynamic message signs to provide travel information or warning messages.

STAKEHOLDER(S)	Clackamas County, Milwaukie
COMMUNICATIONS REQUIREMENTS	Communications is needed between variable message signs, field sensors and devices and controller.
COST	$480,000 for project deployment/$14,400 for annual O&M
OPERATIONS & MAINTENANCE	Requires training maintenance staff to use new electronic message signs. Maintenance duties will include upkeep of field sensors and devices.
NEEDS ADDRESSED	• Need to improve safety • Need to reduce traffic congestion and delay
BENEFITS	• Reduces crashes and improved safety • Reduces delay

PROJECT NUMBER CC-27, CC-35, CC-37	PEDESTRIAN/BICYCLE COUNT STATIONS
OBJECTIVE	Install permanent pedestrian/bicycle real time count stations
DESCRIPTION	Install new pedestrian and bicycle count stations on trails and pedestrian/bicycle bridges. Connect these stations to existing communication network to provide real time information and capture data for developing multimodal needs. 
STAKEHOLDER(S)	Clackamas County, Gladstone, Wilsonville
COMMUNICATIONS REQUIREMENTS	Connect count stations to existing communication network
COST	CC-27: $40,000 for project deployment/$1,200 for annual O&M CC-35: $60,000 for project deployment/$1,800 for annual O&M CC-37: $60,000 for project deployment/$1,800 for annual O&M
OPERATIONS & MAINTENANCE	Maintenance of new field devices is needed.
NEEDS ADDRESSED	• Need automated remote trail count stations for bicycles and pedestrians • Need remote trail counters connected to communications infrastructure
BENEFITS	• Help identify multi-modal needs

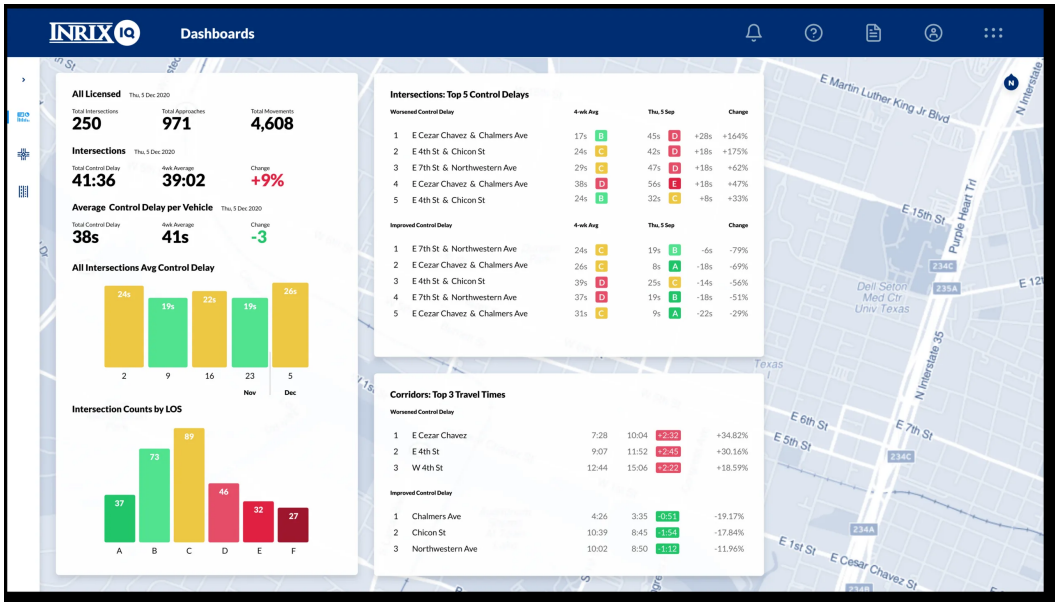
PROJECT NUMBER CC-28 THROUGH CC-34	PEDESTRIAN FLASHER UPGRADES
OBJECTIVE	Upgrade power and communications to existing flashers and install passive pedestrian detection.
DESCRIPTION	These projects will add communications and upgrade to hardwired AC power at existing flashers. It will also add passive pedestrian detection at existing Rectangular Rapid Flashing Beacons (RRFB). Specifically, these projects will add: • Wireless communication to existing pedestrian crossing flashers • AC power to existing pedestrian crossing flashers • AC power to existing school zone flashers • Passive detection at midblock pedestrian crossings • Passive detection to existing RRFBs  
STAKEHOLDER(S)	Clackamas County, Gladstone, Happy Valley, Lake Oswego, Milwaukie, Oregon City, West Linn, Wilsonville
COMMUNICATIONS REQUIREMENTS	Communications from field devices to controller is needed.
COST	CC-28: $20,000 for project deployment/ $600 for annual O&M CC-29: $120,000 for project deployment/$3,600 for annual O&M CC-30: $60,000 for project deployment/$1,800 for annual O&M CC-31: $80,000 for project deployment/$2,400 for annual O&M CC-32: $20,000 for project deployment/ $600 for annual O&M CC-33: $140,000 for project deployment/$4,200 for annual O&M CC-34: $40,000 for project deployment/$1,200 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed initially to install communications and power. Maintenance of upgraded field devices and communications is needed.
NEEDS ADDRESSED	• Need to improve pedestrian safety • Need to improve pedestrian quality of service
BENEFITS	• Increases pedestrian safety • Improves pedestrian satisfaction • Improve maintenance and operational efficiency

PROJECT NUMBER CC-36	WILSONVILLE MULTIMODAL DETECTION/TIMING
OBJECTIVE	Install bicycle detection and implement traffic signal timing to support bicycle and pedestrian movements.
DESCRIPTION	To provide safe and efficient bicycle and pedestrian movements at signalized intersections, traffic signal timings could include minimum greens long enough to support bicycle movements through the intersection and clearance times calculated for bicycle speeds. Bicycle detection may be deployed as part of this project as well. If high enough bicycle volumes, or safety issues from conflicting bicycle and vehicle movements are an issue, bicycle specific traffic signals may be installed. This project may be coordinated with upgrades to traffic signal equipment for crossings at traffic signals or with one of the traffic surveillance and management projects for crossings on major arterials.  
STAKEHOLDER(S)	Clackamas County, Wilsonville, ODOT
COMMUNICATIONS REQUIREMENTS	If bicycle detection is provided, communications between the detectors and controller will be needed.
COST	$200,000 for project deployment/$6,000 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours are needed to develop bicycle specific signal timings. Maintenance of new field devices is needed.
NEEDS ADDRESSED	• Need for safe and efficient bicycle and pedestrian crossings
BENEFITS	• Reduces bicycle stops and delay • Potential to improve bicycle travel time reliability • Increases safety

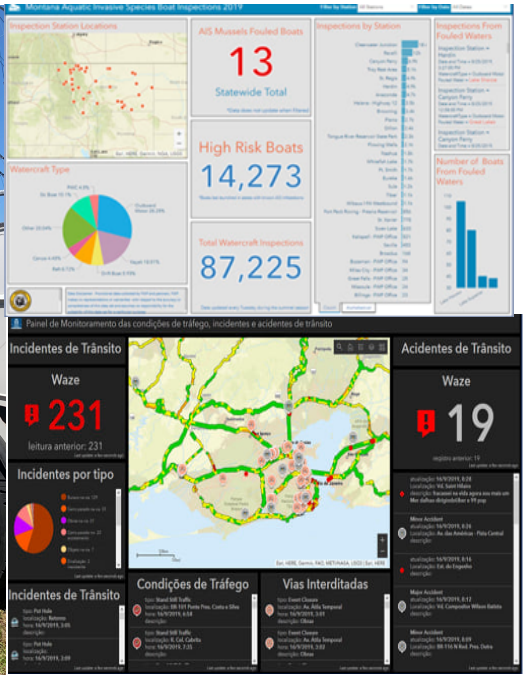
PROJECT NUMBER CC-38 THROUGH CC-40	TRANSIT SIGNAL PRIORITY
OBJECTIVE	Provide priority at traffic signals for buses behind schedule to improve transit travel time reliability on corridors with traffic signals.
DESCRIPTION	This project includes the use and deployment of detectors at traffic signals and emitters on buses. The project will include the installation of transit signal priority (TSP) emitters on select buses and traffic signal controller software upgrades along the selected corridors to support transit signal priority. Corridors in the region will be selected based on levels of current traffic congestion and transit ridership. Specific corridors include: • Sunnyside Road • King Road • Kruse Way • Boones Ferry Road • Molalla Avenue/ 7th Street • OR 99E  
STAKEHOLDER(S)	Clackamas County, Happy Valley, Lake Oswego, Oregon City, ODOT
COMMUNICATIONS REQUIREMENTS	A communications interface will be needed between each transit vehicle and each traffic signal along a transit priority corridor. Potential interfaces include preemption equipment used by emergency response, loops embedded in the pavement that detect bus presence, radio frequency tags and readers or a central management system that requests priority based on vehicle locations.
COST	CC-38: $280,000 for project deployment/$8,400 for annual O&M CC-39: $100,000 for project deployment/$3,000 for annual O&M CC-40: $180,000 for project deployment/$5,400 for annual O&M
OPERATIONS & MAINTENANCE	Maintenance includes keeping the software up to date, and upkeep of Opticom detectors and communications.
NEEDS ADDRESSED	• Need reliable transit travel times to promote alternative modes of transportation
BENEFITS	• Reduced transit delay • Schedule adherence and reliability • Reduced operational costs • Enhanced transit service • Increased ridership

PROJECT NUMBER CC-41	TRAVELER INFORMATION
OBJECTIVE	Provide travel time information through permanent Dynamic Message Signs (DMS)
DESCRIPTION	Install permanent DMS at strategic locations along corridors to provide real time travel data. Data will be collected from county devices and/or third-party sources. Locations where DMS signs will be deployed: • Wilsonville Road • Sunnyside Road westbound • Clackamas Town Center 
STAKEHOLDER(S)	Clackamas County, Happy Valley, Wilsonville
COMMUNICATIONS REQUIREMENTS	Communications is needed between variable message signs, field sensors and devices and controller.
COST	$1,520,000 for project deployment/$45,600 for annual O&M
OPERATIONS & MAINTENANCE	Requires training maintenance staff to use new electronic message signs. Maintenance duties will include upkeep of field sensors and devices.
NEEDS ADDRESSED	• Need to provide arterial travel times • Need to provide travel time variable message signs on arterial roadways
BENEFITS	• Provide information for travelers to make informed choices • Improve travel time reliability

PROJECT NUMBER CC-42	AUTOMATED PERFORMANCE MEASURES
OBJECTIVE	Develop automated performance reporting system
DESCRIPTION	Develop and install an automated performance measure reporting system. Through the use of a dashboard, display information in easily digestible format related to travel time, congestion, quality of signal timing, status of field devices, etc. Performance metrics would come from high resolution traffic signal data, travel time data from existing devices or third-party data, and from an asset management system.
STAKEHOLDER(S)	Clackamas County
COMMUNICATIONS REQUIREMENTS	Communication from the Clackamas County Traffic Operations Center (TOC) to ITS field devices.
COST	$1,000,000 for project deployment/$30,000 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed to manage the Traffic Operations Center (TOC). County maintenance crews will be responsible for maintaining the ITS equipment and communication network.
NEEDS ADDRESSED	• Signal performance measures • Create a dashboard of the central signal system
BENEFITS	• Improved information for decision makers and operations personnel



PROJECT NUMBER CC-43	ASSET MANAGEMENT SYSTEM
OBJECTIVE	Implement an Asset Management System
DESCRIPTION	Deploy an asset management program to effectively monitor and manage assets over their lifecycle. Monitor overall asset condition trends and assist with identifying critical investment needs from both a maintenance and capital program perspective.

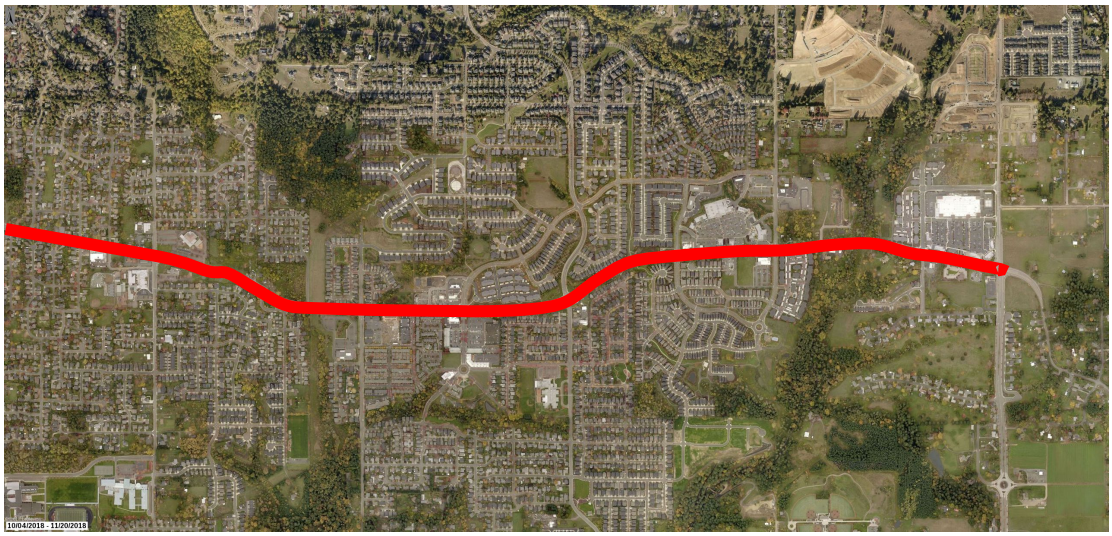


STAKEHOLDER(S)	Clackamas County
COMMUNICATIONS REQUIREMENTS	Communication from the Clackamas County Traffic Operations Center (TOC) to ITS field devices.
COST	$90,000 for project deployment/$2,700 for annual O&M
OPERATIONS & MAINTENANCE	Staffing hours needed to manage the Traffic Operations Center (TOC). County maintenance crews will be responsible for maintaining the ITS equipment and communication network.
NEEDS ADDRESSED	• Need to keep ITS devices operating
BENEFITS	• Proactive maintenance • Forecast maintenance cost and resources needed

PROJECT NUMBER CC-44	DYNAMIC SPEED CONTROL
OBJECTIVE	Deploy variable message signs to display a lower speed limit at specific times or to provide real-time speed feedback to travelers.
DESCRIPTION	Dynamic speed control systems may change the speed limits in real time based on traffic, adverse weather or road surface conditions. Part-time speed limit systems are also useful in school zones and construction work zones. Some components of a dynamic speed control system include: • Traffic and speed sensors • Environmental sensors • Variable message signs • Communications from equipment to controller Examples of when to use dynamic speed control include stretches of congested roadways, weather-susceptible roadways, areas that experience highly variable, severe fog, and longer-term construction work zones.
STAKEHOLDER(S)	Clackamas County, Happy Valley, Wilsonville, ODOT
COMMUNICATIONS REQUIREMENTS	Communications is needed between variable message signs, field sensors and devices and controller.
COST	$1,300,000 for project deployment/$39,000 for annual O&M
OPERATIONS & MAINTENANCE	Requires training maintenance staff to use new electronic message signs. Maintenance duties will include upkeep of field sensors and devices.
NEEDS ADDRESSED	• Reduce vehicle speeds • Reduce crashes
BENEFITS	• Improves safety • Increases compliance of speed limits

PROJECT NUMBER CC-45	OR224 INTEGRATED CORRIDOR MANAGEMENT
OBJECTIVE	Integrate traffic surveillance and traffic control equipment with ODOT for key routes in Clackamas County to better manage traffic that diverts from area freeways due to major incidents on the freeways.
DESCRIPTION	This project will deploy traffic surveillance and control devices (system detectors, cameras, variable message signs, and changeable fixed message signs) on arterials to manage diverting traffic during a major incident. The use of CCTV cameras will enable agency staff to monitor roadway operating conditions, identify and confirm incidents, and to monitor incident management progress. Images from the cameras will also be broadcast to the public on the County and ODOT traveler information websites. The deployment of variable message signs provides opportunities to display real-time information to motorists in advance of an incident to help them make an informed decision about their route choices. Other strategies that will be implemented on arterials to better manage incident traffic includes advanced signal control (traffic responsive signal timing or adaptive signal timing), on-demand "green-wave" routing of emergency response vehicles, and transit signal priority.  
STAKEHOLDER(S)	Clackamas County, Milwaukie, ODOT
COMMUNICATIONS REQUIREMENTS	A connection is required between arterial traffic management equipment and the Clackamas County Traffic Operations Center (TOC) and the ODOT Traffic Management Operations Center (TMOC).
COST	$2,140,000 for project deployment/$64,200 for annual O&M
OPERATIONS & MAINTENANCE	County and ODOT maintenance crews will be responsible for maintaining the new technology (cameras, variable message signs, fiber optic cable, and components).
NEEDS ADDRESSED	• Need to better manage incidents and clear incidents faster • Need to plan alternate corridors for incident response to divert traffic • Need incident signal timing plans • Need variable message signs to provide traveler information
BENEFITS	• Improved real-time traffic conditions information and traveler information • Increased capacity and throughput during incidents • Reduction in congestion and delay due to incidents

PROJECT NUMBER CC-46	HAPPY VALLEY SAFETY IMPROVEMENT
OBJECTIVE	Evaluate current operations and safety for implement recommendations
DESCRIPTION	Identify intersection safety hot spot improvements on Sunnyside Road at SPIS locations between 122nd Avenue and 172nd Avenue. This could include a safety analytics system to provide supporting traffic flow data, incident detection data, and real-time traveler information. This information helps improve the efficiency of traffic management, incident management, and operations and maintenance management, which effectively helps improve roadway safety and efficiency. It could also include advance dynamic message signs to provide travel information or warning messages or speed feedback signs.



STAKEHOLDER(S)	Clackamas County, Happy Valley
COMMUNICATIONS REQUIREMENTS	Depends on recommendations
COST	$480,000 for project deployment/$14,400 for annual O&M
OPERATIONS & MAINTENANCE	Depends on recommendations
NEEDS ADDRESSED	• Reduce crashes
BENEFITS	• Improved safety • Improved operations

APPENDIX

TRANSPORTATION EQUITY INDICATORS

REVIEW & METHODOLOGY, LAST UPDATED AUGUST 2020

Date: 12/5/19 *(Updated August 2020)*
Subject: Transportation Equity Indicators – Review & Methodology - DRAFT
From: Abe Moland, Health and Transportation Impact Planner, CCPHD

Purpose

In Clackamas County, a resident's zip code can be a better predictor of health than their genetic code. This is why it is essential to adopt an equity lens to make data informed decisions to consider the unique needs of vulnerable populations in planning and transportation projects and address disparities occurring throughout the county.

There are various equity-based initiatives occurring within the Department of Transportation and Development and other jurisdictions that influence the built environment within the county. This memo 1) reviews existing, publically available methodologies that have been used to understand geospatial distribution patterns of vulnerable populations within Clackamas County, and 2) explores a method for the county to use to incorporate an equity lens to transportation and planning work (draft).

Definitions

- **Transportation Equity Lens** – A geospatial analysis of the community that a) acknowledges that individuals and groups differ in transportation ability or need and b) attempts to address this disparity through intentional distribution of resources to accommodate all users.
- **Transportation Inequity –** Barriers in the transportation system or planning process that prevent individuals or groups from meaningfully participating in the planning process or accessing needed transportation modes to obtain their highest quality of life.

Local Plan Review

Publically available transportation and planning documents (n=40) were collected and analyzed for methodologies to map vulnerable populations. **Appendix A** outlines the collection approach. Plans were included in the analysis if they:

- Included demographic analysis of variables that were framed through a vulnerability, equity, opportunity, environmental justice, or transportation disadvantage lens, or included language that was people-focused and attempted to account for disparities between demographic categories that create and perpetuate inequities;
- Mapped the demographic variables identified, and;
- Were completed after 2005.

Appendix B documents the complete list of plans reviewed. Some plans may have conducted equity analysis in the development stages, but were not included in this review because the final public document did not include mention of the equity lens or documentation of developmental progress memos describing this analysis were not publically available. Of the plans reviewed, less than a quarter (n=9, 22.5%) were found to incorporate an equity lens. The plans included in analysis listed in Table 1.

Table 1. Transportation Plans that included geospatial analysis of equity variables

Plan	Year	Variables Used
Sandy Transit Existing Conditions Report	2019	65 and older per square mile per census block, people who identify as Asian, Black, White, Native American/other, and People who identify as Hispanic
Clackamas County Safety Action Plan	2019	Youth between 15-25, rural populations, and 65 and older
City of Milwaukie Transportation System Plan	2018	More than ¼ mile walk to a transit stop
Gladstone Transportation System Plan	2017	Residents younger than 18 per acre, 65 and older per acre, Hispanic or Latino, disability status by employment rate for the 20-60 population, people who earn 0-1.99x the poverty level
Canby Area Transit Plan	2017	Under 18 by square mile per census block, 65 and older per square mile per census block, People who identify as Asian, Black, White, Native American/other, people who identify as Hispanic, and residents in poverty per square mile by census block group
SMART Transit Plan	2017	Under 18 by square mile per census block, 65 and older per square mile per census block, non-white population by census block, median household income by census block
West Linn Transportation System Plan	2016	Younger than 16, 65 and older, racial minority (undefined, non-English speakers undefined, population with a disability, people who earn 0-1.99 times the federal poverty line
Lake Oswego Transportation System Plan	2013	Residents younger than 18 per acre, 65 and older per acre
Clackamas County Transportation System Plan	2015	17 and younger normalized by census block, 65 and older normalized by census block, Non-white normalized by census block, Non-Hispanic normalized by census block, Households where no adult speaks English well normalized by census block, Households under 200% poverty line normalized by census block, Households with 0-1 vehicles normalized by census block, living within 500ft of a freeway or highway

The plans integrated an equity lens in the following ways:

- **Sandy Transit Existing Conditions Report. (2019)** The report identifies seniors and people of color to understand where need is for transit in the area, what delivery might look like for specific populations (language considerations), and if transit service changes will affect people equitably. It is frames as less of a "need assessment" and more as a civil rights assessment to avoid unequal treatment on the basis of race or ethnicity.
- **Clackamas County Transportation Safety Action Plan. (2019)** The plan updates the 2012 County Safety Action Plan and incorporated an interdisciplinary stakeholder group to inform the discussion defining vulnerable road users. Under contributing factors to serious and fatal crashes, the plan found 36% involved drivers under the age of 25 and 17% involved older adults 65 years and older. The plan also identifies a higher rate of severe crashes occurring in rural areas (45% despite only 20% of the population living in these areas). The Safety Action Plan is the only document to highlight the rural/urban inequity.
- **City of Milwaukie Transportation System Plan. (2018)** The plan defines "transportation disadvantaged" as individuals who have difficulty obtaining transportation because of their age, income, physical, or mental disability. The plan includes a summary of environmental justice findings that make an effort to identify underserved and vulnerable populations to improve

transportation options and avoid future impacts. Findings highlight areas where households are not within ¼ mile of a bus stop, as well as a lack of system connectivity for people who walk or bike.

- **Gladstone Transportation System Plan. (2017)** The plan identifies socio-economically sensitive populations as minorities, elderly people, people with low incomes, and people with disabilities. Evaluation criteria for project prioritization gave one point for a project being in an area with a high concentration of children, disabled, low-income, or elderly people.
- **Canby Area Transit System Master Plan. (2017)** In the existing conditions the transit plan outlines seniors, youth, and low-income residents as populations of focus for transit planning. It also maps residents by race/ethnicity.
- **SMART Master Plan. (2017)** The plan maps median household income and percent non-white populations by census block group.
- **West Linn Transportation System Plan. (2016)** The city identifies equity as one of the six desired outcomes of the planning efforts, defined as "equity exists relative to the benefits and burdens of growth and change to the region's communities". Within the context of the TSP, is also outlined as a goal and identified as "transportation facilities that are accessible to all members of the community". To prioritize projects, the evaluation criteria give points if a project increased the number of transportation disadvantaged populations (elders, youth, and transit riders) within a 20-minute walk, bike, or bus-shed of schools, parks, schools, and employment areas.
- **Lake Oswego Transportation System Plan. (2013)** The plan highlights growing senior populations and system updates that allow people to age in place as important considerations. Within the transit needs analysis, the plan suggest strategies to accommodate people with disabilities or visual impairment and connect disadvantaged communities with community/employment centers. The plan does not define "disadvantaged community". The plan conducts spatial analysis on senior and youth population densities.
- **Clackamas County Transportation System Plan. (2012)** The plan outlines six policies related to equity, health and sustainability. The policies focus on supporting walking, biking, and transit connections in area with identified transportation-disadvantaged populations, coordinating land use and transportation planning to minimize environmental pollution, and continue to provide public transit services to under-served areas, particularly for seniors and people with disabilities.

Several plans (n=11) included discussion of demographic information through an equity lens or incorporated equity-based language in the guiding principles of the document. **Appendix C** captures descriptions of the language used.

Review Observations

A majority of the plans included reviewed indicators that described youth, seniors, communities of color, and low-income households. Indicators on limited English proficiency, disability, and ethnicity appeared less frequently. Equity indicators related to travel access and the physical environment appeared least frequently. Figure 1 shows the frequency of indicators in plans included.

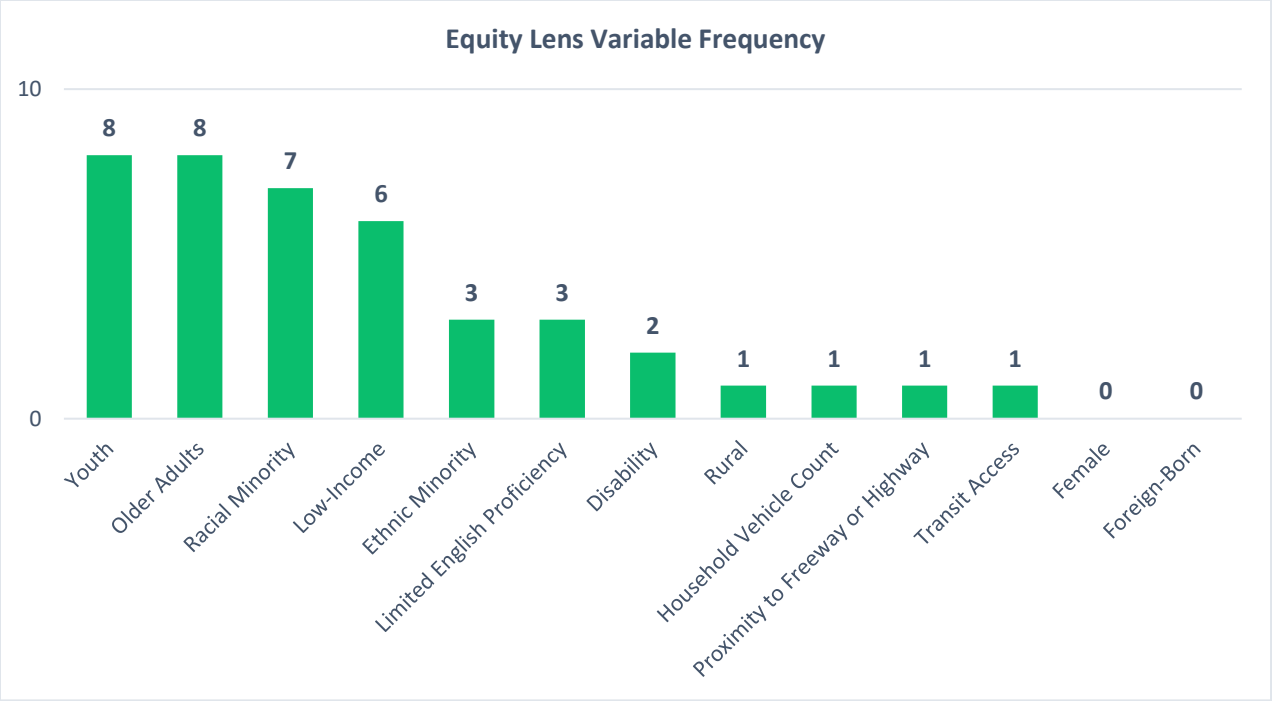


Figure 1. Frequency of variables used to conduct equity-type analysis in transportation and comprehensive plans within Clackamas County boundaries.

When a plan discusses equity and the transportation planning process, it is almost exclusively within the context of transit development, citing transit-dependent populations as one of the most transportation disadvantaged groups.

Cross Sector Review

To inform future direction of transportation equity within Clackamas County, the following plans related to equity within the county were reviewed, as well as leading practices from across the region and nation in developing indices to identify populations with differing needs within the community.

Clackamas County Community Health Improvement Plan (2017)

The Clackamas County Community Heath Improvement Plan (CHIP) describes priorities, goals, and objectives to improve the health and quality of life in Clackamas County. These directives are informed through three guiding principles: 1) Assessing life across the lifespan, 2) Grounded in Health Equity, and 3) Trauma-informed approaches. All acknowledge that not all residents in Clackamas County have equitable access to opportunities and systems that contribute to good health due to discrimination and other structural inequities like poverty, institutional racism, and gender inequality.

The CHIP maps percent non-English speakers per census block group (CBG), percent of population within 1 km of a bus stop per CBG, percent children with Medicaid per CBG, and median household income by CBG,

Oregon Metro (2018)

As part of the regional transportation planning process, metro evaluated the region through an equity lens to evaluate the investment strategy against historically marginalized communities in the region.

The final indicators used were people of color, people with low incomes, and English language learners where densities were higher than the regional average.

Delaware Valley Regional Planning Commission (2018)

The Delaware Valley Regional Planning Commission (DRVPC) Communities of Concern report explores the idea that the risk of being in a severe crash is linked to where one lives. The analysis expands the definition of environmental justice communities to include a variety of demographic and socioeconomic indicators of disadvantage beyond race and income.

Variables included were single female headed households, carless households, older adults, and people with limited English proficiency. After creating an index of the demographic and social variables, and normalizing crashes by population and area, they found that in 91% of the census tracts where crash rates were above average, the census tract was also above average for at least one correlated indicator of potential disadvantage. This analysis informed the TIP project benefit evaluation criteria.

Broward Metropolitan Planning Organization (2018)

The Broward MPO in South Florida developed a systematic process to consistently evaluate transportation plans and programs within its region against federal and state nondiscrimination authorities, produce meaningful outcomes for the community through transportation planning programs for vulnerable populations, and identifying adverse impacts early on in the planning process rather than at the project funding or delivery stage. The MPO used a threshold-based approach to analysis with the goals of: 1) Using accessible data, 2) be flexible depending on project needs, 3) be easy to use, 4) be objective, and 5) be open-sourced.

Based on review of existing MPO plans and programs and feedback from a working group, the final indicators selected were racial minority, ethnic minority, youth ages 10-17, older adults aged 65+, population below the poverty line, LEP populations, and populations with a disability. Optional indicators to be used with caution for reliability due to small number included zero vehicle households, female heads of household, and no high school diploma (25+).

Indicator Selection Recommendation (Draft)

Based upon review of existing plans and best practice, the following indicators are proposed to best capture potential disadvantage in the county:

1. Populations 65 and older
2. Populations younger than 18
3. Communities of Color
4. Hispanic/Latino Ethnicity
5. Low Income Households
6. Limited English Proficiency
7. Disability status

Ultimately, the criteria used in an index of this type should be grounded in feedback and experience of DTD staff and the community members they serve.

Index Methodology

The described below was used to create the index. It is modeled after approaches used by the Delaware Valley Regional Planning Commission and the Broward County Metropolitan Planning Organization. The methodology uses a threshold-based approach to identifying higher concentrations of the population of interest at the census block group level in comparison to the County as a whole. Thresholds were assigned score and then combined with other variables to create a composite score.

The methodology has involves five steps:

1. Calculate mean value (county average) of indicator.
2. Calculate standard deviation (SD) of indicator range.
3. Create 5 bins centered on mean value using SD.
4. Normalize values using 0-4 score based on SD bins to develop indicator score.
    a. Block groups with a zero percent estimate within individual indicator were assigned a score value of zero.
5. Sum individual indicator scores for index score.

Index Interpretation *(Draft)*

The scores can be interpreted in the following way for an individual indicator:

Table 2. Individual variable score meaning.

Score	Interpretation
0	Well below county average
1	Below county average
2	County average
3	Above county average
4	Well above county average

The summed score can be interpreted as below.

Table 3. Composite score interpretation.

Score	Interpretation
≤12	Below county average
13-14	County average
15-19	Above county average
≥20	Well above county average

A map of the composite equity index is shown in Figure 2.

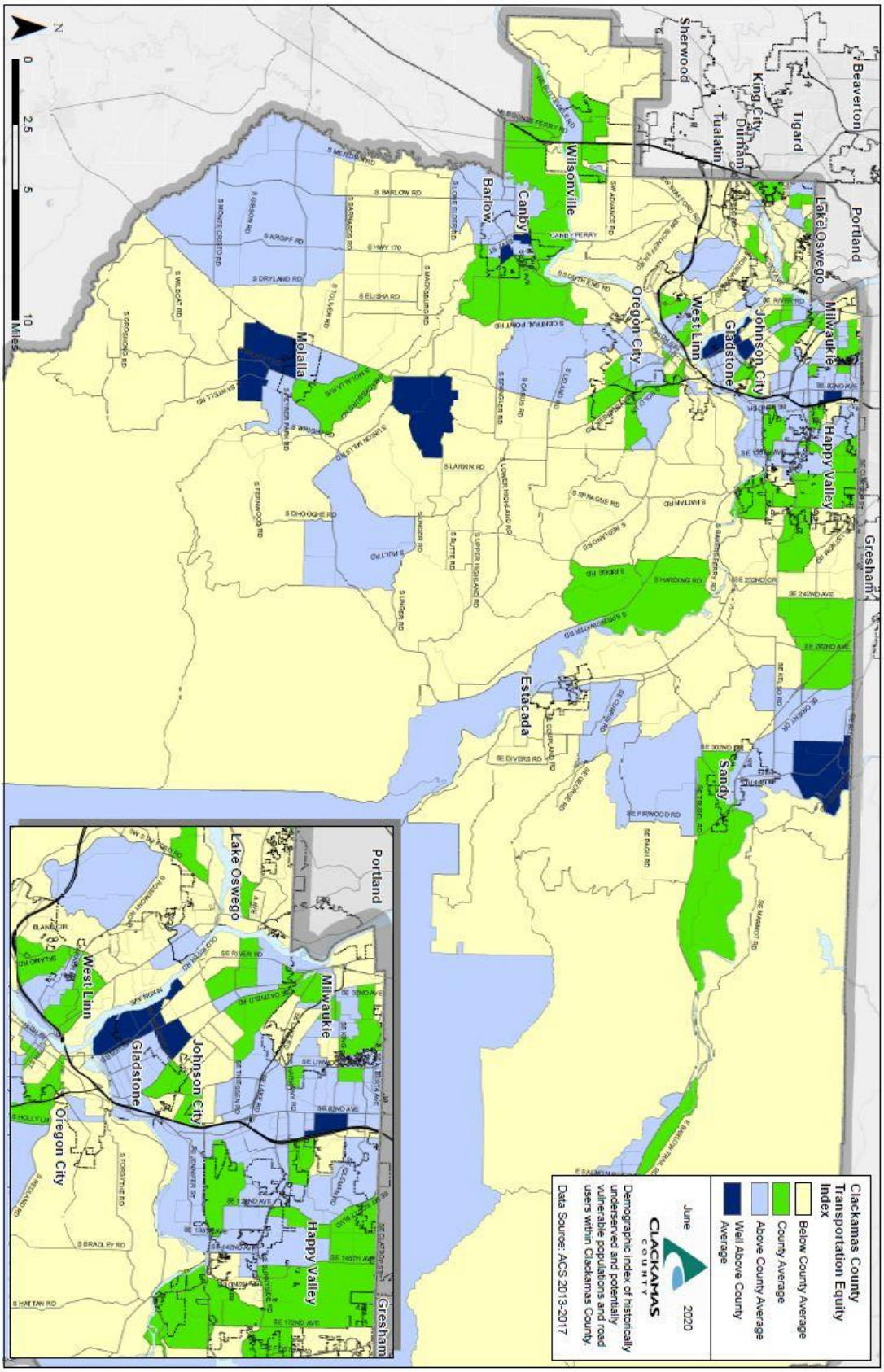


Figure **2. Sample map of the composite equity index score mapped.**

Appendix A. Plan Review Methodology

To collect plans, the following search process was followed:

- Review of existing Clackamas County transportation documents
- Review of state transportation documents
- Key word search of city websites
- Key word search of transportation and planning documents including: “equity”, “vulnerable”, “justice”, “opportunity”, “diversity”, and “disadvantage”.
- Snowball collection process from identified plan efforts including staff memos, interim development reports, technical appendices and glossaries, and public meeting notes.

Appendix B. Complete Plan Review List

1. Oregon City Comprehensive Plan (2004)
2. Oregon City Transportation Demand Management Plan (2017) *(strategies for walking/biking access)*
3. Oregon City Beavercreek Road Concept Plan (2008 and readopted 2016)
    a. January 17th, 2019 Citizen Involvement Presentation *(acknowledges zoning updates will unlock development opportunities in areas historically underserved that need to drive to reach destinations)*
4. Oregon City Park Place Concept Plan and Appendix (2008)
5. Oregon City South End Concept Plan (2014)
    a. Planning Commission Issues Matrix (2014) *(Highlights concern for senior citizen needs, specifically mobility options related to TriMet service and housing options that allow aging in place, like first floor unit options)*
6. City of Milwaukie Central Milwaukie Land Use & Transportation Plan (2015)
7. City of Milwaukie Downtown and Riverfront Land use Framework Plan (2015)
8. City of Milwaukie Lake Road Multimodal Plan (1997)
9. City of Milwaukie Tacoma Station Area Plan (2013)
10. Lake Oswego Uplands Neighborhood Plan (2017)
11. Lake Oswego First Addition/Forest Hills Neighborhood Plan (2008) *(mentions diverse age range)*
12. Lake Oswego Evergreen Neighborhood Association Plan (2005) *(“Values broad range of housing types and price levels to bring people of diverse ages and incomes into daily interaction”)*
13. Sandy Comprehensive Plan (1997)
14. Estacada Active Transportation Plan (2018)
15. Estacada Downtown & Riverside Area Plan (2011)
16. Happy Valley Transportation System Plan (2014)
17. Happy Valley Comprehensive Plan (2017)
18. Pleasant Valley North Carver Comprehensive Plan CAC Concept Overview (2019)
19. West Linn Highway 43 Concept Plan (2016)
20. West Linn Comprehensive Plan (2017)
21. Canby Comprehensive Plan (2019) *(acknowledges there are areas of transportation disadvantage and limited transit service)*
22. Canby Transportation System Plan (2010)

23. Molalla Transportation System Plan (2018) *(includes transportation disadvantaged in evaluation criteria but does not define)*
24. Molalla Comprehensive Plan (2014)
25. Wilsonville Active Transportation Plan (2013)
26. Downtown Molalla Development and OR 211 Streetscape Plan (2007)
27. Villebois Village Master Plan (2013)
28. Wilsonville Comprehensive Plan (2019)
29. Mt Hood Multimodal Transportation Plan (2014)

Appendix C. Description of Plans that Discussed Equity but Did Not Map.

The following plans documented an assessment of demographic indicators, but did not map them:

- **Estacada Transportation System Plan (2018).** The plan defines transportation disadvantaged as people who do not have automotive transport of their own due to disability or income status. The plan outlines people with low incomes, seniors, and people with disabilities specifically.
- **Wilsonville Transportation System Plan (Updated 2019).** The plan uses the EPA definition of environmental justice, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." The plan further describes it as an effort to identify underserved and vulnerable populations to improve transportation options and reduce future inequalities. The plan identifies Charbonneau and the southern edge of Villebois as focus areas due to higher proportions of seniors and low income groups, but does not provide maps.

In the planning stages of the Wilsonville TSP, the framing of how environmental justice was discussed at length. Many projects in the plan fulfilled environmental justice goals, they just weren't documented through that lens. Environmental justice language was important to include for applying for Metro or federal funding. Mapping environmental justice indicators and underserved population areas was cautioned against for avoiding the possible discomfort it might raise if someone was identified as living in one of those areas.

Inequities are not commonly identified in planning documents, however, guiding principles occasionally incorporate language around equitable outcomes that are goals of transportation and land use planning efforts:

- **City of Milwaukie Downtown and Riverfront Land Use Framework Plan (2015)** – Provide for people of all ages, cultures, ethnic groups, and incomes.
- **City of Milwaukie Community Vision (2017) -** Milwaukie is an inclusive community of diverse people from a variety of backgrounds that honors our differences and shared similarities. We are engaged and come together in many ways through various events and community gathering places, where we can celebrate our interests and passions.
- **City of Milwaukie Comprehensive Plan (draft) –** Ensure that [pedestrian and bicycle] improvements are inclusive and provide access for people of all ages and abilities. Provide

housing options and reduce housing barriers for people of all ages and abilities, with a special focus on people of color, aging populations, and people with low incomes.

- **Lake Oswego Transportation System Plan (2014) –** Goal D Accessibility – Provide a multimodal transportation system that is suitable for community members of all ages, income levels and physical abilities to access daily needs and services. Goal G Sustainability - Provide a transportation system that maintains and improves economic vitality, environmental health, social equity and well-being for citizens today and in the future. *(While Goal 4 was people-oriented, the evaluation criteria used for project selection for this goal were mode focused)*
- **Gladstone Transportation System Plan 2017) –** Goal III Accessibility – Provide a multimodal transportation system that is accessible to all members of the community and minimizes out of area travel. Objective A. Ensure adequate access for children, disabled, low-income or elderly people.
- **Sandy Transportation System Plan (2011) –** Transportation Goal: Mobility – Improve mobility for the transportation disadvantaged. *(The plan does not define transportation disadvantaged but outlines transit-dependent individuals as people with disabilities, youth, elderly, and people with low incomes)*
- **West Linn Transportation System Plan (2016) –** Goal 3. Equity - Develop transportation facilities that are accessible to all members of the community. 3B. Ensure transportation services (and impacts) are equitably distributed to all segments of the population.
- **Downtown Molalla Development and OR 211 Streetscape Plan (2007) –** Guiding Principle 3 – Improve walking and bicycling conditions – Strive for universal access to all important destinations for all residents regardless of age, physical capabilities, or skill.
- **Villebois Village Master Plan (2013) –** Diversity: Refers to Villebois' commitment to providing a community that offers many options and choices for those who live, work, and play there (referring to housing, the village center, parks and open space, and transportation).

While not a transportation-related document, the City of Milwaukie integrates a racial equity lens into their housing policy decision-making structure. Milwaukie defines equitable housing as, "diverse, quality, physically accessible, affordable housing choices with access to opportunities, services, and amenities". The lens tool that Milwaukie developed asks questions about unintended consequences, how policy supports historically marginalized communities, and who benefits and is burdened from decisions. The lens also highlights that people of color in Milwaukie are more likely to be cost-burdened from rent, have lower rates of homeownership, and have been historically underrepresented in the decision –making process in comparison to white people.

Additionally, the City of West Linn Sustainable West Linn Strategic Plan outlines a goal to work towards transportation affordability, aiming to have all households in West Linn spending 15% of their income on transportation costs.

Clackamas County Transportation Equity Index

- Below County Average
- County Average
- Above County Average
- Well Above County Average

June 2020

CLACKAMAS COUNTY

Demographic index of historically underserved and potentially vulnerable populations and road users within Clackamas County.

Data Source: ACS 2013-2017