LANE COUNTY TRAFFIC COMMUNICATIONS MASTER PLAN

NOVEMBER 2022

LANE COUNTY OREGON

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INTRODUCTION

Intelligent Transportation Systems (ITS) leverage 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 communications network provides the connection between the ITS field devices and the County's personnel that allows for remote access and the ability to efficiently operate and manage the system. This report outlines the plan to develop the communications system that will enable Lane County to communicate with existing and future ITS devices. This document builds upon the Central Lane Intelligent Transportation System Plan, focusing on the Lane County transportation system and the necessary infrastructure to interconnect the County devices.

The Lane County Traffic Communications Master Plan includes the following:

CHAPTER 1 – EXISTING ITS EQUIPMENT

Documents the existing conditions of ITS and traffic signal field equipment operated by Lane County.

CHAPTER 2 – STAKEHOLDER NEEDS

Documents the user and system needs relating to the traffic signal system, communications network, roadway monitoring, data sources and performance measures.

CHAPTER 3 – TRAFFIC SIGNAL SYSTEM

Discusses the existing conditions, user needs and recommendations related to the traffic signal system.

CHAPTER 4 – TRAFFIC SIGNAL COMMUNICATIONS NETWORK

Discusses the existing conditions and user needs related to the communications network. Summarizes communications network alternatives to support network monitoring and reporting.

CHAPTER 5 – TRAFFIC DATA

Discusses the existing conditions, user needs and recommendations related to traffic data sources.

CHAPTER 6 – CLOSED-CIRCUIT TELEVISION CAMERAS

Discusses the existing conditions, user needs and recommendations related to closed-circuit television (CCTV) camera standardization.

CHAPTER 7 – SUPPLEMENTAL ITS TECHNOLOGY

Discusses recommendations related to supplemental ITS technologies.

CHAPTER 8 – EMERGING TECHNOLOGY

Describes connected and automated vehicle technology and identifies relevant opportunities and applications.

CHAPTER 9 – COMMUNICATIONS ARCHITECTURE

Describes a phased build-out recommendation related to the communication infrastructure to support centralized monitoring and reporting.

CHAPTER 10 – IMPLEMENTATION PLAN

Describes how to deploy the Traffic Communications Master Plan. Includes a range of projects that allow the County to communicate with existing and future transportation technology devices, providing a safe, efficient, equitable and multimodal transportation system.

EXISTING ITS EQUIPMENT

INTRODUCTION

The purpose of this chapter is to document the existing conditions of ITS and traffic signal field equipment operated by Lane County. The existing conditions inventory includes traffic signal controllers, vehicle detection, emergency vehicle preemption, CCTV cameras, battery backup and the communications network.

EXISTING INFORMATION

The project limits include 21 traffic signals and four school zone flashing beacons (two units at two locations), as shown in Figure 1. The County provided record drawings for all project intersections and a field review of each location was conducted on October 5, 2021.

The following sections of this chapter summarize the existing equipment and communications infrastructure as of the field review date. The attached table provides detailed information about each location.

TRAFFIC SIGNAL CONTROLLERS

As shown in Figure 1, one intersection operates with Type 170 traffic signal controllers and 20 intersections operate with Intelight 2070 LDX traffic signal controllers operating Q-Free MAXTIME local software (ATC).

The Intelight 2070 LDX traffic signal controller with Q-Free MAXTIME local software is the current standard used by ODOT and multiple local agencies within Oregon for all new traffic signals. ODOT, City of Portland, Washington County and Clackamas County plan to replace existing Type 170 and Type 2070 controllers with Intelight controllers operating MAXTIME.

CENTRAL SIGNAL SYSTEM

The traffic signals in Lane County currently do not connect to a central signal system.

TRAFFIC SIGNAL CABINETS

The existing controller cabinets within Lane County are Type 332. Some cabinets were initially installed as early as 1987. The Type 332 controller cabinet is the industry standard for Type 170 and Type 2070 traffic signal controllers. The Type 332 cabinet has limited output files and overlap operation is constrained. Future needs may require cabinets to house GPS receivers, backpack style uninterrupted power supply (UPS), network switches, power supply for Pan/Tilt/Zoom (PTZ) cameras, peer-to-peer communication devices, roadside units (RSU), and ITS devices. Existing cabinets are also constrained by the limited availability of inputs and output files.

VEHICLE DETECTION

Most of the traffic signals use inductive loops for vehicle detection. Two intersections use video detection and two intersections have Wavetronix radar detection for one or more approaches, as shown in Figure 2. The field review did not include a detail assessment of the functionality of each detector/zone. However, County staff indicates that all detection is operational.

Inductive loop detectors consist of wires cut into the pavement. When a vehicle drives over the loop, the current is interrupted and a call is sent to the traffic signal controller. This type of detection has historically been the standard of agencies since it tends to be dependable and accurate, if installed and maintained properly. Once the detectors are installed, they cannot be relocated, so additional detection would need to be added if the operational needs change.

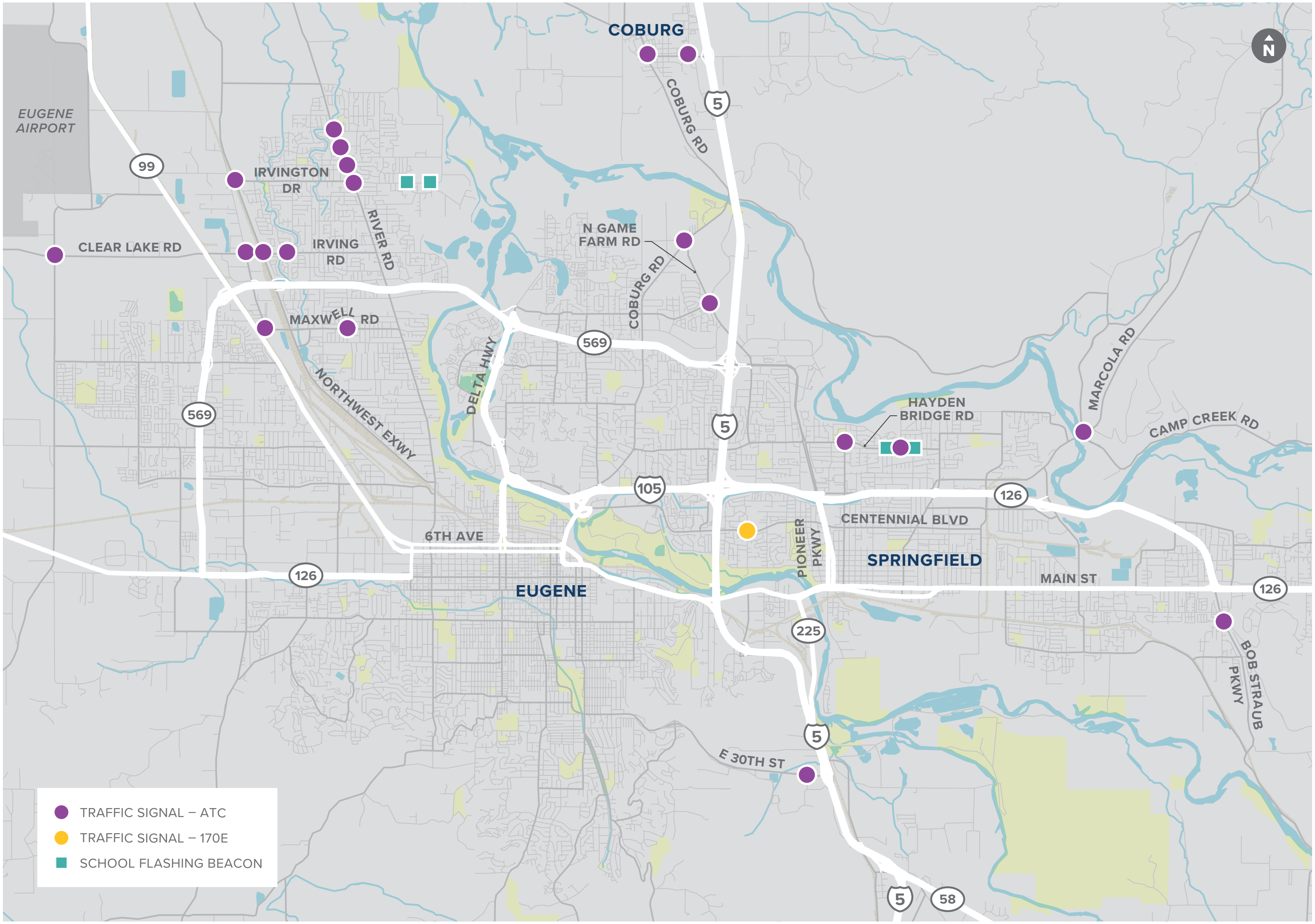


FIGURE 1. LANE COUNTY EXISTING TRAFFIC SIGNALS

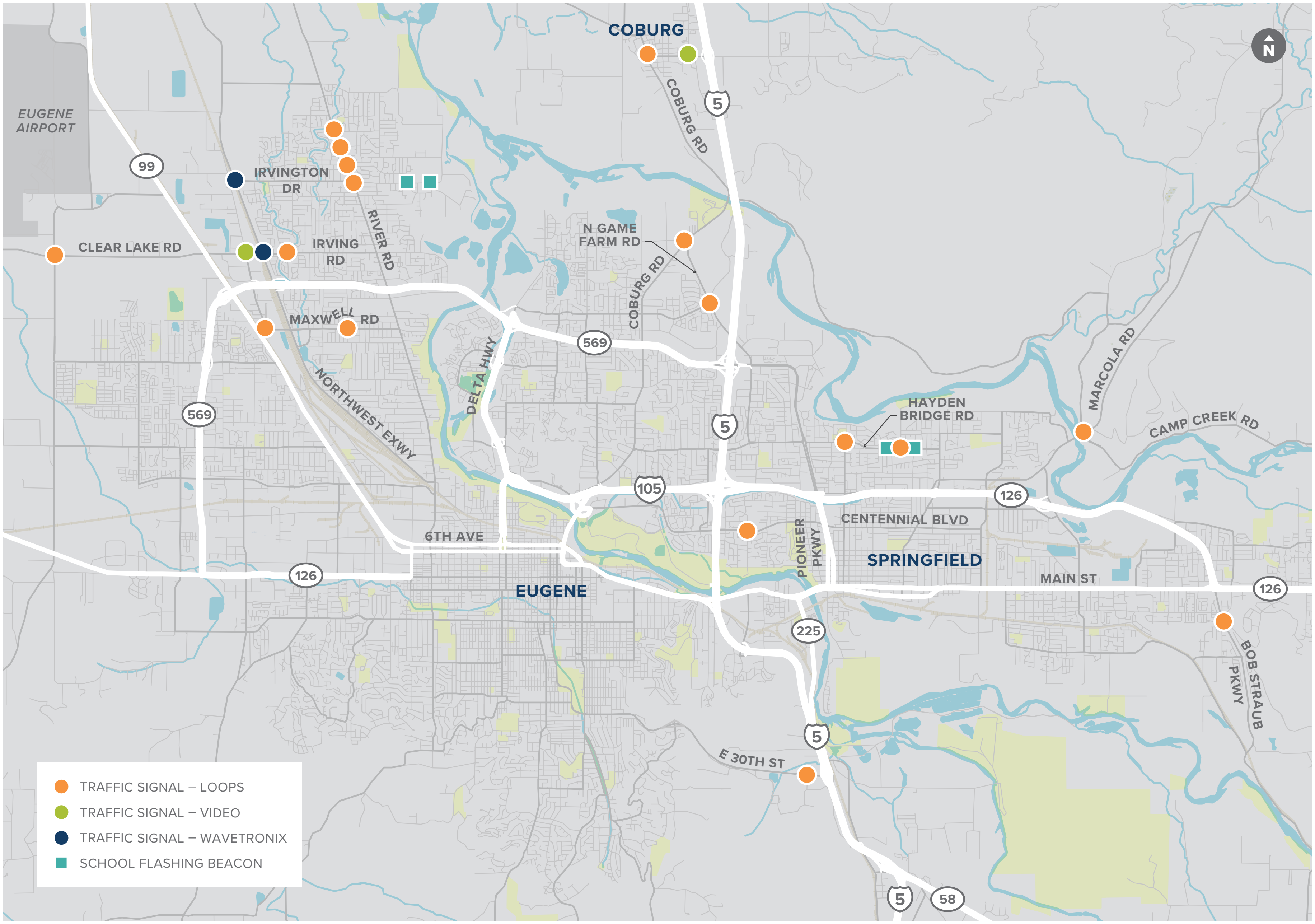


FIGURE 2. LANE COUNTY EXISTING SIGNAL DETECTION TYPES

Another drawback is they can be damaged due to construction at/near the intersection that cuts the roadway or by poor pavement quality.

Video detection is a non-intrusive type of detection that uses detection zones “drawn” onto the pavement within a camera image. When a vehicle drives through the zone, a call is sent to the traffic signal controller. This type of detection provides flexibility in detection zone placement and minimizes down time due to damaged detection caused by pavement conditions. The video zones are less accurate when used to collect volumes, and the calls are common due to shadows, sun glare, heat spots, and occlusion.

Radar detection is a non-intrusive type of detection that uses radar zones configured within the lane. When a vehicle drives through the zone, a call is sent to the traffic signal controller. This type of detection provides flexibility in detection zone placement and minimizes down time due to damaged detection caused by pavement conditions. Two types of radar units are typically used at an intersection, one for advanced detection and one for stop bar (presence) detection. This type of detection provides accurate volume counts.

EMERGENCY VEHICLE PREEMPTION

All signalized intersections except Clear Lake Road/ Green Hill Road and E 30th Avenue/Eldon Schafer Drive have emergency vehicle preemption (EVP) detection. EVP overrides the normal traffic signal operations and serves the direction where an emergency vehicle is coming from.

RAILROAD INTERCONNECT

The signalized intersections of Irvington Drive/Northwest Expressway and Irving Road/ Northwest Expressway have interconnect cable between the railroad controller and the traffic signal controller to provide preemption for track clear out when a train approaches that at-grade crossing.

CLOSED-CIRCUIT TELEVISION CAMERAS

There are no operational closed-circuit television (CCTV) cameras at the project intersections. CCTV cameras provide the ability to remotely view and monitor roadway and intersection conditions.

BATTERY BACKUP

The two traffic signals located next to the railroad crossings have battery backup systems to provide power in case of an outage. Battery backup systems provide power to a traffic signal, allowing it to operate for a limited time period until power is restored.

SCHOOL ZONE FLASHING BEACONS

School zone flashing beacons are installed at two locations: along Wilkes Drive near Madison Middles School and along Hayden Bridge Way near Elizabeth Page Elementary School. The beacons provide warning to drivers entering a school speed zone. They are located on a school speed limit sign and flash for a set period of time during arrival and dismissal periods. Each school zone has a pair of flashing beacons (one for each approach to the school) and each beacon location has a Spot Device controller.

COMMUNICATIONS NETWORK

There are no traffic signals currently connected back to a central system. Copper interconnect was found at or near 11 traffic signals, but not physically connected to the traffic signal controller. At some locations, the copper cable is in an existing conduit and at other locations, it is strung aerially. The copper communication wire was installed in anticipation of connecting the traffic signal controllers to a central system (see Figure 3).

The existing aerial copper cables will need to be traced to determine the exact pathways for connectivity and all existing copper cables will need to be tested to confirm the viability of reuse.

The traffic signal at Centennial Boulevard & Aspen Street has a connection to the City of Springfield’s network.

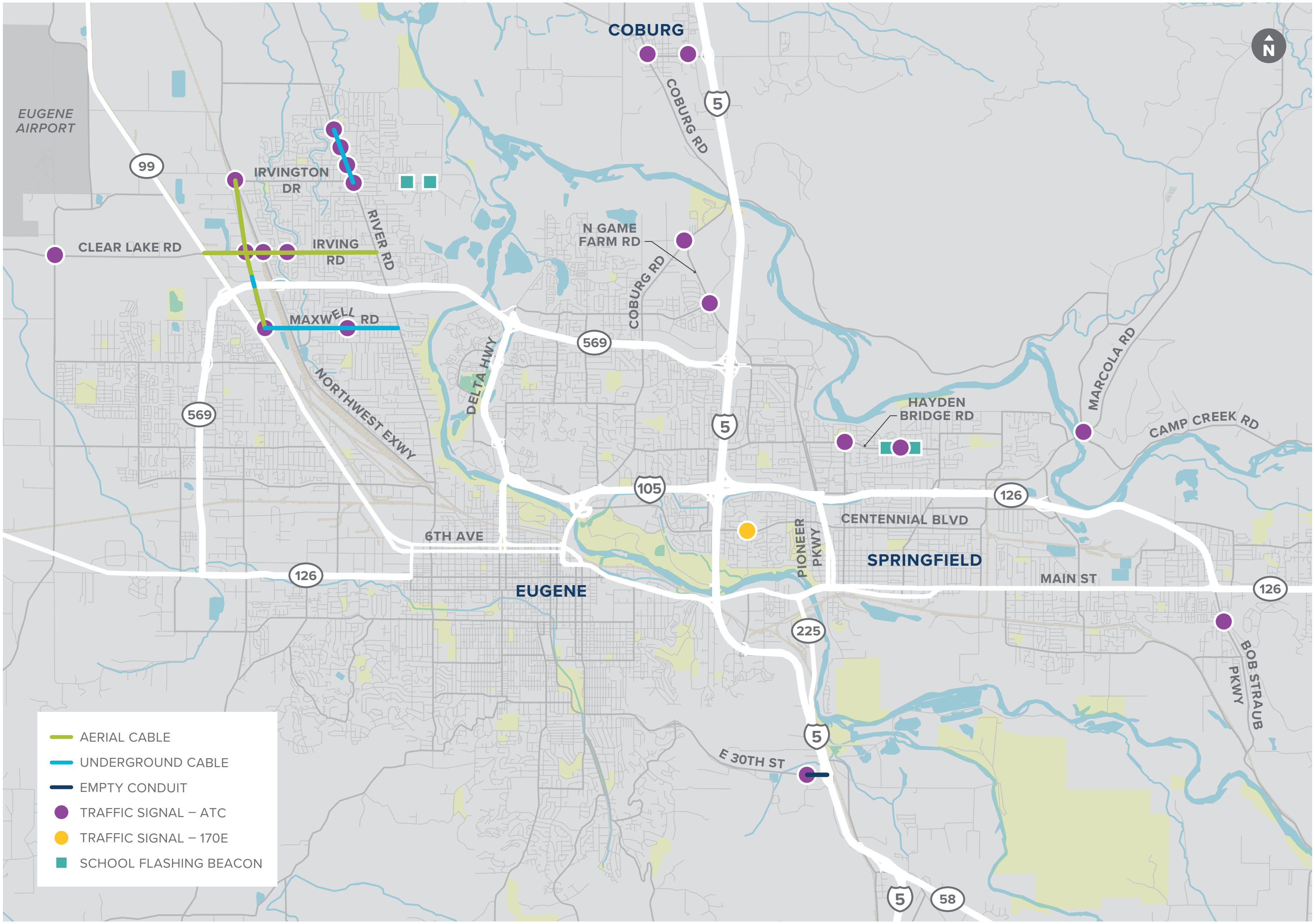


FIGURE 3. LANE COUNTY TRAFFIC SIGNALS AND COMMUNICATIONS NETWORK

TABLE 1. LANE COUNTY ITS AND TRAFFIC SIGNAL EXISTING CONDITIONS

LOCATION	EQUIPMENT			
	CONTROLLER	DETECTION	PREEMPTION	COMMUNICATIONS
CLEAR LAKE ROAD & GREEN HILL ROAD	ATC	Loops	no	none
IRVINGTON DRIVE & NORTHWEST EXPY	ATC	Wavetronix, loops on EB	yes	Possible copper connection
RIVER ROAD & SPRING CREEK DRIVE	ATC	Loops	yes	Copper - not connected
RIVER ROAD & LYNNBROOK DR/OROYAN AVE	ATC	Loops	yes	Copper - not connected
RIVER ROAD & RIVER LOOP 2	ATC	Loops	yes	Copper - not connected
IRVINGTON DRIVE & RIVER ROAD	ATC	Loops	yes	Copper - not connected
IRVING ROAD & PRAIRIE ROAD	ATC	Video (Traficon)	yes	Copper - not connected
IRVING ROAD & NORTHWEST EXPY	ATC	Wavetronix, loops on EB	yes	Possible aerial copper, not connected
IRVING ROAD & KALMAI STREET	ATC	Loops	yes	Copper - not connected
PRAIRIE ROAD & MAXWELL ROAD	ATC	Loops	yes	Copper - not connected
MAXWELL ROAD & GROVE STREET	ATC	Loops	yes	Copper - not connected
COBURG ROAD & E PEARL STREET	ATC	Loops	yes	none
E PEARL STREET & COBURG INDUSTRIAL WAY	170E	Video (Iteris)	yes	none
COBURG RD & COUNTY FARM RD/N GAME FARM RD	ATC	Loops	yes	none
N GAME FARM RD & CRESCENT AVE/ARMITAGE RD	ATC	Loops	yes	none
HAYDEN BRIDGE WAY & N 5TH STREET	ATC	Loops	yes	none
CENTENNIAL BOULEVARD & ASPEN STREET	ATC	Loops	yes	Copper to City system
MARCOLA RD & OLD MOHAWK RD/CAMP CREEK RD	ATC	Loops	yes	none
E 30TH AVENUE & ELDON SCHAFER DRIVE	ATC	Loops	no	none
BOB STRAUB PARKWAY & S 57TH STREET	ATC	Loops	yes	none
WILKES DRIVE & KENDRA ST AND RIVER LOOP 1				none
HAYDEN BRIDGE WAY & DEBRA DR				none
HAYDEN BRIDGE WAY & N 14TH ST/PAGE ELEM	ATC	Loops	yes	none

Note: ATC controller = Intelight 2070 LDX

STAKEHOLDER NEEDS

INTRODUCTION

The purpose of this chapter is to document the user and system needs for the Lane County Traffic Communications Master Plan. The needs relate to Lane County's existing traffic signal system, school zone flashing beacons, vehicle detection, CCTV cameras, battery backup units and the communications equipment necessary to connect to roadside devices and support the remote operation of traffic signals.

The Traffic Communications Master Plan will improve the scalability and maintainability of Lane County's traffic signal communications network and deployment of Intelligent Transportation Systems (ITS). Currently, Lane County has 20 traffic signals with no communication to them. This plan will identify the communications network necessary to support remote access and identify future projects that the County can include in future budget planning and grant applications. The County traffic signals are spread throughout the County, with some located close to traffic signals operated by the City of Eugene, City of Springfield and ODOT. This plan will look to leverage existing and incorporate future network connections with these agencies.

The needs for this effort will build upon the recently completed Central Lane ITS Plan. The vision, goals, and objectives developed from the regional planning effort were used as a starting point for Lane County's Communications Master Plan.

The Central Lane ITS Plan's mission, goals, and objectives as well as user and system needs that are relevant for the Lane County Traffic Communications Master Plan are included in this chapter. The content was gathered from Central Lane ITS Plan project stakeholders through a joint workshop followed by key stakeholder interviews and supplemented by meetings with Lane County Traffic Communications Master Plan stakeholders.

Overall, the stakeholder needs support the implementation of the Regional ITS Plan, network system development that is scalable and compatible with existing network architecture, and leverage existing infrastructure for corridor development.

THIS CHAPTER INCLUDES:

1. STAKEHOLDER INVOLVEMENT
2. PROJECT MISSION, GOALS, AND OBJECTIVES
3. SUMMARY OF REGIONAL ITS SYSTEM NEEDS
4. SUMMARY OF TRAFFIC COMMUNICATION MASTER PLAN NEEDS

STAKEHOLDER INVOLVEMENT

REGIONAL ITS PLAN STAKEHOLDER ENGAGEMENT

To ensure the success and utility of Central Lane Metropolitan Planning Organization's (CLMPO) Regional ITS Plan, a coalition of stakeholders were asked to provide input and build consensus on the future of the regional system. Stakeholders are defined as jurisdictional partners who own and manage the infrastructure, including:

- Lane Council of Governments (LCOG)
- City of Eugene
- City of Springfield
- City of Coburg
- Lane County
- Lane Transit District (LTD)
- Oregon Department of Transportation (ODOT)

Stakeholders attended a workshop to collaborate from a regionwide perspective. The workshop included a review of the mission, goals, objectives, and ITS needs identified in the 2004 ITS Plan, confirmation of what remained relevant, discussion of updated mission language, goals, objectives, and updated ITS needs that should be reflected in the plan update. The workshop was followed by personal interviews with key stakeholders to expand upon and/or further illustrate what had been discussed during the workshop, as well as any additional needs related to their respective jurisdictions.

As expected with a regional stakeholder group, needs varied between jurisdictions. As a result, the ITS identified system needs identified in this document may not apply to all stakeholders.

TRAFFIC COMMUNICATIONS MASTER PLAN STAKEHOLDER ENGAGEMENT

For the Lane County Communication Master Plan, a subset of these stakeholders either attended a workshop, or participated in follow up discussions to document needs, share regional ITS efforts and collaboration opportunities, and establish clear expectations and outcomes for the ITS Equipment Evaluation, Agency ITS Architecture, and Traffic Communications Master Plan deliverables. Stakeholders included:

- Lane Council of Governments
- City of Eugene
- City of Springfield
- Lane County
- Oregon Department of Transportation

PROJECT MISSION, GOALS, AND OBJECTIVES

The regional ITS planning effort developed a mission statement and accompanying goals and objectives to guide the development and ultimate deployment of ITS in the CLMPO area.

MISSION STATEMENT

Improve the safety, health, security, and movement of goods, people, and services for all modes of the transportation network by using advanced technologies, establishing agency coordination, maximizing existing system capacity and infrastructure, and providing real time traveler information.

GOALS AND OBJECTIVES

The goals and objectives for this Regional ITS Plan are described below and on the following page.

Goals, in the context of this plan, are guiding statements that set local priorities for the implementation of ITS in the region. They establish the overall implementation direction for agencies involved in the development of this plan and are typically value statements.

Objectives, in the context of this plan, are ways to meet the established goal. They are typically action-oriented strategies and are intended to be specific, attainable, and measurable. Objectives can be met through a variety of actions.

GOAL 1: IMPROVE THE SAFETY AND SECURITY OF THE TRANSPORTATION SYSTEM

OBJECTIVES:

- Reduce crashes impacting all people (walking, biking, driving, etc.)
- Improve emergency response times
- Implement and maintain ITS-related technology and strategies that proactively work to prevent incidents from occurring
- Reduce the conflict between people using different modes of transportation

GOAL 2: IMPROVE THE EFFICIENCY OF THE TRANSPORTATION SYSTEM

OBJECTIVES:

- Optimize travel time
- Reduce travel delay
- Enhance travel time reliability
- Reduce fuel consumption
- Reduce environmental impacts of delays
- Improve maintenance and operations efficiencies
- Incorporate emerging transportation technologies, prioritizing people, safety, and community benefit

GOAL 3: PROVIDE IMPROVED TRAVELER INFORMATION

OBJECTIVES:

- Provide real-time traveler information for all people using the transportation system
- Provide real-time road condition and weather information at key regional facilities

GOAL 4: DEVELOP AND DEPLOY COST EFFICIENT ITS INFRASTRUCTURE

OBJECTIVES:

- Deploy systems that are integrated with existing ITS infrastructure
- Deploy systems that are integrated with future transportation infrastructure improvements
- Deploy systems with a high benefit-to-cost ratio, with emphasis on cost effective equipment to add the greatest value possible
- Deploy systems that maximize the use of existing infrastructure
- Integrate deployments with existing and ongoing local and regional projects
- Coordinate funding opportunities
- Deploy sustainable ITS infrastructure that can be maintained long term

GOAL 5: INTEGRATE REGIONAL ITS PROJECTS WITH LOCAL AND REGIONAL PARTNERS

OBJECTIVES:

- Share infrastructure resources between local and regional agencies
- Continue to coordinate and integrate projects with other agencies
- Create and build public and private partnerships for ITS deployment, operations, and maintenance
- Promote interoperability for systems and devices to effectively manage the system

GOAL 6: MONITOR TRANSPORTATION PERFORMANCE MEASURES

OBJECTIVES:

- Make transportation data accessible between jurisdictions
- Collect and record transportation data, such as traffic volume, speed, loop occupancy, and incident data
- Maintain a geographic information system (GIS) database of the transportation infrastructure, including ITS devices
- Make use of robust third-party performance measurement solutions to provide performance measure aggregation and analytics tools such as dashboards

SUMMARY OF REGIONAL ITS SYSTEM NEEDS

This section provides a summary of the ITS identified system needs for the CLMPO area that are related to objective of the Lane County Traffic Communication Master Plan. The needs were identified by stakeholders and represent key themes for ITS. They are grouped into the following six categories:

1. **Transportation Operations and Management**
2. **Public Transportation Management**
3. **Traveler Information**
4. **Incident, Emergency, and Event Management**
5. **Maintenance and Construction Management**
6. **Data Management and Performance Measurement**

Some of the needs may apply to multiple categories, and any duplicates are likely the result of comments from separate stakeholders.

1 TRAFFIC OPERATIONS AND MANAGEMENT

- Remotely manage and control traffic signals
- Develop robust traffic signal control plan management capabilities to address a wide range of multimodal operational needs
- Monitor and control pedestrian and bicycle crossing aspects of traffic signals in order to facilitate safe crossings at intersection
- Improve signal operations and detection of all modes using information from connected vehicles and advanced infrastructure detection
- Communicate signal phase and timing data to connected vehicles to facilitate improved movement through intersections
- Deploy cameras for surveillance and real-time visual information
- Integrate agency-owned count and travel time sensors with third party data sources
- Implement responsive signal timing
- Expand bicycle detection throughout the region
- Provide interagency access to camera images

2 PUBLIC TRANSPORTATION MANAGEMENT

- Maintain travel time reliability on transit corridors
- Incorporate arterial traffic (and saturation levels) and connected vehicle data to optimize transit service operations

3 TRAVELER INFORMATION

- Integrate local agency traveler information sources with regional systems

4 INCIDENT, EMERGENCY, AND EVENT MANAGEMENT

- Optimize traffic management for major events
- Share video monitoring systems between multiple agencies and law enforcement, while also managing controls for each type of viewer
- Take steps towards Vision Zero

5 MAINTENANCE AND CONSTRUCTION MANAGEMENT

- Monitor the condition of transportation-related infrastructure using both fixed and vehicle-based infrastructure monitoring sensors

5 DATA MANAGEMENT AND PERFORMANCE MEASUREMENT

- Use ITS-collected data to determine the carrying capacity and demand of a corridor for all modes
- Aggregate and archive data collected throughout the region
- Use transportation-related data to support traffic data analysis, performance monitoring, planning, and reporting
- Automate data collection of volumes, speeds, occupancy, vehicle classifications, incidents, preemption calls, etc.
- Integrate third-party vehicle data to support performance monitoring, infrastructure conditions reporting, and environmental monitoring
- Define common performance measures that can be measured and shared between partner agencies
- Update existing Intergovernmental Agreements (IGAs) to include signal performance measures

SUMMARY OF TRAFFIC COMMUNICATION MASTER PLAN NEEDS

This section contains a summary of the Lane County Traffic Communications Master Plan stakeholder needs as identified by the technical advisory committee. These identified needs are in addition to the regional needs documented previously and focus on details specific to the following topics:

1. **Traffic Signal Controllers and Central Signal System**
2. **Communications Network**
3. **Roadway Monitoring**
4. **Data Sources and Performance Measures**

In general, the County is looking for open, standards-based ITS solutions that are user-friendly, provide measurable benefits, and have low operations and maintenance costs. The needs are grouped by functional areas and have not been prioritized. The strategies to address these needs will be identified in each chapter related to each functional area.

1 TRAFFIC SIGNAL CONTROLLERS AND CENTRAL SIGNAL SYSTEM

- Deploy traffic signal controllers and firmware capable of collecting high-resolution data and advanced traffic signal control operations.
- Support remote management of traffic signal controllers.
- Upgrade signal controller cabinets based on ITS needs considering space constraints.
- Identify needs of serial cabinets.
- Operate traffic signals across jurisdictional boundaries.
- Support transit signal priority at County intersections, where appropriate.
- Support future integration of connected and autonomous vehicles.

2 COMMUNICATIONS NETWORK

- Connect each of the county owned signals, school zone flashing beacons and ITS devices back to a central system identifying required hardware and software.
- Establish communications link between Lane County central signal system and other agencies central systems.
- Investigate usage of existing copper installed in County underground and aerial infrastructure.
- Investigate usage of existing conduits connected to or near existing signal cabinets.
- Investigate use of partner jurisdictions' communications network.
- Investigate connecting to City of Eugene's existing communications network.
- Investigate using planned microwave systems in both Eugene and Springfield.
- Investigate using radio links between signals and to locations that can be backhauled to Lane County.
- Investigate use of the Lane County Public Area Network (PAN).

3 ROADWAY MONITORING

- Enable remote monitoring of signalized intersections.
- Identify locations with highest safety risk by measuring near-miss collisions.
- Leverage video analytics to support crash identification and analysis.
- Share video feeds to TripCheck.
- Leverage work zone ITS technology including portable traffic signals.

4 DATA SOURCES AND PERFORMANCE MEASURES

- Record real time traffic data, such as speed, volume, crash analysis, red-light running (detection), speed cameras, maintenance metrics, pedestrian, and bike safety (detection) performance measures.
- Develop pedestrian and bike safety performance measures.
- Develop traffic signal performance measures.
- Create performance measurement reports for planning, operations, and maintenance purposes.
- Deploy vehicle detection capable of collecting lane by lane volumes at or beyond stop bar.
- Deploy vehicle detection capable of collecting lane by lane volumes in advance of the intersection.
- Deploy vehicle detection capable of collecting approach speeds.

TRAFFIC SIGNAL SYSTEM

INTRODUCTION

The purpose of this chapter is to provide recommendations for the traffic signal management system. Items included in this chapter include the traffic signal controller, local and central signal software, multimodal detection, traffic signal cabinets and power supply backup.

THIS CHAPTER INCLUDES:

1. TRAFFIC SIGNAL CONTROLLER/SOFTWARE
2. CENTRAL SIGNAL SYSTEM SOFTWARE
3. MULTIMODAL DETECTION
4. TRAFFIC SIGNAL CABINETS
5. POWER SUPPLY BACKUP

TRAFFIC SIGNAL CONTROLLER/SOFTWARE

EXISTING CONDITIONS

Lane County owns 21 traffic signals. 20 intersections operate with Intelight 2070 LDX traffic signal controllers, while one intersection operates with a Type 170 traffic signal controller (BI Tran software).

The traffic signal at Centennial Boulevard & Aspen Street is owned by Lane County. The physical equipment is maintained by Lane County. The type 170 traffic signal controller is currently connected to the City of Springfield's signal system due to the close proximity to other City signals along Centennial Boulevard. The timings are operated/maintained by the city.

PARTNER AGENCIES

The City of Eugene has a mix of type 170 controllers operating BI Tran software and ATC controllers operating McCain OmniEx software. The City of Springfield operates type 170 controllers operating Bitran software. Within Lane County, ODOT has a mix of type 170 controllers operating Wapiti software, type 2070 controllers operating NWS Voyage and ATC controllers operating Q-Free MAXTIME. ODOT is planning to replace 19 controllers in Springfield with ATC controllers operating Q-Free software.

USER AND SYSTEM NEEDS

The County needs a robust traffic signal controller/software that is capable of safely and efficiently operating the traffic signals in the County.

The traffic signal system needs to:

- Operate a minimum of eight vehicle phases, four pedestrian phases, and four overlap phases
- Provide outputs for special phases, such as bikes and transit queue jumps
- Operate flashing yellow arrow for permissive turns
- Provide transit signal priority timing strategies
- Serve a wide range of multimodal operational needs
- Provide safe crossings at intersections for pedestrians and bicyclists
- Collect high-resolution data enumerations capable of producing performance measurement reports
- Operate traffic responsively
- Operate across jurisdictional boundaries

RECOMMENDATIONS

To meet the user needs for additional functionality and performance measurements, it is recommended that the County replace the remaining Type 170 traffic signal controllers with Intelight 2070 LDX traffic signal controller with Q-Free MAXTIME local software (County plans to complete this in Spring 2022). This is the current standard used by ODOT and multiple agencies within Oregon for all new traffic signals.

For traffic signals that are operated and/or maintained by a partner agency, the recommendation is to use the standard controller/software employed by that agency.

SPRINGFIELD

It is recommended to operate the signals along Centennial Boulevard (one of which is owned by Lane County) with the same local and central software. This means the County signal at Centennial Boulevard and Aspen Street should continue to be part of the Springfield system. The County may choose to transfer the signal to the city. The City may choose to upgrade to Q-Free in the future, at which time the County could gain remote access to the signal. All other signals within Springfield are more remote and don't need to be on the same network as nearby signals for operational efficiency.

EUGENE

There are currently no Lane County signals operated or maintained by the City of Eugene. If the LTD EmX (BRT) is expanded along River Road, it may be advantageous to transfer ownership of the signals to the City of Eugene.

CENTRAL SIGNAL SYSTEM SOFTWARE

EXISTING CONDITIONS

The traffic signals in Lane County currently do not connect to a central signal system. There are communications components in place (Traffic Signal Network memo) that can be built upon to connect the traffic signals to a new central system.

PARTNER AGENCIES

The City of Eugene uses QuicNet to remotely manage the type 170 controllers and McCain Transparity to remotely manage the ATC controllers operating OmniEx software. The City of Springfield uses QuicNet to remotely manage the type 170 controllers operating Bitran software. ODOT is transitioning from TransSuite to using Q-Free MAXVIEW/Kinetic Signals to remotely manage their signals.

USER AND SYSTEM NEEDS

The County needs a robust central traffic signal system that allows the staff to manage, monitor, and operate the county-owned traffic signals.

The central traffic signal system needs to:

- Create, store, and deploy local controller databases remotely
- Monitor real-time status of inputs and outputs, and potentially provide inputs remotely as situation demands at each local traffic signal controller
- Support manual overrides of local operational modes
- Operate traffic responsively
- Provide performance metric reports to aid in operating the signal system and tracking system performance

RECOMMENDATIONS

To meet the user needs for remote management of traffic signals, it is recommended that the County deploy Q-Free Kinetics central signal system. Q-Free Kinetics is the central signal system associated with Q-Free MAXTIME local software and is the current standard used by ODOT and multiple agencies within Oregon for remote management.

The City of Portland plans to purchase an Enterprise license that will cover all Oregon agencies, with the exception of ODOT, who already has a license. In addition to the license, Lane County will need the following to deploy the Q-Free Kinetics central signal system:

- Server (on-premises or Cloud-based)
- Installation Fee (needed to install the software on the server)
- Annual maintenance fee (two years included in Enterprise license, additional years will be paid by County)

The central signal system can operate on a server within the County network and be maintained by County staff or it can operate on a Cloud-based server maintained by a third-party vendor.

Because technology, costs, and internal policies may change over time, the final architecture of the central system should be based on discussions with IT staff and other local agencies closer to the time of deployment to determine the best solution at that time.

MULTIMODAL DETECTION

EXISTING CONDITIONS

Most of the traffic signals in Lane County use inductive loops for vehicle detection. Two intersections use video detection, and two intersections have Wavetronix radar detection.

USER AND SYSTEM NEEDS

The County needs a dependable multimodal detection system to provide inputs for traffic signal operations and data for performance metrics.

The detection system needs to reliably detect multiple modes for signal operations, including:

- Vehicles
- Trucks (freight priority)
- Buses (transit priority)
- Bikes
- Pedestrians

The detection system needs to collect high-resolution detector data to be used by an Automated Traffic Signal Performance Measurement system to produce reports.

The detection system needs to collect and compile multimodal counts.

The County would like to be able to remotely access the detection device through IP to monitor, configure and upload data.

The county would like a technology that will minimize the number of devices at an intersection.

The detection system needs to provide ability to view current conditions at the intersection.

TECHNOLOGY SUMMARY

Listed below are the most common types of detection for traffic signal operations along with a brief description of the technology followed, by a table summarizing the strengths and weaknesses of them.

INDUCTIVE LOOPS

Inductive loop detectors consist of wires cut into the pavement and come in many different sizes and shapes depending on the area to be detected. When a vehicle drives over the loop, the current is interrupted, and a call is sent to the traffic signal controller. This type of detection has historically been the standard of agencies since it tends to be dependable and accurate, if installed and maintained properly. Loops are best used for detecting vehicles and can be used for calculating speed (using two loops). Bicycle detection can be accomplished with special shaped loops or higher sensitivity. Loop detectors cannot typically distinguish between different modes of transportation.

VIDEO DETECTION

Video detection is a non-intrusive type of detection that uses digitized images of an approach, where detection zones can be “drawn” onto the pavement within the image. When a vehicle drives through the zone, a call is sent to the traffic signal controller. Video detection can detect most modes of transportation using different zone sizes and locations. The video zones are less accurate when used to collect volumes, and false calls are common due to shadows, sun glare, heat spots, and occlusion.

- **Single Approach** video detection consists of using one or more fixed cameras for each approach. Once the camera is mounted and aimed, the image is static and the zones are drawn where detection is needed.
- **Multiple Approach** video detection consists of a single fish-eye camera that can see all the approaches to the entire intersection (depending on geometry). The zones are drawn where detection is needed. The camera has a virtual pan-tilt-zoom independent of the video detection zones and can be used for monitoring.

RADAR DETECTION

Radar detection is a non-intrusive type of detection that uses radar beams and detection zones to track vehicles on an intersection approach. When a vehicle drives through the zone, a call is sent to the traffic signal controller. Two types of radar units are typically used at an intersection, one for advanced detection and one for stop bar (presence) detection. The advanced detectors provide accurate volume counts.

INFRARED/THERMAL DETECTION

Infrared/thermal detection is a non-intrusive type of detection, similar to video detection. An infrared camera detects the thermal energy of a vehicle or person and converts it to an electronic signal, which is then processed to produce an image. Like video detection technology, zones can be “drawn” onto the pavement within the image. When a vehicle drives through the zone, a call is sent to the traffic signal controller. Infrared/thermal detection can detect most modes of transportation using different zone sizes and locations. This type of detection is less prone to false calls associated with shadows, sun glare, heat spots, and occlusion.

WIRELESS SENSORS

Wireless sensors are composed of a small unit that is installed in a hole drilled into the center of a travel lane. When a vehicle passes over the sensor, it transmits a call wirelessly to a device (access point) mounted on a nearby pole which then sends the call to the controller via hard wire. The sensor is battery powered, with a limited lifespan. The sensors can be configured to detect bicycles.

Table 2 is a summary of the strengths and weaknesses of the different detection technologies.

TABLE 2. DETECTION TECHNOLOGIES STRENGTHS AND WEAKNESSES

TECHNOLOGY	STRENGTHS	WEAKNESSES
INDUCTIVE LOOPS	• Mature, well-understood technology • Insensitive to inclement weather such as rain, fog, and snow • Provides accurate count data	• Installation requires pavement cut/lane closure • Improper installation decreases pavement life • Wire loops subject to stresses of traffic and temperature • Wires can be cut by construction • Multiple detectors per lane usually required • Advanced detection requires conduit installation (200-300') • Once installed, can't move location
VIDEO DETECTION (SINGLE APPROACH, MULTIPLE CAMERA)	• Each camera can monitor multiple lanes and multiple detection zones/lane • Easy to add and modify detection zones • Can collect multimodal data • Can connect remotely to view/edit configuration	• Installation/maintenance, require lane closure when camera is mounted over roadway • Performance affected by inclement weather (fog, rain, and snow), shadows, occlusion, day-to-night transition, vehicle/road contrast, and camera lens cleanness • Count data is not as accurate as loops or radar • Once installed, camera image is static • May be impacted by camera motion caused by strong winds or vibration of mounting structure • May be impacted by span wires or overhead conductor within field of view • Need clear view of approach
VIDEO DETECTION (MULTIPLE APPROACH, SINGLE CAMERA)	*In addition to strengths listed above* • Single camera covers entire intersection • Can be used to monitor approaches (virtual pan-tilt-zoom)	*In addition to weaknesses listed above* • May need multiple cameras for large or skewed intersections
RADAR DETECTION	• Each sensor can monitor multiple lanes and multiple detection zones/lane • Easy to add and modify detection zones • Typically not impacted by inclement weather or shadows • Can directly measure speed • Can connect remotely to view/edit configuration • Provides accurate count data	• Sensor aiming/configuration can be challenging • Some sensors may not detect stopped vehicles (need special sensor for presence detection) • Overhead conductors within beam cone can cause problems • Can't view images of the roadway and zones

TECHNOLOGY	STRENGTHS	WEAKNESSES
INFRARED/ THERMAL CAMERAS	• Each camera can monitor multiple lanes and multiple detection zones/lane • Easy to add and modify detection zones • Can collect multimodal data • Can connect remotely to view/ edit configuration	• Installation/maintenance, require lane closure when camera is mounted over roadway • Once installed, camera image is static • May be impacted by camera motion caused by strong winds or vibration of mounting structure • May be impacted by span wires or overhead conductor within field of view • Need clear view of approach
WIRELESS SENSORS	• Easy to install and configure • Provides accurate count data • Can connect remotely to view data and edit configuration	• Installation requires pavement core/lane closure • Improper installation decreases pavement life • Multiple sensors per lane usually required • Advanced detection requires conduit installation (200-300’) and possible second access point • Once installed, can’t move location • Limited battery life

RECOMMENDATIONS

Based on the County’s desire for multimodal detection that can be easily configured and remotely managed, a multiple-approach single-camera video detection system meets the needs. There is typically not a one-size-fits-all solution with detection technology. A multiple approach single-camera video detection system may be the first choice, but each location should be evaluated to determine the final solution. The final detection layout should be based on the operational objectives of the traffic signal. This includes, at a minimum, presence detection for all approaches and advanced detection for mainline approaches.

We recommend that any working inductive loop detectors continue to be used, if they meet the operational needs. Many times the existing loop detectors can be supplemented with non-intrusive detection.

TRAFFIC SIGNAL CABINETS

EXISTING CONDITIONS

The existing controller cabinets within Lane County are Type 332. Some cabinets were initially installed as early as 1987. The Type 332 controller cabinet is the industry standard for Type 170 and Type 2070 traffic signal controllers. The Type 332 Compact cabinet has limited output files and overlap operation is constrained.

USER AND SYSTEM NEEDS

Controller cabinet needs to provide:

- A minimum of 32 inputs and 16 outputs
- Space for communications equipment
- Space for detection equipment
- Space for back-up power equipment
- Space for CCTV equipment
- Space that is scalable for future expansion
- A base that will fit on the same base as the existing 332 cabinet

TECHNOLOGY SUMMARY

Table 3 provides a high-level summary of the features of the Type 332x and the ATC (serial) traffic signal controller cabinet.

RECOMMENDATIONS

The Type 332x controller cabinet is an industry standard for Type 170 and Type 2070 traffic signal controllers and can be used for the ATC controller that Lane County uses. The current ODOT standard for new traffic signal construction is the Type 332S cabinet.

ODOT is in the process of updating their traffic signal controller cabinet standard to be the ATC cabinet (sometimes referred to as the Serial Cabinet).

We recommend following the current ODOT standards for traffic signal controller cabinet, which is the 332S now and may be the ATC in the future.

TABLE 3. FEATURE SUMMARY OF THE TYPE 332X AND THE ATC TRAFFIC SIGNAL CONTROLLER CABINETS

FEATURE	TYPE 332X CABINET	ATC CABINET
SIZE	24.3”w x 30.3”d x 67”h (Can vary)	24.3”w x 30.3”d x 67”h
DETECTOR INPUTS	36	48 standard Up to 72
PHASE OUTPUTS	8-phase, 4-pedestrian 4-overlap with aux file	16 or 32 outputs All channels are programmable
CONFLICT MONITOR	16 channels	32 channels
POWER	30 A Circuit Breaker	Clean AC Power Assembly (low voltage)

POWER SUPPLY BACKUP

EXISTING CONDITIONS

The two traffic signals located next to the railroad crossings have battery backup systems to provide power in case of an outage.

USER AND SYSTEM NEEDS

County needs a system to provide back-up power to the traffic signal controller in case of outage at locations close to railroad crossings, has known power issues, has a CCTV camera and/or is in a remote location.

The system needs to:

- Be compatible with existing 332 controller cabinet, existing controller and cabinet component for full-time operation
- Provide a minimum of four hours of run-time operation for an intersection
- Have lightning surge protection compliant with IEEE/ANSI C.62.41
- Be able to shut down in order to protect against internal damage in the event of an overload at the output

RECOMMENDATIONS

We recommend including back-up power supply to the locations and criteria outlined in Table 4.

TABLE 4. RECOMMENDED BACK-UP POWER SUPPLY LOCATIONS AND CRITERIA

INTERSECTION	RAILROAD INTERCONNECT	KNOWN POWER ISSUE	FUTURE CCTV LOCATION	REMOTE LOCATION
IRVINGTON DRIVE & NW EXPRESSWAY	●		●	
IRVINGTON ROAD & NW EXPRESSWAY	●		●	
MARCOLA ROAD & MOHAWK ROAD/ CAMP CREEK ROAD		●		
IRVING ROAD & KALMAI STREET		●		
IRVINGTON ROAD & RIVER ROAD			●	
CLEAR LAKE ROAD & GREEN HILL ROAD			●	●
30TH AVENUE & ELDON SHAFER ROAD				●

TRAFFIC SIGNAL COMMUNICATIONS NETWORK

INTRODUCTION

The purpose of this chapter is to summarize existing communications infrastructure and document communications network alternatives to support centralized monitoring and reporting of Lane County's traffic signals. The recommended approach to the County's communications network will be detailed in the Communications Architecture chapter.

EXISTING INFORMATION

County Public Works owns, operates, and maintains 21 traffic signals and four school zone flashing beacons. The signalized intersections operate with the Q-Free (formerly Intelight) 2070 LDX traffic signal controller supporting communications over Ethernet. The County traffic signals are spread throughout the County, adjacent to traffic signals operated by the City of Eugene, City of Springfield, and the Oregon Department of Transportation (ODOT).

The County Technology Services (TS) maintains County network equipment. County TS has capacity to house central system platforms at the Lane County Public Service Building (125 E 8th Ave) in downtown Eugene. The Public Service Building is connected to the County Public Works facility (3050 N Delta Hwy) via a Eugene Water & Electric Board (EWEB) leased 10 Gbps fiber circuit.

COPPER INTERCONNECT CABLE

NEAR CITY OF EUGENE JURISDICTION

The County owns copper interconnect cable that was installed to provide future communications between two groups of County traffic signals. For the Irving Road signal group, the copper interconnect cable is routed underground and aerially between the six County traffic signals along Prairie Road, Irving Road, and Maxwell Road. For the River Road group, the copper interconnect cable is routed underground. The following are the groups and associated corridors:

IRVING SIGNAL GROUP

- Prairie Road (N-S) from Irvington Drive to Maxwell Road
- Irving Road (W-E) from Highway 99 to River Road
- Maxwell Road (W-E) from Prairie Road to River Road

RIVER ROAD SIGNAL GROUP

- River Road (N-S) from Spring Creek Drive to Wilkes Drive/Irvington Drive

The City of Eugene owns underground copper interconnect cable along River Road, extending north to the River Loop #2 signalized intersection. Signalized intersections with County and City copper interconnect include:

- River Road & River Loop #2
- River Road & Wilkes Drive/Irvington Drive
- River Road & Irving Road
- River Road & Maxwell Road

NEAR CITY OF SPRINGFIELD JURISDICTION

The traffic signal at Centennial Boulevard & Aspen Street is connected to the City of Springfield's network over copper interconnect cable. The copper interconnect cable will be maintained.

FIBER OPTIC CABLE

The County does not own fiber optic cable for traffic signal use. Existing fiber networks in the region that may be options for Lane County are described below.

PUBLIC AGENCY NETWORK (PAN)

The Public Agency Network (PAN) includes a Regional Fiber Consortium (RFC) consortium intended for use by the regional public agencies. The RFC is administered by the Lane Council of Governments (LCOG). Primary fiber strand owners of the RFC include the City of Eugene. The RFC is within the vicinity of Irving area, River Road, and City of Coburg traffic signal locations.

EUGENE WATER & ELECTRIC BOARD (EWEB)

The Eugene Water & Electric Board (EWEB) owns and leases fiber optic communications primarily within or near the City of Eugene jurisdiction. EWEB owns infrastructure within the vicinity of the Irving Road area, River Road, and Game Farm Road traffic signal locations. County TIS has an existing lit circuit over EWEB fiber connection between the County Public Services Building and the Public Works facility.

SPRINGFIELD UTILITY BOARD (SUB)

The Springfield Utility Board, similar to EWEB, owns and leases fiber optic communications primarily within or near the City of Springfield jurisdiction. SUB owns infrastructure within the vicinity of Game Farm Road, Hayden Bridge Road, and Bob Straub Parkway traffic signal locations.

LANE TRANSIT DISTRICT (LTD)

The Lane Transit District owns fiber optic communications primarily along the Emerald Express (EmX) Bus Rapid Transit (BRT) route which provides network connections between station platforms and the LTD Headquarters.

MICROWAVE RADIO

Lane Radio Interoperability Group (LRIG) is a regional partnership supporting the deployment of radio communications. Radio equipment is installed on radio towers (some owned by the County, some leased) to provide wireless communications between public agency buildings and remote site locations. Line of site and bandwidth needs are critical considerations when evaluating the feasibility of microwave radio.

CELLULAR

The County operates cellular modems using County wireless plans. Signal strength, network security, and bandwidth needs are critical considerations when evaluating the feasibility of cellular.

COMMUNICATIONS BANDWIDTH CONSIDERATIONS

The traffic signal communications network can be supported by multiple communications technologies including hardwired and wireless options. Each technology has its bandwidth capacity limitations ranging from hardwired fiber optics (up to 10 Gbps) to wireless 4G LTE cellular (up to 50 Mbps). Typical bandwidth capacity per technology is summarized in Table 5.

TABLE 5. COMMUNICATIONS TECHNOLOGY BANDWIDTH CAPACITY

TECHNOLOGY TYPE	HARDWIRED	WIRELESS	TYPICAL BANDWIDTH
FIBER OPTIC COMMUNICATIONS	●		1 Gbps (up to 10 Gbps)
INTERNET SERVICE PROVIDER	●		200 Mbps (up to 1 Gbps)
COPPER INTERCONNECT	●		50 Mbps (up to 100 Mbps)
MICROWAVE RADIO		●	100 Mbps (up to 300 Mbps)
CELLULAR (5G)		●	50 Mbps (up to 1 Gbps)
CELLULAR (4G LTE)		●	5 Mbps (up to 50 Mbps)

The anticipated network demand at a traffic signal can significantly vary based on the equipment installed and connected to the communications network. Typical traffic signal equipment such as the traffic signal controller and vehicle detection have low bandwidth requirements due to small file sizes and infrequent data uploads. CCTV cameras, however, demand the highest amount of bandwidth especially when streaming real-time video feeds. The following table provides the typical bandwidth demand of a fully built-out traffic signal with a multi-sensor and Pan Tilt Zoom (PTZ) camera.

TABLE 6. SIGNALIZED INTERSECTION EQUIPMENT BANDWIDTH DEMAND

EQUIPMENT TYPE	BANDWIDTH
TRAFFIC SIGNAL CONTROLLER	100 Kbps
VEHICLE DETECTION	100 Kbps
MALFUNCTION MANAGEMENT UNIT	100 Kbps
PEDESTRIAN PUSHBUTTONS	100 Kbps
EMERGENCY VEHICLE PREEMPTION	100 Kbps
CONNECTED VEHICLE APPLICATIONS	100 Kbps
MULTI-SENSOR, 360° CAMERA	20,000 Kbps
PTZ CAMERA	4,400 Kbps
BANDWIDTH CONTINGENCY	25,000 kbps
TOTAL MAX	**50,000 Kbps or 50 Mbps**

The County bandwidth needs for a single traffic signal can be assumed as follows:

- Traffic Signal with no CCTV camera = 1 Mbps
- Traffic Signal with PTZ camera only = 10 Mbps
- Traffic Signal with Multisensor and PTZ camera = 50 Mbps

NEW COMMUNICATIONS INFRASTRUCTURE CONSIDERATIONS

Communications infrastructure, including underground conduit and aerial span wire, have a high capital construction cost compared to wireless technologies. Existing underground conduit and aerial pathways owned by the County or partner agency could be leveraged for new communications cable such as replacing copper interconnect with fiber optics. The following should be considered when evaluating existing pathways and the installation of new infrastructure.

EXISTING UNDERGROUND CONDUIT PATHWAYS

- **Conduit use –** communications and power cabling should not share the same conduit space.
- **Conduit capacity –** conduit should maintain 60 percent maximum capacity. Installation of new cable may require removal of existing.
- **Junction boxes –** junction box size may not meet cable bend radius requirements requiring junction box replacement.

NEW UNDERGROUND CONDUIT INFRASTRUCTURE

- **Conduit size –** typical conduit diameter is 2" minimum for communications cable.
- **Conduit installation –** conduit could be trenched for shorter runs typically within landscaped areas or bored for longer runs along a corridor.
- **Splice vaults –** when installing fiber optic communications, an underground splice vault is recommended at each drop location to avoid network disruptions such as when a traffic signal cabinet is struck by a vehicle.
- **Construction cost –** typical construction cost for trenched conduit is $40 per linear foot and for bored conduit is $80 per linear foot.

EXISTING AERIAL PATHWAYS

- **Over-lash –** new communications cable could be over-lashed to existing aerial cable under an existing pole attachment agreement.

NEW AERIAL INFRASTRUCTURE

- **Pole attachment agreement –** installation of new cable on utility poles will require a pole attachment agreement.
- **Make ready work –** upon pole loading review, the utility pole owner may determine necessary make ready work such as new anchors and guy wire to be completed prior to attachment of the new cable.
- **Span wire –** aerial fiber optic cable could be self-supporting or require a span wire between utility poles.

COMMUNICATIONS TECHNOLOGY ALTERNATIVES

The communications technology alternatives, as shown in Table 7, summarize the available options at each County signalized intersection. The Communication Architecture chapter further evaluates each option by confirming capital construction cost, on-going operational cost, interagency agreement requirements, site-line and coverage limitations, and bandwidth considerations.

TABLE 7. COMMUNICATIONS TECHNOLOGY ALTERNATIVES

LOCATION	COUNTY EX. COPPER/ NEW FIBER	EWEB FIBER	PAN FIBER	SUB FIBER	WIRELESS RADIO	CELLULAR
CLEAR LAKE RD & GREEN HILL RD					●	●
NW EXPRESSWAY & IRVINGTON DR	●	●	●		●	●
IRVING RD & PRAIRIE RD	●				●	●
PRAIRIE RD & MAXWELL RD	●				●	●
NW EXPRESSWAY & IRVING RD	●	●	●		●	●
IRVING RD & KALMIA ST	●				●	●
MAXWELL RD & GROVE ST	●				●	●
RIVER RD & SPRING CREEK DR	●				●	●
RIVER RD & LYNNBROOK DR	●				●	●
RIVER RD & RIVER LP#2	●				●	●
RIVER RD & IRVINGTON DR/WILKES DR	●	●			●	●
WILKES DR & KENDRA ST		●			●	●
WILKES DR & RIVER LP#1		●			●	●
WILLAMETTE ST & PEARL ST			●		●	●
PEARL ST & COBURG INDUSTRIAL WAY					●	●
COBURG RD & COUNTRY FARM RD					●	●
N GAME FARM RD & ARMITAGE RD		●		●	●	●
CENTENNIAL BLVD & ASPEN ST	●*				●	●
30TH AVE & ELDON SCHAFER DR					●	●
HAYDEN BRIDGE RD & 5TH ST				●	●	●
HAYDEN BRIDGE RD & DEBRA DR S				●	●	●
HAYDEN BRIDGE RD & HAYDEN DR				●	●	●
HAYDEN BRIDGE RD & HARVEST LN				●	●	●
MARCOLA RD & OLD MOHAWK RD			●		●	●
BOB STRAUB PKWY & 57TH AVE				●	●	●

** City of Springfield*

TRAFFIC DATA

INTRODUCTION

The purpose of this chapter is to provide recommendations on traffic data sources including Intelligent Transportation Systems (ITS) and traffic signal equipment, third-party data sources, and partner agency databases. Traffic data helps inform operators on how the transportation network is performing through vehicle and multimodal counts, vehicle speeds and travel times, safety and collision information, origin-destination mapping, vehicle delay, etc.

THIS CHAPTER INCLUDES:

1. EXISTING INFORMATION
2. TRAFFIC DATA NEEDS
3. TRAFFIC DATA SOURCE RECOMMENDATIONS

EXISTING INFORMATION

Lane County receives vehicle count data from tube counts and manual counts on a need basis. The County's roadway information system pulls crash data from the Oregon Department of Transportation site and stores in the system. Lane County does not currently use external data for operating its traffic signal systems.

Lane County does not have access to ITS or traffic signal equipment data, does not purchase third-party data, and does not receive or pull data from partner agencies. A major limitation in data acquisition of County-owned equipment is the lack of communications infrastructure.

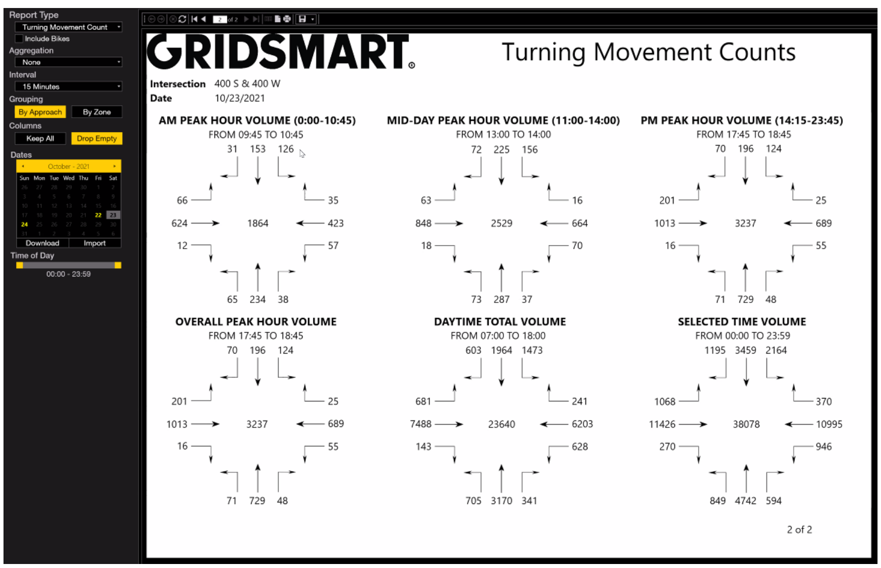
The Oregon Department of Transportation (ODOT) provides partner agency access to an INRIX portal (RITIS) which the County could subscribe to.

TRAFFIC DATA NEEDS

Traffic data can help the County gain insight on how the transportation networking is performing from a mobility and safety standpoint. With this information in hand, the County can identify problem areas, prioritize staff resources, make immediate changes, and measure the impacts of the change.

Traffic data sources can address the following needs of the County:

- Obtain and record data, such as speed, vehicle volume counts and classifications, crash and near-miss collision history, red-light running occurrences, and active mode counts through an automated process.
- Leverage data to inform planning, design, operations, and maintenance decisions.
- Provide traveler information such as road weather conditions and construction closures.
- Make data accessible including CCTV video feeds to regional partner jurisdictions (TripCheck).
- Create performance measures for:
  - » Pedestrian and bike safety
  - » Corridor and intersection performance – e.g. travel times, approach delay, arrivals on green/red
  - » Environmental monitoring – e.g. fuel consumption, greenhouse gas (GHG) emissions
  - » Infrastructure conditions



TRAFFIC DATA SOURCE RECOMMENDATIONS

Traffic data source can include roadside ITS and traffic signal equipment, third-party data sources, and partner agency databases. Roadside ITS and traffic signal equipment data is owned by the public agency and can provide detailed information down to specific movements at an intersection ideal for signal system operators. Third-party data and partner agency databases on the other hand can span across jurisdictional boundaries and provide big picture insights ideal for transportation planners. The following are descriptions and recommendations for each of these types of data sources.

DATA FROM TRADITIONAL ITS AND TRAFFIC SIGNAL CONTROL EQUIPMENT

ITS and traffic signal equipment typically includes traffic signal controllers, vehicle detection, CCTV cameras, battery backup systems, phase selector cards, malfunction management units, and pedestrian pushbutton central control units. All these devices require a communications network connection for transportation operators to pull data back to a central server location and process the data.

For signal system operators, data from the traffic signal controller, vehicle detection equipment, and CCTV camera system are most critical as these devices provide the information necessary to modify and fine-tune traffic signal operations. Data is accessible from the device over a network connection. Data can be stored on-site on dedicated servers or pushed to a virtual environment like a cloud service.

TRAFFIC SIGNAL CONTROLLER

An Advance Transportation Controller (ATC) has the capability of recording controller events (e.g. detector activation, phase change, preempt call) at 1/10th of a second. This data is stored locally on the controller and then pushed to a central system for management and/or performance monitoring purposes. On average an ATC generates 10 Mb per day depending on the number of events at the intersection. All ATCs can communicate over an Ethernet connection to a traffic signal management system and a performance management system. Performance management and Automated Traffic Signal Performance Measures (ATSPMs) are discussed in the Supplemental ITS Technology Recommendations memo.

Traffic Signal Controller Recommendations

- The County should standardize on an ATC controller and upgrade non-ATC controllers to ATC.
- The County should establish Ethernet communications to ATC controllers.
- The County should discuss server and data storage requirements with County IT.
- The County should procure a traffic signal central management system and performance management system that are capable of integrating with the ATC controller.

VEHICLE DETECTION

Vehicle detection equipment can include radar, video, infrared/thermal, and inductive loop technology. With the advent of machine learning, video detection can identify user type (multi-modal), vehicle turning counts, vehicle classifications, and collisions. Video detection, however, has sight line and distance limitations compared to radar. Vehicle detection data can be recorded by the ATC controller as event data or collected independently of the controller. When collected independently, a cabinet device records the data and then pushes the data over the communications network. To limit the amount of data transferred over the network, most video analytics manufacturers process video feeds within the cabinet device.

Vehicle Detection Recommendations

- The County should standardize on stop bar detection that can support both signal operations, performance reporting, and intersection monitoring. Video using a multi-sensor camera (e.g. 360 camera) has been proven for this purpose.
- The County should evaluate cabinet space for a video system processor. Processors range in size by manufacturer (e.g. GRIDSMART = 8.5" x 11.5" x 1.75").

CCTV CAMERA

CCTV cameras can be static, Pan-Tilt-Zoom (PTZ), or multi-sensor. The data provided by a CCTV camera is typically real-time video feeds allowing a transportation operator to observe a signalized intersection remotely. Similar to video detection, CCTV cameras can also leverage machine learning to perform video analytics. The CCTV camera requires the highest bandwidth demand ranging from 5 Mbps to 20 Mbps.

CCTV Camera Recommendations

- The County should consider a CCTV camera deployment that can support stop bar detection, performance reporting, and intersection monitoring.
- Where the County desires real-time video feeds, a fiber optic network connection is recommended.
- Where the County desires short-term video feeds or static images, a cellular connection would suffice.
- To reduce bandwidth requirements, video processing for performance measurement should occur at the signalized intersection either on the camera or processor unit.

BATTERY BACKUP SYSTEM

The battery backup system can detect power loss from a service cabinet. When connected to the communications network, power loss alerts can be provided in real-time to signal technicians.

Battery Backup System Recommendations

- The County should attach battery backup systems to existing traffic signal cabinets.
- The County should procure battery backup systems supporting Ethernet communications.

PHASE SELECTOR CARD

Phase selector cards receive and translate IR and GPS emergency vehicle preemption and transit signal priority (TSP) requests. The phase selector can log request status, frequency, and direction. This data is valuable to emergency responders and transit operators to ensure the phase selector card is working properly. Latest phase selector cards (e.g. GTT Opticom 764) support Ethernet communications and remote reporting to a central management system.

Phase Selector Card Recommendations

- The County should upgrade phase selector cards capable of supporting IR emitters, GPS radios, and Ethernet communications.
- The County should consider procuring a central management system to support maintenance and operations efforts.

PEDESTRIAN PUSHBUTTON CENTRAL CONTROL UNITS

Accessible Pedestrian Signals (APS) pushbuttons can include a central control unit housed in the traffic controller cabinet. The central control unit support Ethernet communications allowing transportation operators to access the control unit and pushbuttons remotely. The central control unit can provide interval timing data.

Pedestrian Pushbutton Control Unit Recommendations

- The County should consider installation of a central control unit in addition to APS pushbuttons.

MALFUNCTION MANAGEMENT UNIT

The malfunction management unit (MMU) can detect signal timing conflicts and monitors voltage of the traffic signal cabinet. When connected to the communications network, the MMU logged information can be pulled for investigative purposes or accessed in real-time.

Malfunction Management Unit Recommendations

- The County should consider upgrading to MMUs supporting Ethernet communications.

DATA FROM THIRD-PARTY SOURCES

Mobility data collected from GPS-equipped freight fleets and personal mobile devices (such smartphones and tablets) offer an alternative source for travel data. The quality of this data varies by how frequently it is recorded, and how accurately its location is mapped. Those two indicators can guide which type of application is best suited for analysis and management purposes.

Third-party data tends to be most valuable for transportation planners as you can quickly identify issues and needs at a larger scale. For signal system operators, this data can help identify hot spots which then requires a detailed investigation using ITS and traffic signal equipment data.

CORRIDOR TRAVEL TIME AND TRAVEL TIME RELIABILITY

Corridor-level travel time metrics are based on vehicle speed information. The corridor can be broken down into segments to help identify where congestion or locations of delay occur. This can help agencies start big picture and then focus on hot spot locations. Hot spots can be generated from poorly timed traffic signals or reoccurring peak-hour volumes.

Corridor Travel Time and Travel Time Reliability Recommendations

- The County should evaluate the Regional Integrated Transportation Information System (https://ritis.org/intro) which is a public agency available data source.
- The County should partner with other regional agencies like ODOT and LCOG who may have third-party data contracts already in place (e.g. INRIX).
- For short-term validation studies, the County could consider using low-cost Google API data.

TRAVELER INFORMATION

Traveler information cannot only be shared with the traveling public, but also be provided by them and shared with others. Mobile applications act as a clearing house for information generated by both driver observation and public agency planned events.

Traveler Information Recommendations

- In partnership with other regional agencies, the County should explore traveler information partnerships with third-party applications (e.g. WAZE).

CONNECTED VEHICLE DATA

Connected vehicles have the capability of generating and transmitting high-resolution and frequent (e.g. every second) speed, location, and vehicle diagnostics data. A large majority of connected vehicles include those with the OnStar system. Connected vehicle data can be used for travel times and hard breaking locations. Connected vehicle data is typically purchased by a third-party data aggregator and processor and converting the data to user-friendly dashboards and reports.

Connected Vehicle Data Recommendations

- The County should monitor the penetration rate of connected vehicle data as vehicles begin to adopt this standard.

DATA FROM REGIONAL PARTNER JURISDICTIONS

EUGENE - TRANSPARITY API

- The County should consider use of signal data from adjacent City of Eugene signals.

ODOT – MAXVIEW

- The County should consider use of signal data from adjacent ODOT signals.

ODOT - HTTPS://TRIPCHECK.COM/PAGES/API

- The County should consider use of travel time data, incident information, and general traveler information through ODOT’s TripCheck portal.

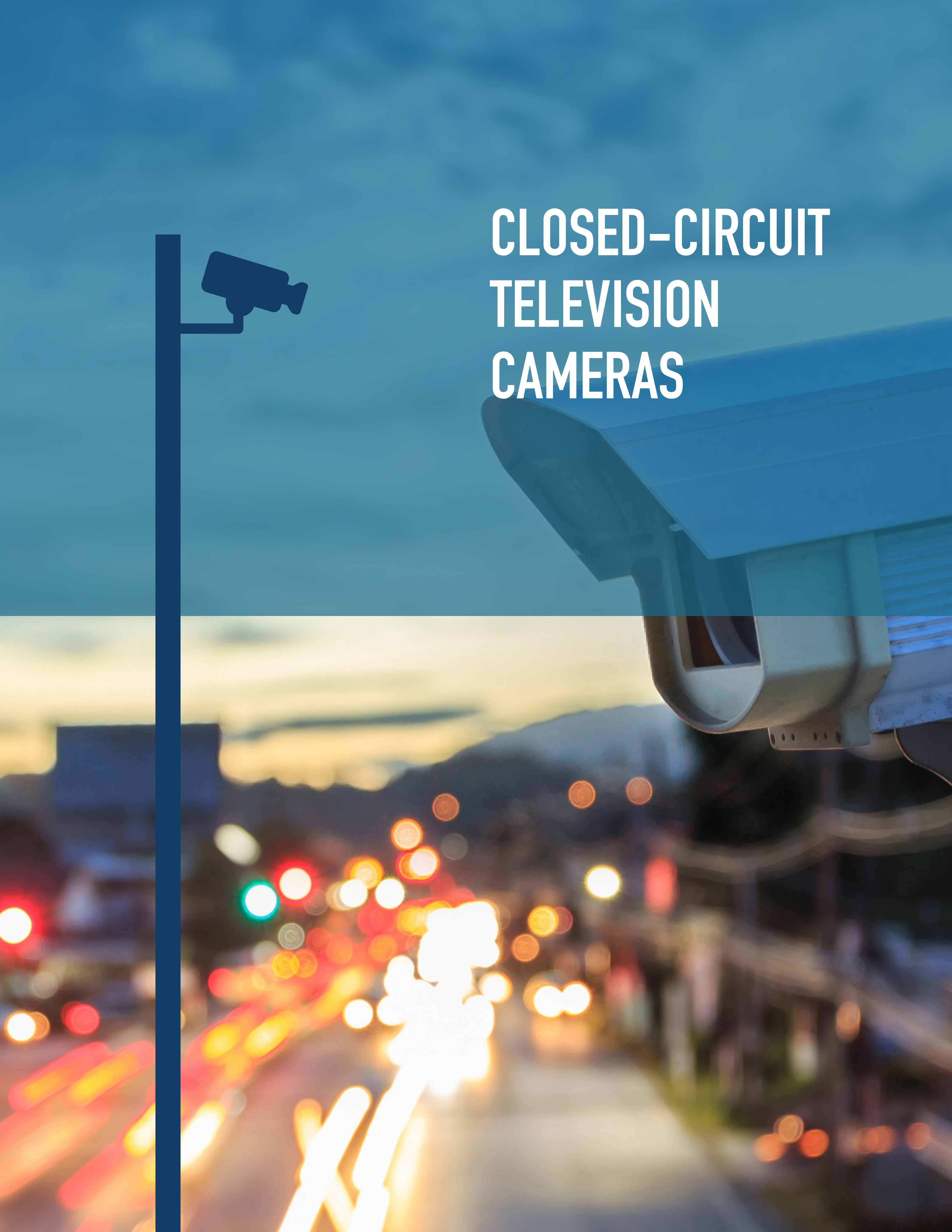
ODOT – INRIX PORTAL (RITIS)

- The County should consider use of INRIX speed and travel time data through RITIS.

LCOG DATA

- The County should consider use of static regional data collected by LCOG for use in evaluating travel patterns and safety issues.

CLOSED-CIRCUIT TELEVISION CAMERAS



INTRODUCTION

The purpose of this chapter is to provide recommendations on closed-circuit television (CCTV) camera standardization. CCTV cameras will meet ONVIF standards for interagency video sharing, support pan-tilt-zoom (PTZ) functionality, and integrate video analytics for traffic data collection (e.g., vehicle counts and classification) and traffic monitoring. Video detection cameras used for stop bar detection is covered in the Traffic Signal System chapter.

THIS CHAPTER INCLUDES:

EXISTING INFORMATION

There are no operational CCTV cameras at the 21 Lane County project intersections.

Regionally, Oregon Department of Transportation (ODOT) District 5 operates 18 CCTV cameras, mainly on freeways and the City of Eugene operates 15 CCTV cameras. ODOT's standard CCTV models are Siqura PD910 (PTZ) and Siqura BC910 (fixed). The City of Eugene's standard CCTV model is Siqura PD910 (PTZ). Both ODOT and the City of Eugene provide video feeds to ODOT's traveler information website TripCheck.

CCTVs in the region are centrally controlled by each agency. There is no Center to Center (C2C) communication available to allow agencies to share/operate CCTVs interchangeably. Communication connections at Lane County signalized intersections are not currently in place to enable Public Works staff to view video feeds from remote locations.

Recognizing the importance of CCTV in real time traffic management, incident management and maintenance management, the Central Lane County Regional ITS Plan calls for additional CCTVs to be installed as part of freeway and Arterial Active Transportation Management (ATM) deployment. It also recommends development of a regional video sharing agreement to promote interagency coordination. Multiple freeway and arterial corridor projects identified in the Regional ITS Plan include CCTV cameras as part of the project elements.

The DKS team met with representatives of regional stakeholders including Lane County, City of Eugene, Lane Council of Governments (LCOG) and ODOT for this project and the following stakeholders' needs are identified pertaining to CCTV implementation:

- Enable remote monitoring of signalized intersections.
- Integrate video detection and surveillance functions.
- Collect vehicle turning movement counts and conduct bike and pedestrian demand analysis
- Identify and validate locations with highest safety risk by measuring near-miss collisions.
- Leverage video analytics to support crash identification, traffic studies and needs analysis.
- Share video feeds to TripCheck.

TYPICAL CCTV CAMERA SYSTEM COMPONENTS

CCTV CAMERA PURPOSES

CCTV cameras typically serve two key purposes at a signalized intersection. The first purpose is for vehicle detection. The second purpose is for intersection surveillance.

VIDEO DETECTION

Video detection cameras are typically considered an alternative form of vehicle detection (i.e., in lieu of other detection such as inductive loops) to provide presence detection for signal controller operation. Modern video detection technology allows real time detection of vehicular, bicyclist, and pedestrian data. Traditionally, a camera is installed on a lighting or signal mast arm on each approach of the intersection. An alternative deployment is to install fisheye-type cameras on a signal pole to detect vehicle presence from all approaches. The alternative deployment has a potential cost saving as only a single camera is typically required; however, the design and deployment requires more detailed field investigation to decide the mounting height to ensure adequate coverage. Video detection CCTV cameras are typically deployed at signalized intersections in an arterial environment. Please also refer to Traffic Signal System chapter on video detection.

INTERSECTION SURVEILLANCE

Surveillance CCTV cameras are Pan-Tilt-Zoom (PTZ) or fixed cameras that can be deployed either in freeway or arterial environments. The primary function of a surveillance camera is to monitor the roadway for congestion, trouble spots, incidents, equipment failures, and then allowing the operator to visually verify traffic management strategies (i.e., Traffic Incident Management Response, signal timing adjustments). Images from the cameras can be broadcasted on a traveler information website for public traveler information. Surveillance cameras are helpful in traffic management and maintenance, especially for ITS assets not located near a maintenance facility. This chapter focuses on the discussion of surveillance camera deployment.

Many vendors provide CCTV camera products for the transportation industry. Some vendor's camera models are more designed for video detection, some are suitable for surveillance. Some vendors provide products for both purposes. Table 8 lists the common CCTV vendors and the cameras primary application.

TABLE 8. COMMON CCTV CAMERA VENDORS AND APPLICATIONS

VENDOR	PRIMARY APPLICATION
ECONOLITE	Video Detection
ITERIS	Video Detection
MIOVISION	Video Detection/Surveillance
GRIDSMART	Video Detection/Surveillance
SIQURA	Surveillance
BOSCH	Surveillance
AXIS	Surveillance
PELCO	Surveillance
COHU	Surveillance
WTI	Surveillance

VIDEO MANAGEMENT SYSTEM

Video management systems (VMS) are a central part of video management and is used to monitor, analyze, and record video from CCTV camera equipment. Most vendors provide embedded software to support video management of their own products, however, depending on the number of cameras, it may be more ideal for an agency to deploy a VMS to be able to operate CCTVs from multiple vendors while also supporting cross compatibility with partner agency VMS. The main functions of a VMS include:

- Collects video from cameras and other sources
- Records / stores that video to a storage device
- Provides an interface to both view the live video, and access recorded video

There are many commercial off the shelf (COTS) VMS options available in the market as listed in Table 9.

TABLE 9. VMS VENDORS AND APPLICATIONS

VENDOR/APPLICATION NAME
VIDEOINSIGHT
AVIGILON CONTROL CENTER (ACC) VMS
BOSCH VMS
ONSSI OCULARIS ES VMS
EXAQVISION VMS
GENETEC OMNICAST VMS
LENSEC PERSPECTIVE VMS
CAMELEON (FLIR)
MILESTONE ENTERPRISE EDITION VMS
SIQURA DIVA
TELESTE VMS
DELCAN INTELLIGENT NETWORKS VMS MODULE

VIDEO ANALYTICS SOFTWARE

The current state of the safety identification and reporting practice is reactive, relying heavily on historical records of crashes reported to law enforcement. This information often lacks timeliness, completeness, and accuracy. The duration between the incident and its official record in the database can take multiple years, and the published crash reports often have missing or inaccurate data elements. Emerging technologies like video analytics provide the tools required to address safety risks proactively, leveraging the ability to quantify near-misses and causal behavior to support problem identification and treatment selection, and near real-time evaluation after implementation by comparing before-and-after road user behavior and near-misses.

Video analytics vendors provide data in a dashboard format that still requires further analysis and interpretation to draw appropriate conclusions and make sound engineering recommendations. This allows identification of potential safety treatments at locations, developing a repeatable process to analyze and develop a performance measurement program to track intersection health over time. The Central Lane County Regional ITS Plan identifies video analytics for safety as an element of multiple arterial transportation management corridor projects.

Most of the latest surveillance CCTV cameras have a video analytics function either built into the camera software (i.e., Bosch, Pelco and Axis) or integrated with a third-party Video Analytics Software (VAS). VAS monitors digitally encoded video streams of traffic cameras, using its algorithms for operator desired functions such as detecting incidents, near miss collision, and continuous collection of real-time traffic data. Most VAS provide on-premise and external cloud-based platforms such as Google Cloud Platform (GCP) or Amazon Web Services (AWS). There are several COTS VAS options available in the market with a few of those listed in Table 10.

TABLE 10. VAS VENDORS AND APPLICATIONS

VENDOR/APPLICATION NAME
TRAFFICVISION
CITILOG
SENSTAR
BRIEFCAM

RECOMMENDED CAMERA INSTALLATION LOCATIONS

Per stakeholders meeting, Lane County is facing challenges in responding to public complaints related to traffic signal malfunctions. It is desirable that the County can view and verify traffic signal issues via CCTV before field crews are dispatched. This is especially critical when travel times to reach the remote traffic signals can exceed one hour round trip.

CCTV cameras are also useful for observing traffic signal operation from a safety and congestion point of view. For safety improvements, it may be useful to observe driver behavior in higher crash locations or could add video analytics, as mentioned previously, to capture near miss instances. Locations with higher crash frequency should be considered first. See Table 11 for the top ten County signalized intersections having high crash history over a five-year period (2015-2019).

On more congested intersections, signal timing adjustments may be implemented remotely using cameras to observe the changes. Using total approach volumes at a signalized intersection we can estimate relative congestion levels. See Table 11 for the total daily approach volumes.

TABLE 11. TOP TEN SIGNALIZED INTERSECTION CRASH LOCATIONS

LOCATION	CRASH FREQUENCY	APPROACH VOLUME
PRAIRIE ROAD AT IRVING ROAD	13	15,675
NW EXPRESSWAY AT IRVING ROAD	12	18,250
RIVER ROAD AT IRVINGTON DRIVE	8	22,050
EAST 30TH AVENUE AT ELDON SCHAFER DRIVE	6	15,825
CENTENNIAL BOULEVARD AT ASPEN STREET	7	9,400
GREEN HILL ROAD AT CLEAR LAKE ROAD	6	10,200
NW EXPRESSWAY AT IRVINGTON DRIVE	5	13,175
MARCOLA ROAD AT CAMP CREEK ROAD	5	11,600
COBURG ROAD AT COUNTRY FARM ROAD	5	9,200
HAYDEN BRIDGE ROAD AT HARVEST LANE	5	5,975

Based on maintenance, safety, and congestion levels it is recommended that CCTV cameras be installed at the locations shown in Table 12.

At locations that are further away from the Lane County Public Works Facility it is recommended that uninterruptible power supply battery backup systems (BBS) be installed to minimize system outage. Refer to Traffic Signal System Recommendations Memo for BBS discussion.

TABLE 12. RECOMMENDED CCTV LOCATIONS

LOCATION	EQUIPMENT			
	CONTROLLER	DETECTION	PREEMPTION	COMMUNICATIONS
GREEN HILL ROAD & CLEAR LAKE ROAD	ATC	Loops	no	none
MARCOLA ROAD & CAMP CREEK ROAD	ATC	Loops	yes	none
E 30TH AVENUE & ELDON SCHAFER DRIVE	ATC	Loops	no	none
PRAIRIE ROAD & IRVING ROAD	ATC	Video (Traficon)	yes	Possible aerial copper, not connected
NW EXPRESSWAY & IRVING ROAD	170E	Wavetronix loops on EB	yes	Possible aerial copper, not connected
NW EXPRESSWAY & IRVINGTON DRIVE	170E	Wavetronix loops on EB	yes	Possible copper connection
COBURG ROAD & COUNTRY FARM ROAD	ATC	Loops	yes	none

RECOMMENDED CCTV CAMERA SYSTEM SPECIFICATIONS

CCTV SPECIFICATIONS

Based on the stakeholders needs, DKS recommends the County deploy surveillance cameras with built-in video analytics functions. The selected CCTV model must meet the following specifications.

- **ONVIF compliant:** The proposed camera must utilize the Open Network Video Interface Forum (ONVIF) Profile S protocol to integrate video camera system communication drivers for flexibility and system interoperability.
- **IP-based:** The proposed camera must be an Internet Protocol camera, or IP camera, and must support Ethernet communication.
- **PoE:** The proposed camera must support Power over Ethernet (PoE). Camera must include Category 6 Ethernet (Cat6) PoE cable and PoE injector if deemed necessary.
- **IP67:** The proposed camera must meet Ingress Protection (IP) 67 rating and deemed fit enough to withstand dust, dirt, and sand.
- **High Definition:** The camera must provide Multiple stream options: 1080p and 4K and have the functionality of H.264 video compression technology.
- **PTZ:** The proposed camera must have Pan, Tilt, Zoom Functionality with minimum 30X Optical and 21X Digital Zoom.
- **Browser Streaming:** Proposed camera must be IP addressable supporting streaming over a web browser.
- **Video Management System:** The proposed camera must support ONVIF protocol allowing compatibility and integration with COTS VMS.
- **Video Analytics Capability:** The proposed camera must have built-in software to perform the following analytics without additional software:
  - » Vehicle detection
  - » Vehicle count data
  - » Vehicle classification data
  - » Incident detection
  - » Near-miss collision detection
  - » Motion detection
  - » Security detection
  - » Multiple user-configurable alarms
  - » Intelligent Tracking

INSTALLATION SPECIFICATIONS

- **Camera Mounting:** Cameras are recommended to be installed on the existing signal pole (Figure 4). The mounting height and angle must be decided based on coverage and vendor recommendations.
- **Camera Cable Routing:** CAT6 cable is utilized to connect the CCTV camera to a Layer 2 Ethernet switch in the existing traffic cabinet. It is recommended that the CCTV camera is mounted on the signal pole next to the traffic signal cabinet to reduce the cabling distance. The maximum cabling distance from the CCTV to the Ethernet switch is 328 feet) without introducing additional devices such as a PoE extender. The cable should be installed in existing conduit assuming available conduit capacity (minimum 35 percent).
- **Cable termination:** CCTV cabling will be terminated at the traffic signal cabinet.

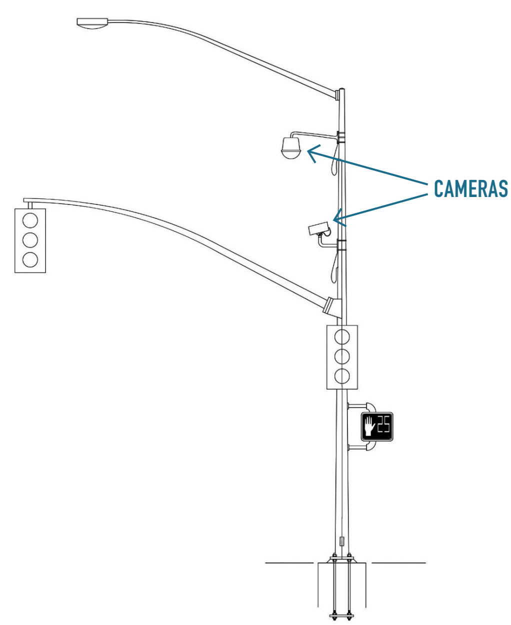


FIGURE 4. TYPICAL CCTV MOUNTING ON A SIGNAL POLE

NETWORK SPECIFICATIONS

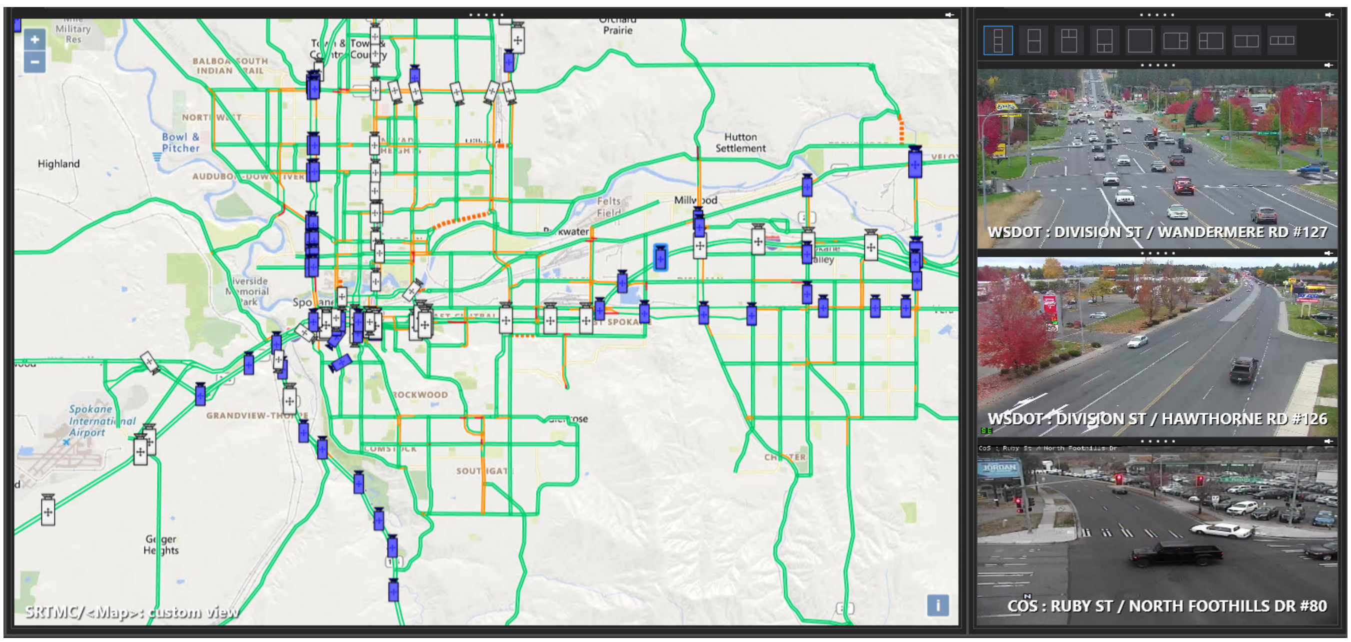
- **ONVIF compliant:** The proposed camera must utilize the Open Network Video Interface Forum (ONVIF) Profile S protocol to integrate video camera system communication drivers for flexibility and system interoperability.
- **Fiber Communications:** Fiber optic communications is preferred for PTZ cameras, however, wireless can be a low-cost alternative where fiber is not available.
- **Ethernet Switch:** Cabinet Ethernet switches should support 1 Gigabit per second (Gbps) upload/download speeds.
- **Bandwidth Considerations:** For bandwidth calculations, CCTV cameras typically demand 5 Megabit per second (Mbps) for real-time video streaming. Table 6 indicates different bandwidth requirements depending on streaming scenarios (i.e., reducing frame rate and resolution). Note that the bandwidth requirements can differ between CCTV manufacturers and models. The numbers provided in Table 13 are for estimating purpose only.

TABLE 13. BANDWIDTH REQUIREMENTS PER STREAMING SCENARIOS

RESOLUTION	FRAME RATE	BANDWIDTH BUDGET
1080P(2MP)	5	850kbit/s
1080P(2MP)	10	1.3Mbit/s
1080P(2MP)	20	1.8Mbit/s
1080P(2MP)	30	2.2Mbit/s
1080P(2MP)	60	3.4Mbit/s
720P(1MP)	5	400kbit/s
720P(1MP)	10	630kbit /s
720P(1MP)	20	880kbit /s
720P(1MP)	30	1.1Mbit/s
720P(1MP)	60	1.55Mbit/s

VIDEO MANAGEMENT SYSTEM NEEDS

- VMS allows both desktop application (client/server) and web client access.
- VMS allows open Application Programming Interface (API) for 3rd party integration.
- VMS allows administrative centralized access and configuration management but can be configured from client with Admin access.
- VMS is designed for multi-camera vendor and not specific to a vendor product line.
- VMS allows a video wall module for display/control of video wall video content with remote client access to wall server and wall software.
- VMS can handle multiple multicast video streams.
- VMS should include camera presets and scrolling.
- VMS allows video recordings and retrieving.
- VMS allows automated video sharing (i.e., video clips, live video, or shots for websites).



RECOMMENDED VIDEO MANAGEMENT SYSTEM APPROACH

The only current VMS deployed within Lane County is ODOT's Cameleon system. ODOT utilizes the Cameleon (FLIR) system to connect to all ODOT CCTV cameras statewide, however, the Cameleon system is isolated to ODOT's network. Deployment of a shared VMS as part of a future regional project would help promote the video exchange between agencies and emergency service providers. As the County's CCTV camera system grows, procurement of a VMS would be considered as a mid- to long-term project.

A VMS that is COTS is recommended following industry standards reducing the risk of regional incompatibility. The following factors should be considered when selecting a VMS.

- Price, including capital and on-going costs
- VMS Vendor Product Tiers
- Simplicity of Use
- 3rd Party Camera Support and Integration
- Enterprise Management
- Redundancy

RECOMMENDED IMPLEMENTATION CONSIDERATIONS

The following policies are recommended for Lane County CCTV deployment:

- Deploy a CCTV system with video analytics ability that can be utilized for both traffic data collection and crash analysis.
- Deploy a CCTV system that allows video streaming, video recording and retrieving.
- Integrate County video feeds with ODOT's TripCheck website.
- Discuss video sharing needs with other regional agencies for traffic monitoring and incident management.
- Establish policy pertaining to data extracted from Video Analytics Software.
- If a uniform VMS is considered, the procurement and deployment of the VMS should be a joint effort among all regional agencies.

SUPPLEMENTAL ITS TECHNOLOGY

INTRODUCTION

The purpose of this memo is to provide recommendations on supplemental Intelligent Transportation System (ITS) technologies. Recommendations are based on alignment with County needs. The base ITS communications network will be flexible and open to support these technologies in the future.

EXISTING INFORMATION

Lane County, the Oregon Department of Transportation, Lane Transit District, City of Eugene, and the City of Springfield have already deployed some level of ITS technologies. These can be grouped into the following general categories.

TRANSIT MANAGEMENT

- Electronic fare collection
- Real-time passenger information
- Automatic passenger counting
- Computer-aided dispatch

FREEWAY MANAGEMENT

- Variable message signs
- Queue warning systems
- Ramp meters
- Travel time sensors
- Road Weather Information Systems
- CCTV

ARTERIAL MANAGEMENT

- ATC controllers
- Video detection
- Radar detection
- Emergency vehicle preemption
- Dynamic flashers – Speed feedback, school zone flashers, pedestrian hybrid beacons (PHB), and rectangular rapid flashing beacons (RRFBs)
- CCTV

SUPPLEMENTAL ITS TECHNOLOGY NEEDS

Supplemental ITS technology are additional equipment or applications that can be layered on to the ITS communications network to address a specific need. When evaluating ITS technology, the County should consider standards-based solutions that are user friendly, provide measurable benefits, and have low operations and maintenance cost.

Supplemental ITS technology can address the following needs of the County:

- Deploy traffic signal controller capable of collecting high-resolution data, producing Automated Traffic Signal Performance Measures (ATSPMs), and supporting adaptive signal control.
- Support transit signal priority at County intersections, where appropriate.
- Leverage work zone ITS technology such as portable traffic signals.

SUPPLEMENTAL ITS TECHNOLOGY RECOMMENDATIONS

Supplemental ITS technologies have been organized into the following categories:

1. **Traffic Signal System**
2. **Advanced Safety Systems**
3. **Automated Enforcement**
4. **Road & Weather Information Systems**
5. **Smart Work Zone Technology**

1 TRAFFIC SIGNAL SYSTEM

Advanced traffic signal controller operation includes performance reporting, adaptive signal control, and multimodal detection.

AUTOMATED TRAFFIC SIGNAL PERFORMANCE MEASURES – HIGH PRIORITY

Automated Traffic Signal Performance Measures (ATSPMs) leverage the high-resolution data recorded by an Advanced Transportation Controller (ATC). In addition to an ATC and network connection, a central ATSPM platform is required. ATSPM platforms are typically cloud-based and require a one-way communications path from the ATC through the agency firewall. ATSPM platforms rely on detector actuations to measure arrivals on green/red, approach delay, phase split failures, etc. For the full suite of ATSPMs, stop bar and advanced detection (~350ft) is required. ATSPMs allow operators to measure signal timing performance and make adjustments as needed.

ATSPM Recommendations

- The County should release a Request for Information to learn more about ATSPM platforms that are compatible with the County's ATC controller.
- The County should procure an ATSPM platform considering IT networking requirements, vehicle detection needs, and on-going annual service costs.

ACCESSIBLE PEDESTRIAN SYSTEMS PUSHBUTTONS – HIGH PRIORITY

Accessible Pedestrian Systems (APS) pushbuttons are an audible device that provides status of WALK and DON'T WALK intervals to pedestrians who are blind or have low vision. APS upgrades have been a mandatory federal requirement for intersection upgrade projects. APS pushbuttons can replace existing pushbuttons but require additional cables back to the traffic signal cabinet. Installation of APS has proven to improve safety for vulnerable users, reduce pedestrian delay, and increase the number of crossings before the phase change. APS pushbuttons can directly terminate to cabinet inputs or to a central control unit allowing synchronous data link control (SDLC) communications to the signal controller.

APS Pushbutton Recommendations

- As part of signalized intersection upgrade projects, the County should upgrade to 2-wire APS pushbuttons leveraging existing pushbutton cables.
- The County should consider the need to install a central control unit for remote monitoring purposes.

LEADING PEDESTRIAN INTERVAL – HIGH PRIORITY

Leading Pedestrian Interval (LPI) is a signal timing strategy that typically gives pedestrians a three- to seven-second head start into the crosswalk before the parallel vehicle phase turns green. The strategy reduces right turning vehicle conflicts with pedestrians as the pedestrian are move visible.

LPI Recommendations

- When re-timing traffic signal controllers, the County should consider LPIs into the signal timing plan, where warranted.

ADAPTIVE SIGNAL CONTROL – LOW PRIORITY

Adaptive Signal Control (ASC) measures vehicle arrivals in real-time and adjusts phase and cycle times to accommodate demand. ASC is an alternative to Time-of-Day plans and may improve intersection and corridor operations depending on the operating objectives and field conditions. ASC also works well when traffic volumes fluctuate such as during an unplanned event. ASC requires reliable communications and detection. Detection upgrades implemented for ATSPMs, such as advanced detection, are required for ASC.

ASC Recommendations

- The County should continue to deploy ATC controllers capable of ASC.
- The County should implement advanced and stop bar detection to support future ASC.

TRANSIT SIGNAL PRIORITY – LOW PRIORITY

Transit Signal Priority (TSP) includes vehicle-to-infrastructure communications between the transit vehicle and the traffic signal controller. Traditional TSP equipment include an infrared (IR) emitter or GPS radio on the transit vehicle, an IR receiver (all approach directions) or single GPS radio mounted to the signal pole, and the phase selector card in the traffic signal cabinet. The phase selector card relays a TSP request message to the controller implementing a TSP timing strategy such as an early green or green extension. TSP is typically installed along Bus Rapid Transit corridors.

TSP Pushbutton Recommendations

- The County should identify future Lane Transit District (LTD) BRT routes (e.g. River Rd) that may require TSP.
- The County should confirm TSP equipment used by LTD BRT corridors.
- The County should upgrade to phase selector cards that support IR emitters and GPS radios.

EMERGENCY VEHICLE PREEMPTION – LOW PRIORITY

Emergency Vehicle Preemption (EVP) leverages the IR receiver or GPS radio and phase selector card at the signalized intersection. Through the vehicle emitter code, the phase selector card can distinguish between an emergency vehicle and a transit vehicle. The phase selector card relays a preemption request message to the controller giving the emergency vehicle a green light at the signalized intersection. IR technology is currently deployed at most County intersections; however, the technology suffers from sight line and lens cleanliness issues. GPS, on the other hand, can actively detect the location and speed of the approaching vehicle improving accuracy. Migration to a GPS-based system will require upgrades of emergency vehicle equipment.

EVP Recommendations

- The County should discuss emergency services desire to migrate from IR-based detection to GPS-based detection. This will require emergency vehicles to be equipped with GPS radios.
- The County should upgrade traffic signals to support EVP based on emergency services selected system. If IR is maintained, all intersection approaches should have an IR receiver. If GPS is selected, all intersections should have a single GPS radio.
- The County should upgrade phase selector cards to support both IR and GPS.

2 ADVANCED SAFETY SYSTEMS

Advanced safety systems include devices that warn or notify of an unanticipated situation such as a rail closure or mid-block crossing.

RECTANGULAR RAPID FLASHING BEACONS – HIGH PRIORITY

Rectangular Rapid Flashing Beacons (RRFBs) is a pedestrian actuated treatment option commonly deployed at school, trail, and mid-block crossings to improve safety at uncontrolled, marked crosswalks. The device includes two rectangular flashing beacons attached to a pedestrian crossing sign pole that flash when activated. The number of poles varies between two and four poles depending on the number of lanes. The devices can be powered via hardwired service drop or solar panel.

RRFB Recommendations

- The County should continue to deploy RRFBs at mid-block crossings where heavy pedestrian traffic is expected (e.g., near schools).

BLANK OUT SIGNS – LOW PRIORITY

Blank out signs mounted to a mast arm or dedicated pole can alert drivers of an upcoming travel restrictions or modifications. Blank out signs can be used near at-grade rail crossings, areas of high pedestrian traffic, and intersection approaches with dynamic lane control. Signs are connected to controller cabinet outputs and are illuminated when a configured condition is met.

Blank Out Sign Recommendations

- The County should look at strategic placement locations for rail closure blank out signs particularly at intersections near the Northwest Expressway.

3 AUTOMATED ENFORCEMENT

Automated enforcement solutions are standalone technologies that do not integrate into a public agency's communications network. These technologies are operated and maintained by a third-party.

RED LIGHT CAMERAS – LOW PRIORITY

Red light cameras are installed at intersection approaches on standalone poles and on signal mast arms. The equipment on the standalone pole faces towards the intersection allowing image capture of the traffic signal head and vehicle license plate. The equipment on the signal mast arm includes a sensor which detects when a vehicle proceeds through the intersection while the light is red. The equipment requires a dedicated service drop and relies on cellular communications for reporting infractions.

Red Light Camera Recommendations

- The County should explore enforcement requirements with City of Eugene and the Lane Council of Governments (LCOG).

SCHOOL ZONE SPEED CAMERAS – LOW PRIORITY

School zone speed cameras are installed at school zone limits on standalone poles. The equipment captures vehicle speeds using radar technology and vehicle license plate using an illuminator and camera. The equipment requires a dedicated service drop and relies on cellular communications for reporting infractions.

School Zone Speed Camera Recommendations

- The County should explore enforcement requirements with City of Eugene and the Lane Council of Governments (LCOG).

4 ROAD & WEATHER INFORMATION SYSTEMS

Road and weather information systems provide County maintenance crews and the traveling public real-time information on roadway weather conditions.

FLOOD WARNING SYSTEMS – LOW PRIORITY

Flood warning systems measure local rainfall, stream level, and streamflow data to proactively alert of potential flooding conditions. With this information, County crews can close a road subject to flooding and divert traffic to an alternate route. Information can be shared publicly through an agency website, third-party route planning applications (e.g. Google), etc.

Flood Warning System Recommendations

- The County should consider a flood warning system if there are locations with routine flooding impacting the County roadway network.

FLEET VEHICLE TRACKING – LOW PRIORITY

Fleet vehicle tracking allows public works maintenance superintendents to quickly locate agency vehicles and efficiently assign resources as needed. Vehicle location information can also be shared with the public such as with agency snowplows. This allows the public to understand which roadways have been cleared and are safe to travel. Snowplow location information can be displayed on an agency website via a map interface.

Fleet Vehicle Tracking Recommendations

- The County should explore fleet vehicle tracking technologies specifically focused on snowplows.

ROADWAY CONDITION SYSTEMS – LOW PRIORITY

Roadway condition systems provide real-time roadway condition data such as temperature and pavement saturation using an environmental sensor. These systems can be installed permanently at spot sample locations typically near agency-owned communications infrastructure or installed on fleet vehicles for mobile detection. Information can be shared with the public when dangerous conditions exist.

Roadway Condition System Recommendations

- The County should determine where hazardous weather conditions have frequently impacted roadway safety (e.g. collision history).

5 SMART WORK ZONE TECHNOLOGY

Smart work zone technology is real-time, portable, and automated application of ITS and traffic signal control to temporary construction work zones.

PORTABLE TRAFFIC SIGNAL – LOW PRIORITY

Portable traffic signals improve safety within a work zone by giving motorists an advance notice to slow down before approaching the work zone. Dual-head, LED signals are mounted to a trailer which is lightweight and compact for easy positioning. Portable traffic signals reduce the need for traffic control personnel reducing pedestrian to vehicle conflicts. When two portable traffic signals are deployed, radio communications between signals allows for timing coordination.

Portable Traffic Signal Recommendations

- The County should procure two portable traffic signals with trailers for County maintenance crews.
- The County should develop traffic control specifications for use of portable traffic signals.

PORTABLE DMS AND CCTV CAMERA – LOW PRIORITY

Portable Dynamic Message Sign (DMS) and CCTV camera are mobile ITS devices that support traveler information and real-time monitoring. DMS are mounted to a trailer with dedicated camera pole. Equipment is typically powered by a battery source stored on the trailer. Cellular communications allow operators to monitor the current conditions using video feed snapshots.

Portable DMS and CCTV Camera Recommendations

- The County should develop traffic control specifications for a portable DMS and CCTV camera trailer.

EMERGING TECHNOLOGIES

INTRODUCTION

The purpose of this chapter is to describe connected and automated vehicles (CAVs), identify some relevant opportunities and applications, propose what Lane County can do to get ready, and provide potential policies and the implications. Finally, it recommends Lane County adopt a "wait and see" policy approach with respect to CAV planning and technology adoption.

THIS CHAPTER INCLUDES:

CAV BACKGROUND

Connected vehicles (CVs) and automated vehicles (AVs) are distinct concepts, though there are benefits of combining.

CONNECTED VEHICLE BASICS

Connected vehicles can send data to and/or receive data from their environments while in operation. Connected vehicles will be able to communicate with other moving vehicles and with the roadside infrastructure, improving the situational awareness for both automated and human-driven vehicles. Using communication technology, vehicles will have advanced notification of incidents and/or events happening around them that the cameras and sensors on the vehicle otherwise would not "see."

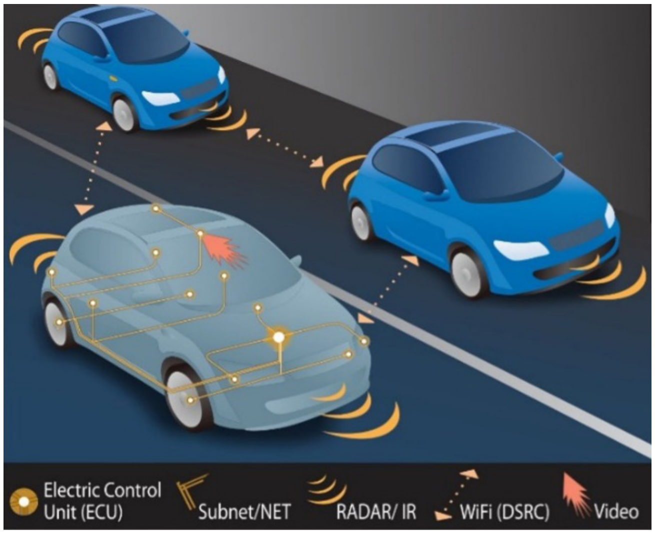


FIGURE 5. VEHICLE-TO-VEHICLE (V2V) COMMUNICATIONS

The following list presents a sample of the notifications that a connected vehicle could receive:

- Slowing or stopped vehicles ahead
- An approaching emergency vehicle
- Hazardous weather conditions or icing on the roadway
- Traveler information including road conditions ahead

The CV technologies involved are maturing, and their eventual use will require public agencies to provide supporting institutional and physical infrastructure.

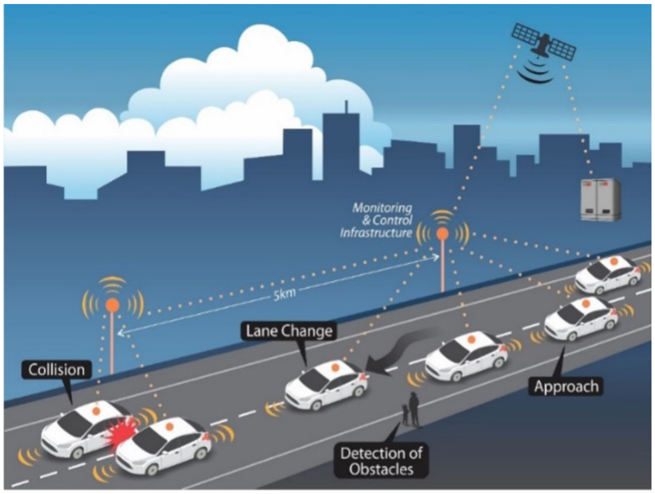


FIGURE 6. VEHICLE-TO-INFRASTRUCTURE (V2I)

AUTOMATED VEHICLE BASICS

Automated vehicles have varying levels of automation ranging from adaptive cruise control, lane-assist technology up to full automation with no pedals or steering wheel. The Society of Automotive Engineers (SAE) has identified six levels of automation to describe the range of human involvement in the vehicle operation from full control (no automation) to full automation.

AVs have the potential to impact our transportation system in dramatic ways. They have the potential to eliminate nearly 90 percent of transportation fatalities and, if they are shared, could result in reshaping city streets by reducing the need for on-street parking.

Projections about when AVs will become common place vary like with any forecast, but once the technology is proven and reliable, the change to the majority of the fleet becoming automated will likely take between 10 and 20 years with nearly 95 percent of vehicles being fully automated around 2040.

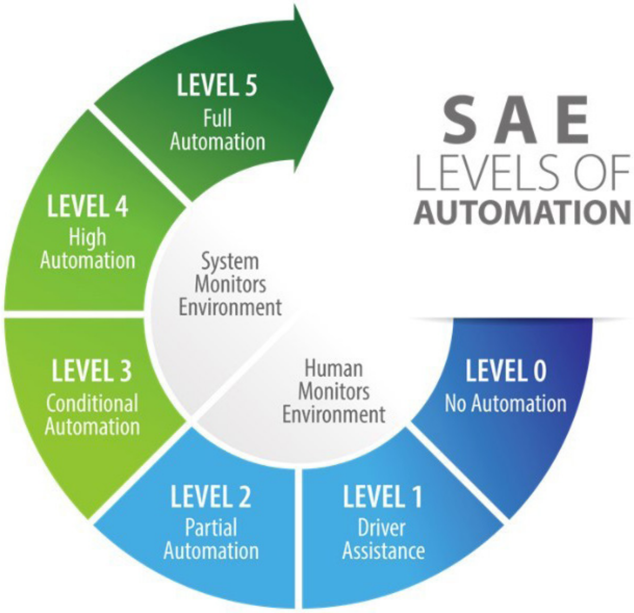


FIGURE 7. SOCIETY OF AUTOMOTIVE ENGINEERS SIX LEVELS OF AUTOMATION

RELEVANT CAV APPLICATIONS AND OPPORTUNITIES

This section presents relevant CAV opportunities to help Lane County policy makers, planners, and designers anticipate the breadth of implications CAV may have for the region.

CONNECTED VEHICLE APPLICATIONS

As part of its Connected Vehicle program, the USDOT has defined 56 distinct CV applications that enable vehicles to "talk" to other vehicles or the infrastructure. This allows vehicles to share hazardous roadway conditions with other vehicles for example. The USDOT list of applications can be the starting point for the County to begin to consider which are most relevant to the County's goals and objectives and to narrow the list accordingly. USDOT categorizes the applications into high-level functional groups and associated application "bundles" including : Data capture, Environment, Mobility, Road weather, and Safety.

A sample of CV applications that may be relevant to Lane County include:

- Transit and freight signal priority
- Intersection signal phase and timing information provided to drivers/vehicles
- Queue warnings provided to drivers/vehicles
- Red light violation warning provided to drivers/vehicles

Many CV applications that share roadway condition information using standard cellular networking are feasible today, while CV applications using specialty high-speed radios (C-V2X and DSRC) are designed specifically for low-latency, mission-critical automotive and safety applications. However, these applications currently have limited application today since the majority of vehicles are not equipped with CV radios.

AUTOMATED VEHICLE OPPORTUNITIES

As we move forward considering AV policies, testing and implementing AV technology, it is important to be mindful that there are many applications for automated vehicle technology. AVs vary widely in size, shape, and functionality and support a range of mobility and goods movement use cases. Everything from passenger vehicles to transit vehicles, to long and short-haul trucks, to garbage trucks, to agricultural and mining equipment may benefit from AV technologies. When setting policies, it is important to consider the full range of AV applications that may emerge.

For Lane County, early AV deployment could include:

- Low-speed automated shuttles on dedicated routes, such as the University of Oregon campus or public streets
- Specialized automated driver assist systems (ADAS), such as automated docking for LTD's EmX BRT vehicles to achieve more precise vehicle alignment at stations and in navigating facilities with minimal ROW
- Automated, small form-factor local delivery vehicles

PREPARING FOR CAV

This section presents select technology initiatives and planning activities Lane County may consider to support CAV adoption in the County and leverage other technology and communications investments already being made.

CONNECTED VEHICLES

Most CVs applications that involve County operations require information exchange between the connected vehicle and the Agency's roadside infrastructure. Intersections with traffic signals typically have the underlying systems and field devices needed to support communications to a vehicle, including communications, sensors, cameras, and a computer/controller. Even so, some improvements will be required to run a CV application and communicate directly to the vehicle.

There are three primary actions Lane County can take now to prepare for connected vehicles that also provide other immediate ITS and operations benefits. (Note that recommendations 1 and 2 are aligned with the recommendations detailed in the Signal System Recommendations Tech Memo and the Traffic Signal Communications Network Tech Memo.)

1. **Install a reliable, resilient communications infrastructure with sufficient bandwidth and capacity to support CV applications. This may be Agency-owned, leased line, or joint-venture. Characteristics of such a communications infrastructure are:**

    a) Improved throughput (e.g., via fiber optics)

    b) High reliability (via IP-based networking and redundancy)

    c) Expanded coverage (via field-to-center and center-to-center links)

    Installing communications infrastructure today enables new CV applications and supports many well-established systems such as signal priority, real-time data collection, adaptive signal control, automated signal performance measures, video sharing, video analytics, and traveler information.

2. **Install the advanced transportation controller (ATC), which provides an intelligent intersection computer the County can use to operate future CV applications.**

3. **Plan additional capacity in intersection conduits and on poles, for potential public-private partnerships and future County needs.**

AUTOMATED VEHICLES

Compared with CV, there is less that the County can do to prepare for AV. Given the broader regional impacts of AV, regional policies will likely guide Lane County actions and decisions. Such actions include policies to ensure safety of public streets, protections for vulnerable road users (VRUs), and mitigations of potential negative impacts, such as increased VMT and congestion.

Initial activities the County may consider include:

1. **Conduct outreach to engage with a larger stakeholder audience composed of private sector stakeholders including local business and technology companies.**

2. **Identify existing regulatory and/or legal hurdles to AV investment and testing.**

3. **Consider policies and positions the County may choose when the private sector begins to operate AVs, particularly because AVs may increase overall vehicle miles traveled (VMT) if they are individually owned or driving around with zero occupants.**

4. **Consider and plan for AV use cases that may be meaningful in Lane County.**

5. **Follow the developments, learn from other public agency policies, and shape the County's policies and direction based on peers' lessons learned.**

CAV POLICY CONSIDERATIONS

This section introduces relevant CAV-related policies for consideration. First, it identifies some key CAV-related measures and outcomes to monitor to help inform ongoing CAV policy. Then, it highlights and contrasts three different CAV policy positions the County may adopt—“wait and see”, “moderate welcoming”, and “leading edge”. Finally, it presents a recommendation to pursue a “wait and see” approach.

KEY MEASURES TO MONITOR

Regardless of the policy the County elects to pursue, it will remain important to closely monitor some of the key measures that an increasing penetration of CAV might have on County roadways. Based on how these measures change, the County may consider different policy levers to promote the positive or counter the negative.

- **VMT:** without policies encouraging shared use, AVs may make single-occupancy (and even zero-occupancy) trips more attractive, thus contributing to an increase of VMT, as well as congestion, pollution, collisions, and other negative externalities associated with increased VMT.
- **Curb use demand patterns:** As on-demand rides and delivery services increase, the value of and competition over curb space will increase. Monitoring where and when such uses are highest allows the County and other agencies to identify where pick-up/drop-off locations and loading zones make the most sense.
- **Interactions between vehicles and vulnerable road users (VRUs):** It is far from clear whether the onboard sensing suite of current AVs or those of the near-future are sufficiently capable of recognizing and avoiding pedestrians and other VRUs. It is therefore critical that the County be prepared to monitor crashes involving CAVs and even develop a capability to identify near-misses so problems are detected and alerted to before they result in crashes. Near-miss detection, for example through camera-based video analytics at the intersection, can provide safety benefits even without CAVs. They can help engineers identify operational issues with traffic signal operations or roadway design that may be contributing to dangerous situations to help prevent serious collisions from occurring in the first place.

Monitoring and measuring these changes can be accomplished using sensors, cameras, and/or third-party data. The County can also leverage communications infrastructure installed to traffic field devices to transport the field data to a central data monitoring system.

CAV POLICY OPTIONS

With respect to promoting and facilitating CAV adoption in the region, there are three distinct policy and leadership positions Lane County may consider— “wait and see”, “moderate welcoming”, and “leading edge”. The details of these positions and the potential benefits and drawbacks of each are described below.

POLICY #1: “WAIT AND SEE”

A “wait and see” policy is conservative about committing too early to a particular technology or solution. Recognition that there are many advances occurring in CAV with significant potential benefits in safety, mobility, and operational efficiency, but that the field is still too new to develop practices around—standards still evolving, core technologies still being evaluated, and how much of the purported benefits can actually be realized in a real-world setting is still being debated.

Leadership Position: Adopting a “wait and see” position means that the County believes that other agencies, regions, etc. are better suited to advance the development, testing, and validation of these solutions. The implication is that County will have less of an opportunity to influence how the applications and technology advance, regarding practices, standards, use cases addressed, partnerships, and location of investments.

CAV Investment Priorities: A “wait and see” policy promotes targeting CAV investments that satisfy two criteria: (1) are likely needed for future CAV applications and (2) also support immediate needs that have a well-understood benefit and value.

All three recommendations from the previous section—upgraded communications infrastructure, adoption of modern ATC controllers, and allocation of additional capacity on poles and in conduit—satisfy both criteria. These priorities provide the County the fundamental capabilities and capacity to introduce new functionality as CAV applications become established. And these investments can all be activated on Day 1, supporting any number of established use cases.

BENEFITS

- Lowest risk of committing resources and making investments in solutions that may become obsolete or do not provide benefit
- The policy may be more in line with County’s general philosophical approach; easier anticipated adoption and implementation

DRAWBACKS

- Minimal ability to affect how technology evolves and what use cases are prioritized (i.e., once tech and applications are established, may not be well suited to County’s needs)
- Potential missed opportunity to leverage local technology/corporate partners

POLICY #2: "MODERATE WELCOMING"

A "moderate welcoming" policy maintains most of the conservatism of the "wait and see" policy, but seeks some limited, strategic opportunities to participate in and potentially influence the development of CAV technology and applications. The County acknowledges the benefits of CAV and believes they may have applicability within the County. The County has identified a use case where CAV makes sense and is willing to expend budget, resources, and political capital to implement a limited test.

Leadership Position: Policy acknowledges that other regions and agencies will be at the leadership forefront (think San Francisco, Phoenix, Pittsburgh for AV testing and the various CV testbeds—New York City, Tampa, Wyoming, Columbus) but the County can be opportunistic in the few areas it wants to develop and help influence how the technology and applications evolve. Leverage proximity to and relationship with the University of Oregon and local technology companies.

CAV Investment Priorities: "Moderate welcoming" policy pursues the investments identified in "wait and see" but introduces more formal standards and requirements to integrate into future projects on a County-wide basis. Example strategies could include:

- Collaborate with other counties, cities, and agencies—Eugene, Portland, ODOT, and others—to develop a sub-area approach to CAV.
- Seek out a pilot/demonstration project and/or partnership arrangement with another agency or corporate partner. Examples:
  - » AV shuttle pilot with a local technology partner such as Google on the University campus
  - » ADAS components on LTD's EmX BRT vehicles
  - » CV demonstration—Signal Phase and Timing (SPaT), Transit Signal Priority (TSP), Freight Signal Priority (FSP), transit safety partnership w/ LTD
  - » Make signal state information available publicly via an application programming interface (API) to enable app developers, original equipment manufacturers (OEMs) to integrate into real-time navigation/traveler information applications.

BENEFITS

- Good overall risk balance—conservative long-term technology planning, limited scale/ exposure in a higher-risk pilot
- May raise the profile of County in CAV/ technology world; a potential attractor for innovative technology companies (economic development opportunities)

DRAWBACKS

- May represent a shift in County's approach with respect to investing in innovative technology, public-private partnerships; institutional/political pushback possible

POLICY #3: “LEADING EDGE”

An “all in” approach, with the County implementing one or more CAV concepts on a large scale. This policy represents the most significant shift and a bet that CAV is operationally ready. The County must be confident that both the technology is mature enough and that there is a concrete use case that would provide real safety, mobility, or efficiency benefits. Resulting from this policy would be a significant dedication of budget, resources, and political capital. It may also result in new organizational and business models, with a closer partnership with third-party service providers or other private entities.

Leadership Position: Significant shift to establish a national leadership role in CAV.

CAV Investment Priorities: Significant investments in updating field equipment, potentially County-wide. Examples include:

- Upgrade intersections to be C-V2X V2I-capable and equip fleet vehicles (transit, freight, personal vehicles, etc.) with onboard CV equipment
- Automated bus/shuttle connector providing frequent service between key nodes (downtown transit center, park & ride, BRT lines)
- Establish dedicated lanes for CAV
- Collaborate with cities, ODOT, others to develop a sub-area approach to CAV.

BENEFITS

- Riskier approach and the benefits are not well known, but if successful, could position the County as a leader in new and smart mobility applications and ultimately a potential attractor for innovative technology companies (economic development opportunities)

DRAWBACKS

- Greater chance for failures on specific projects because the technologies are emerging

RECOMMENDATION: ADOPT A “WAIT AND SEE” POLICY

It is recommended that Lane County adopt a “wait and see” policy approach with respect to CAV on County facilities given the limited existing ITS infrastructure and location on the outer edges of the region’s corridors. The County’s CAV technology investments should be value-focused, targeted to those areas that both address other immediate needs and support future CAV application development. Upgraded communications infrastructure, adoption of modern ATC controllers, and allocation of additional capacity in the field all align with this approach.

This recommendation is in line with regional policies on emerging technology, in particular the MPO’s 2022 Regional Transportation Plan (RTP). The RTP notes that while it is still too early to know how automation will impact the transportation sector, it recommends supporting equipment and technology investments that promote equitable and safe urban mobility solutions. The activities identified in this tech memo align with the RTP guidance. The County should continue to monitor regional plans to ensure continued alignment with regional policy.

COMMUNICATIONS ARCHITECTURE

INTRODUCTION

The purpose of this chapter is to provide a phased build-out recommendation for Lane County's communications to support centralized monitoring and reporting of Lane County's traffic signals. The chapter includes County Communications Architecture Maps to help visualize recommendations.

THIS CHAPTER INCLUDES:

1. RECOMMENDATION PROCESS
2. PHASE 1: SHORT-TERM RECOMMENDATIONS
3. PHASE 2: NEAR-TERM RECOMMENDATIONS
4. PHASE 3: LONG-TERM RECOMMENDATIONS

RECOMMENDATION PROCESS

The communications recommendations process considered signal groupings based on geographical locations, existing and new hardwired and wireless communications media, and the estimated cost associated with each group based on media type. The recommendations assume that each traffic signal cabinet provides the point of access to the traffic signal controller and other ITS devices at the intersection.

TRAFFIC SIGNAL GROUPS

Traffic signal groups were created based on proximity to one another (under one mile). Signal groups allow for a phased build-out approach. Large signal groups can also reduce fiber lease cost by identifying a single aggregation point for backhaul. Eight signal groups have been identified ranging from one to six signalized intersections.

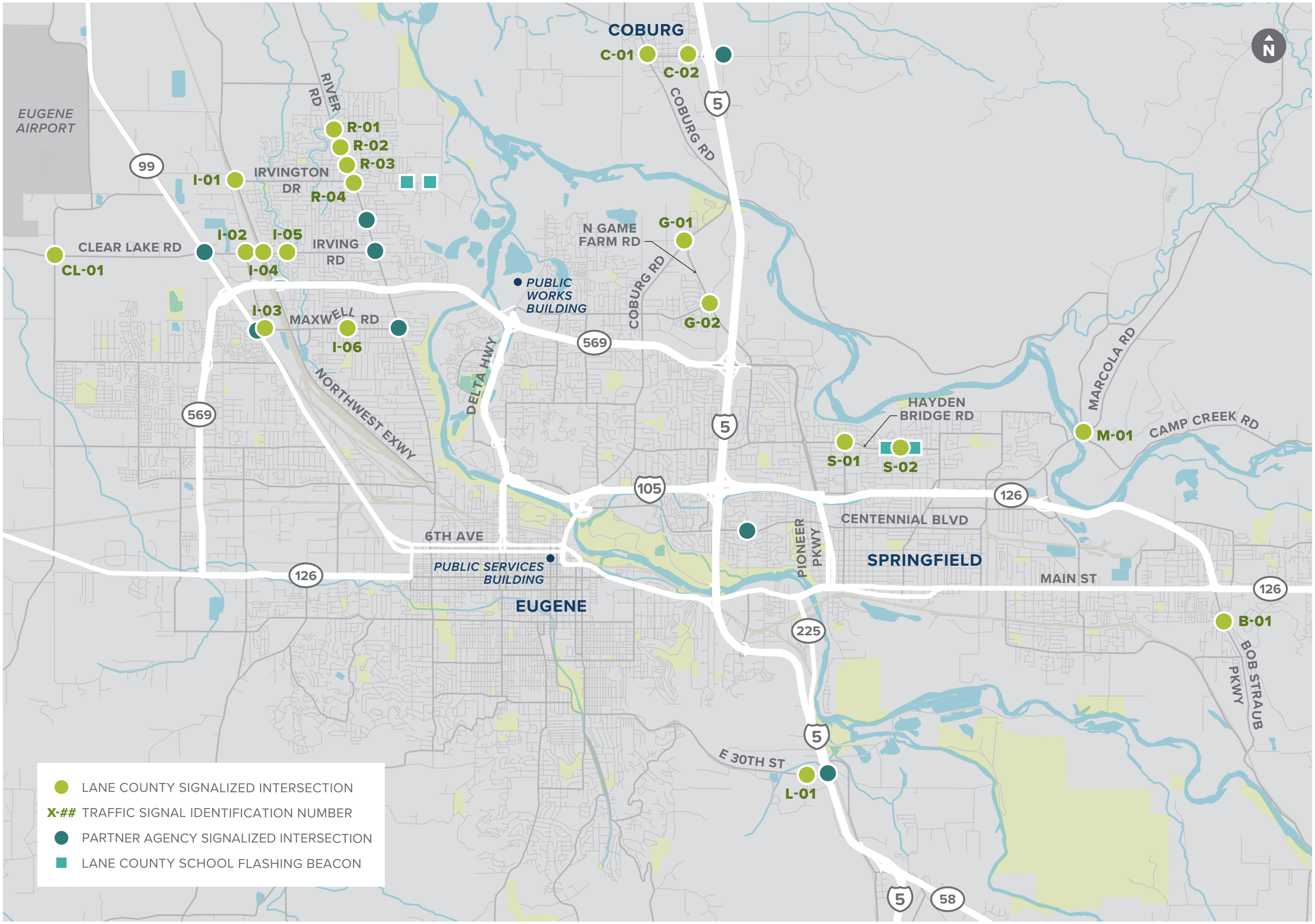


FIGURE 8. TRAFFIC SIGNAL GROUPS

IRVING ROAD SIGNAL GROUP

The Irving Road Signal Group is comprised of six signalized intersections. This group was identified due to the existing copper interconnect running between intersections. The group is near existing Eugene Water & Electric Board (EWEB) fiber optic communications.

Irving Road Signal Group	
I-01	NW Expressway & Irvington Drive
I-02	Irving Road & Prairie Road
I-03	Prairie Road & Maxwell Road
I-04	NW Expressway & Irving Road
I-05	Irving Road & Kalmia Street
I-06	Maxwell Road & Grove Street

RIVER ROAD SIGNAL GROUP

The River Road Signal Group is comprised of four signalized intersections. This group was identified due to the existing copper interconnect running between intersections. The group is near existing City of Eugene copper interconnect. The group also includes two school zone flashing beacon systems.

River Road Signal Group	
R-01	River Road & Spring Creek Drive
R-02	River Road & Lynnbrook Drive/ Oroyan Street
R-03	River Road & River Lp#2
R-04	River Road & Wilkes Drive/Irvington Drive

GAME FARM ROAD SIGNAL GROUP

The Game Farm Road Signal Group is comprised of two signalized intersections. This group was identified due to the proximity amongst one another. The group is near existing EWEB and Springfield Utility Board (SUB) fiber optic communications.

Game Farm Road Signal Group	
G-01	Coburg Road & North Game Farm Road/ Country Farm Road
G-02	North Game Farm Road & Armitage Road/Crescent Avenue

SPRINGFIELD SIGNAL GROUP

The Springfield Signal Group is comprised of two signalized intersections. This group was identified due to the proximity amongst one another. The group is near existing SUB fiber optic communications. The group also includes two school zone flashing beacon systems.

Springfield Signal Group	
S-01	Hayden Bridge Road & 5th Street
S-02	Hayden Bridge Road & Harvest Lane

BOB STRAUB PARKWAY SIGNAL GROUP

The Bob Straub Parkway Signal Group is comprised of one signalized intersection. This is an isolated intersection. The group is near existing SUB fiber optic communications.

Bob Straub Parkway Signal Group	
B-01	Bob Straub Parkway & 57th Avenue

Marcola Road Signal Group

The Marcola Road Signal Group is comprised of one signalized intersection. This is an isolated intersection. The group is near existing PAN fiber optic communications.

Marcola Road Signal Group	
M-01	Marcola Road & Old Mohawk Road/ Camp Creek Road

LANE COMMUNITY COLLEGE SIGNAL GROUP

The Lane Community College Signal Group is comprised of one signalized intersection. This is an isolated intersection. The group is near existing SUB fiber optic communications.

Lane Community College Signal Group	
L-01	30th Avenue & Eldon Schafer Drive

COBURG SIGNAL GROUP

The Coburg Signal Group is comprised of two signalized intersections. This group was identified due to the proximity amongst one another. The group is near existing the Lane Council of Governments Public Agency Network (PAN) fiber optic communications.

Coburg Signal Group	
C-01	Willamette Street & Pearl Street
C-02	Pearl Street & Coburg Industrial Way

CLEAR LAKE ROAD SIGNAL GROUP

The Clear Lake Road Signal Group is comprised of one signalized intersection. This is an isolated intersection located approximately 1.8 miles from the Irving Signal Group. Nearest existing fiber optic communications is approximately 1.0 miles to the north at the Eugene Airport

Clear Lake Road Signal Group	
CL-01	Clear Lake Road & Green Hill Road

COMMUNICATIONS MEDIA

The communications media that was considered included wireless and hardwired options. The primary drivers for media selection included capital cost, on-going cost, and bandwidth availability to support CCTV camera streaming and centralized monitoring. Refer to Traffic Signal Communications Network chapter for additional information.

EXISTING COPPER INTERCONNECT

The Irving Road Signal Group is interconnected with abandoned copper interconnect. The interconnect could be repurposed to support communication aggregation of all six signalized intersections to a single backhaul location. The copper interconnect would need to be tested and Ethernet switches support Ethernet of copper would need to be procured. Since the County owns the copper interconnect, no on-going costs are expected. Copper interconnect can support signalized intersections equipped with CCTV cameras streaming live video (+100 Mbps).

INTERNET SERVICE PROVIDER – PRIVATE

Internet Service Providers (ISPs), such as Comcast, have existing fiber and coax cable lines throughout the greater Eugene area. An ISP drop would include a hardened router installed in the traffic signal cabinet and connected to a nearby service point. Each connection would be billed monthly as a flat fee. Field devices would be accessible through the internet. Cable can support signalized intersections equipped with CCTV cameras streaming live video (+15 Mbps), however, when linking multiple intersections together, bandwidth can reach capacity affecting video quality.

LEASED FIBER OPTIC CABLE – PUBLIC

The Lane Council of Governments (LCOG) manages the Public Agency Network (PAN) which is a partnership between public agencies to share fiber optic assets and transmission facilities. To connect to the PAN, a fiber drop cable would be installed between the traffic signal cabinet and the nearest PAN access point. The Eugene Water & Electric Board (EWEB) and the Springfield Utility Board (SUB) are key fiber asset owners. Fiber would be leased and billed based on number of fiber pairs and fiber run distances. Fiber optics can support signalized intersections equipped with CCTV cameras streaming live video (+1 Gbps).

NEW FIBER OPTIC CABLE

New fiber optic cable considers replacement of existing copper interconnect assuming the same pathway would be used. New fiber optic cable also considers shorter runs between closely spaced intersections. Considering the cost of construction, longer runs like those supporting communications backhaul are not recommended as a standalone project. Fiber optics can support signalized intersections equipped with CCTV cameras streaming live video (+1 Gbps).

WIRELESS – CELLULAR

Cellular communication is a quick and low-cost solution as it doesn't rely on conduit infrastructure and leverages the County's wireless data plan. A private wireless network can be established between traffic signal cabinets and a central location. Drawbacks include data limitations related to CCTV video steaming. Cellular communication is adequate for centralized signal system management and short-term video streaming only. Cellular communication can also act as an alternative pathway once hardwired communication is installed.

WIRELESS – RADIO

Wireless radios rely on antennas providing point-to-point communications. A clear line-of-site is mandatory so typically two antennas are mounted to a high point (e.g. tower) with one antenna communicating to multiple signalized intersection antennas and the other acting as backhaul to a single antenna at the central location. The Eugene area has a few towers, however most are privately owned and require a lease for antenna mounting. Wireless radios can support signalized intersections equipped with CCTV cameras streaming live video (+100 Mbps).

COST EVALUATION

The cost evaluation of each signal group considered capital and annual cost based on each communications media type. Capital costs include design, permitting, and construction (materials and labor). Annual costs include lease cost and on-going maintenance for County-owned assets. Five-year and 10-year total costs were provided for future budgeting purposes. For leased fiber optic cable cost evaluation, the signal groups have been organized based on predecessor leased fiber connections. For example, the Irving Road Signal Group will need to have an established EWEB fiber connection before expanding this connection to the River Road Signal Group. Leased fiber optic cable costs reflect only the additional cost of connecting the signal group to the predecessor signal groups.

IRVING ROAD SIGNAL GROUP

The Irving Road Signal Group include six signalized intersections. For hardwired communications, all traffic signals would communicate to a single backhaul location where an ISP provider or the PAN network access point already exists.

TABLE 14. IRVING ROAD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
REPURPOSED COPPER WITH ISP COAX CABLE	$50,000.00	$1,800.00	$59,000.00	$68,000.00	$11,333.33
NEW FIBER WITH ISP COAX CABLE	$405,000.00	$1,800.00	$414,000.00	$423,000.00	$70,500.00
REPURPOSED COPPER WITH LEASED PAN FIBER	$50,000.00	$8,400.00	$92,000.00	$134,000.00	$22,333.33
NEW FIBER WITH LEASED PAN FIBER	$405,000.00	$8,400.00	$447,000.00	$489,000.00	$81,500.00
CELLULAR	$18,000.00	$3,600.00	$36,000.00	$54,000.00	$9,000.00
WIRELESS RADIO	$52,000.00	$500.00	$54,500.00	$57,000.00	$9,500.00

RIVER ROAD SIGNAL GROUP

The River Road Signal Group include four signalized intersections. For hardwired communications, all traffic signal cabinets would communicate to a single backhaul location. Backhaul would either leverage the PAN as an extension of the Irving Road Signal Group or establish a new ISP drop. The two school zone flasher systems would be connected via cellular.

TABLE 15. RIVER ROAD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
REPURPOSED COPPER WITH ISP COAX CABLE	$25,000.00	$1,800.00	$34,000.00	$43,000.00	$10,750.00
NEW FIBER WITH ISP COAX CABLE	$27,000.00	$1,800.00	$36,000.00	$45,000.00	$11,250.00
REPURPOSED COPPER WITH LEASED PAN FIBER	$25,000.00	$840.00	$29,200.00	$33,400.00	$8,350.00
NEW FIBER WITH LEASED PAN FIBER	$27,000.00	$840.00	$31,200.00	$35,400.00	$8,850.00
CELLULAR	$12,000.00	$3,600.00	$30,000.00	$48,000.00	$12,000.00
CELLULAR – SCHOOL ZONE	$6,000.00	$1,200.00	$12,000.00	$18,000.00	$9,000.00
WIRELESS RADIO	$39,000.00	$500.00	$41,500.00	$44,000.00	$11,000.00

GAME FARM ROAD SIGNAL GROUP

The Game Farm Road Signal Group include two signalized intersections. For hardwired communications, new aerial fiber optic cable would be installed between cabinets with one cabinet acting as the dedicated backhaul connection.

TABLE 16. GAME FARM ROAD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
NEW FIBER WITH ISP COAX CABLE	$150,000.00	$3,600.00	$168,000.00	$186,000.00	$31,000.00
NEW FIBER WITH LEASED PAN FIBER	$150,000.00	$5,880.00	$179,400.00	$208,800.00	$34,800.00
CELLULAR	$6,000.00	$3,600.00	$24,000.00	$42,000.00	$7,000.00
WIRELESS RADIO	$26,000.00	$500.00	$28,500.00	$31,000.00	$5,166.67

SPRINGFIELD SIGNAL GROUP

The Springfield Signal Group include two signalized intersections. For hardwired communications, new aerial fiber optic cable would be installed between cabinets with one cabinet acting as the dedicated backhaul connection.

TABLE 17. SPRINGFIELD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
NEW FIBER WITH ISP COAX CABLE	$150,000.00	$3,600.00	$168,000.00	$186,000.00	$93,000.00
NEW FIBER WITH LEASED PAN FIBER	$150,000.00	$2,880.00	$164,400.00	$178,800.00	$89,400.00
CELLULAR	$6,000.00	$1,200.00	$12,000.00	$18,000.00	$9,000.00
CELLULAR – SCHOOL ZONE	$6,000.00	$1,200.00	$12,000.00	$18,000.00	$9,000.00
WIRELESS RADIO	$26,000.00	$500.00	$28,500.00	$31,000.00	$15,500.00

BOB STRAUB PARKWAY SIGNAL GROUP

The Bob Straub Parkway Signal Group includes one signalized intersection. For hardwired communications, a new ISP cable drop or PAN fiber drop would be required.

TABLE 18. BOB STRAUB PARKWAY SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
ISP COAX CABLE	$10,000.00	$3,600.00	$28,000.00	$46,000.00	$46,000.00
LEASED PAN FIBER	$35,000.00	$5,880.00	$49,400.00	$78,800.00	$78,800.00
CELLULAR	$3,000.00	$600.00	$6,000.00	$9,000.00	$9,000.00
WIRELESS RADIO	$19,500.00	$500.00	$22,000.00	$24,500.00	$24,500.00

MARCOLA ROAD SIGNAL GROUP

The Marcola Road Signal Group includes one signalized intersection. For hardwired communications, a new ISP cable drop or PAN fiber drop would be required.

TABLE 19. MARCOLA ROAD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
NEW FIBER WITH ISP COAX CABLE	$10,000.00	$3,600.00	$28,000.00	$46,000.00	$46,000.00
NEW FIBER WITH LEASED PAN FIBER	$20,000.00	$4,200.00	$41,000.00	$62,000.00	$62,000.00
CELLULAR	$3,000.00	$600.00	$6,000.00	$9,000.00	$9,000.00
WIRELESS RADIO	$19,500.00	$500.00	$22,000.00	$24,500.00	$24,500.00

LANE COMMUNITY COLLEGE SIGNAL GROUP

The Lane Community College Signal Group includes one signalized intersection. For hardwired communications, a new ISP cable drop or PAN fiber drop would be required.

TABLE 20. LANE COMMUNITY COLLEGE SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
ISP COAX CABLE	$10,000.00	$3,600.00	$28,000.00	$46,000.00	$46,000.00
LEASED PAN FIBER	$20,000.00	$5,880.00	$49,400.00	$78,800.00	$78,800.00
CELLULAR	$3,000.00	$600.00	$6,000.00	$9,000.00	$9,000.00
WIRELESS RADIO	$19,500.00	$500.00	$22,000.00	$24,500.00	$24,500.00

COBURG SIGNAL GROUP

The Coburg Signal Group includes two signalized intersections. For hardwired communications utilizing the PAN for backhaul, new underground fiber optic cable would be installed between cabinets with one cabinet acting as the dedicated backhaul connection. For hardwired communications utilizing an ISP drop, each cabinet will have a separate backhaul connection.

TABLE 21. COBURG SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
ISP COAX CABLE	$20,000.00	$3,600.00	$38,000.00	$56,000.00	$28,000.00
NEW FIBER WITH LEASED PAN FIBER	$212,500.00	$8,400.00	$254,500.00	$296,500.00	$148,250.00
CELLULAR	$6,000.00	$3,600.00	$24,000.00	$42,000.00	$21,000.00
WIRELESS RADIO	$26,000.00	$500.00	$28,500.00	$31,000.00	$15,500.00

CLEAR LAKE ROAD SIGNAL GROUP

The Clear Lake Road Signal Group includes one signalized intersection. For hardwired communications, a new ISP cable drop would be required. PAN is not available.

TABLE 22. CLEAR LAKE ROAD SIGNAL GROUP COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL	10 YEAR AVG. PER INTERSECTION
ISP COAX CABLE	$10,000.00	$3,600.00	$28,000.00	$46,000.00	$46,000.00
CELLULAR	$3,000.00	$600.00	$6,000.00	$9,000.00	$9,000.00
WIRELESS RADIO	$19,500.00	$500.00	$22,000.00	$24,500.00	$24,500.00

PHASE 1: SHORT-TERM RECOMMENDATIONS

The short-term recommendations are anticipated to be carried out within two years of the completion of this plan. These recommendations will provide wireless communications to all County-owned traffic signal cabinets supporting centralized monitoring and reporting. Once wireless communications is established, the largest signal groups (Irving Road and River Road) will be considered for hardwire communications given the existing copper interconnect installed amongst these two signal groups. The wireless communications within these signal groups could be maintained as redundant pathways or repurposed for other signal groups helping reduce on-going data costs.

SHORT-TERM RECOMMENDATIONS INCLUDE:

- Purchase and implement central system software.
- **All Locations –** installation of cellular communications at all County signalized intersections and centralized location (Public Service Building).
- **Irving Road and River Road Signal Groups –** testing and possible termination of existing copper interconnect.
- **Irving Road and River Road Signal Groups –** procurement and installation of 10 Ethernet over copper switches, capable of future fiber optic connection.
- **Irving Road Signal Group –** establishment of PAN fiber backhaul.
- **River Road Signal Group –** negotiation of available City of Eugene communications pathway from Wilkes Drive to Irving Drive connecting Irving Road and River Road Signal Groups.

ALTERNATIVES INCLUDE:

- **All locations –** installation of wireless radios.
- **Irving Road and River Road Signal Groups –** ISP cable drops.

TABLE 23. SHORT-TERM COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL
ALL LOCATIONS – CELLULAR	$69,000.00	$13,800.00	$138,000.00	$207,000.00
IRVING ROAD SIGNAL GROUP – REPURPOSED COPPER WITH LEASED PAN FIBER	$50,000.00	$8,400.00	$92,000.00	$134,000.00
RIVER ROAD SIGNAL GROUP – REPURPOSED COPPER WITH COE PATHWAY	$32,000.00	$500.00	$34,500.00	$37,000.00
TOTAL	**$151,000.00**	**$22,700.00**	**$264,500.00**	**$378,000.00**

FIGURE 9. SHORT-TERM ARCHITECTURE

PHASE 2: NEAR-TERM RECOMMENDATIONS

The near-term recommendations are anticipated to be carried out within five years of the completion of this plan. These recommendations will upgrade existing copper interconnect to fiber optic cable and extend the PAN network fiber backhaul to the Game Farm Road Signal Group. The wireless communications within the Game Farm Road Signal Group could be maintained as a redundant pathway or removed helping reduce on-going data costs.

NEAR-TERM RECOMMENDATIONS INCLUDE:

- **Irving Road Signal Group –** upgrade 4.75 miles of copper interconnect with fiber optic cable, utilizing existing pathways (aerial, conduit) within the Irving Road Signal Group, install new patch panels, and connect to existing Ethernet switches.
- **River Road Signal Group –** upgrade 0.75 miles of copper interconnect with fiber optic cable, utilizing existing pathways (conduit) within the River Road Signal Group, install new patch panels, and connect to existing Ethernet switches – coordinate with City of Eugene regarding fiber upgrades from Wilkes Drive to Irving Drive along River Road.
- **Irving Road and River Road Signal Groups –** utilize existing PAN fiber backhaul established in Phase 1.
- **Game Farm Road Signal Group –** install new fiber optic cable between Game Farm Road Signal Group signals (two total), install new patch panels and Ethernet switches.
- **Game Farm Road Signal Group –** extend PAN fiber backhaul to Game Farm Road Signal Group.

ALTERNATIVES INCLUDE:

- **Game Farm Road Signal Group –** ISP cable drop.

TABLE 24. NEAR-TERM COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL
ALL LOCATIONS – CELLULAR	$0.00	$13,800.00*	$69,000.00	$138,000.00
IRVING ROAD SIGNAL GROUP – NEW FIBER	$405,000.00	$8,400.00*	$447,000.00	$489,000.00
RIVER ROAD SIGNAL GROUP – NEW FIBER	$27,000.00	$500.00	$29,500.00	$32,000.00
GAME FARM RD SIGNAL GROUP – NEW FIBER WITH LEASED PAN FIBER	$150,000.00	$5,880.00	$179,400.00	$208,800.00
TOTAL	**$582,000.00**	**$28,580.00**	**$724,900.00**	**$867,800.00**

** Cost estimate includes on-going annual costs incurred from Phase 1.*

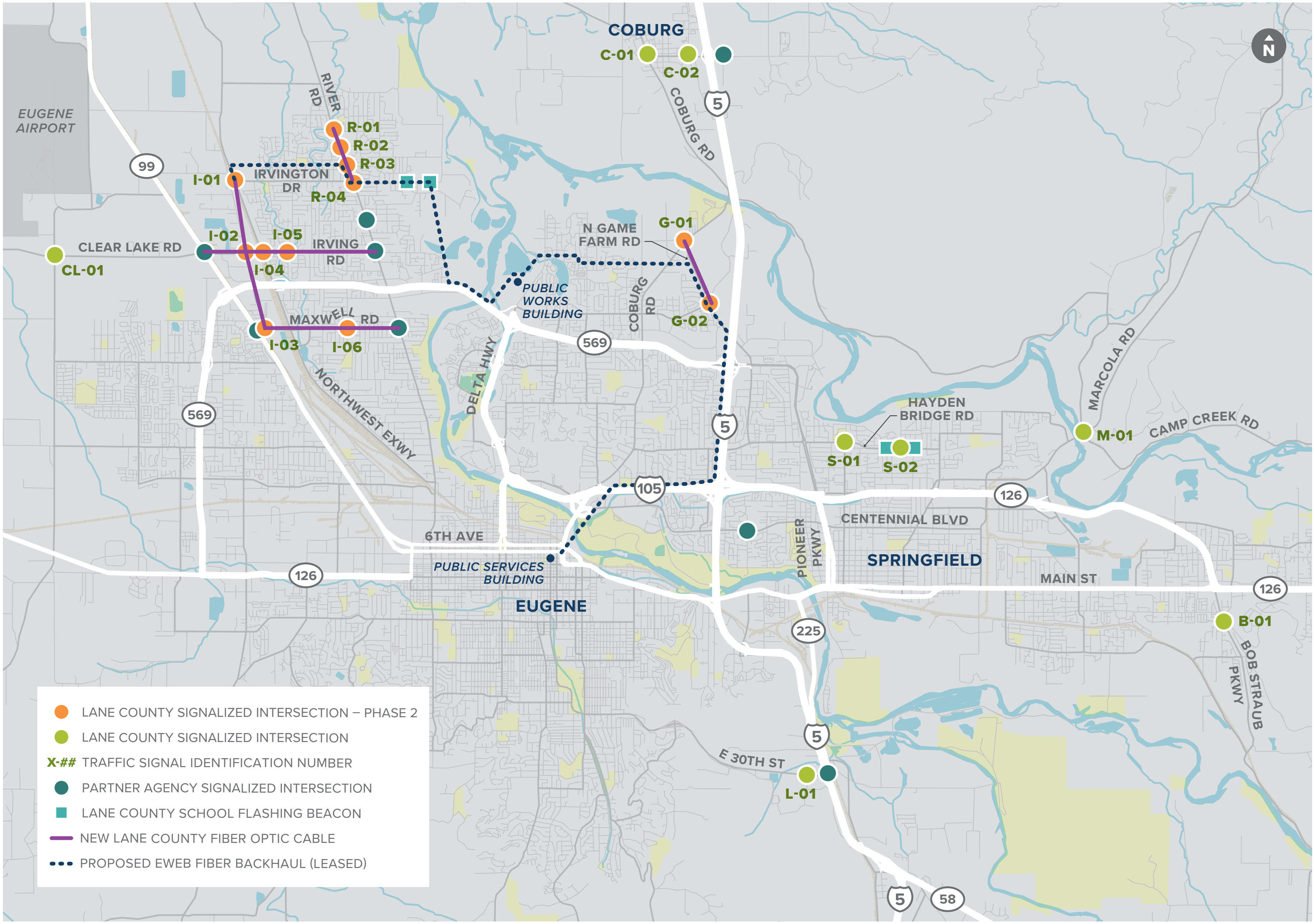


FIGURE 10. NEAR-TERM ARCHITECTURE

PHASE 3: LONG-TERM RECOMMENDATIONS

The long-term recommendations are anticipated to be carried out beyond 5 years of the completion of this plan. These recommendations have a lower return on investment due to the on-going cost of PAN fiber use and isolated location of individual traffic signals. The County should consider regional agency partnerships when exploring alternatives to the PAN fiber infrastructure.

LONG-TERM RECOMMENDATIONS INCLUDE:

- **Springfield Signal Group –** install new fiber optic cable between Game Farm Road Signal Group signals (two total), install new patch panels and Ethernet switches, extend PAN fiber backhaul.
- **Bob Straub Parkway Signal Group –** install new Ethernet switch, extend PAN fiber backhaul.
- **Marcola Road Signal Group –** install new Ethernet switch, extend PAN fiber backhaul.
- **Lane Community College Signal Group –** install new Ethernet switch, extend PAN fiber backhaul.
- **Coburg Signal Group –** install new fiber optic cable between Coburg Signal Group signals (two total), install new patch panels and Ethernet switches, extend PAN fiber backhaul.
- **Clear Lake Road Signal Group –** install new fiber optic cable between Clear Lake Road Signal Group and the Irving Road Signal Group, install new patch panel and Ethernet switch.

ALTERNATIVES INCLUDE:

- **Game Farm Road Signal Group –** ISP cable drop.

TABLE 25. LONG-TERM COST ESTIMATES

	CAPITAL COST	ANNUAL COST	YEAR 5 TOTAL	YEAR 10 TOTAL
ALL LOCATIONS – CELLULAR	$0.00	$13,800.00*	$69,000.00	$138,000.00
IRVING ROAD SIGNAL GROUP – ON-GOING FROM PHASE 2	$0.00	$8,400.00*	$42,000.00	$84,000.00
RIVER ROAD SIGNAL GROUP – ON-GOING FROM PHASE 2	$0.00	$500.00*	$2,500.00	$5,000.00
GAME FARM ROAD SIGNAL GROUP – ON-GOING FROM PHASE 2	$0.00	$5,880.00*	$29,400.00	$58,800.00
SPRINGFIELD SIGNAL GROUP – NEW FIBER WITH LEASED PAN FIBER	$50,000.00	$2,880.00	$64,400.00	$78,800.00
BOB STRAUB PARKWAY SIGNAL GROUP – LEASED PAN FIBER	$27,000.00	$5,040.00	$52,200.00	$77,400.00
MARCOLA ROAD SIGNAL GROUP – LEASED PAN FIBER	$27,000.00	$3,600.00	$45,000.00	$63,000.00
LANE COMMUNITY COLLEGE SIGNAL GROUP – LEASED PAN FIBER	$70,000.00	$5,040.00	$95,200.00	$120,400.00
COBURG SIGNAL GROUP – NEW FIBER WITH LEASED PAN FIBER	$212,500.00	$18,480.00	$304,900.00	$397,300.00
CLEAR LAKE ROAD SIGNAL GROUP – NEW FIBER	$612,200.00	$500.00	$614,700.00	$617,200.00
TOTAL	**$998,700.00**	**$54,040.00**	**$1,268,900.00**	**$1,539,100.00**

** Cost Estimate includes on-going annual costs incurred from Phases 1 and 2.*

FIGURE 11. LONG-TERM ARCHITECTURE

IMPLEMENTATION PLAN

INTRODUCTION

This chapter presents deployment of Lane County's Traffic Communications Master Plan. The deployment plan includes a range of projects that address the needs of the County based on existing condition evaluation, stakeholder needs assessment, and technology identification/evaluation throughout the duration of the project development. The following sections provide a project list with cost estimates, a matrix that prioritizes the projects, and information on funding opportunities, strategies and timeline. A one-page write up is also provided to describe the details of each project.

THIS CHAPTER INCLUDES:

1. PROJECT DEVELOPMENT
2. PROJECT PRIORITIZATION
3. FUNDING OPPORTUNITIES, STRATEGIES, AND TIMELINE
4. PROJECT DETAILED WRITEUPS
5. FUTURE CONSIDERATIONS

PROJECT DEVELOPMENT

The Implementation Plan of the Traffic Communications Master Plan is intended to identify projects that meet the agency's needs over the next several years and provide a roadmap to meet the long-term goals of the agency. The most critical information of the Deployment Plan is the Project List, which was developed based on stakeholder needs assessment and aligned with the established vision for the county. Ultimately, the project list should be used to guide funding and identify which stakeholders should be involved and the responsibilities for each stakeholder. Figure 12 shows the proposed projects in a map view and note that only projects involving physical infrastructure/device installation are shown on the map.

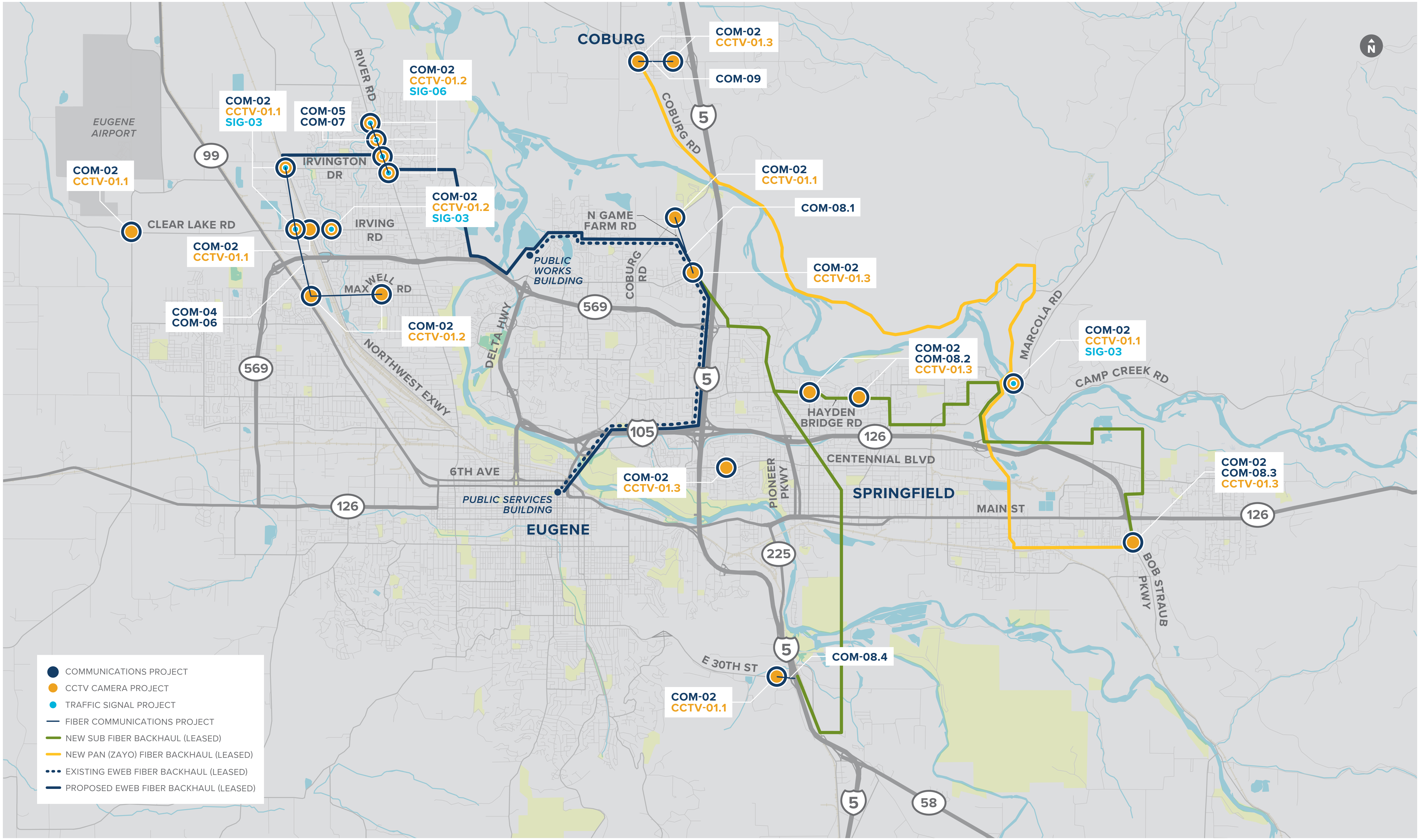


FIGURE 12. IMPLEMENTATION PLAN PROJECT LOCATIONS

The project list, as shown in Table 26, details the project number, project phase, project title, a brief description, and project cost. Project cost include capital cost (design, materials, labor, and contingency) and annual operational cost. These projects vary greatly due to the ever-evolving nature of transportation technology. The cost estimate utilized regional cost data. It is intended to illustrate the magnitude of each project's cost and should be refined as the project is being developed and implemented.

TABLE 26. IMPLEMENTATION PLAN PROJECT LIST

PROJECT NO.	PROJECT TITLE	DESCRIPTION	CAPITAL COST	ANNUAL OPERATIONAL COST
SIG-01 PHASE 1	TRAFFIC SIGNAL MANAGEMENT SYSTEM	Purchase server and central arterial system software.	$45,000	$10,000
COM-01 PHASE 1	WIRELESS COMMUNICATIONS PILOT PROJECT	Install cellular modem and CCTV camera at a pilot signalized intersection.	$22,500	$600
COM-02 PHASE 1	WIRELESS CELLULAR COMMUNICATIONS	Install cellular communications at 20 signalized intersections.	$72,000	$12,000
COM-03 PHASE 3	WIRELESS RADIO COMMUNICATIONS	Install wireless radio equipment at five signalized intersections, County transmission tower, and Public Service Building.	$64,000	$500
COM-04 PHASE 1	COPPER COMMUNICATIONS – IRVING ROAD SIGNAL GROUP	Connect six signalized intersections to existing copper interconnect and connect to EWEB network for fiber backhaul to Public Service Building.	$70,000	$8,400*
COM-05 PHASE 1	COPPER COMMUNICATIONS – RIVER ROAD SIGNAL GROUP	Connect four signalized intersections to existing copper interconnect and utilized existing CoE communications along River Road to Maxwell Road.	$45,000	$500
COM-06 PHASE 2	FIBER COMMUNICATIONS UPGRADE – IRVING ROAD SIGNAL GROUP	Replace 4.75 miles (25,000 feet) of copper interconnect with fiber interconnect. Install in-cabinet splice enclosure within six signal cabinets.	$742,000	$8,400*
COM-07 PHASE 2	FIBER COMMUNICATIONS UPGRADE – RIVER ROAD SIGNAL GROUP	Replace 3,500 feet of copper interconnect with fiber interconnect. Install in-cabinet splice enclosure within four signal cabinets.	$126,000	$1,000
COM-08.1 PHASE 2	FIBER COMMUNICATIONS UPGRADE – GAME FARM ROAD	Install in-cabinet splice enclosures and patch panels within two cabinets. Connect each cabinet to EWEB fiber for backhaul connection.	$154,000	$14,280*
COM-08.2 PHASE 3	FIBER COMMUNICATIONS UPGRADE – SPRINGFIELD	Install in-cabinet splice enclosures and patch panels within two cabinets. Connect each cabinet to SUB fiber for backhaul connection.	$70,000	$17,160*

**Annual Operational Cost is a running total as COM projects are added extending fiber lease distances.*

PROJECT NO.	PROJECT TITLE	DESCRIPTION	CAPITAL COST	ANNUAL OPERATIONAL COST
COM-08.3 PHASE 3	FIBER COMMUNICATIONS UPGRADE – BOB STRAUB PARKWAY	Install in-cabinet splice enclosures and patch panel within one cabinet. Connect cabinet to SUB fiber for backhaul connection.	$35,000	$22,200*
COM-08.4 PHASE 3	FIBER COMMUNICATIONS UPGRADE – LANE COMMUNITY COLLEGE	Install in-cabinet splice enclosures and patch panels within one cabinet. Connect each cabinet to SUB fiber for backhaul connection.	$98,000	$27,240*
COM-09 PHASE 3	FIBER COMMUNICATIONS UPGRADE – COBURG	Install new fiber interconnect between Coburg Road and Coburg Industrial Way along E Pearl Street (2,500 feet). Install in-cabinet splice enclosures and patch panels within two cabinets. Connect to PAN at Coburg Road for backhaul connection.	$325,000	$45,720*
COM-10 PHASE 3	FIBER COMMUNICATIONS UPGRADE – CLEAR LAKE	Install new fiber interconnect between Highway 99 and Green Hill Road along Clear Lake Road (1.8 miles). Install in-cabinet splice enclosure and patch panels within cabinet.	$860,000	$500
SIG-02 PHASE 1	TRAFFIC SIGNAL OPERATIONS GUIDEBOOK	Details signal timing strategies that could be implemented using the central signal management system.	$50,000	$5,000
SIG-03 PHASE 1	BATTERY BACKUP SYSTEM	Install backpack cabinets with battery backup system at three signalized intersections.	$24,000	$100
CCTV-01.1 PHASE 1	CCTV SURVEILLANCE	Install CCTV cameras at high-priority intersections with known collision history. Seven locations. Install video wall and operator workstation at Public Works facility.	$110,000	$1,500
CCTV-01.2 PHASE 2	CCTV SURVEILLANCE	Install CCTV cameras at intersections connected to copper and/or fiber optic communications. Seven locations.	$70,000	$1,000
CCTV-01.3 PHASE 2	CCTV SURVEILLANCE	Install CCTV cameras at remaining intersections. Seven locations.	$70,000	$1,000
SIG-04 PHASE 2	AUTOMATED TRAFFIC SIGNAL PERFORMANCE MEASUREMENT PLATFORM	Purchase ATSPM platform that integrates with traffic signal controllers.	$50,000	$10,000
SIG-05 PHASE 1	NON-INTRUSIVE DETECTION PILOT	Evaluate non-intrusive detection technologies (video, radar) and video analytics platforms. Standardize on detection technology for future traffic signal improvements.	$5,000	
SIG-06 PHASE 2	TRANSIT SIGNAL PRIORITY UPGRADES	Upgrade existing IR preemption equipment to GPS along River Road (four signalized intersections).	$20,000	$500

**Annual Operational Cost is a running total as COM projects are added extending fiber lease distances.*

PROJECT PRIORITIZATION

To help the County to select the most valuable project and allocate the right resources to the maximize the value delivery, the proposed projects in the list are prioritized using a matrix. The criteria of scoring include user needs, cost, savings, improvements in terms of operation, safety, and return on investment. Each category is scored from most to least desirable, and the scoring of each category is relative among all the projects. Table 27 depicts the details of the matrix. Figure 13 shows the phasing of the projects based on prioritization and dependencies.

TABLE 27. PRIORITIZATION OF THE IMPLEMENTATION PLAN PROJECTS

PROJECT NO.	COST	DEPENDENCY	USER NEEDS	MAINTENANCE SAVINGS	IMPROVED OPERATIONS	INCREASED CAPABILITY	IMPROVED SAFETY	RETURN ON INVESTMENT
SIG-01	●	◐	●	○	●	●	◐	●
COM-01	●	●	●	●	●	●	◐	●
COM-02	◐	●	●	●	●	●	◐	◐
COM-03	●	◐	●	○	◐	○	◐	◐
COM-04	●	●	●	○	○	○	◐	◐
COM-05	●	◐	●	○	○	○	◐	◐
COM-06	–	○	●	○	○	○	◐	–
COM-07	●	◐	●	○	○	○	◐	●
COM-08.1	○	◐	●	○	○	○	◐	○
COM-08.2	●	◐	●	○	○	○	◐	◐
COM-08.3	●	◐	●	○	○	○	◐	●
COM-08.4	◐	◐	●	○	○	○	◐	○
COM-09	–	◐	●	○	○	○	◐	–
COM-10	–	◐	●	○	○	○	◐	–
SIG-02	●	–	●	–	●	●	●	◐
SIG-03	●	–	◐	◐	○	○	●	●
CCTV-01.1	◐	○	●	●	◐	◐	◐	○
CCTV-01.2	●	○	●	●	◐	◐	◐	◐
CCTV-01.3	●	○	●	●	◐	◐	◐	◐
SIG-04	●	–	●	○	●	●	●	◐
SIG-05	●	–	●	◐	○	◐	◐	●
SIG-06	●	–	◐	◐	○	○	○	●

● *Most desirable* ◐ *Desirable* ○ *Somewhat desirable* – *Least desirable*

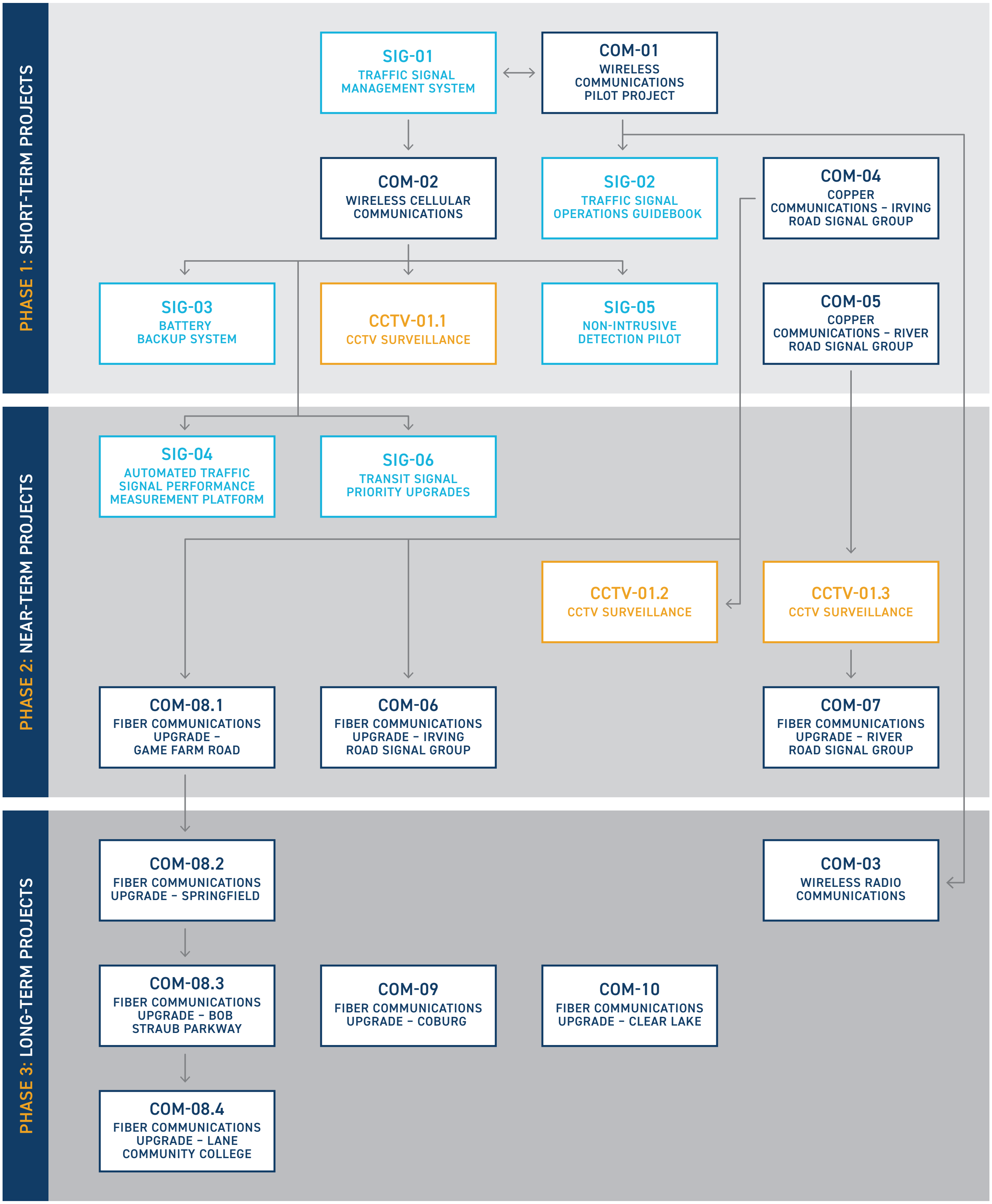


FIGURE 13. PROJECT SEQUENCING

FUNDING OPPORTUNITIES, STRATEGIES, AND TIMELINE

There are numerous grants available from both federal and local levels to fund the projects. From federal level, the U.S. Department of Transportation provides grants to help build up and maintain a fast, safe, efficient, accessible, and convenient transportation system for the American people, today and into the future. This section describes the available grants and the timeline of availability.

HSIP/ARTS

The Highway Safety Improvement Program (HSIP) is a federally funded, state-administered program that allows states to address their most serious safety needs. HSIP is a core Federal-aid program with the purpose to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned roads and roads on tribal land. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads with a focus on performance.

All roads within the state of Oregon are eligible to receive HSIP funding under the All-Roads Transportation Safety (ARTS) Program. In 2020, ODOT solicited ARTS applications from ODOT Regions and local agencies for safety projects for ARTS 2024-2027 cycle. Lane county has been receiving ART grant and it is expected that Lane County will continue applying for this grant for 2028 ARTS cycle.

THE RURAL GRANT PROGRAM

The Rural Surface Transportation Grant Program will support projects to improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, and generate regional economic growth and improve quality of life. It is also a competitive Grant, which is part of the fiscal year (FY) 2022 MPDG. The grant program funding will be made available in 2022 under the MPDG combined NOFO. 2022 cycle application was due on May 23, 2022, and Lane County may consider future years opportunities for the cycle of FY 2026 – FY 2030.

INFRA

INFRA (known statutorily as the Nationally Significant Multimodal Freight & Highway Projects) awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas. It is also a competitive Grant, which is part of the FY 2022 MPDG. The funding will be made available in 2022 under the MPDG combined NOFO. INFRA 2022 cycle application was on due May 23, 2022, and Lane County may consider future years opportunities for the cycle of FY 2026 – FY 2030.

IIJA

The Infrastructure Investment and Jobs Act (IIJA) provides approximately $550 billion for Federal highway programs over a five-year period (fiscal years 2022 through 2026). Funding from the IIJA is expansive in its reach, addressing energy and power infrastructure, access to broadband internet, water infrastructure, and more. Some of the new programs funded by the bill could provide the resources needed to address a variety of infrastructure needs at the local level. Most of this funding is apportioned (distributed) to States based on formulas specified in Federal law. ODOT has allocated $300 million funding to support cities, counties and for safety, bicycle/pedestrian, bridge, and other community priorities. Lane County should consider this funding opportunity to support its local projects.

SMART

Sec. 25005 of the Bipartisan Infrastructure Law (BIL) establishes the Strengthening Mobility and Revolutionizing Transportation (SMART) Grants Program to "conduct demonstration projects focused on advanced smart city or community technologies and systems in a variety of communities to improve transportation efficiency and safety." The program is appropriated at $100M annually for fiscal years 2022–2026. To accomplish the objectives identified in BIL, the SMART Grants Program will fund projects that focus on using technology interventions to solve real-world challenges facing communities today. This will require creativity and local experimentation. The SMART Program will support a range of approaches: new transportation applications of existing and emerging technologies; expanded and systematized use of proven technologies; and deep integration of solutions with existing transportation systems. The 2022 SMART Notice of Funding Opportunity will be issued in September 2022, and applications will be due in November 2022.

SAFE STREETS AND ROADS FOR ALL GRANT PROGRAM

The Bipartisan Infrastructure Law established the new Safe Streets and Roads for All (SS4A) discretionary program with $5 billion in appropriated funds over the next 5 years. In fiscal year 2022 (FY 2022), up to $1 billion is available. The SS4A program funds regional, local, and Tribal initiatives through grants to prevent roadway deaths and serious injuries. The deadline for applications for FY 2022 was September 15, 2022. Lane County may continue monitoring the future cycle of this grant for FY 2027.

SURFACE TRANSPORTATION BLOCK GRANT PROGRAM AND TRANSPORTATION ALTERNATIVES

The Surface Transportation Block Grant program (STBG) provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals. As under the FAST Act, the BIL directs FHWA to apportion funding as a lump sum for each State then divide that total among apportioned programs. Each State's STBG apportionment is calculated based on a percentage specified in law. Federal law requires that 10 percent of STBG funds was set aside for Transportation Alternatives (TA). Lane county has been receiving STBG/TA grant, and it is expected that Lane County will continue applying for this grant to fund county's projects.

CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT PROGRAM

Administered by FHWA, the Congestion Mitigation and Air Quality Improvement (CMAQ) program was implemented to support surface transportation projects and other related efforts that contribute air quality improvements and provide congestion relief. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (non-attainment areas) and for former non-attainment areas that are now in compliance (maintenance areas). Lane county has been receiving CMAQ grant, and it is expected that Lane County will continue applying for this grant to fund county's projects.

SAFE ROUTES TO SCHOOL PROGRAMS

Safe Routes to School (SRTS) is an approach that promotes walking and bicycling to school through infrastructure improvements, enforcement, tools, safety education, and incentives to encourage walking and bicycling to school. SRTS initiatives improve safety and levels of physical activity for students. ODOT administrates funding to support SRTS program. Lane County may apply for fundings from ODOT to fund the projects planned in this report.

PROJECT DETAILED WRITEUPS

The following pages provide one-page summaries of the projects listed in the table above. The one-page summaries include the project objective, description, stakeholders, communications requirements, costs, operations and maintenance needs, user needs addressed, and benefits.

Some projects were grouped into categories based on similar purposes and outcomes; therefore, a one-page summary of a category can effectively describe the nature of several projects. Though a category may cover several projects, associated costs for each project are still separated.

Lane County currently does not have a formal Traffic Operations Center (TOC), and the staff will operate traffic signals from the desk of maintenance facility. The TOC described in this chapter refers to an informal TOC as what is currently being practiced by Lane County.

PROJECT NUMBER: SIG-01

TRAFFIC SIGNAL MANAGEMENT SYSTEM

OBJECTIVE

Provide capability to monitor traffic signals to support regional traffic management strategies

DESCRIPTION

Purchase and implement central system software. This includes Q-Free Kinetics Central Software (PBOT Contract), licensing (ODOT Contract), software assurance ($500/yr/controller), and necessary supporting hardware including server, firewall, and core switch.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Requires communication between central signal system server and traffic signals. Implemented concurrently with COM-01

COST

$37,000 for Capital Cost and $10,000 for annual operational cost

OPERATIONS & MAINTENANCE

- Training staff on new system
- Staffing hours needed to monitor signal operations
- Reallocate staff time from field review to remote access from office
- Duties may include monitoring traffic signal performance and adjusting signal timings 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

- More effective traffic management, incident management, and maintenance management
- Improved travel times and travel time reliability will result from the ability to manage the signal system
- Reduces delay, fuel consumption and vehicle emissions

PROJECT NUMBER: COM-01

WIRELESS COMMUNICATIONS PILOT PROJECT

OBJECTIVE

Provide connection to the Traffic Signal Management System. Provide remote viewing of signalized intersection via CCTV camera. Measure bandwidth capacity over cellular and wireless radio communications.

DESCRIPTION

Install cellular modem and CCTV camera at a pilot signalized intersection. Determine location – site line to existing tower, cellular coverage, future fiber/copper, Copper/Fiber Ethernet Switches Cellular Modem/Router.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Requires Ethernet switches to support copper and fiber interconnect. Implemented concurrently with SIG-01.

COST

$22,500 for Capital Cost and $600 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires operation hours from Traffic Operations Center (TOC)
- Requires training for staff to maintain the devices
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need to be able to manage traffic operations
- Need for communications to central signal system for management
- Need to remotely monitor traffic signal status

BENEFITS

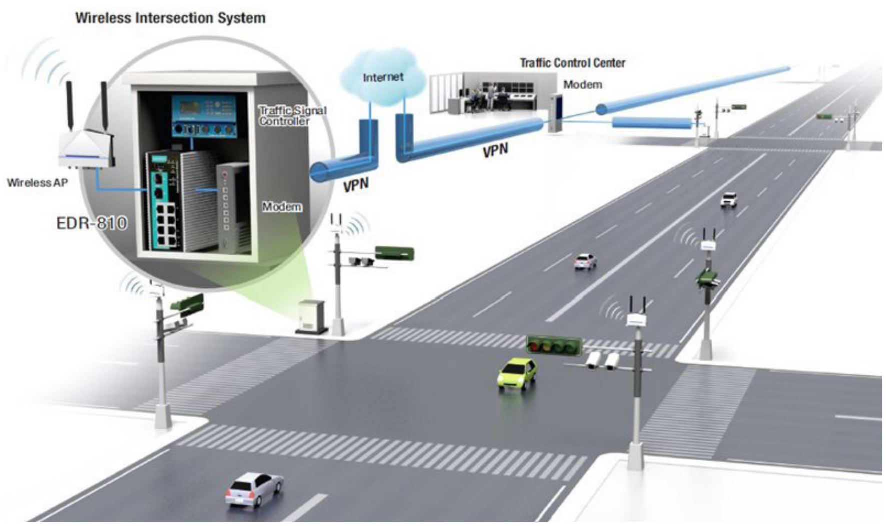
- Improved safety and efficiency of arterial corridors, therefore reducing delay and emergency response times
- More effective traffic management, incident management, and maintenance management

PROJECT NUMBER: COM-02

WIRELESS CELLULAR COMMUNICATIONS

OBJECTIVE

Provide connection to the Traffic Signal Management System.



DESCRIPTION

Install cellular communications at 20 signalized intersections. Determine location - site line to existing tower, cellular coverage, future fiber/copper, Copper/Fiber Ethernet Switches Cellular Modem/Router, Provide connection to the Traffic Signal Management System.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Requires Ethernet switches to support copper and fiber interconnect. Implemented after SIG-01 and COM-01.

COST

$72,000 for Capital Cost and $12,000 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need for communications to central signal system for management
- Need to be able to remotely manage traffic operations
- Need to improve traffic signal operation

BENEFITS

- More effective traffic management, incident management, and maintenance management
- 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: COM-03

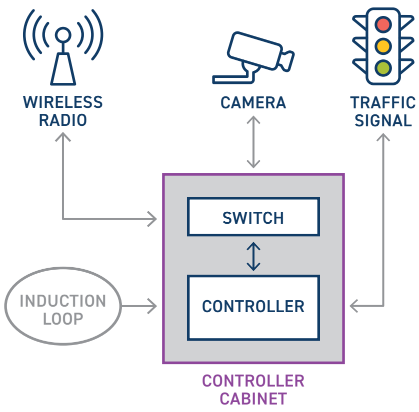
WIRELESS RADIO COMMUNICATIONS – CONTINGENT ON COUNTY TOWER CONSTRUCTION

OBJECTIVE

Provide connection to the Traffic Signal Management System.

DESCRIPTION

Install wireless radio equipment at five signalized intersections, County transmission tower, and Public Service Building.



STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Requires new Ethernet switches supporting copper and fiber interconnect. Implemented after SIG-01 and COM-01

COST

$64,000 for Capital Cost and $500 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need for communications to central signal system for management
- Need to be able to remotely manage traffic operations
- Need to improve traffic signal operation

BENEFITS

- More effective traffic management, incident management, and maintenance management
- Improved travel times and travel time reliability will result from the ability to manage the signal system
- Reduces fuel consumption and vehicle emissions

COPPER COMMUNICATIONS

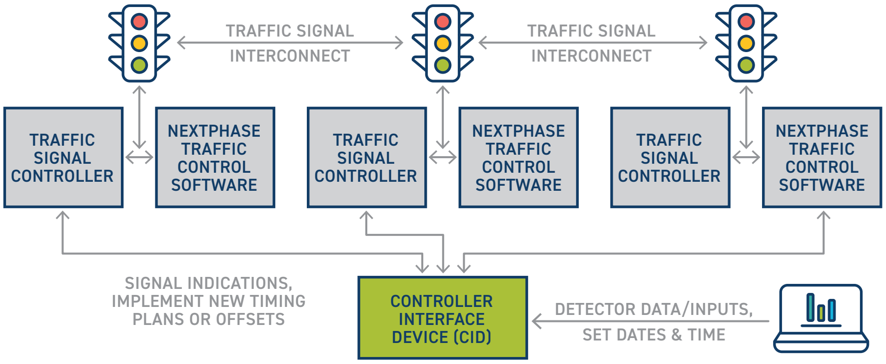
OBJECTIVE

Provide connection to the Traffic Signal Management System.

DESCRIPTION

Connect the six signalized intersections of the Irving Road Signal Group to existing copper interconnect and connect to EWEB network for fiber backhaul to Public Service Building. Assumes copper will be fully functional.

Connect the four signalized intersections of the River Road Signal Group to existing copper interconnect and utilize existing City of Eugene communications along River Road to Maxwell Road. Assumes copper will be fully functional.



STAKEHOLDERS

Lane County, Eugene

COMMUNICATIONS REQUIREMENTS

Requires CoE cabinet patching of copper interconnect pair for County use. Implemented after COM-02

COST

COM-04: Irving Road
$70,000 for Capital Cost and
$8,400 for annual operational cost

COM-05: River Road
$45,000 for Capital Cost and
$500 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need for communications to central signal system for management
- Need to be able to remotely manage traffic operations
- Need to improve traffic signal operation

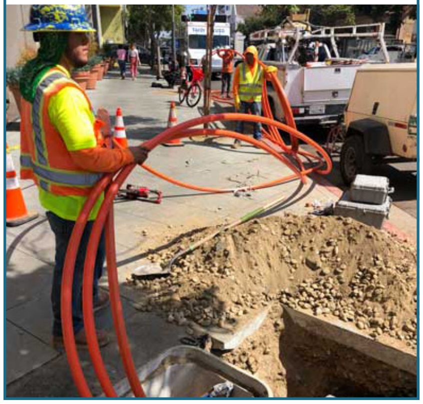
BENEFITS

- More effective traffic management, incident management, and maintenance management
- Improved travel times and travel time reliability will result from the ability to manage the signal system
- Reduces fuel consumption and vehicle emissions

PROJECT NUMBERS: COM-06 & COM-07 FIBER COMMUNICATIONS UPGRADE

OBJECTIVE

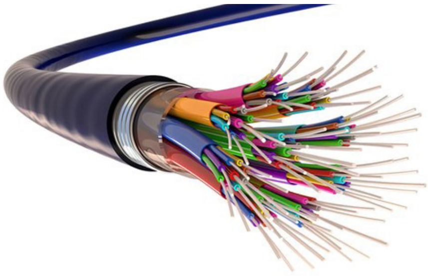
Provide connection to the Traffic Signal Management System.



DESCRIPTION

Replace 4.75 miles (25,000 feet) of copper interconnect with fiber interconnect for the Irving Road Signal Group. Install in-cabinet splice enclosure within six signal cabinets. Assumes use of existing pathway.

Replace 3,500 feet of copper interconnect with fiber interconnect for the River Road Signal Group. Install in-cabinet splice enclosure within four signal cabinets. Assumes use of existing pathway.



STAKEHOLDERS

Lane County, Eugene

COMMUNICATIONS REQUIREMENTS

Contingent on City of Eugene extending fiber optic network to River Road and Irvington Drive. Implemented after COM-04 and COM-05.

COST

COM-06: Irving Road
$742,000 for Capital Cost and $8,400 for annual operational cost

COM-07: River Road
$126,000 for Capital Cost and $1,000 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

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

- More effective traffic management, incident management, and maintenance management
- Improved travel times and travel time reliability will result from the ability to manage the signal system
- Reduces fuel consumption and vehicle emissions

PROJECT NUMBERS:
COM-08.1 THROUGH COM-10

FIBER COMMUNICATIONS UPGRADE

OBJECTIVE Provide connection to the Traffic Signal Management System.

DESCRIPTION

- **COM-08.1 Game Farm Road:** Install in-cabinet splice enclosures and patch panels within two cabinets. Connect each cabinet to EWEB fiber for backhaul connection. Assumes new aerial fiber between intersections.
- **COM-08.2 Springfield:** Install in-cabinet splice enclosures and patch panels within two cabinets. Connect each cabinet to SUB fiber for backhaul connection. Assumes individual SUB fiber drops at each location. School zone flashers connected to wireless.
- **COM-08.3 Bob Straub Parkway:** Install in-cabinet splice enclosures and patch panel within one cabinet. Connect cabinet to SUB fiber for backhaul connection. Assumes individual SUB fiber drop.
- **COM-08.4 Lane Community College:** Install in-cabinet splice enclosures and patch panels within one cabinet. Connect each cabinet to SUB fiber for backhaul connection. Assumes use of existing pathway.
- **COM-09 Coburg and Marcola:** Install new fiber interconnect between Coburg Road and Coburg Industrial Way along E Pearl Street (2,500 feet). Install in-cabinet splice enclosures and patch panels within three cabinets. Connect to PAN at Coburg Road and Marcola Road for backhaul connection. Assumes new underground conduit and fiber between intersections.
- **COM-10 Clear Lake:** Install new fiber interconnect between Highway 99 and Green Hill Road along Clear Lake Road (1.8 miles). Install in-cabinet splice enclosure and patch panels within cabinet.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

COM-08.1
Extends EWEB (COM-04) backhaul distance +seven miles. Implemented after COM-04.

COM-08.2
Leverages EWEB backhaul and adds SUB backhaul +four miles. Implemented after COM-08.1.

COM-08.3
Leverages EWEB backhaul and adds SUB backhaul +seven miles. Implemented after COM-08.2.

COM-08.4
Leverages EWEB and SUB backhaul and extends SUB backhaul +seven miles. Implemented after COM-08.3.

COM-09
Requires use of PAN for backhaul, 22 miles.

COM-10
Extends Irving Signal Group fiber network with existing EWEB backhaul.

PROJECT NUMBERS:
COM-08.1 THROUGH COM-10

FIBER COMMUNICATIONS UPGRADE

COST

COM-08.1
$154,000 for Capital Cost and
$14,280 for annual operational cost

COM-08.2
$70,000 for Capital Cost and
$17,160 for annual operational cost

COM-08.3
$35,000 for Capital Cost and
$22,200 for annual operational cost

COM-08.4
$98,000 for Capital Cost and
$27,240 for annual operational cost

COM-09
$325,000 for Capital Cost and
$45,720 for annual operational cost

COM-10
$860,000 for Capital Cost and
$500 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

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

- More effective traffic management, incident management, and maintenance management
- Improved travel times and travel time reliability will result from the ability to manage the signal system
- Reduces fuel consumption and vehicle emissions

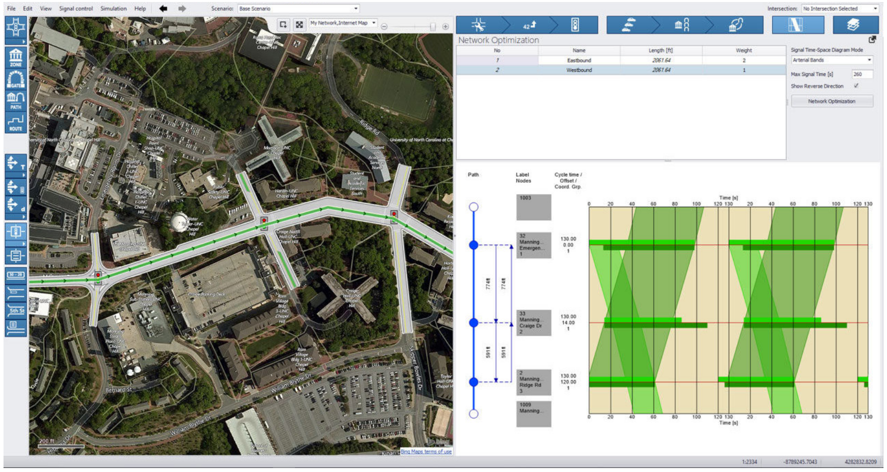
TRAFFIC SIGNAL OPERATIONS GUIDEBOOK

OBJECTIVE

Streamline and improve traffic signal operation.

DESCRIPTION

Details signal timing strategies that could be implemented using the central signal management system.



STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Implemented after SIG-01 and COM-01

COST

$50,000 for guidebook development

$5,000 staff time to make operational changes based on guidebook recommendations

OPERATIONS & MAINTENANCE

- Duties include monitoring traffic signal performance and adjusting signal timings in response to incidents and special events

NEEDS ADDRESSED

- Need to be able to manage traffic operations efficiently
- Need to respond to incidents and special events

BENEFITS

- More effective traffic management, incident management, and maintenance management
- 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: SIG-03 BATTERY BACKUP SYSTEM

OBJECTIVE

Replace existing BBS at two railroad locations, install new at one known power issue location.

DESCRIPTION

Install battery backup system at four signalized intersections:

- Irvington Drive & NW Expressway
- Irvington Road & NW Expressway
- Marcola Road & Mohawk Road/ Camp Creek Road
- Irving Road & Kalmai Street

STAKEHOLDERS

Lane County

COMMUNICATIONS REQUIREMENTS

Implemented after COM-02.

COST

$18,000 for Capital Cost and $100 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need to improve traffic signal system reliability
- Need to manage traffic efficiently

BENEFITS

- Improved safety during power outage.
- Reduce staff time to restart controller when power returns.

PROJECT NUMBERS:
CCTV-01.1 THROUGH CCTV-01.3

CCTV SURVEILLANCE

OBJECTIVE

Deploy arterial surveillance and management system at selected intersections.

DESCRIPTION

- **CCTV-01.1:** Install CCTV cameras at high-priority intersections with known collision history at seven locations: Green Hill/Clear Lake, Marcola/Camp Creek, 30th/Eldon Schafer, Prairie/Irving, NW Expressway/Irving, NW Expressway/Irvington, Coburg/Country Farm. Install video wall and operator workstation at Public Works facility.
- **CCTV-01.2:** Install CCTV cameras at intersections connected to copper and/or fiber optic communications. Seven locations: River/Spring Creek, River/Lynbrook, River/River Loop 2, Irvington/River, Irving/Kalmai, Prairie/Maxwell, Maxwell/Grove.
- **CCTV-01.3:** Install CCTV cameras at remaining intersections. Seven locations: Coburg/Pearl, Pearl/Coburg Industrial Way, Game Farm/Crescent, Hayden Bridge/5th Street, Centennial/Aspen, Bob Straub/57th, Hayden Bridge/14th.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

CCTV-01.1
Implemented after COM-02

CCTV-01.2
Implemented after COM-04

CCTV-01.3
Implemented after COM-05

COST

CCTV-01.1
$70,000 for Capital Cost and $1,000 for annual operational cost

CCTV-01.2
$70,000 for Capital Cost and $1,000 for annual operational cost

CCTV-01.3
$70,000 for Capital Cost and $1,000 for annual operational cost

OPERATIONS & MAINTENANCE

- Requires operation hours from Traffic Operations Center (TOC)
- Requires training for staff to maintain the devices
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

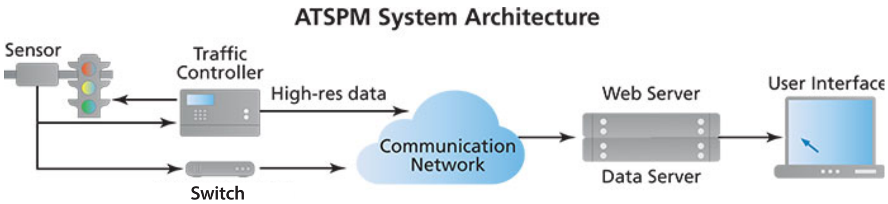
- Need to be able to manage traffic operations
- Need to remotely monitor traffic signal status
- Need to monitor real time traffic conditions
- Need to efficiently manage incidents

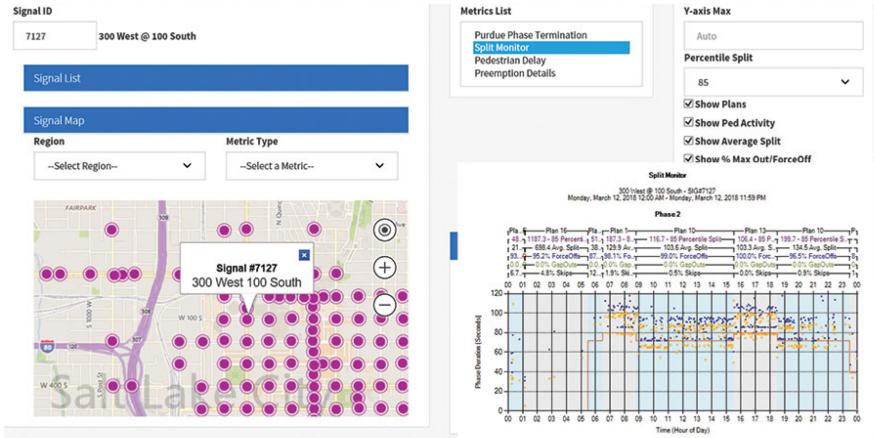
BENEFITS

- Improved safety and efficiency of arterial corridors, therefore reducing delay and emergency response times
- More effective traffic management, incident management, and maintenance management

OBJECTIVE

Deploy automated traffic signal performance measurement (ATSPM) system.





DESCRIPTION

Purchase or activate ATSPM platform that integrates with traffic signal controllers. Future Kinetics module, third-party system (e.g., ClearGuide, TraffOps). ATSPM platform selection will depend on operator needs and availability through existing central system (Q-Free Kinetics). Controller agnostic third-party systems (e.g. ClearGuide, TraffOps, INRIX) may act as an alternative to address specific user needs.

STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Implemented after COM-02

COST

$50,000 for Capital Cost and $10,000 for annual operational cost (assumes cost not included with current Q-Free Kinetics agreement)

OPERATIONS & MAINTENANCE

- Staffing hours needed to learn new system
- Reallocate staff time from reactive to proactive maintenance
- Maintenance crews will be responsible for maintaining the ITS equipment and communication network

NEEDS ADDRESSED

- Need to provide signal performance measures
- Need to collect traffic data to improve signal timing
- Need to diagnose traffic signal system issue remotely

BENEFITS

- More effective traffic management, incident management, and maintenance management
- Improved information for decision makers and operations personnel
- Improved signal operation
- Improved safety

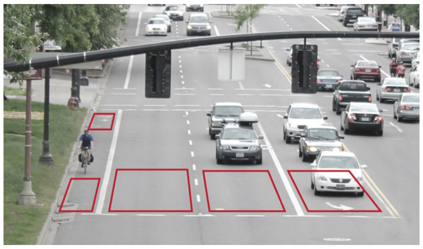
PROJECT NUMBER: SIG-05 NON-INTRUSIVE DETECTION PILOT

OBJECTIVE

Evaluate and identify alternate detection technologies.

DESCRIPTION

Evaluate non-intrusive detection technologies (video, radar) and video analytics platforms. Standardize on detection technology for future traffic signal improvements. Assume demonstration equipment provided by Vendors and installed by County. Evaluate multimodal detection accuracy, vehicle counts and classifications, and safety analytics (e.g., near-miss detection, red-light running).



STAKEHOLDERS

Lane County, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Implemented after COM-02

COST

$5,000 for Capital Cost

OPERATIONS & MAINTENANCE

- Requires training for staff to monitor and operate new technology
- Requires training for staff to maintain the devices and infrastructure
- Maintenance duties include preventive maintenance of field devices and troubleshooting

NEEDS ADDRESSED

- Need to detect/classify multimodal traffic data
- Need to collect traffic data to enhance signal timing
- Need to improve safety

BENEFITS

- Improved travel times and travel time reliability will result from the ability to detect multimodal traffic data more efficiently
- Reduces fuel consumption and vehicle emissions
- Improve safety

PROJECT NUMBER: SIG-06 — TRANSIT SIGNAL PRIORITY UPGRADES

OBJECTIVE

Upgrade existing TSP system to improve transit travel time reliability on corridors with traffic signals.

DESCRIPTION

Upgrade existing IR preemption equipment to GPS along River Road (four signalized intersections). Contingent on LTD Bus Rapid Transit expansion project.

STAKEHOLDERS

Lane County, Lane Transit District, ODOT, Eugene, Springfield

COMMUNICATIONS REQUIREMENTS

Implemented after COM-02

COST

$20,000 for Capital Cost and $5,000 for annual operational cost

OPERATIONS & MAINTENANCE

- Staffing hours needed to manage the Traffic Operations Center (TOC)
- Maintenance crews will be responsible for maintaining the TSP equipment and communication network
- Maintenance includes keeping the software up to date

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

FUTURE CONSIDERATIONS

The projects listed in the implementation plan focuses on bringing traffic signal online and being able to manage them using a central management software. The transportation technology is evolving rapidly, which provide tools/ opportunities for the county to manage traffic even more efficiently and effectively. This chapter lists (as shown in Table 28) the technologies for future consideration after the implementation of the projects proposed is completed.

TABLE 28. TECHNOLOGY FOR FUTURE CONSIDERATION

CATEGORY	TECHNOLOGY
SIGNALS	Blank out signs
SIGNALS	Serial Cabinet Upgrades
SIGNALS	Non-Intrusive Detection Upgrades
SIGNALS	APS Pushbutton Upgrades
SIGNALS	Adaptive Signal Control
SIGNALS	Safety Analytics and Count System Pilot
ITS	Automated Enforcement
ITS	RWIS
ITS	Fleet Vehicle Tracking
ITS	Smart Work Zone Technology
ITS	Speed Feedback Signs

BLANK OUT SIGNS

This project will evaluate and update static signs to be LED Blank-Out Signs. Blank-Out Signs are an excellent way to reinforce traffic signals and minimize undesirable motorist movements, creating a safer driving environment. The Blank-Out Sign is illuminated in LEDs providing an easily visible message in all conditions.

SERIAL CABINET UPGRADES

It is recommended that the County upgrade cabinet standard from 332 to ATC, or serial cabinet.

NON-INTRUSIVE DETECTION UPGRADES

Based on the recommendation of SIG-05 on the project list, the county can deploy non-intrusive detection technologies (i.e., video, radar) to supplement or replace existing loop detectors, if there is loop failure or other construction project which may require replacement of loop.

APS PUSHBUTTON UPGRADES

It is recommended that county upgrade existing pedestrian button to Accessible Pedestrian Signal (APS) pushbutton, APS pushbutton is a pedestrian push button that communicates when to cross the street in a non-visual manner, such as audible tones, speech messages, and vibrating surfaces. Deployment of such system will help visually impaired and all pedestrians by alerting them to when the walk sign turns on and the status of the walk cycle.

ADAPTIVE SIGNAL CONTROL TECHNOLOGY

This project will pilot and deploy an Adaptive Signal Control Technology (ASCT) system. ASCT adjusts the timing of the signal phasing to accommodate changing traffic patterns and ease traffic congestion, under certain conditions. This is accomplished using an adaptive traffic control system consisting of both hardware and software. ASTC can improve travel time reliability and reduce delay by adjusting the signal timing in response to changing traffic conditions, instead of based on predetermined coordination plans. The County should maximize the use of the local and central systems and the tools afforded by an ATSPM system prior to planning for and deploying an ASCT.

SAFETY ANALYTICS AND COUNT SYSTEM PILOT

The project will pilot and evaluate analytics platforms that allow multimodal detection accuracy, vehicle counts and classifications, and safety analytics (e.g., near-miss detection, red-light running).

ROAD WEATHER INFORMATION SYSTEMS

A Road Weather Information System (RWIS) is comprised of Environmental Sensor Stations (ESS) in the field, a communication system for data transfer, and central systems to collect field data from numerous ESS. These stations measure atmospheric, pavement and/or water level conditions. Central RWIS hardware and software are used to process observations from ESS to develop nowcasts or forecasts, and display or disseminate road weather information in a format that can be easily interpreted by a manager. RWIS data are used by road operators and maintainers to support decision making.

FLEET VEHICLE TRACKING

This project will evaluate and deploy a Fleeting Vehicle Tracking System. This system utilizes a vehicle tracking device and software to monitor and manage a fleet of vehicles. Through fleet tracking, a fleet manager or business owner can collect data on location and vehicle health.

SMART WORK ZONE TECHNOLOGY

The project will deploy field device and system to better manage work zone to minimize congestion caused by construction work and improve safety. The system may include CCTVs, mobile DMSs , speed feedback signs, and platforms that providing information on construction work, predict travel time, delay, or speed on a work zone, on a real-time basis.

SPEED FEEDBACK SIGNS

The project will upgrade power and communications to existing speed feedback signs and flashers. It may also add passive pedestrian detection at existing Rectangular Rapid Flashing Beacons (RRFB).