Federal Highway Administration

Integrated Corridor Management Deployment Planning Grant

I-84 Multimodal Corridor: A Regional Concept of Transportation Operations for Integrated Corridor Management

Metro

Oregon Department of Transportation

CITY OF PORTLAND, OREGON 1851

Multnomah County

CITY OF GRESHAM

TRIMET See where it takes you.

Portland State UNIVERSITY

Portland | Oregon | January 29, 2014 (Revised)

1.0 Introduction

The Portland, Oregon metropolitan area is pleased to present FHWA with our application for the Integrated Corridor Management Deployment Planning Grant. The partners that have collaborated to prepare this application share the belief that in selecting the Portland region, FHWA will wisely invest in a community that is ready to advance its efforts in collaborative transportation system management.

The Portland region is a low risk, high reward "living laboratory" demonstration site for the ICM program. All the puzzle pieces are in place, the region just needs a plan and momentum around a collaborative integrated corridor management project to maximize the I-84 corridor, which includes Oregon's busiest and most unreliable stretch of freeway.

Portland I-84 Corridor Unique Assets:	***FHWA/Agency/Public Benefits:***
• Mature multimodal system with a built out freeway/arterial network; multiple transit modes including light-rail transit, streetcar, and bus service; park & ride facilities; bicycle network	• Corridor has a robust set of travel options that support vibrant, diverse communities. Offers a truly multimodal environment to pilot ICM practices.
• Active traffic management devices including queue warning, variable speed limits, travel time signage on full color matrix VMS signs, and CCTV	• Much of the technology needed to support an ICM approach is in place today. Agencies actively use technology to improve the travel experience.
• Adaptive signal control on several arterial corridors	• Agencies are experienced with advanced technologies that smooth travel flow.
• All agencies on a common central ATMS software and traffic controller platforms	• Centralized system helps agencies to better maintain signals and manage progression across agencies. Multi-agency collaboration on ITS is common practice in the region and critical
• Shared communications infrastructure	• Ability to share information is in place. Mature system with defined protocols necessary for ICM.
• Data acquisition software module (recently completed custom fusion software)	• Ability to capture and consolidate data from ITS field devices and share with all ITS applications including TripCheck.com and Portal. The right data in a readily accessible/automated format is key to successful ICM.
• Automated performance metrics and transportation data warehouse	• Established data archive financially supported and valued by agencies. Ensures easy access to data for ICM performance metrics.
• Established regional committees for regular information sharing and project collaboration	• Proven model for regional collaboration. Strong foundation to support an active ICM committee.

The Integrated Corridor Management Deployment Planning Grant has arrived at the perfect moment for the Portland region to build on its strong track record of innovative transportation policies and investments to advance toward truly integrated management of its transportation assets. Investing in the Portland region as an ICM deployment site will further national best practices in linking planning and operations, and demonstrate the cost-effectiveness of system management and operations in solving regional transportation challenges.

2.0 Overview of the Portland Metropolitan Region

The Portland metropolitan region is located in the northwest corner of the State of Oregon. The region encompasses the urbanized portions of Clackamas, Multnomah and Washington counties and their 25 cities. The region is significantly influenced by its location on the confluence of two rivers. The Willamette, which flows south to north through the central business district, converges with the Columbia River just a few miles north of downtown. The Columbia divides Oregon from Washington; two interstate highway bridges (I-5, I-205) are the only roadways that cross the river within the metro area. The Figure 1 displays the geographic expanse of the Portland metropolitan region.

Managing a Growing Region

The population in the Portland metro region is growing larger and more diverse. Even during the "lost decade" of 2000-2010 the region added 15% more residents. The region's current population stands at 2.2 million (Portland-Vancouver MSA) and is expected to increase by 1.03 million residents by 2040.

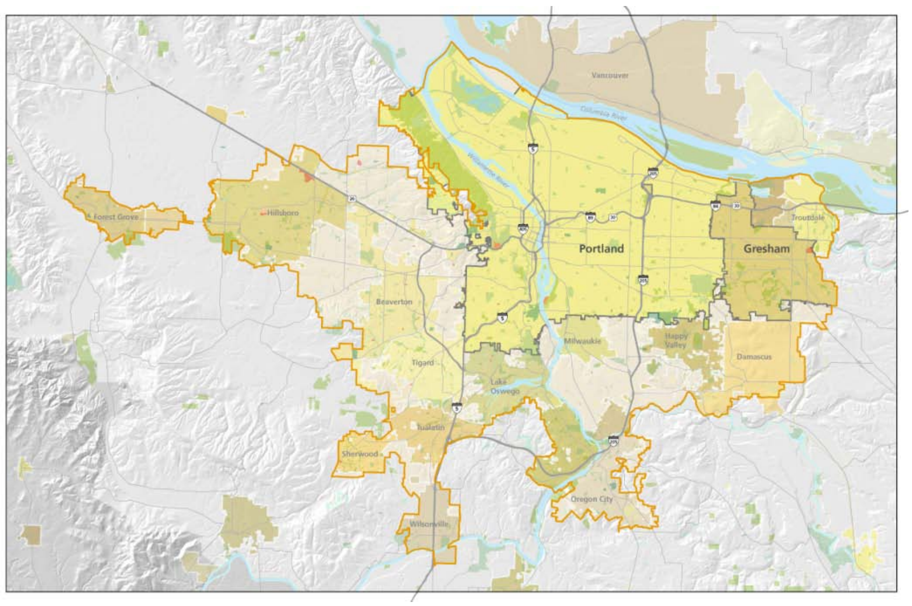


Figure 1 – Map of the Portland Metropolitan Region

Oregon and, especially, the Portland region are known for managing growth via strong land use and transportation policies and regulations. As a result, the region is adding more people while its geographic footprint expands at a much slower rate. Rather than sprawl into valuable agricultural and forest lands, urban growth is channeled into centers and corridors according to a regionally adopted vision, the Metro 2040 Growth Concept. Appendix A includes a map of the 2040 Growth Concept.

Transportation Drives a Trade-dependent Economy

The region is both an international gateway and a domestic hub for commerce. The region's two major rivers support marine-dependent industrial uses and deep water marine terminals with shipping access to the Pacific and the interior Northwest. Portland International Airport provides passenger and cargo service including access to Europe and Asia. I-5, I-84 and I-205 connect the Portland region to the Canada to Mexico trade corridor. Similar to the freeway network connections, two railroads, BNSF and Union Pacific operate mainlines and rail yards in the region. The region is also the terminus for the Olympic pipeline, which carries fuel to terminals sited along the Willamette River.

The region's geographic location and transportation attributes has profoundly influenced its economy. The regional economy is highly dependent on the Manufacturing and Warehousing, Trade, Transportation and Utilities sectors. A recent Brookings Institute found that the region ranked 12th nationally in value of annual exports ($22 billion) and 2nd in export's share of gross metropolitan product (GMP). The ability to move freight reliably and efficiently is paramount for the region.

Regional Transportation Policy Supports Integrated Corridor Management

The Portland region's most recent long-range transportation plan, the *2035 Regional Transportation Plan* (RTP) addressed the dual challenge of accommodating a growing population in a compact urban footprint while fostering economic competitiveness by elevating the role of system management and operations. **Goal 4: Emphasize Effective and Efficient Management of the Transportation System** seeks to ensure that *existing and future multimodal transportation infrastructure and services are well-managed to optimize capacity, improve travel conditions and address air quality goals.*

To support this goal, the 2035 RTP introduced the *Mobility Corridor Concept*, fashioned on ICM thinking of integrating transportation assets in order to move people and freight seamlessly across the region. Figure 2 depicts a corridor cross section for the Mobility Corridor Concept. The concept is the framework for evaluating performance and identifying investment strategies and priorities in a travel shed.

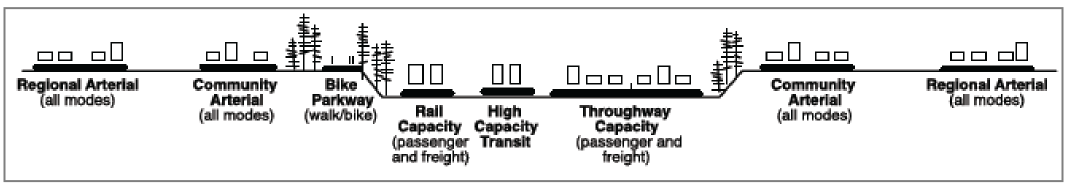


Figure 2 – Regional Mobility Corridor Concept

This application proposes to combine several of these mobility corridors that boast numerous transportation assets and advanced intelligent transportation system capabilities in order to develop a Regional Concept of Transportation Operations that will guide development of an integrated systems management approach.

In conjunction with the 2035 RTP, the region also adopted its first *Regional Transportation System Management and Operations (TSMO) Plan.* The plan lays out goals and principles for cooperative and collaborative management of the region's transportation system and provides a 10-year investment strategy for TSMO. The plan is described in more detail in section 2.5.

2.1 Description of the I-84 Multimodal Corridor

The proposed study corridor spans from Portland Central City to Gresham Regional Center, encompassing a broad swath of the densest mixed use neighborhoods in the eastern Portland region. This mobility corridor centers on I-84 from its starting milepost in downtown Portland to the edge of the urbanized area. The project area

Figure 3 – Map of I-84 Multimodal ICM Project Area

encompasses over 45 square miles. Figure 3 displays a map of the project area boundaries.

The corridor includes a sophisticated mix of transportation infrastructure and services including portions of three interstate freeways (I-84, I-5, I-205), three light rail transit routes, a streetcar route, numerous arterials, a robust bus network, and an expanding network of bike routes.

Appendix B includes maps of the corridor's freeway and arterial network, transit network and the existing and planned bike routes.

2.2 Agency Partners

The key agencies that operate networks and services in this corridor have a long and successful history of collaboration on planning and implementation of transportation projects. Important to note that in addition to the operating agencies that will serve as managing partners on the I-84 ICM project, there are other important stakeholders that will be engage in the ICM process including the Port of Portland, C-Tran (Clark County WA transit provider), local emergency responders, neighborhood associations, and the business community, particularly the freight representatives. Follow is a brief description of each partner agency that will serve on the project management team. Appendix C provides letters of commitment from each partner agency.

Metro will serve as the lead agency for the I-84 Multimodal ICM project. As the metropolitan planning organization (MPO) for the Portland region, Metro does not have operational or implementation responsibility in this corridor or elsewhere. However, as the regional planning agency, it is responsible for evaluating trends in transportation, land use, demographics, and other topics and holds authority for federal transportation funds in the region. In 2005, Metro created the Regional Mobility Program to advance transportation system management and operations planning in the region and oversee funding specifically allocated for TSMO.

Oregon Department of Transportation (ODOT) is the state agency responsible for transportation. The project area is wholly located within ODOT's Region 1, which encompasses nearly 900 miles of highway. ODOT exercises statewide leadership and vision in promoting, developing, and managing a statewide network of transportation systems and facilities. Within the region, ODOT operates and maintains 375 traffic signals, more than 200 cameras, 45 permanent variable message signs, 150 ramp meters, and a fleet of eleven incident response vehicles. The Transportation Management Operations Center (TMOC), located at the Region 1 headquarters in downtown Portland, is the nerve center of ODOT's regional freeway management system.

TriMet is a municipal corporation providing public transportation for the urbanized areas of the tri-county Portland region. TriMet operates a comprehensive transit network including a 52-mile MAX light rail system, 79 bus lines, 14.7-mile WES Commuter Rail and paratransit service for people with disabilities. TriMet carries more people than any other U.S. transit system its size. Weekly ridership on buses and MAX has increased for all but one year in the past 23 years. TriMet ridership has outpaced population growth and daily vehicle miles traveled for more than a decade. TriMet has a strong record of commitment to utilizing advanced technologies to enhance its service.

Multnomah County is the most populous county in the state of Oregon. It includes six cities within its jurisdiction including the cities of Portland and Gresham. The Land Use and Transportation Division manage the road infrastructure in unincorporated Multnomah County and smaller cities, excluding Portland and Gresham. The Bridge section manages and maintains six of the Willamette River bridges, including the Burnside, Broadway, Hawthorne and Morrison lift span bridges in the I-84 project area.

City of Gresham is a municipal corporation in the state of Oregon. It is the 4th largest city in Oregon with a population of 108,956. The Gresham Department of Environmental Services is the agency that builds and maintains the public works infrastructure within the city. The Transportation Division designs, operates and maintains a system of more than 898 lane miles of streets, including pedestrian and bicycle facilities, streetlights, traffic signals and road signs.

City of Portland, Bureau of Transportation (PBOT) oversees a $8.4 billion infrastructure investment from streets and structures to traffic signals and street lights. The agency maintains approximately 4,000 lane miles of streets within 147 square miles and oversees nearly 1000 traffic signals: 700 are centrally controlled and 275 have been upgraded to accommodate transit prioritization for TriMet buses and light rail vehicles. PBOT's Traffic Operations Center (TOC) allows the agency to address detailed traffic signal and operations maintenance issues.

Portland State University (PSU) is the largest university in Oregon, with approximately 30,000 enrolled students. Since 2006, PSU has been host to one of USDOT's University Transportation Center and competed successfully in 2013 to be designated as the National UTC for research on USDOT's Livable Communities goal. PSU's transportation research assets and facilities include five research labs in Civil and Environmental Engineering as well as Portal, a transportation data archive with approximately 10 years of ITS data from Portland area highways as well as transit, signal and multimodal count records.

2.3 Management and Operations Assets in I-84 Corridor

I-84 multimodal corridor benefits from significant investment in management and operations (M&O) capabilities that improve travel for all modes. The following series of maps and narrative inventory the M&O assets by system management function.

Freeway Management

Figure 4 displays ODOT's M&O assets in the I-84 corridor including the communication network, signals, ramp meters, cameras, and variable message signs.

Figure 4 – Map of ODOT Assets in the I-84 Corridor

ODOT has operated an incident response (IR) program since 1997. The full service program currently has a fleet of 11 IR trucks that dispatched by operators who use real-time traffic data and Closed-Circuit TV (CCTV) camera feeds to detect and verify incidents on area freeways. The trucks carry basic repair tools and traffic control equipment as well as variable message signs and a communications system. Dispatch occurs via the TMOC. The city of Portland's Traffic Operations Center offers complementary service to that provided by the Oregon Department of Transportation (ODOT), primarily focusing on city streets such as the area surrounding the 20,000-seat Moda Center arena and the Oregon Convention Center.

Arterial Management

City of Gresham Assets

Figure 5 displays the ITS assets in Gresham and eastern Multnomah County. They share a fiber optic communications backbone from the City Hall MAX platform to the Troutdale interchange on I-84 at 257th Ave. The ITS project currently under design will extend the fiber optic backbone. The project will also install an arterial VMS for northbound 181st Avenue approaching the I-84 freeway. When complete, there will be communications to 103 of the 116 traffic signals in Gresham and East Multnomah County.

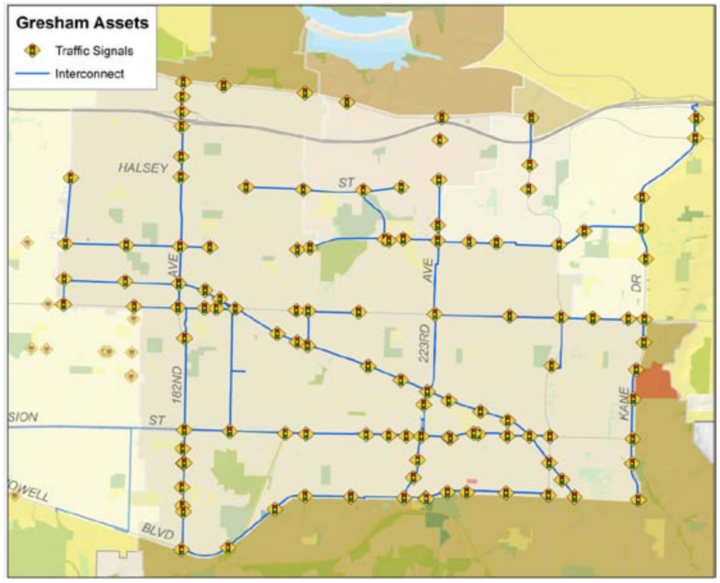


Figure 5 – Map of Gresham Assets in the I-84 Corridor

City of Portland Assets

Figure 6 displays the PBOT assets in the study corridor. PBOT operates the traffic signals at approximately 382 signalized intersections within the proposed corridor. Major signalized east-west streets are NE Halsey St, NE Glisan St, E Burnside St, SE Stark St, SE Division St, and SE Powell Blvd. Signals at the I-205 interchanges and on Powell from 82nd Ave to 148th Ave are operated by ODOT. The communications network consists of fiber optic, twisted pair, and ten conductor lines. The communications network covers inner SE Powell Blvd, outer SE Division St, NE Glisan St, NE Sandy Blvd, SE Stark St, Cesar Chavez Blvd, 82nd Ave, 102nd Ave, and 122nd Ave. However, critical sections of the communication system are missing east of I-205. Many extensions of the network are planned, including extensions along 122nd Ave to cover the entire length from I-84 to US 26.

PBOT operates 16 traffic cameras within the corridor, mostly found at major intersections along Grand Ave, MLK Jr. Blvd and 82nd Ave, with two cameras on 122nd Ave at SE Powell Blvd and at SE Division St. Approximately 17 additional cameras are planned as a part of an ongoing project in the corridor, mostly along 122ndAve and 148thAve at major intersections. PBOT operates seven Variable Message Signs in the corridor to display traffic information. All the signs are currently located along SE Powell Blvd and along 82nd Ave. Additionally, the agency operates several Bluetooth readers along 82nd Ave to measure travel times. More Bluetooth readers are planned for key arterials in the East Portland area.

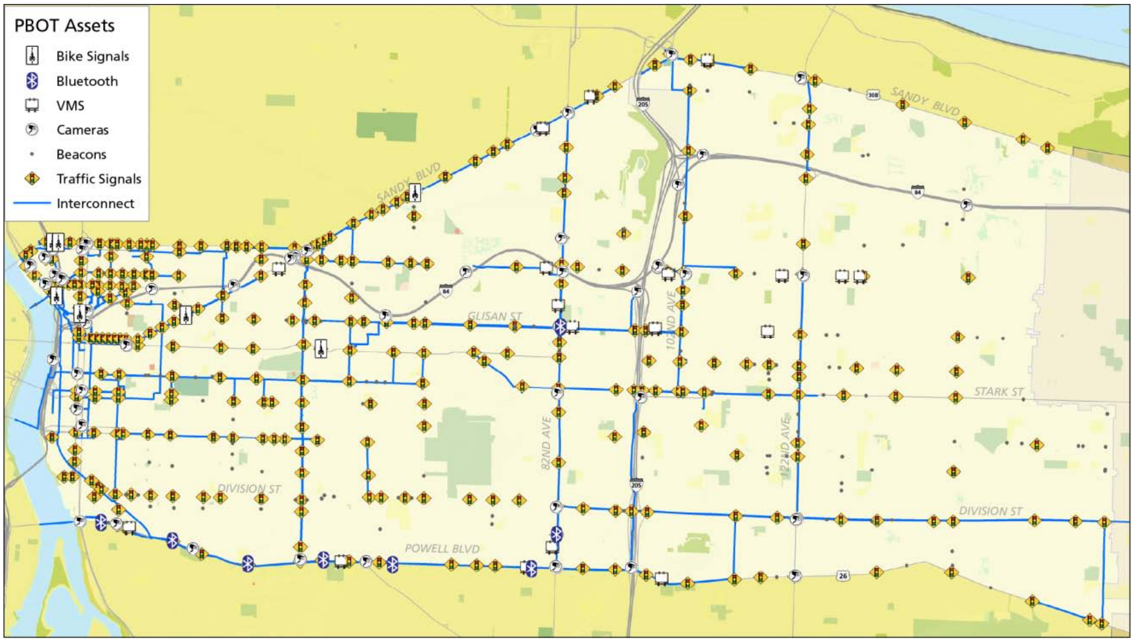


Figure 6 – Map of Portland Assets in the I-84 Corridor

Transit Management

Figure 7 displays TriMet's assets in the I-84 corridor. TriMet operates three light rail lines and 24 stations in the corridor. The three lines have average weekday boardings over 82,000 riders. During peak hours, west of Gateway Transit Center, TriMet operates trains at five minute headways with adequate capacity. East of the Gateway Transit Center, 15 minute headways with adequate capacity available.

TriMet operates eight parallel east-west bus lines with 15 minute or better peak service. There are over 1,000 bus stops along these lines with a total weekday ridership average of 55,000. There are also dozens of connecting bus and feeder bus routes in the corridor (including downtown) with 1,061 bus stops and a weekday ridership average of 40,000. Additionally, there are also 12 park and ride lots for bus and MAX light rail passengers in the corridor, with most of these having additional capacity available. Transit signal priority is operational along Division and Powell, a high capacity bus routes in the corridor. Signal priority is also prevalent at major intersections throughout the corridor.

TriMet has recently invested in an upgrade of its CAD/AVL system and communications. The agency has outfitted its entire fleet with automatic passenger counters and can provide real time passenger load information. TriMet is constructing a state of the art command center for bus and light rail operations, a new Operations Center, and upgrading its MAX control software as part of the new Portland/Milwaukie Light rail line construction, to be operational in 2015. Other ITS assets include fiber all along the light rail routes that provide real time camera feeds to the command center. TriMet has installed cameras all along the light rail routes and at all MAX stations.

Figure 7 – Map of TriMet Assets in the I-84 ICM Corridor

Traveler Information

ODOT's traveler information website, www.TripCheck.com, serves over 1.6 million visitors per month. The site provides real time road conditions and trouble spots including weather, traffic incidents, construction, and maintenance. In the Portland region, TripCheck includes a color-coded speed map that shows average speeds on the region's freeways. Site visitors have access to real-time camera views to check road conditions for freeways and other key locations such as mountain passes. The service is also available for mobile devices and via Twitter. Travelers can also dial 511 to access the same immediate road and weather information available on TripCheck.

TriMet is an industry leader in providing real time and customer information to its passengers for both bus and rail. There are monitor screens at MAX stations providing real time updates. TransitTracker provides passengers with real time updates through mobile apps and text messages. Mobile ticketing was recently added.

Transportation Demand Management (TDM)

Metro's Regional Travel Options program supports partner agencies in local TDM activities for residents and employers. Within theI-84 corridor, TriMet manages an employer outreach program. Portland and Gresham both manage TDM programs that focus on activities such as individualized marketing campaigns, "Bike to Work" days, Bike Commute Challenge, Sunday Parkways, group walks, and infrastructure installations including wayfinding signage and bike racks. In addition, two non-profit transportation management associations operate in the corridor, Lloyd TMA and Gresham TMA.

2.4 Corridor Performance

The following section demonstrates the region's capabilities for monitoring transportation performance while highlighting issues in the I-84 corridor. This corridor experiences problems common in dense urban areas – congestion, service reliability, and safety. In this environment, traditional approaches such as road widening are like climbing Mt Everest – costly and survival is uncertain. TSMO solutions are more affordable and welcomed by the community, as evidenced by the level of TSMO investment seen in the previous section. **The next logical step in tackling the persistent performance issues in this corridor is through an ICM approach**.

Freeway Congestion

I-84 travelers experience daily peak direction congestion: westbound in the am peak and eastbound in the pm peak. Figures 8 and 9 demonstrate these trends using Inrix analytic tools.

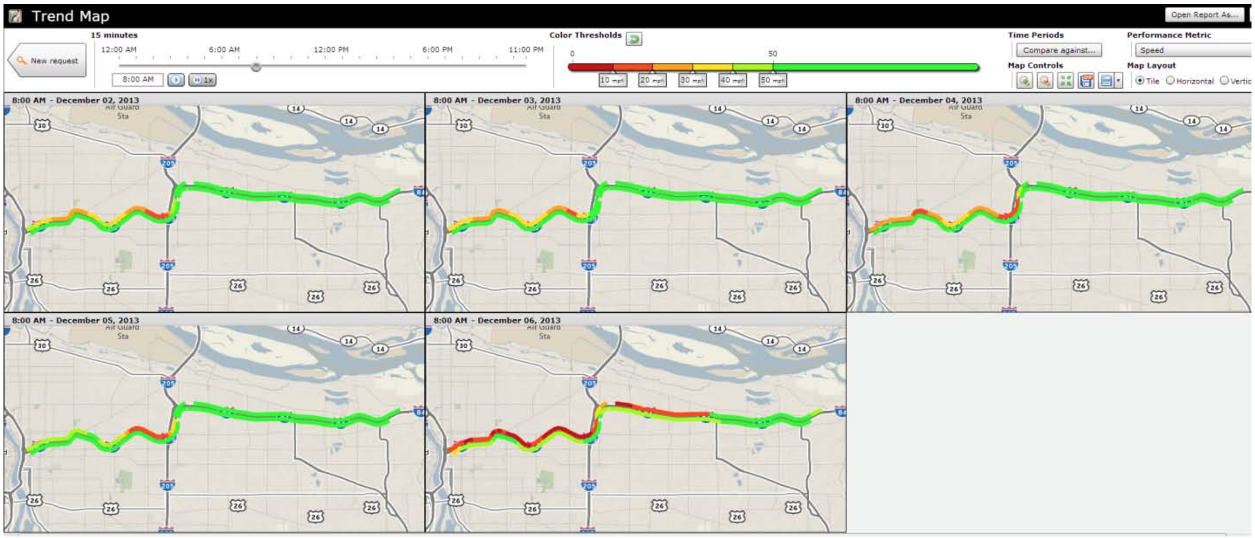


Figure 8 – I-84 AM Peak Hour Congestion, December 2013

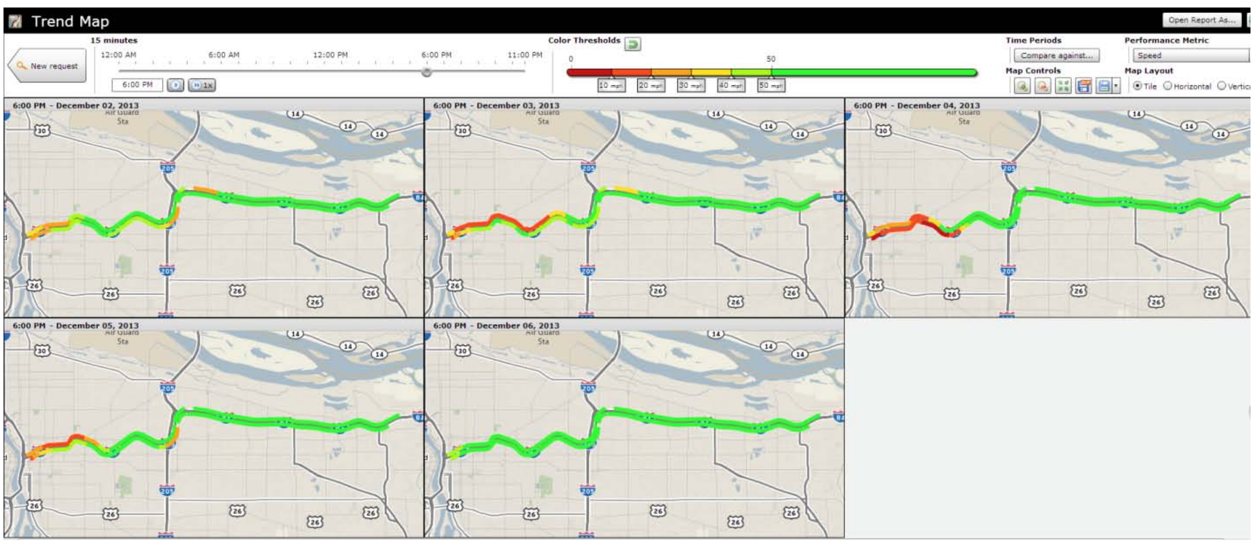


Figure 9 - I-84 PM Peak Hour Congestion, December 2013

While consistently congestion, travel time on I-84, particularly west of I-205, is unpredictable. Figure 10 provides a scan over a week in December 2013. Buffer times ranged from 3 minutes to 1 hour and 40 minutes.

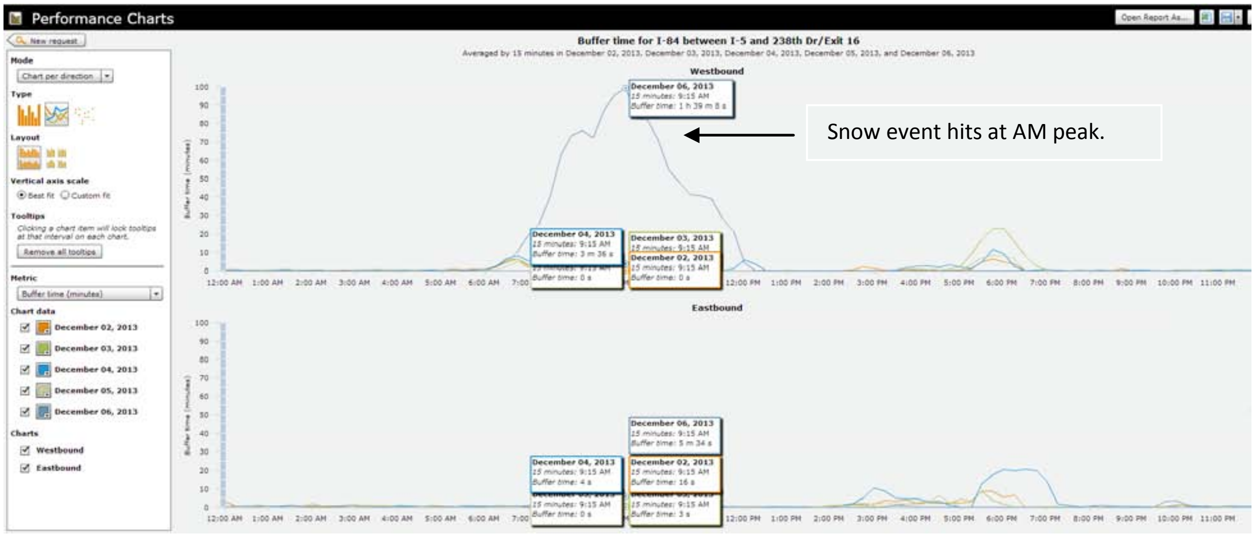


Figure 10 – I-84 Buffer Time, December 2 – 6, 2013

Arterial Congestion

Table 1 summarizes the performance of ODOT managed arterial roads in the I-84 corridor, drawn from the *2013 Corridor Bottleneck Operations Study* completed for ODOT facilities in the Portland region.

Table 1 – ODOT Arterial Road Performance

Major facility	Average Daily Traffic (ADT)	Issues
US 26 (Powell Boulevard)	ADT ranges from about 18,500 to 54,000 motor vehicle trips based on the location on the facility. • OR 99W – 54,100 • 39th Avenue – 35,200 • Foster Road – 39,500 • 82nd Avenue – 24,900 • Interstate 205 – 34,200 • 122nd Avenue – 18,500 • 174th Avenue – 19,900	• Congestion related to the Ross Island Bridge in the AM and PM peak periods that can reach back to 39th Ave • Congestion focused around the I-205 interchange area during the AM and PM peak periods • Calculated crash rates over 1.0 from 112th Ave to 148th Ave in Outer Powell area (for 2006 to 2008) • Minimal sidewalks present from I-205 to Portland boundary at 176th Ave
Highway 213 (82nd Avenue)	ADT ranges from about 22,200 to 26,200 motor vehicle trips based on the location on the facility. • Fremont Street – 22,200 • Interstate 84 – 25,900 • Division Street – 25,500 • Powell Blvd – 26,200	• Congestion related to heavy vehicle volumes and number of access points along SE 82nd Ave
Highway 99E (Grand/MLK)	Average daily traffic is approximately 46,200 motor vehicle trips near the Ross Island Bridge.	• Localized congestion at signalized intersections
US 30 (Sandy Blvd)	ADT ranges from about 22,200 to 26,200 motor vehicle trips based on the location on the facility. • OR99E – 22,100 • 60th Avenue – 22,000 • 82nd Avenue – 31,600 • Interstate 205 – 48,000 • 102nd Avenue – 23,500	• Localized congestion at signalized intersections

Major facility	Average Daily Traffic (ADT)	Issues
	• 122nd Avenue – 19,100 • 148th Avenue – 14,000 • 162nd Avenue – 14,800	

Freeway and Arterial Safety

Figure 11 maps the fatal and serious crashes that have occurred on the region's freeway and arterial networks between 2007 and 2009. The I-84 ICM project area accounts for several high fatal/serious crash locations in the region.

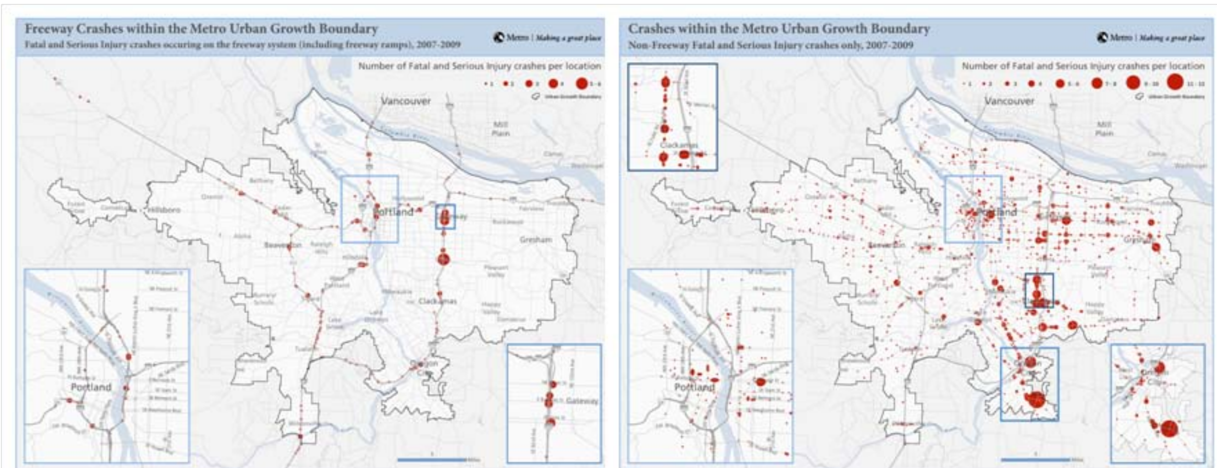


Figure 11 – Maps of Freeway and Arterial Crashes, 2007-2009

Transit Ridership and On-Time Performance

Figure 12 shows the average weekday transit ridership activity in the corridor overlaid on a Transit Environment Composite map, rated on a scale from zero to four, with four being the most conducive environment. Due to comprehensive land use and transportation investments, this corridor rates as one of the most transit-supportive in the region.

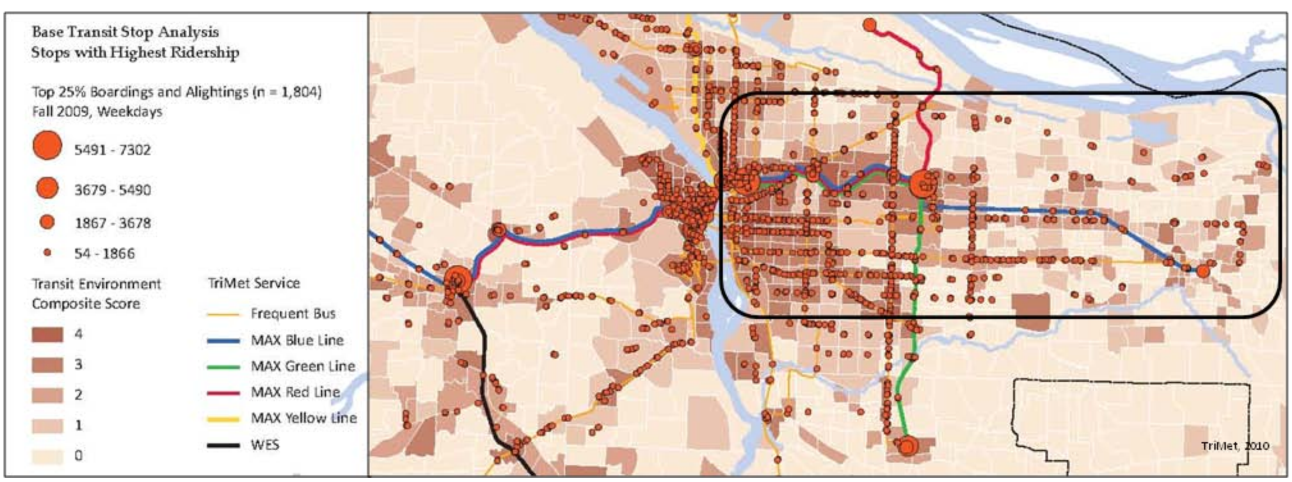


Figure 12 – Map of Transit Stops with Highest Ridership

Figure 13 shows the transit on-time performance in the PM peak travel period, available in Portal. Many of the routes on key arterials in the I-84 corridor experience regular delay in the evening rush hour.

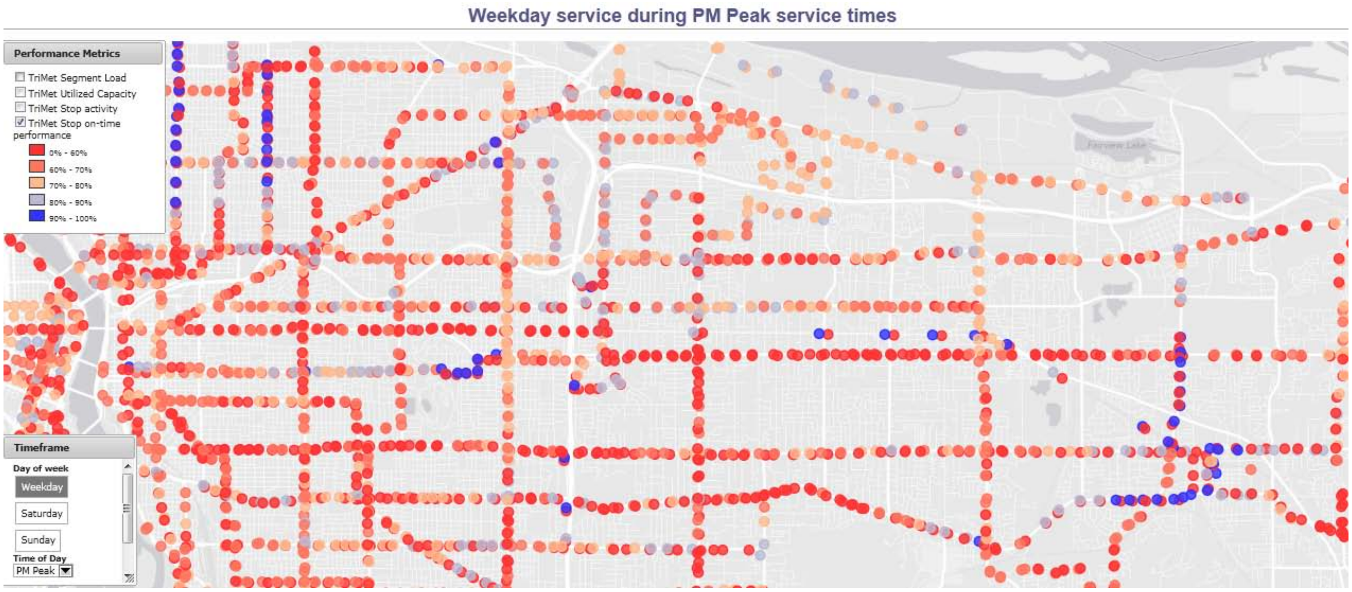


Figure 13 – Transit On-time Performance by Stop, fall 2013

Truck Activity

Figure 14 displays the 2013 average daily truck activity in the Portland region. The recently completed *Westside Freight Access and Logistic Analysis* identified inner I-84 and I-205 as critical links in the logistics chain for the region's computer and electronics manufacturers, providing access to the air cargo facilities at Portland International airport. In addition, many of the arterials in the corridor provide first and last mile access for truck dependent industries. The *Regional Freight and Goods Movement Task Force* identified congestion and travel time reliability as their top issues to be addressed by the 2010 *Regional Freight Plan*.

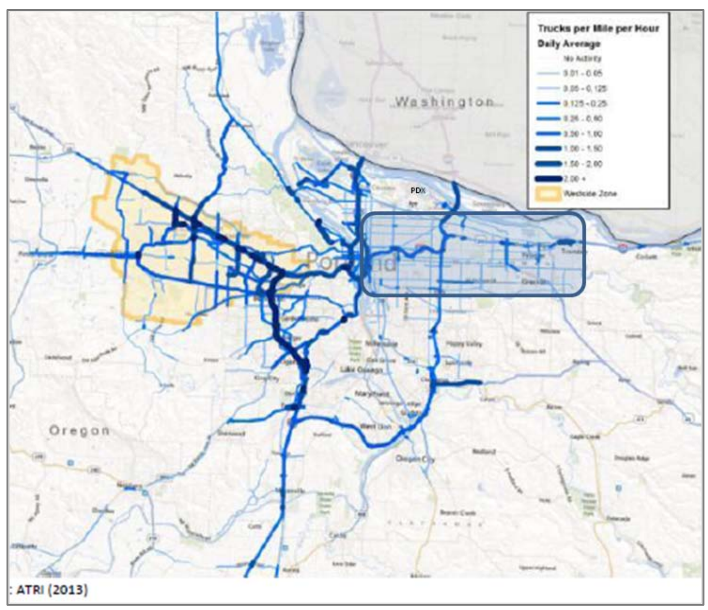


Figure 14 – Map of Average Daily Truck Activity in the Region

Bicycle Corridor Potential

Bicycle travel is an important element in the I-84 corridor, which reports the highest bike mode share in the region. The Zone Potential Map in Figure 15 demonstrates the quality of the environment for bicycling. The corridor boasts the most potential for good bicycling conditions based on land use pattern, topography, and road connectivity.

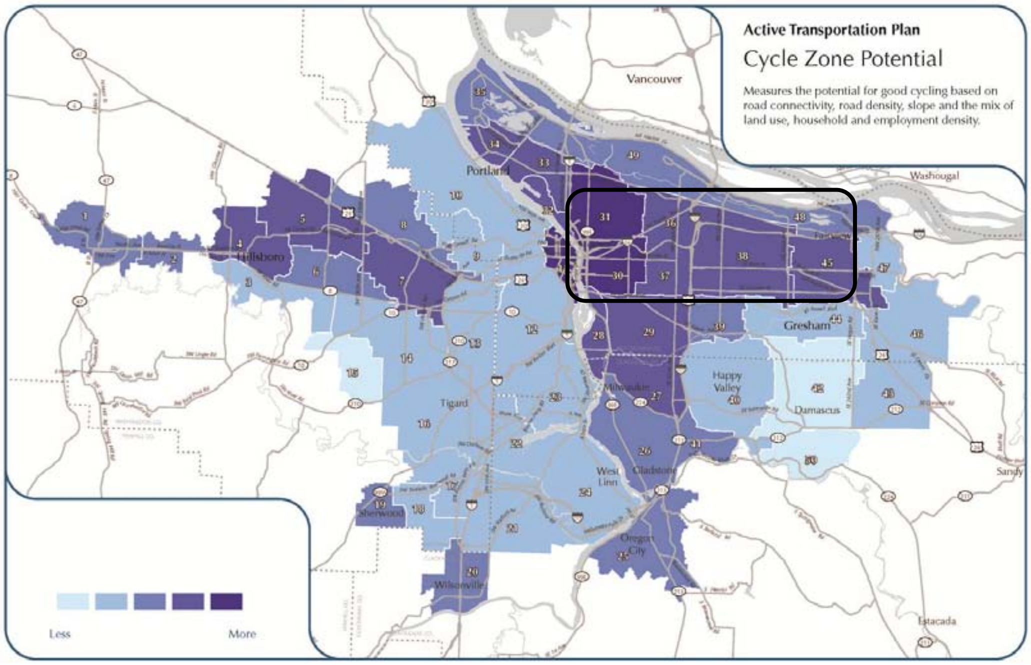


Figure 15 – Map of Cycle Zone Potential in the Region

2.5 Integrated Decision-making and Operations

Transportation decision-making in the Portland region occurs within a culture of cross-agency collaboration that has spanned decades. The result is a community that serves as a model for innovation in the areas of transportation and land use. This culture of collaboration is well demonstrated in the region's TSMO activities. **With its mature multi-agency coordination process and project partnering experience, the region is well positioned to successfully implement an ICM project.**

Metro – MPO

Metro is the federally mandated metropolitan planning organization designated by Oregon's governor to develop an overall transportation plan and to allocate federal funds for the Portland region. The elected Metro Council provides leadership from a regional perspective, focusing on issues that cross local boundaries and require collaborative solutions, including long range plans and funding. Four advisory committees facilitate transportation planning and decision making:

- Joint Policy Advisory Committee on Transportation (JPACT)
- Metro Policy Advisory Committee (MPAC)
- Transportation Policy Alternatives Committee (TPAC)
- Metro Technical Advisory Committee (MTAC).

TransPort

TransPort is a committee formed initially in 1993, with ODOT as the lead agency. The original mission of the committee was to develop the ATMS Plan as part of a Federally-funded ITS Early Deployment Study. Today, TransPort serves as the TSMO technical advisory committee for the region, with Metro as the committee manager and ODOT as chair. In this capacity, the committee makes recommendations to the MPO technical and policy boards on regional TSMO policy and sub-allocation of federal funding. The committee is the primary forum for sharing information and coordination of TSMO deployments for the region. The committee meets monthly. Voting membership is open to transportation operating agencies within the MPO boundary but participation in the meetings is open and is well attended by the consulting community. Appendix D provides a copy of the TransPort bylaws.

An I-84 ICM leadership committee would be established as a sub-committee of TransPort in order to connect the group to the regional policy and funding decision-making structure.

Cooperative Telecommunications Infrastructure Committee (CTIC)

Assembled in 1997, the Cooperative Telecommunications Infrastructure Committee (CTIC) is a collaborative group made up of operations and IT staff from ODOT, TriMet, Clackamas County, Washington County and the cities of Beaverton, Gresham and Portland. The committee operates as a sub-committee of TransPort. Through the collaborative effort, bandwidth on existing fiber optic communication networks is exchanged to avoid duplication where jurisdictions overlap. The agencies have a quid pro quo system of exchanging bandwidth, where only use of the network is swapped among the stakeholders. A unique feature of this project is that no funding has changed hands throughout the development of the fiber network. Each agency focused on installing the portions of the network that support the individual agency's operations, and the efforts were coordinated to eliminate redundancy. A collective architecture for the project was developed. An intergovernmental agreement exists to document roles and responsibilities for the effort. **TransPort has programmed funding for a Communications Master Plan, to begin in summer of 2014, which would support an ICM project.**

Advanced Traffic Management System (ATMS) Plan

The *Region-wide Advanced Traffic Management System (ATMS) Plan* was created in 1994 and updated in 2005 as part of the *Regional ITS Architecture*. This plan stresses the need for collaboration among agencies and jurisdictions in the Portland region. The plan includes a discussion of the information and data sharing among operating agencies that would be necessary to meet the ATMS Plan mission "to safely reduce delays, emissions, and fuel consumption by users of the region's multimodal transportation system through cooperative action by public and private agencies." The 2005 plan update includes operational concepts for Regional Traffic Control, Traveler Information, Incident Management, Public Transportation, Maintenance and Construction and Archived Data Management. **The 2005 Regional Operational Concept Plan and ITS Architecture are foundational resources for the targeted I-84 Multimodal ICM Project.**

Regional ITS Architecture

The first Regional ITS Architecture for the Portland region was developed in 2001 by TransPort. In 2005, the region completed its first update under the direction of the TransPort ITS Architecture subcommittees, which includes of representatives from the City of Portland, Clackamas County, FHWA, ODOT, and Tri-Met. **TransPort has programmed funding for a Regional ITS Architecture update to begin in summer of 2014. The latest update will incorporate ICM elements as necessary to address this corridor.**

Regional TSMO Plan

In conjunction with the development of the region's 2035 Regional Transportation Plan, TransPort developed the *Regional Transportation System Management and Operations Plan.* The plan provides a policy road map and investment strategy for TSMO and is funded through the Surface Transportation Program (STP) at the level of $1.5 million per year. To date, the region has awarded over $13.6 million in dedicated TSMO funds. TransPort also pursues other funding avenues, such as the ICM Deployment Planning grant, and has been able to secure funding to upgrade traffic signal systems, enhance incident response coordination, and advance data collection and archive capabilities. **The TSMO Plan provides the overarching policy framework for the I-84 Multimodal ICM Project.**

Regional Traffic Signal System

Based on its history of collaboration and sharing the same local traffic signal hardware and software, TransPort agencies jointly selected and implemented a common central traffic signal system. The city of Portland led the selection process for procuring equipment, and maintains and operates the central traffic signal system server. Partners jointly operate and maintain communications infrastructure to support the system. The cooperation created by this process has also led to joint efforts to agree on a new traffic controller standard (including software) and selection of an adaptive control algorithm. The benefits of this include reduced implementation and maintenance costs; shared control and monitoring of multiple agencies' traffic signal during incidents and special events; a large pool of trained staff on common platform; and a common source for traffic data from the region's traffic detectors

Portland State University ITS Lab and Portal

With critical support of TransPort agencies, the Portland State University ITS Laboratory was founded in 2000. This lab supports students and faculty who conduct research on how intelligent transportation systems (ITS) can most effectively be deployed in the Portland Metro area and throughout the nation. PSU's ITS Lab is home to the Portal, the region's transportation data archive. The goal of the Portal archive is to serve as the regional clearinghouse for transportation data by offering up many data types in an easily accessible interface. PSU manages the data archive with financial and technical assistance from TransPort members. Today, partner agencies supply the archive with volume and speed observations from area freeways at 20-second intervals, actual signal and phase time information from 400 traffic signals, volume counts from arterial stations, hourly weather observations, incident dispatch logs, variable message sign logs, and stop-level transit activity. **Portal will be an integral part of the I-84 Multimodal ICM project implementation.**

Multimodal Arterial Performance Management Regional Concept of Transportation Operations

The Regional TSMO Plan identified arterial data collection and archiving as a high priority for supporting active traffic management. TransPort recently completed the first phase of a multi-phased effort to enhance data collection for arterial roads across the region. The *Multimodal Arterial Performance Management Regional Concept of Transportation Operations* (RCTO) provides a "how to" guide for using existing technology to automated the collection of travel data on arterial roadways. The RCTO also describes a common regional approach to multimodal arterial performance measurement using automated data collection systems.

TransPort is now overseeing Phase II of the arterial data collection project, which includes upgrades to the software applications that run the region's traffic signal controllers and the central server. These upgrades will result in the ability for the region to automatically collect and transfer arterial performance data. Future phases include a Regional Communications Master Plan (2014) that will identify improvements to the existing communications network to facilitate sharing of data between TransPort partners, and most significantly the transportation data archive at PSU. TransPort has programmed funding to complete key gaps in the communications network, identified in the planning process.

2.6 Related Projects and Programs

The Portland region has embarked on a number of significance investments in planning, operations, and infrastructure that are highly supportive of an ICM approach and that can be woven into an ICM framework for the I-84 corridor.

Region-wide Investments

TripCheck Updates
ODOT is working on an update to TripCheck's Portland speed map to include arterial travel speeds. ODOT has also developed a web tool, TripCheck Local Entry Tool, for local agencies to share local events (incidents, special events, construction, etc.) in a central system. The site allows agencies to determine how broadly information is shared, ranging from internal to the traveling public. **The TripCheck Local Entry Tool will be a vital internal and external communications tool for the I-84 ICM project.**

Transit Computer-Aided Dispatch/Automated Vehicle Location (AVL/CAD) System Upgrade
TriMet has used a CAD/AVL system to manage bus operations since the mid 1990s. TriMet recently updated the system to improve bus tracking and performance monitoring capabilities. The new system also supports other ITS solutions such as TriMet's *TransitTracker* and automatic stop announcements in buses and trains. It also helps analyze transit operations such as on time performance and passenger loads. **Key ridership and performance data generated from the systems will be accessible in Portal.**

Map Trip Planner and Mobile Ticketing
TriMet's *Map Trip Planner* was released in beta in October 2011, marking the first fully open-source/open-data trip planner by a U.S. transit agency. In August 2012, the agency replaced the existing map trip planner. The new trip planner uses all open-source technologies, including *OpenTripPlanner* for multimodal routing. TriMet is exploring the possibility of integrating other local transit agencies so riders can plan long-distance trips. In 2013, TriMet also introduce a first of its kind mobile ticketing application that can be downloaded to an Android or iPhone smart phone to purchase and use transit fares for all vehicle types in its fleet.

Greater Portland Traffic Incident Management (TIM) Team
With the assistance of a SHRP2 grant from FHWA, ODOT and Metro are partnering to establish a TIM team for the region. Identified as a key objective of the Regional TSMO Plan, the Greater Portland TIM Team will be a cross-discipline, multi-agency forum for facilitating improvements to incident management practices in the region. **The Greater Portland TIM Team will be established in spring 2014 and will be a key stakeholder to the I-84 Multimodal ICM project.**

SHRP2 L35A Grant - Local Methods for Modeling, Economic Evaluation, Justification and Use of the Value of Travel Time Reliability in Transportation Decision Making
Metro is partnered with the University of Arizona on a SHRP2 funded project to investigate the use of travel time reliability measures for project evaluation and program development. The project will advance the region's capability to generate travel time reliability using its multi-modal dynamic traffic assignment model. **This work is directly relevant to an ICM approach for the I-84 corridor. The region currently has a DTA model in place that would be used for analyzing alternatives in the Analysis, Modeling, and Simulation (AMS) phase of the project.**

I-84 Corridor Investments

I-84 Active Corridor Management (ACM) Project

A precursor to an I-84 Multimodal ICM project, the I-84 ACM project seeks to improve traffic operations on surface streets in the east Portland and Gresham. The project will enable the active management of arterial traffic signals during incidents; monitor performance and respond to conditions on a daily basis; and enhance coordination between ODOT, the City of Gresham, and City of Portland during incidents, construction and special events. It will also improve arterial operations for pedestrians, bicycles, transit, and motor vehicles through proactive management of the traffic control system. Three operational scenarios are included: Review of Signal Timings, Incident Management Response, and Pedestrian and Truck Use in Off-Peak Periods. Phase 1 of the project completes a concept of operations, systems engineering documentation, and final plans ahead of Phase 2 construction. Appendix E provides the draft I-84 ACM Concept of Operations document. TransPort allocated $ 1.4 million funding for the project, sufficient to substantially construct the ACM system that will include traffic signal controller and software upgrades, system detectors, Bluetooth sensors, CCTV cameras, and communications infrastructure necessary to connect the field devices to the central traffic control system. **The I-84 ACM project is foundational to the I-84 Multimodal ICM project. Along with the East Metro Connections ITS Implementation, described in the next section, these projects represent a substantial investment in ITS infrastructure necessary to implement an ICM project.**

Figure 7 – Map of I-84 ACM Project Area

East Metro Connections ITS Project

Metro in partnership with ODOT, Multnomah County, and the cities of Fairview, Gresham, Troutdale and Wood Village, completed a corridor action plan for the eastern portion of the region that prioritized TSMO as a key strategy. TransPort allocated funding to support the East Metro Connections ITS project, currently under development.

In support of the I-84 ACM project, the East Metro Connections ITS project extends Ethernet communications to 14 previously isolated traffic signals and modernize the signal controllers. It upgrades an additional 13 traffic signals with Ethernet communications and modern controllers along the four main north/south corridors. The project installs an arterial variable message sign for northbound traffic on NE 181st Avenue approaching the I-84 freeway interchange. It extends the East County fiber optic communications backbone. It also expands Gresham's existing SCATS traffic adaptive system by eight intersections and upgrades five intersections along the existing

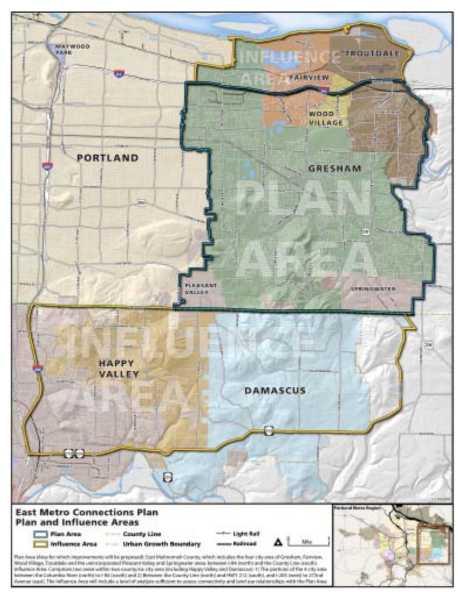


Figure 8 – Map of East Metro Connections Planning Area

SCATS corridor with modern controllers, Ethernet communications, and new timing to add flashing yellow arrow left turns.

I-5/I-205 Bi-state Traveler Information Signage Project

ODOT and Washington State DOT (WSDOT) are jointly developing a project to provide destination travel times within the I-5 and I-205 corridors in the Portland OR – Vancouver WA region. The project includes a combination of white on green guide signs showing travel times via multiple routes to select destinations and uses existing variable message signs for travel time. ODOT and WSDOT are coordinating efforts in terms of travel time data sharing and signage design. Both agencies in are currently in the project design phase. TransPort provided funding to support ODOT's investment. **The I-84 Multimodal ICM project benefits from the availability of en-route traveler information on I-205 and the ability to expand the system to I-84.**

Powell-Division Transit and Development Project

Beginning in fall 2013, the Powell-Division Transit & Development Project will result in a multi-agency corridor investment strategy that will define a high capacity transit project for a Small or New Starts application, develop transit supportive land use actions, and prioritize related projects to stimulate community and economic development. The project area for Powell-Division project overlaps significantly with the proposed I-84 Multimodal ICM project area.

Figure 9 – Map of Powell-Division Transit and Development Project Area

The Powell-Division Transit and Development project is anticipated to result in an agreement on a transit alternative by winter 2014, transitioning into a design and EIS phase in 2015. **The similar trajectories of the high capacity transit project and the I-84 Multimodal ICM project provide the opportunity to collaborate on technical and stakeholder outreach in the corridor; and to integrate a new high capacity transit service line into the operational planning for the corridor.**

Advanced Bridge Lift Notification Project

Multnomah County is developing an advance notification of bridge "lifts" for its four drawbridges over the Willamette River in downtown Portland. The concept will be enable an ITS approach on both a planned and unplanned basis. Scheduled bridge lifts will be forecast and communicated, as well as impromptu lifts or other outages. Hardware devices will be installed on the bridges to augment "schedule" data to validate bridge open/closed status. The current plans are to make this information available in a variety of forums: Twitter, Internet, cell phone alerts, etc. The advance warning of a bridge lift or closure will enable re-routing of traffic to alternate pathways across the Willamette River. Average daily traffic on these bridges ranges from 30,000 vehicles per day to 50,000. Bridge lifts create significant delay on the network.

Multimodal Data Set for Portland Oregon Region: Test Data Set for the FHWA Connected Vehicle Initiative Real-Time Data Capture and Management Program
Portland State University, in partnership with ODOT, TriMet, City of Portland, and Metro, led an effort to develop a multimodal test data for a section of the I-205 corridor, approximating the section identified for the I-84 Multimodal ICM project. The data set contains freeway loop detector data, weather data, incident data, arterial count data, signal phase and timing data, limited Bluetooth travel time data and bus and light rail data. The FHWA-funded effort was significant to developing methodologies for data capture and evaluating the data quality from the capture devices. Since the ability to accurately monitor performance is integral to ICM implementation, **this work provides important lessons for advancing the I-84 Multimodal ICM project.**

3.0 Project Overview

The following section provides the concept for the I-84 Multimodal ICM project. It lays out the project vision, goals, and objectives as identified by the project partners. It defines a preliminary set of project success factors and key performance indicators that will guide development of the I-84 Multimodal ICM project and can serve as measures of success for implementation. Lastly, it provides details regarding the proposed scope of work, funding request and project management.

3.1 Project Vision and Goals

Vision

The I-84 corridor stakeholders will collaboratively and proactively manage the multimodal I-84 corridor to ensure safe, reliable, efficient, and equitable mobility for people and goods by using technology and public/private cooperation to integrate the operation of its transportation facilities and services.

Goals

In December 2012, 28 key stakeholders participated in an FHWA-sponsored *ICM Knowledge and Technology Transfer* workshop focused on the I-84 corridor. The workshop identified issues and goals for implementing an ICM approach to improve travel in the I-84 corridor. As a result of the workshop, regional stakeholders have coalesced around the idea of advancing an ICM pilot in the I-84 corridor. Following are the goals the stakeholders identified for the I-84 Multimodal ICM project.

Goals	Issues identified in December 2012 ICM Workshop
Implement a systematic multimodal approach, complete with performance measures and evaluation approaches, in accordance with multimodal mobility corridor concepts.	• *"Sometimes we have independent projects that work against each other, because we don't know about the other project."* • *"We do not have the ability right now to coordinate multimodal transportation operations on a daily basis."* • *"Part of the challenge is letting travelers know there are options. Because right now, [drivers] are not going to drop their car and take transit. They are taking an alternate route based on their knowledge of the road network."* • *"We need to look at our transportation as a network. Not the individual parts. Everybody needs to be involved, not just "I own this and that is all I am involved with."* • *"I'd like to see a more integrated performance measurement approach, and then evaluating our strategies from a multimodal standpoint."*

Balance mobility, safety and access considerations.	• *"We want to limit what gets onto I-84 to make it flow better, but don't want to cut off neighborhood/arterial access."*
Relieve incident-related congestion and non-recurring bottlenecks.	• *"Start with improving multimodal, interagency protocols for incidents to day-to-day operations."* • *"Want to manage traffic related incidents and subsequent congestion that impacts I-84 between I-5 and I-205… use the vision that comes out of this meeting to figure out how to mitigate incidents faster."*
Improve multimodal access for corridor users.	• *"Interested to increase access to our transit facilities – park and rides."* • *"Interested in discussions about access and multimodal aspects of corridor."* • *"[As a freeway agency] we can work more closely with our transit agencies to share information about what we are doing and why, and they will hopefully do the same."* • *"We do a good job of getting together when there are major incidents, but we can do a better job of sharing information on a daily basis. We should be using the ATMS and TripCheck.com for sharing information back and forth. When we do a bus bridge we should be calling the arterial managers from the affected counties.*
Better manage freight mobility in the corridor.	• *"We have major freight rail lane running through corridor."* • *I-84 is principal truck route for Oregon and the Portland region.*
Leverage intelligent transportation system (ITS) technologies to become even more *active* and *integrated*.	• *"When a problem shows up, now somebody has to call somebody. Its manual – would like it to be more automated."* • *"ITS systems throughout corridor is the vision."* • *"Bluetooth and other data collection systems implemented throughout the corridor."*
Balance state and local needs in transportation planning and operations.	• *"When we look at the corridor at a planning level, there tends to be a focus on the state system, not the local level."*

3.2 Project Success Factors and Performance Indicators

Project Success Factors

The Phase 1 of the I-84 Multimodal ICM project will successful when:

<u>Realistic and prioritized</u> vision, goals and objectives for the integrated I-84 corridor are agreed upon by key stakeholders and documented in a joint memorandum of understanding.

<u>Clear roles and responsibilities</u> of stakeholders are documented in a memorandum of understanding.

<u>Multi-agency asset/resources inventory</u> to drive architecture updates and baseline for alternatives analysis is completed.

<u>Tangible and specific</u> alternatives analyses (built around "use cases") for the I-84 corridor are identified for advancement into Phase II, which will develop a detailed concept of operations, system requirements specifications and an implementation plan.

Performance Indicators

The 2035 RTP established a set of performance indicators to guide decision making and performance assessment for the region's transportation investments. These indicators will be applied to the I-84 Multimodal ICM project.

Safety — Reduce number of fatalities and serious injuries for pedestrian, bicyclist, and motor vehicle occupants in the corridor.

Congestion – Reduce vehicle hours of delay per person.

Reliability – Reduce travel time variability in the corridor.

Travel – Reduce vehicle miles traveled per person in corridor.

Transportation Choices – Increase mode share for transit, bicycling and walking in corridor.

Transit Service – Increase transit on-time performance in the corridor.

Environment – Reduce vehicle emissions in the corridor.

Economy – Increase fuel savings for vehicles traveling in the corridor.

3.3 Scope of Work – Phase 1

The Portland metropolitan region proposes to apply the ICM Planning Deployment Grant to fund and accomplish the following set of major activities.

Activity 1 Stakeholder Participation Plan

Develop a stakeholder participation process to generate input and support from a cross-section of stakeholders at key points in the concept development.

Activity 2 Vision – Goals – Objectives

Conduct stakeholder workshops to refine the desired vision, measurable goals and objectives for ICM in the I-84 corridor.

Activity 3 ICM Operational Alternatives

Develop an initial set of operational alternatives to achieve the desired vision, measurable goals and objectives for ICM in the I-84 corridor. Identify asset requirements and other operations needs to support ICM strategy. Document resources necessary to implement ICM operational strategies including funding and staffing. Crosswalk operational strategies with the Regional ITS Architecture to document supporting market packages and to identify gaps in the architecture.

Activity 4 Alternatives Analysis

Bundle operational strategies into operational scenario packages for evaluation. Prepare base year Dynamic Traffic Assignment model network for the I-84 corridor. Conduct a mesoscopic-level evaluation of up to four operational scenarios to assess effectiveness of operational strategies using corridor performance indicators. Refine operational alternatives based on analysis for advancement into Phase 2 implementation.

Activity 5 Infrastructure Improvements

Document existing and planned near-term operations assets in corridor. Conduct an analysis to compare existing/planned assets with ICM asset requirements to identify set of infrastructure improvements necessary to support operational alternatives.

Activity 6 Relationships and Procedures

Document current operational relationships and procedures in corridor. Assess current operational relationships and procedures to identify issues and recommended actions for ICM operations.

Activity 7 Project Management Plan (PMP)

Prepare an ICM PMP as the guiding document for the managing and advancing implementation of the I-84 Multimodal ICM project.

Activity 8 Systems Engineering Management Plan (SEMP) Framework

Prepare a SEMP framework to guide provide a structure for systems engineering as the ICM project progresses towards implementation.

Activity 9 I-84 Corridor ICM Regional Concept of Transportation Operations (RCTO) Final Report

Prepare final report to document the recommended ICM vision, goals and objectives, ICM operational strategies, infrastructure improvements, relationship and procedural changes/enhancements, and resources. The PMP and SEMP will be included as appendices to the final document.

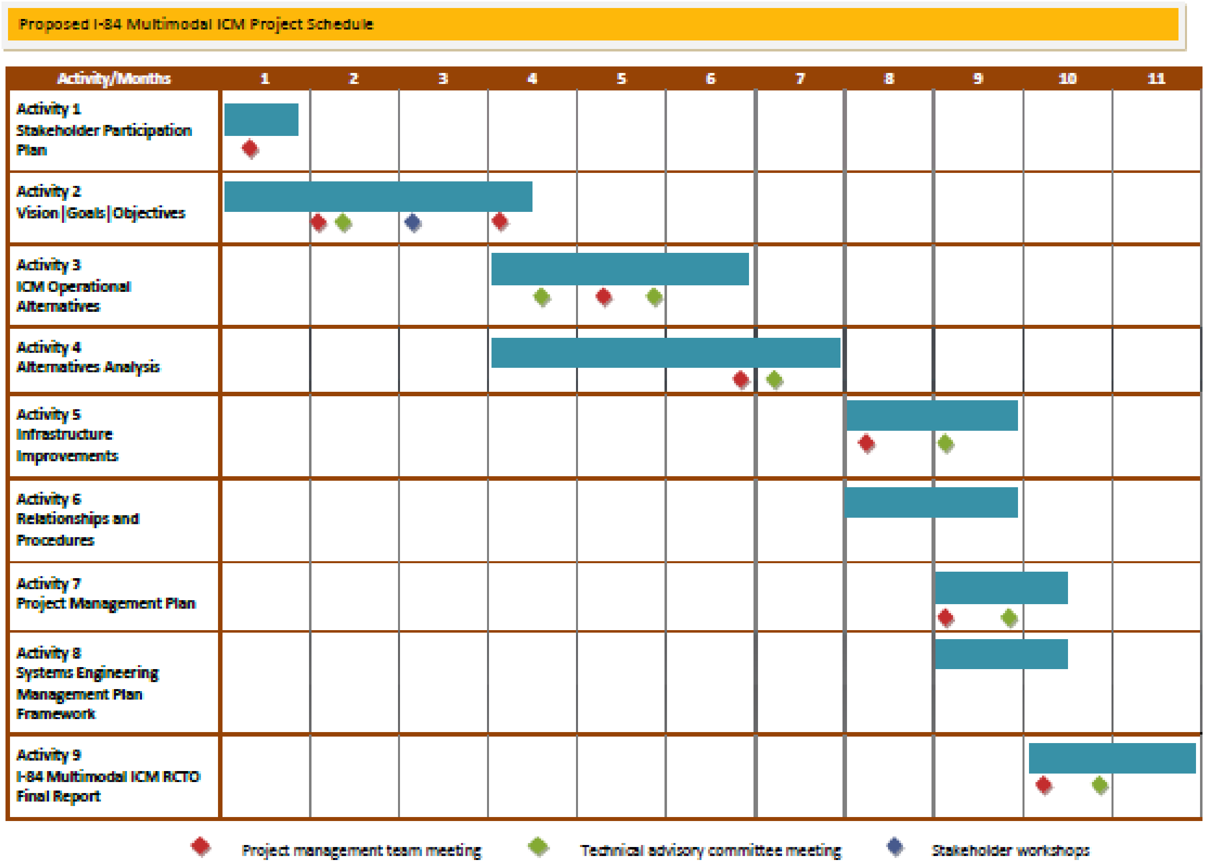
3.4 Budget and Schedule

The total project cost for I-84 Multimodal ICM RCTO is **$239,600**. The total FHWA funding request is **$191,680**. The proposed local match is **$47,920**. The match will be provided using in-kind services from partner agencies. Following is a breakdown of the project costs by major activity.

Budget

Major Activity		Estimated Cost	Federal Share	Local Share
Activity 1	Stakeholder Participation Plan	$ 11,000	$ 8,800	$ 2,200
Activity 2	Vision – Goals – Objectives	$ 33,400	$ 26,720	$ 6,680
Activity 3	ICM Operational Alternatives	$ 44,200	$ 35,360	$ 8,840
Activity 4	Alternatives Analysis	$ 43,000	$ 34,400	$ 8,600
Activity 5	Infrastructure Improvements	$ 34,800	$ 27,840	$ 6,960
Activity 6	Relationships and Procedures	$ 24,400	$ 19,520	$ 4,880
Activity 7	PMP	$ 16,600	$ 13,280	$ 3,320
Activity 8	SEMP Framework	$ 16,600	$ 13,280	$ 3,320
Activity 9	I-84 Multimodal ICM RCTO Final Report	$ 15,600	$ 12,480	$ 3,120
	Totals	**$ 239,600**	**$ 191,680**	**$47,920**

Project Schedule



3.5 Project Management

Following is a list of key organizations and staff committed to participating on the project team. Letters of commitment are provided in Appendix D.

Agency	Lead Staff	Role
Metro	Deena Platman, Principal Transportation Planner	Project Manager
	Brian Monberg, Senior Transportation Planner	Key stakeholder/technical advisor
ODOT Region 1	Dennis Mitchell, Traffic Engineer	Project Management Team
	Alan Snook, Major Projects Manager	Key stakeholder/technical advisor
TriMet	Steve Callas, Manager, Service and Performance Analysis	Project Management Team
	Jeffrey Owen, Transportation Planner	Key stakeholder/technical advisor
Multnomah County	Brian Vincent, County Engineer	Project Management Team
	Joanna Valencia, Senior Planner	Key stakeholder/technical advisor
City of Gresham	Jim Gelhar, Traffic Engineer	Project Management Team
	Katherine Kelly, Transportation Planning Manager	Key stakeholder/technical advisor
City of Portland	Peter Koonce, Signals and Street Lighting Program Manager	Project Management Team
	Art Pearce, Transportation Planning Manager	Key stakeholder/technical advisor

Agency	Lead Staff	Role
Portland State University	Jon Makler, Education & Technology Transfer Program Manager	Project Management Team
	Dr. Kristin Tufte, Associate Professor – Computer Science	Key stakeholder/technical advisor

Metro will serve as project manager. ODOT will administer the federal-aid transportation funds granted to the project including the preparation of the multi-party IGA necessary for capturing local match funds committed by the project partners and the consultant work order contract. The phase I work will be completed by a consultant. Metro will lead the consultant selection process in collaboration with the Project Management Team. Once retained, Metro will manage the consultant, including monitoring project schedule, approving deliverables and reviewing invoices prior to ODOT final review and payment.

3.6 Phase 2 Methodology

Phase 2 of the I-84 Multimodal ICM project will accomplish the following:

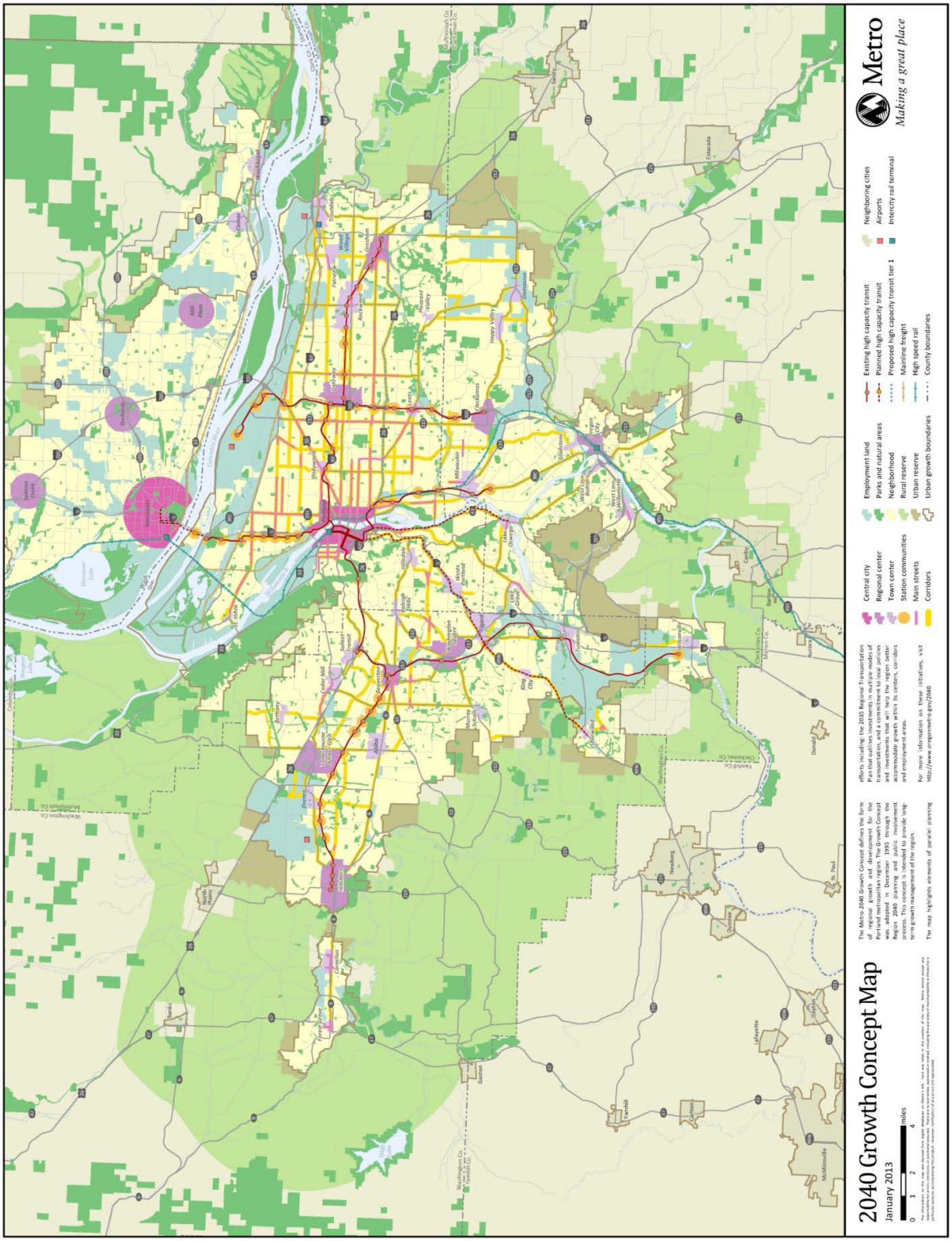
- Refine the Phase 1 concept of operations adding in details for institutional, operational, and technical elements, which may necessitate updating the regional ITS architecture.
- Prepare and implement an Analysis, Modeling, and Simulation (AMS) plan, leveraging Portland Metro's established Dynamic Traffic Assignment (DTA) mesoscopic modeling, activity-based modeling, and micro simulation modeling capabilities. The Plan will support AMS evaluation in Phase 2 to distinguish expected performance and cost/benefit of recommended ICM treatments for priority scenarios, leading to stakeholder buy-in and political support for the specific Phase 2 ICM treatment(s) that will make up the project. The AMS plan will also direct periodic evaluation of the ICM strategies.
- Develop the Decision Support System for I-84 corridor management by augmenting existing activities.
- Update the PMP and SEMP.
- Complete remaining planning and implementation of system engineering elements including system requirements, preliminary design, specifications, estimates, project bidding approach, ICM treatment testing plans (verification and validation), leveraging Portland's multimodal automated performance measures system, and establishing interagency agreements to field implement and perfect the ICM treatments.

3.7 Conclusion

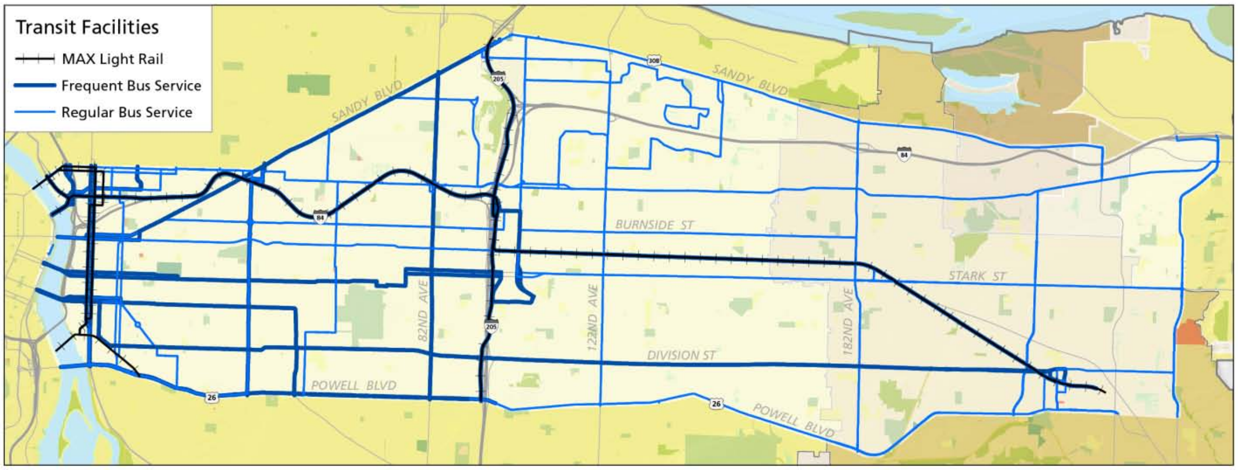
The Portland region is uniquely suited and ready to advance an ICM project in the I-84 corridor.

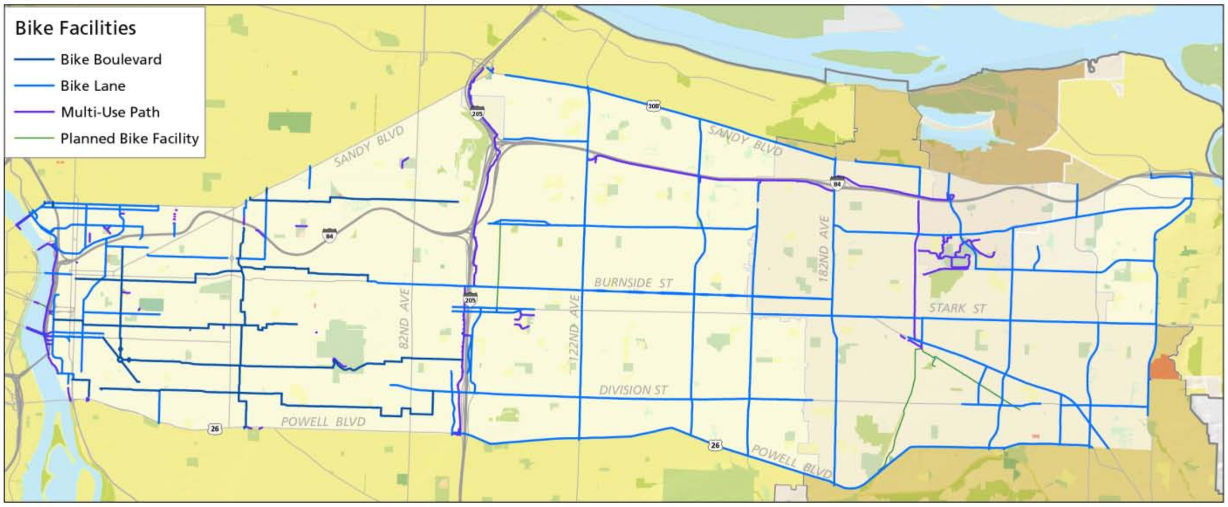
- The key regional partners are committed to the project and have demonstrated success in collaborating on TSMO projects.
- The region is making significant investments in the I-84 corridor and recognizes the value of an integrated approach to managing the corridor.
- The ICM Planning Deployment Grant is the catalyst to spark the ICM effort.

Appendix A – 2040 Growth Concept Map



Appendix B – Maps of the I-84 Corridor Facilities





Appendix C – Letters of Support

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503-797-1804 TDD
503-797-1793 fax
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METRO COUNCIL PRESIDENT TOM HUGHES

January 9, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez:

As the regional government for the Portland, Oregon, metropolitan area, Metro crosses city limits and county lines to work with communities to create a vibrant and sustainable region. The Federal Highway Administration's (FHWA) Integrated Corridor Management Deployment Planning grant is a welcome opportunity to engage partners around improving mobility in a vital transportation corridor. We are pleased to submit an application for the *I-84 Multimodal Integrated Corridor Management (ICM) Regional Concept of Transportation Operations (RCTO)* project.

The Portland region's penchant for collaboration and openness to new ideas has placed it at the forefront of implementing smart ways to make travel safer and more efficient. With the region's track record of successful technology deployments, the I-84 Multimodal ICM project is a low risk, high reward investment that can serve as a FHWA model for best practices.

Metro and its project partners are committed to working jointly to make the I-84 corridor safer, more reliable, and less impactful to the environment and the wallet. We look forward to partnering with FHWA to advance the ICM approach in the Portland region.

Sincerely,

Tom Hughes

Tom Hughes
Metro Council President

Oregon
John A. Kitzhaber, M.D., Governor

Department of Transportation
Region 1
123 NW Flanders St.
Portland, OR 97209-4012
Phone: (503) 731-8200
Fax: (503) 731-3266

January 10, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez,

The Oregon Department of Transportation is continually looking for new and innovative ways to manage congestion, provide safe roadways for travel, proactively plan and prioritize investments while building partnerships with our local and regional agencies. The Integrated Corridor Management (ICM) Deployment Planning Grant is an excellent opportunity for all of those goals. This letter is being submitted in support of Metro's application for ICM Deployment Planning Grant funds administered by the Federal Highway Administration Office of Transportation Management.

The objective of the ICM Deployment Planning Grant program is to advance transportation planning and development efforts to improve the management of the system. Investing in the Portland region through this effort will help further ODOT's mission of providing a safe, efficient transportation system that supports economic opportunity and livable communities. It is programs like this that help keep the Portland region innovative and on the cutting edge of best practices in advancing towards a truly integrated management of its transportation assets.

Thank you for your consideration of Metro's application. We look forward to collaborating with them, and other partnering agencies, as we all move forward with efforts like this that help plan solutions to regional transportation challenges.

Sincerely,

Jason Tell
ODOT Region 1 Manager

TRIMET

January 8, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez,

TriMet is pleased to support Metro's grant application to the Federal Highway Administration Office of Transportation Management for the Integrated Corridor Management (ICM) Deployment Planning Grant.

Our objective is to advance transportation planning and development efforts to improve the management of the system. This closely aligns with the ICM Deployment Planning Grant program objectives. The agencies that currently manage the transportation corridor have a tradition of working together in partnership and we look forward to improving these relationships as we work together to manage the corridor as an integrated system. In working more closely, we know that we can provide better overall mobility and access, manage congestion and provide travelers better information about their transportation choices. This objective is consistent with the MAP-21 emphasis on accelerating technology and innovation deployment, and will contribute to our agencies' ability to meet the system performance goals called for in MAP-21.

This research will support TriMet in providing bus, light rail and commuter rail service in the Portland metro area. Due to the usefulness of this effort to us, TriMet staff will be providing staff time as in-kind match to the project. Our transportation options connect people with their community, while easing traffic congestion and reducing air pollution—making our region a better place to live. As we carry out our mission in the region now and into the future, it is crucial that we maximize the efficiency of the multimodal transportation system and accessibility for all transportation users.

We look forward to working with Metro, the City of Portland, other regional partners, and the Federal Highway Administration to improve our understanding of these emerging techniques.

Sincerely,

Neil McFarlane

Neil McFarlane
General Manager

Tri-County Metropolitan Transportation District of Oregon
1800 SW 1st Avenue, Suite 300, Portland, Oregon 97201 • 503-238-RIDE (7433) • TTY 7-1-1 • trimet.org

Commissioner Diane McKeel

Multnomah County

January 6, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez,

Multnomah County is pleased to support Metro's proposal to the Federal Highway Administration (FHWA) Office of Transportation Management for the I-84 Multi-modal Integrated Corridor Management (ICM) Deployment Planning Grant.

The objective of the ICM Deployment Planning Grant program is to advance transportation planning and development efforts to improve the management of the system. The regional partners working on this grant have a long-standing relationship working together and we look forward to improving the management of the corridor as an integrated system. By working together, we know that there are ways we can manage congestion and provide travelers better information about their transportation choices. MAP-21 calls for accelerating technology and innovation deployment, and this grant will contribute to the region's ability to meet the system performance goals.

The County is currently engaged in a study to develop a system for advance notification of bridge "lifts". The County maintains and operates four draw bridges across the Willamette River including the bridge connecting I-84 to downtown Portland. These bridge "lifts" delay traffic on the four draw bridges and their connecting routes. Scheduled bridge lifts will be forecast and communicated, as well as impromptu lifts or other outages. The current plans are to make this information available through social media and cell phone alerts.

The advance warning of a bridge lift or closure will enable re-routing of traffic across the Willamette River. Average daily traffic on these bridges ranges from 30,000-50,000 vehicles per day. This system will add ITS infrastructure to the corridor and contribute significantly to the desired outcome of the I-84 Multi-modal ICM study. In addition, the County has committed staff time to provide technical review and input for the study.

The goals of this research align with the region's goals to provide a multimodal system that improve the quality of life for its citizens through proactive transportation operations, advance technologies, and best practices for transportation management. As more people bike, walk and take transit, it is crucial to maximize the efficiency of the multimodal transportation system and accessibility for all transportation users.

501 SE Hawthorne Blvd., Suite 600 | Portland, Oregon 97214 | Phone: 503.988.5213

We are proud of our successes to date and look forward to working with Metro, other regional partners, and the FHWA to improve our use of these emerging techniques.

Sincerely,

Diane McKeel

Diane McKeel

501 SE Hawthorne Blvd., Suite 600 | Portland, Oregon 97214 | Phone: 503.988.5213

CITY OF GRESHAM 1333 N.W. Eastman Parkway | Gresham, OR 97030 | 503-618-2346

January 9, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez,

The letter is to confirm the City of Gresham's support for Metro's Integrated Corridor Management (ICM) Deployment Planning Grant application. The ICM Deployment Planning Grant program is intended to advance transportation planning and development efforts for ICM corridors. The I-84 ICM Corridor is an excellent candidate for enhanced ICM, as many systems management elements that would be required for ICM are already in place or are currently being deployed.

The agencies in metropolitan Portland have a tradition of working on projects cooperatively, with the larger agencies sharing access to available transportation infrastructure and technologies with the smaller ones. This proposed ICM project will further that cooperation by allowing the regional partners to efficiently manage a regional multi-modal corridor that spans five cities, Multnomah County, the Tri-County Metropolitan Transit District, and the Oregon Department of Transportation, to the benefit of tens of thousands of commuters every day.

The goal of the Deployment Planning Grant project is consistent with Gresham's objective to provide a safe, efficient, and accessible transportation network that's balanced to provide equal opportunities for pedestrians, bicyclists, and motorized vehicle drivers.

We are proud of our previous successes and look forward to working with Metro, other regional partners, and the Federal Highway Administration to improve our understanding of these emerging techniques. Gresham will provide staff time as necessary to facilitate this project.

Sincerely,

Erik Kvarsten
City Manager
City of Gresham, Oregon

CITY OF
PORTLAND
BUREAU OF
TRANSPORTATION

CITY OF PORTLAND, OREGON
1851

Steve Novick
Commissioner

Leah Treat
Director

January 9, 2014

Victor Mendez, FHWA Administrator
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Mendez,

The letter is to confirm the Portland Bureau of Transportation's commitment to support Metro's proposal submission to the Federal Highway Administration Office of Transportation Management related to the Integrated Corridor Management (ICM) Deployment Planning Grant.

The objective of the ICM Deployment Planning Grant program is to advance transportation planning and development efforts to improve the management of the system. The various partner agencies that currently manage the transportation corridor have a tradition of working together and we look forward to improving these relationships as we work together to manage the corridor as an integrated system. In working more closely, we know that we can manage congestion and provide travelers better information about their transportation choices. This objective is consistent with the MAP-21 emphasis on accelerating technology and innovation deployment, and will contribute to agencies' ability to meet the system performance goals called for in MAP-21.

The goals of this research aligns with the City of Portland, Bureau of Transportation goals to be a leading and progressive, multimodal, transportation agency that is focused on improving the quality of life for its citizens through proactive transportation operations, advance technologies, and best practices for transportation management. As the City seeks to reduce its carbon footprint, we are encouraging more and more people to bike and walk and take transit. As we promote these activities, it is crucial to maximize the efficiency of the multimodal transportation system and accessibility for all transportation users.

We are proud of our previous successes and look forward to working with Metro, other regional partners, and the Federal Highway Administration to improve our understanding of these emerging techniques.

Sincerely,

Greg Jones
Assistant Director

Portland State
UNIVERSITY

PO Box 751
Portland, OR 97207-0751

January 8, 2014

Victor Mendez
Federal Highway Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Re: Support for Metro's ICM Proposal

Mr. Mendez,

Portland State University is pleased to support this proposal from Metro and its partners to participate in your agency's Integrated Corridor Management program. The university is fortunate to exist within a living laboratory and to have excellent, long-term relationships with transportation agencies. Our motto is "Let knowledge serve the city" and our faculty, including Robert Bertini, Christopher Monsere and Miguel Figliozzi, work extensively on maximizing the productivity of all transportation infrastructure and services.

Portland State University will contribute to this project through the participation of faculty, students and staff. We have a number of sponsored research projects, many with support from our University Transportation Center, that are complementary to the scope of this proposal. We will also leverage Portal, the transportation data archive that is housed at the university. Portal's manager, Jonathan Makler, will serve as the primary liaison to Metro and the project team.

In light of the Portland region's commitment to achieving mobility and accessibility through the integration of transportation and land use and the intelligent deployment of management strategies – and because of the extraordinary relationship between transportation practitioners and our university – you may find no better setting in which to demonstrate innovative programs such as Integrated Corridor Management.

If I can be of further assistance, please don't hesitate to contact me.

Sincerely,

Jonathan Fink

Jonathan Fink
VP, Research and Strategic Partnerships
(503) 725-9944
jon.fink@pdx.edu

Cc: Tom Hughes, Metro Council President

Congress of the United States
Washington, DC 20510

January 7, 2014

Victor Mendez
Administrator
Federal Highway Administration
1200 New Jersey Ave SE
Washington, D.C. 20590

Dear Administrator Mendez:

We are writing to express our support for Metro's application for an Integrated Corridor Management Planning Deployment Grant.

Metro would use the funds to implement its I-84 Multimodal Integrated Corridor Management Regional Concept of Transportation Operations project. The project would integrate existing transportation infrastructure along the I-84 corridor in Oregon.

Metro is an elected regional government serving 25 cities in Clackamas, Multnomah, and Washington counties in Oregon. It manages urban growth, transportation planning, waste disposal, and development issues within the Portland Metro area. This grant would give the Portland Metro area a significant upgrade in its infrastructure that would provide a safer and more reliable I-84 corridor. In addition this project would reduce carbon emissions and costs for commuters in the Portland Metro area.

Thank you for your full and fair review of Metro's grant application. Should you have any questions about this application please do not hesitate to contact John Valley in Senator Merkley's office at 503-326-3395, or Jay Ward in Senator Wyden's office at 503-326-7525, or Ree Armitage in Representative Blumenauer's office at 503-236-7702.

Sincerely,

Jeffrey A. Merkley
United States Senator

Ron Wyden
United States Senator

Earl Blumenauer
Member of Congress

Appendix D
TransPort Committee
Bylaws and Operating Procedures
As approved January 12, 2005

Mission Statement

The primary mission of the Intelligent Transportation Systems (ITS) Subcommittee is to provide a forum for cooperative ITS planning and deployment. The TransPort Committee assures compatibility between currently deployed technology and new national, state, regional and jurisdictional initiatives, consistent with U.S. DOT requirements for a Regional ITS Architecture to support implementation of federally funded ITS infrastructure.

This mission is achieved through the following activities:

- TransPort is responsible for initial evaluations and recommendations relating to the region's ITS planning, programming and implementation activities.
- TransPort prepares and updates the Regional ITS architecture in conformance with US DOT rules and regulations.
- Transport provides input on the ITS Element for future updates of the Regional Transportation Plan and regional comments to the Oregon Highway Plan.
- TransPort assures that all ITS-based transportation management projects envisioned in the Regional Transportation Plan that receive regionally allocated federal funds are compliant with the Regional ITS Architecture, as required by TEA-21.
- TransPort assures that all ITS projects are developed using a systems engineering process.
- TransPort establishes collaborative rules and policies for the development of network architectures, designs, implementation plans, expansion plans and maintenance plans to create a regional communications network infrastructure to serve all partner organizations.
- Transport works collaboratively to prepare and submit special ITS grant requests in response to federal RFPs.

The ITS Subcommittee is authorized to evaluate regional ITS initiatives for technical merit; evaluate projects submitted for regional, state and federal funding through the MTIP and STIP processes, and propose coordination of funds authorized to implement regional ITS technology integration initiatives where no individual project sponsor has been identified. It is also authorized to evaluate ITS initiatives for technical merit and provide comment on regional priorities position papers regarding federal appropriations and reauthorization requests.

Operating Procedures

History

The Transport Committee was formed initially for the federally funded ITS Early Deployment Study in 1993 and has continued meeting since then. The committee continues to operate in a consensus manner for cooperative ITS planning and deployment.

Committee Membership

The ITS Subcommittee membership shall be non-exclusive and open to all jurisdictions wishing to attend. The primary members of the sub committee consist of representatives of ODOT; Tri-Met; Washington, Clackamas and Multnomah Counties; and the City of Portland. Continued attendance is urged by Port of Portland; FHWA; Clark County, Washington; C-TRAN, Southwest Washington RTC, the City of Vancouver Washington, Washington State DOT-Southwest Region, the Cities of Gresham and Beaverton; the City of Portland Bureau of Emergency Communication and Portland State University. Outreach shall continue to encourage at least occasional attendance from other cities in the three-county urban area; representation from the regional freight industry and expanded representation from regional emergency services providers. Committee members operate as equal partners with one vote for each agency. To be considered as an active TransPort committee member, each agency needs to be present for at least 50% of the TransPort meetings throughout any calendar year.

Committee Member Responsibilities

Committee members will coordinate within their respective agencies and develop consensus within their agency prior to adopting rules. Committee members or their alternatives shall attend and participate in the sub-committee meetings. If a jurisdiction's representative or alternate has three consecutive unexcused meeting absences, that jurisdiction will lose its status as a voting member. Absences may be excused at the discretion of the ODOT TransPort Committee staff. A jurisdiction may regain active committee status by submitting a letter of commitment and with the consensus of the committee.

Member Agency Responsibilities

TransPort Committee members will coordinate internally with intra-agency staff to discuss TransPort Committee related issues within their respective agencies to ensure that common agency interests are fully represented at the full TransPort Committee meetings and so that votes or actions of the TransPort Committee have the full internal agreement of their respective agencies.

Meetings

The TransPort Committee will hold regular meetings. The Committee shall agree on the frequency and time of meetings and may hold additional meetings as needed with reasonable notice to members.

Quorum

The TransPort Committee may hold meetings without a quorum and discuss issues relating to their responsibilities and duties under these operating procedures so long as no actions are taken. At least one agency representative from four of the six primary TransPort Committee agencies must be present to constitute a quorum for the purposes of adopting rules, agreements or other commitments. Proxies from non-attending agencies will be accepted.

Relationship to TPAC

The TransPort Committee is a recognized subcommittee of the Transportation Policy Alternatives Committee (TPAC). TransPort will provide review and report on ITS activities and proposals as directed by TPAC. Monthly reporting of meeting minutes shall be provided in the TPAC Monthly Progress Report by Metro staff assigned to the committee. Representatives of TransPort will report to TPAC annually on progress implementing the region's ITS priorities and on other ITS-related issues.

Powers/Authority

The TransPort Committee has authority to adopt rules, polices, procedures and / or other commitments regarding the use and sharing of the ITS system. However, none of the TransPort actions shall supercede any individual agency's laws, rules, policies and procedures..

Voting

In general all actions are undertaken on a consensus basis. If consensus is not attained on an policy, decision, rule, or other action taken by the TransPort Committee, then a 2/3-majority agreement of the TransPort Committee members is required to pass that item. Each active TransPort agency shall have one vote on the Committee, except for Metro who is a non-voting member. Agencies who are unable to attend a specific meeting may designate a proxy for that meeting. The proxy does not have to be from the same agency as the absent member.

Amendments

Any amendment to these operating procedures shall require the 2/3-majority approval of the TransPort Committee member agencies.

Termination

Agencies may withdraw from the TransPort Committee at anytime.

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Appendix E – Draft I-84 Active Corridor Management Concept of Operations

CITY OF PORTLAND:

ACTIVE CORRIDOR MANAGEMENT

DRAFT CONCEPT OF OPERATIONS

Version Number 0-1
December 27, 2013

Document Description

Client	City of Portland
Contract Number	29860
Project Name	Active Corridor Management
Related Task	Task 2.2 – Draft, Revised Draft, and Final Concept of Operations
Prepared By	DKS Associates
Document Name	Active Corridor Management Concept of Operations
File Path	\\pdxfiles3\x-drive\projects\2012\p12016-009 (odot-pbot active corridor management)\2 systems engineering\2.2 conops\2013-12-16 draft conops.docx
Date Document Approved	

Version Control

Version Number	Date	Description of Change	Author
0-1	12/27/2013	Initial Document	DKS Associates

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1. SCOPE OF PROJECT

The project aims to improve arterial operations near I-84 and I-205 in east Portland. The project will provide active corridor management tools that enable the City of Portland to manage arterial traffic signals during incidents, monitor performance and respond to arterial conditions on a daily basis, and coordinate with agency partners during incidents and events.

The project will improve arterial operations for pedestrians, bicycles, transit, and motor vehicles by actively managing arterial traffic signals. The proposed system will provide 24/7 monitoring of the traffic signal system and equipment performance and deliver information about current incidents and events to the City of Portland traffic managers. By improving performance monitoring and real-time information, the project expects to improve the quality of service provided on many east Portland arterials, which lack current real-time information.

The implementation will also support cooperation between the City of Portland, ODOT, and the City of Gresham during freeway incidents or other events. The active corridor management concept focuses on operating the transportation system as a cohesive network. Within the project area for this active corridor management project, the City of Gresham and ODOT operate traffic control devices and gather information about incidents and events that must be shared to support a coordinated response.

This project will construct and implement transportation system management and operations infrastructure including cameras, system detectors, Bluetooth sensors, and supporting network infrastructure along major arterials in east Portland bounded by NE Airport Way on the north, SE Division Street on the south, 92nd Avenue on the west, and 162nd Avenue on the east as shown in Figure 1. The devices will be integrated into the City's and ODOT's Transportation Operation Centers.

2. PURPOSE

The purpose of this project is to provide the necessary tools to the City of Portland for managing both recurring and non-recurring congestion on arterials in east Portland. I-205 and I-84 serve high volumes of traffic during peak travel times. There is a need to both monitor and actively adjust signal timing on corridors that parallel these routes in order to optimally manage the congestion.

The purpose of this document is to outline how the Active Corridor Management System in East Portland will operate. Active Corridor Management is defined as:

> “the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. It increases throughput and safety through the use of integrated systems with new technology, including the automation of dynamic deployment to optimize performance quickly and without the delay that occurs when operators must deploy operational strategies manually.”[1]

This document has been prepared in accordance with best practices in traffic incident management.[2] The following map shows the project boundaries.

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[1] *ATDM Program Brief: Active Traffic Management*. U.S. Department of Transportation, Federal Highway Administration, Oct. 2012. Publication # FHWA-HOP-13-003. http://international.fhwa.dot.gov/pubs/pl07012/atm_eu07_01.cfm

[2] *Best Practices in Traffic Incident Management*. U.S. Department of Transportation, Federal Highway Administration, Sept. 2010. http://ops.fhwa.dot.gov

Figure 1 : Project Area

3. REFERENCED DOCUMENTS

This concept of operations was developed with input from stakeholders, related, projects, and the following reference documents:

- *Best Practices in Traffic Incident Management*. U.S. Department of Transportation, Federal Highway Administration, September 2010, http://ops.fhwa.dot.gov/publications/fhwahop10050/fhwahop10050.pdf
- *I-5/Barbur Boulevard Incident Management Operational Plan.* DKS Associates. October 2002.
- *Integrating Active Traffic and Travel Demand Management: A Holistic Approach to Congestion Management*. U.S. Department of Transportation, Federal Highway Administration, January 2011. http://international.fhwa.dot.gov/pubs/pl07012/atm_eu07_01.cfm
- *Portland Multimodal Arterial Performance Management: Implementation Guidance Document.* DKS Associates and Kittelson and Associates. February 2013.
- *Portland Regional Transportation System Management and Operations Plan 2010-2020*. Metro, March 2010. http://www.oregonmetro.gov/index.cfm/go/by.web/id=21962
- *Regional ITS Architecture and Operational Concept Plan for the Portland Metropolitan Area.* DKS Associates. October 2005.

4. PROJECT GOALS AND OBJECTIVES

The overall goal of the project is to improve traffic operations on surface streets in outer east Portland, primarily focusing on non-recurrent events such as incidents on nearby freeways. There are three project objectives to accomplish the project goal:

1. Provide operators with real-time system dashboard and historic performance measure reports.
2. Make real-time signal timing adjustments to improve signal operations immediately due to changes in traffic patterns from incidents or congestion.
3. Automate control at the local level to improve traffic signal operational efficiency.

5. BACKGROUND

NE Glisan Street, NE Halsey Street, NE Sandy Boulevard, and SE Division Street run parallel to I-84 and serve several neighborhoods on the eastside of Portland. These facilities are vital links in the street network and are critical routes during incidents on I-84 and I-205. The I-205/I-84 interchange serves high volumes of traffic during peak travel times and can also be affected by an incident along I-205. These arterial corridors currently lack the necessary communications network and intelligent transportation system (ITS) devices used in other parts of the region to actively manage the arterial corridors. This lack of ITS infrastructure means the City of Portland traffic signal operators are unable to respond in real-time to incident traffic conditions or to monitor performance of the arterials on a day-to-day basis.

The following sections describe the current infrastructure and policies in place affecting performance monitoring, active signal operations, and local signal control decisions.

5.1 Performance Monitoring

Currently, there is no way to monitor the operational performance and system health in the project area due to lack of field devices and a limited communications network. To observe traffic conditions or signal operations, PBOT staff must drive out to the field. This is a time consuming process and limits the extent of the areas engineers can observe each day.

The central traffic signal system provides the ability to communicate with the traffic signals and collect historical traffic signal phase and detector data that can be used to analyze the operation of the traffic signal. However, the use of this system requires network communications between the central traffic signal system server at the City of Portland building and the field devices.

Many of the traffic signals east of I-205 and south of I-84 currently operate with Wapiti firmware on Model 170 traffic signal controllers. The existing controllers and firmware have limited capabilities for system monitoring and arterial performance measurement data collection. The traffic signal system is accessed by PBOT operators through the TransSuite central signal system. All traffic signals with communications can be monitored and timings adjusted through the central system.

The existing communications system in east Portland is limited to a few traffic signals. Traffic signals along portions of 122nd Avenue and SE Stark Street are interconnected with older aerial twisted-pair interconnect cables. These traffic signals currently use low-speed analog FSK modems for local communications. While there is a fiber optic cable installed overhead along SE Division Street, there are currently no drops to the traffic signals. Figure 2 shows the existing communications infrastructure in the project area.

Figure 2 : Existing Communciations Network

5.2 Active Signal Operations for Incident Management

Currently, the traffic signal system operations are not actively reviewed and updated unless there is a citizen complaint or during a periodic signal timing review. There are no incident management plans developed for the traffic signal system in the project area.

During a major incident, such as a freeway closure, the timing plans operating on the signal controllers remain on the set time of day plans for City of Portland signals. Elsewhere in the city, such as on 82nd Avenue and SW Barbur Boulevard, the city has developed incident management plans and procedures to quickly adapt the signal system to major incidents or freeway closures. In addition, the existing traffic signal communications system in east Portland is limited and constrains the operator's ability to actively respond to changing traffic conditions in real-time. The City of Gresham signals on 181st Avenue operate using the Sydney Coordinated Adaptive Traffic System (SCATS); therefore, the signals will automatically adapt to changes in traffic, rather than needing an operator to manually change the timings.

While signal timings are typically updated periodically, there are no set procedures for proactively evaluating and optimizing signal timings. Each district engineer has different informal procedures and priorities. Due to the limited communications network, engineers must visit each traffic signal controller in the field to update and optimize traffic signal timings. This limits the number of signals that can be updated each day.

5.3 Local Traffic Signal Health and Control Decisions

Currently, signal technicians and engineers cannot monitor and actively respond to failed traffic signal detectors. The existing Model 170 traffic signal controllers have limited support for monitoring detector status by approach. The 2070 controllers with NWS Voyage firmware used elsewhere in the city support detailed monitoring of individual detectors. However, the limited remote communications in this area would still require field visits to most intersections to monitor detector health.

The current traffic signal controllers do not allow advanced logic of the local intersection. For example, implementing freight priority along key routes or serving pedestrian phases more quickly during low volume periods is not possible using the current system.

6. PROJECT STAKEHOLDERS AND NEEDS

This section outlines project stakeholders and their needs for performance monitoring, active signal operations, and automating local traffic signal control.

6.1 Performance Monitoring

The following table lists the agencies involved in this project, their roles and responsibilities, and the positions at each agency that are responsible for the listed tasks.

Table 1 : Stakeholder Roles and Responsibilities

Agency	Position	Role/Responsibility
City of Portland (PBOT)	Signals Manager *(Peter Koonce)*	Operate and maintain PBOT signal system
	Communications Engineer *(Rob Jennings)*	Manage PBOT TransSuite server
	District Engineers	Monitor PBOT Signal system
		Monitor arterial travel time
		Monitor arterial CCTV cameras
		Modify signal timing on arterials
	ITS Engineer *(Willie Rotich)*	Monitor arterial travel time
		Monitor arterial CCTV cameras
	Signal Technician	Monitor PBOT Signal system
		Modify signal timing on arterials
Oregon Department of Transportation (ODOT)	Traffic Engineer	Operate and maintain freeway ramp meters
	Signal Engineer	Operate and maintain ODOT signal system
	Communications Engineer	Manage ODOT TransSuite server
	ITS Operator	Operate and maintain freeway ramp meters
		Operate and maintain freeway ITS devices
		Alert PBOT/City of Gresham at the beginning and end of a freeway incident
		Organize incident debrief and analysis with other agencies involved
	TMOC Operator	Operate and maintain freeway ITS devices: VMS, CCTV
		Alert PBOT/City of Gresham at the beginning and end of a freeway incident
		Post message on TripCheck when incident occurs
City of Gresham	Traffic Engineer	Operate and maintain signal system east of project area
		Monitor signals, CCTV during incident
		Modify signal timing on arterials
Metro	Transportation Planner	Regional Operations Planning
Portland State University (PSU)	Database Administrator, Features Coordinator	Archive transportation data
TriMet	Dispatch	Manage dispatch of buses and MAX trains
TIM Team	PPB, Fire, Gresham/Troutdale police	Respond to traffic incident so that traffic flow may be restored as safely and quickly as possible

6.2 Performance Monitoring

The user will be able to retrieve historical traffic volumes and traffic signal phase split times, and use this data to adjust the signal timings to serve the traffic volumes more efficiently. Data collected from this project can be archived in the PORTAL regional data warehouse and evaluated for project performance and can also be disseminated through ODOT's TripCheck traveler information web site. The data that is needed includes travel times, live video, and information on volumes, speed, and classification. The field devices needed to gather this data are Bluetooth sensors, CCTV cameras, and system detectors. This information can be used by PBOT to provide real-time traveler information through the TripCheck website and 511. The TripCheck website can also display feeds from the new CCTV cameras.

Completing the communications network will connect the traffic signals to the central traffic signal system and allow PBOT to remotely access traffic signals in order to troubleshoot problems that arise during and outside of normal business hours. This saves staff time driving out to the traffic signal. It can also reduce the time that a traffic signal is not operating properly, which improves the operation of the intersection. An example of this would be a loop detector that is stuck in the "on" position, which produces false calls and inefficient operation of the signal. Using the central traffic signal control system to communicate to the field device, the problem can be automatically reported and remotely diagnosed. Remote access will also enable PBOT to monitor the signal operations and implement special timing plans if an incident occurs on I-205 or I-84.

6.3 Active Signal Operations for Incident Management

The user should be able to remotely adjust signal timings for incident management. In the case of an incident, the user should be able to use the field devices to determine incident location and the diversion routes that are being heavily used by travelers. Based on this information, the user will determine the signal timing adjustments to be made and implement them using the TransSuite central signal system. In order to make signal timing adjustments quickly and efficiently, the affected traffic signals need to have communications links back to the city.

6.4 Automate Control Decisions at the Local Level

The user should be able to increase efficiency of traffic signals in the project area by implementing automatic control decisions at a local level. The project will use advanced traffic signal controller features in order to implement pedestrian responsive operations and truck priority during certain times of day. Additionally, using advanced features will improve general intersection operations, such as reducing delay to left turn movements and side streets and improving the way the traffic signals transition between coordination plans or out of preemption. These features require the use of 2070 traffic signal controllers and upgraded software.

7. CONCEPT FOR THE PROPOSED SYSTEM

The ACM system will improve the management of the arterials in east Portland by providing the City the ability to actively monitor and manage the traffic signal controller operations. It will allow the City to collect arterial performance measurements, which can be used for daily monitoring, maintenance activities and operational improvements. The ACM system will also allow PBOT, ODOT and the City of Gresham to coordinate operations during incidents on I-84 and I-205 by adjusting the traffic signal timing on the alternate route corridors.

The three objectives of the Active Corridor Management System are to:

1. Provide operators with real-time system dashboard and historic performance measure reports.
2. Make real-time signal timing adjustments to improve signal operations immediately due to changes in traffic patterns from incidents or congestion.
3. Automate control at the local level to improve traffic signal operational efficiency.

This project will install ITS elements that address the policy goals described in the Regional Transportation Plan and the Metro Regional Transportation System Management & Operations Plan. It will provide the City with better information about arterial and traffic signal performance to enable traffic signal timing changes that respond to measured corridor deficiencies. It will enable monitoring of traffic signal and detector health, which improves equipment operation and better serves the public, and it will enable shared traffic condition and response information with partner agencies including the City of Gresham and ODOT.

7.1 Performance Monitoring

Historic performance measures reports combined with a real-time system dashboard will provide system operators with an understanding of the actual traffic conditions in the area. With this, operators can quickly determine when traffic patterns do not match typical conditions. The data in the reports and dashboard should include arterial performance data such as travel time along key corridors, vehicle volumes at key intersections, and vehicle classifications. In addition, the real-time dashboard will provide live video of key locations for the operator to visually verify the actual conditions. Performance data from traffic signal controllers can also provide operators with a better understanding of traffic conditions by reporting measures such as phase utilization, percent arrival on green, pre-emption operations, and equipment health.

The devices used for performance monitoring (CCTV, Bluetooth, system detectors) will send data through the same communications infrastructure as the traffic signal controllers. Fiber optic cable is recommended for communications wherever possible because of the amount of data being transmitted on the communications network. Some of the same loops detectors can be used for both performance monitoring and intersection operations.

Performance measures are an important metric used for evaluating the overall health of the system. Monitoring the system allows operators to maximize the efficiency of operations. Performance monitoring involves a real-time dashboard as well as reports on archived data. Some of the proposed performance measurements for both real-time and archived data include:

a) Operations
    1) Volumes (from system detectors)
    2) Signal delay (from controller logs)
    3) Cycle failures (from controller logs)
    4) Travel time (from Bluetooth sensors)
    5) Speed (from system detectors or Bluetooth sensors)
    6) Classification (from system detectors)
    7) Incident location (from CCTV cameras)
b) System Health
    1) Detectors (from controller logs)
    2) Communications links (from controller logs)

7.2 Active Signal Operations for Incident Management

When there is an incident or congestion, system operators will be able to make real-time signal timing adjustments to better serve changes in traffic patterns. If an incident occurs on I-84, traffic may be rerouted to the arterial roadway system, which does not have the capacity to handle the increase in volumes. The system operator, by accessing the dashboard, will be able to quickly determine atypical traffic patterns. During such an event, the City will be able to enable pre-determined traffic signal timing plans to manage the traffic more efficiently. For example, an incident on I-84 westbound may divert traffic onto southbound 181st Avenue to westbound Halsey Street and then onto I-84 west of I-205. In this case, the traffic signal timing plans will favor this route.

7.3 Automate Control Decisions at the Local Level

Detector health, truck priority, and pedestrian responsive signals are upgrades to the system that will be automated.

Identifying failed detectors quickly will greatly improve maintenance and operations. A failed detector can be identified by a report in Portal, rather than the current format of looking through every signal in TransSuite to identify failed detectors. This information will be passed on to the signal maintenance shop so they can make repairs in a timely fashion.

Truck priority allows for an extension of the green signal by detecting trucks upstream of the intersection with loop detectors. Providing this extension reduces delay and stops for the trucks and improve air quality for the area.

Pedestrian delay will be reduced by allowing signals to be more responsive during off-peak periods. For example, if a pedestrian call is logged in the off-peak period, the signal would allow that pedestrian to be served more quickly by skipping phases in the cycle if vehicles from those phases are not present.

8. SYSTEM OVERVIEW AND OPERATIONS DESCRIPTION

The system to be developed includes: upgrading communications links, installing new communications links, and installing new field devices (controllers, system detectors, Bluetooth sensors, and CCTV cameras). Information from the field devices will be available through the user interface. The CCTV cameras will feed directly into the user interface, the video wall in PBOT's Traffic Operations Center. Information from the Bluetooth devices will feed into the Bluetooth data system at the City of Portland and then be stored in Portal. The user will be able to access reports from Portal. Information from the detectors and traffic signal controllers will be stored in TransSuite at the City of Portland. This information will also be sent to Portal and reports made available to users.

Figure 2 shows the proposed ACM system and how the components relate to each other.

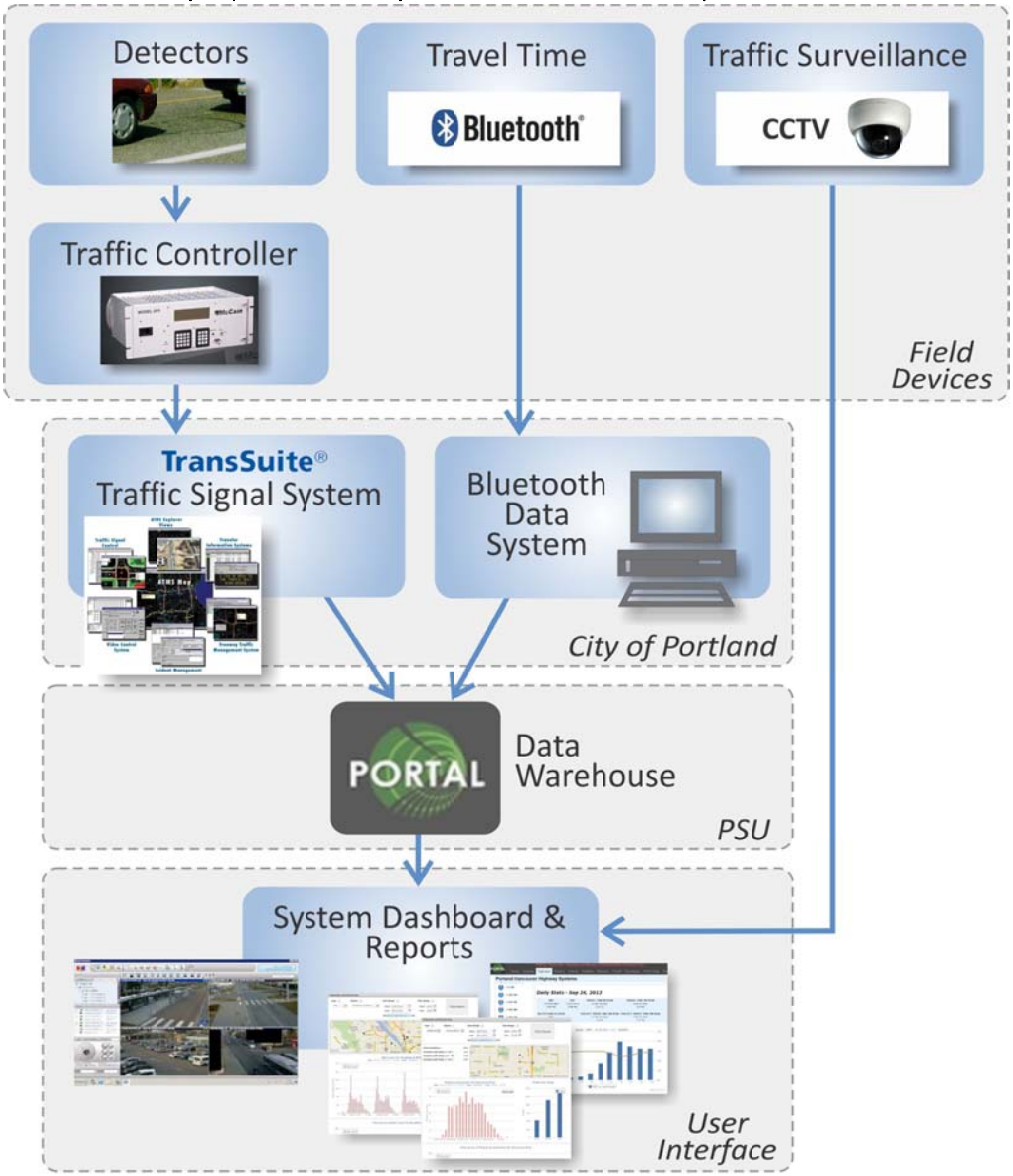

Figure 3 : System Elements

8.1 Communications Links

The communications system provides the backbone for deployment of the active corridor management system project. The exact location of the communications infrastructure will be determined during the design process.

8.1.1 Upgrades

There are several existing communications links that will need to be replaced.

8.1.2 New

New communications links will need to be installed in order to connect traffic signals to the central server system.

8.2 Field Devices

Field devices, when linked to communications and a central server, provide the ability to collect performance measures such as travel time, volumes, speed, and classification.

8.2.1 Traffic Signal Controllers

Many of the traffic signals east of I-205 and south of I-84 currently operate with Wapiti firmware on Model 170 traffic signal controllers. The existing controllers and firmware have limited capabilities for system monitoring, arterial performance measurement data collection and advanced operational features. These features require the use of 2070 traffic signal controllers and upgraded software.

8.2.2 CCTV Cameras

There are currently no CCTV cameras on the arterial streets in the project area. This project will install 25 new CCTV cameras along the arterial network in order to monitor field conditions. The camera locations were selected based on the desire to provide as much coverage at major intersections as possible. The video feed from the CCTV cameras will be transmitted to the ODOT Traffic Operations Center, where live video can be accessed as needed.

8.2.3 Bluetooth Sensors

There are currently no Bluetooth detection sensors in the project area. Bluetooth sensors will be placed along a corridor where travel time data is desired from point to point. The data from the Bluetooth devices will ideally be automatically uploaded and remotely accessible through a service comparable to BlueMAC.

8.2.4 System Detectors

System detectors will collect volume and speed data for vehicles and bicycles at critical locations along the corridors.

8.2.5 *Interface*

The system, comprising communications, Bluetooth devices, CCTV cameras, and system detectors, will send information to communications hubs, which will be accessible to PBOT employees via the central server. Traffic signals with communication links can be accessed through TransSuite.

9. OPERATIONAL SCENARIOS

This section describes the actions that are carried out by the user and/or the system. Operational scenarios described below are:

1) Review Signal Timings
2) Incident Management Response
3) Pedestrian and Truck Use During Off-Peak Periods

9.1 Review Signal Timings

Several steps are involved in reviewing signal timings for the improvement of operational efficiency.

1) Choose an intersection or corridor to review
2) Monitor timings
3) Adjust timings

The intersection or corridor to review will come either from a citizen complaint or from a regular review from a district engineer. The district engineer will review the signal timings and operations using TransSuite. Additional resources that can be used include the dashboard, which will display travel time, travel time reliability, volumes, and classification; and Portal, which will keep records of archived data. Once the district engineer reviews the timings, adjustments can be determined. Finally, the adjusted timings can be implemented through TransSuite.

9.2 Incident Management Response

To facilitate the incident management response, operational scenarios were developed as response to an incident in one of four locations.

- Incident A: I-84 Westbound between 181st Avenue and I-205
- Incident B: I-84 Eastbound between I-205 and 181st Avenue
- Incident C: I-205 Northbound between US 26 (Powell Blvd) and US 30 Bypass (Sandy Blvd)
- Incident D: I-205 Southbound between US 30 Bypass (Sandy Blvd) and US 26 (Powell Blvd)

The operational scenarios are meant to facilitate movement of traffic on arterial streets east of I-205 and north/south of I-84. Figure 3 illustrates the arterials that will be used as diversion routes in response to the incidents outlined above. The specific diversion route that drivers take depends on location of incident, their final destination, and length of closure. Figure 4 shows possible diversion routes for the Incident A scenario (an incident on I-84 in the westbound direction between the 181st Avenue and I-205 exits).

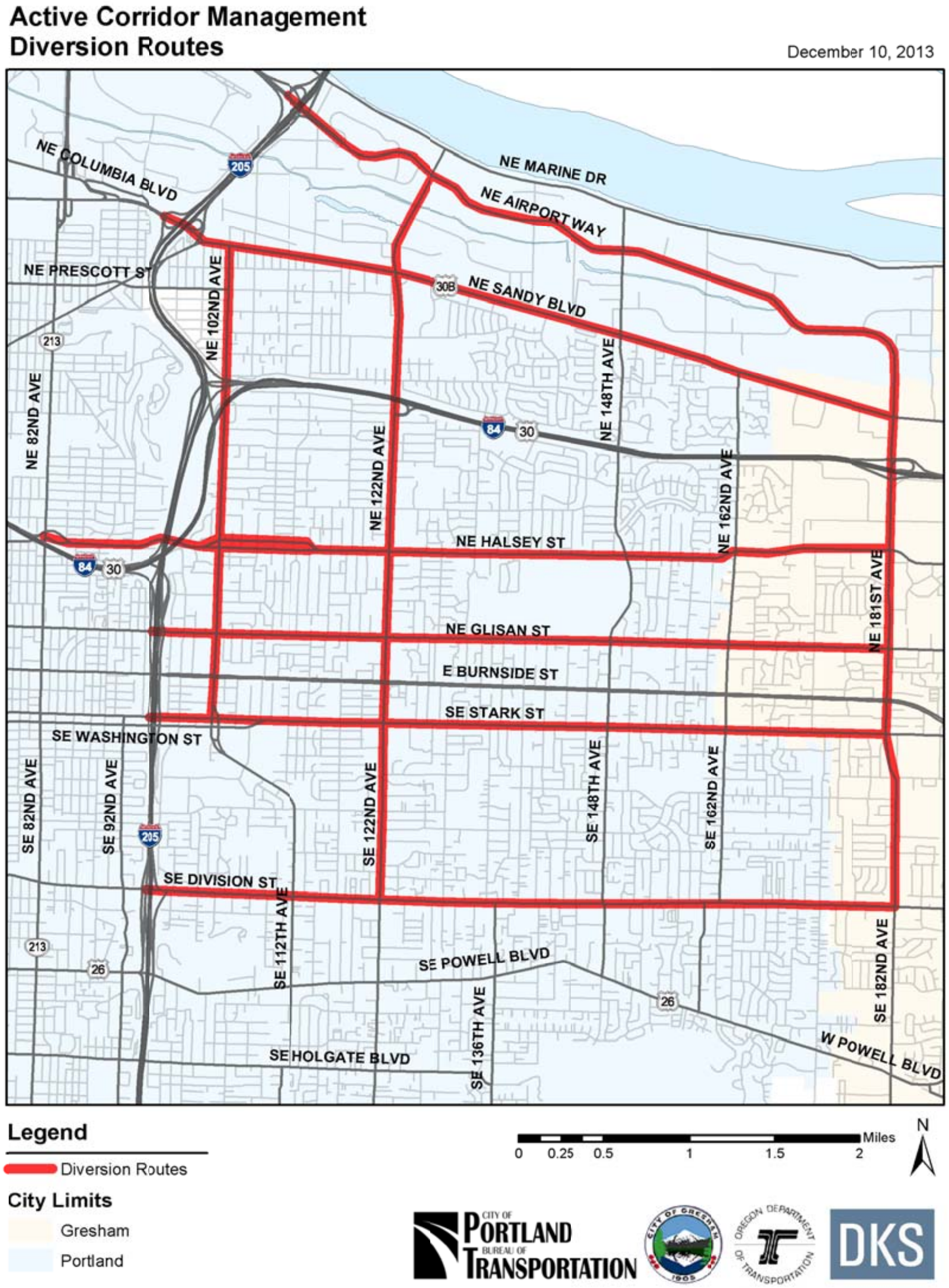

Figure 4 : Diversion Routes

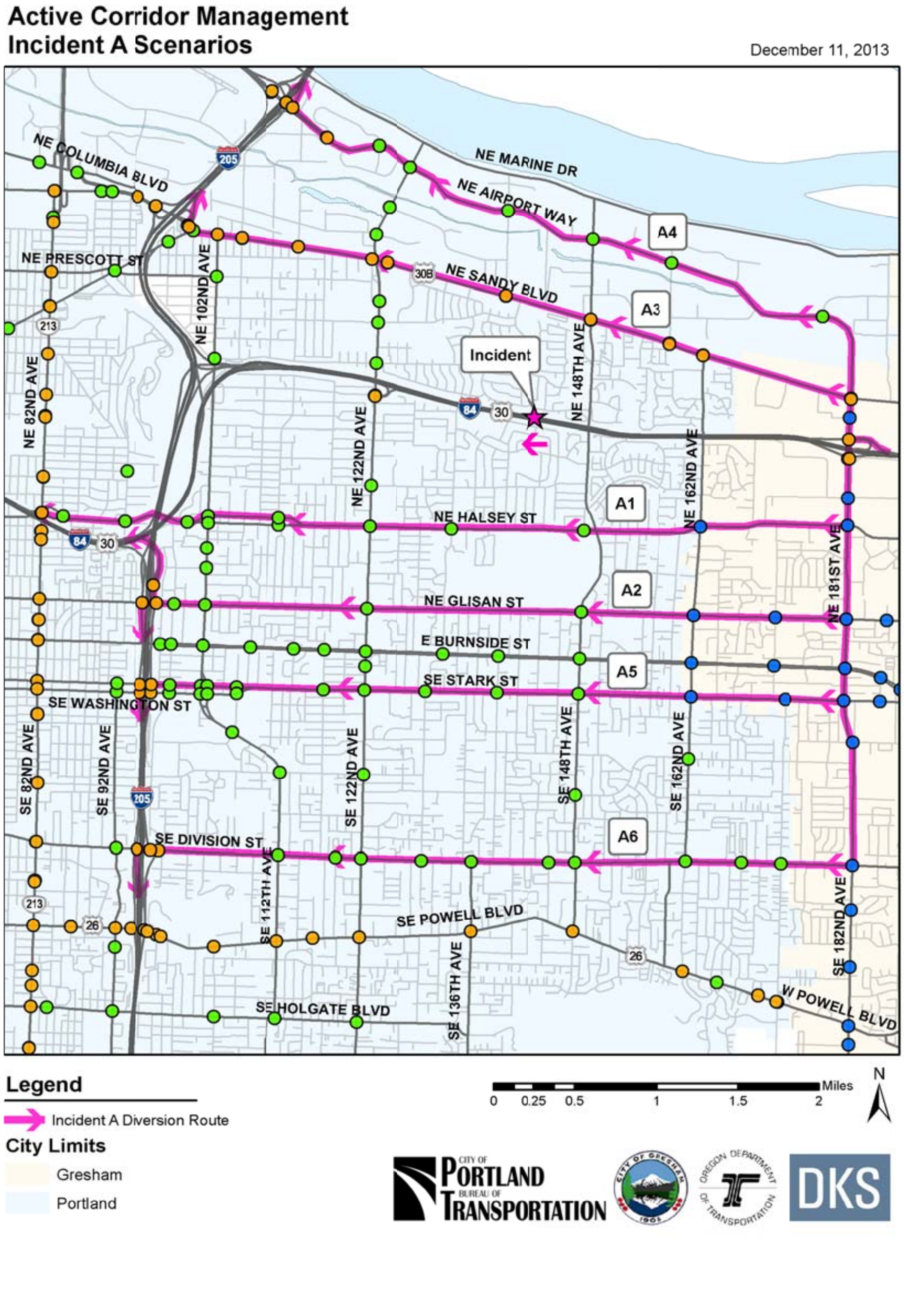

Figure 5 : Incident A AScenarios

Summarized below in Table 2 are the physical constraints and predicted percent of diverted traffic for each scenario for Incident A. The percent of diverted traffic was estimated from the 2010 Metro Gamma Forecast/1-hour PM Peak Travel Demand Model and represents the percentage of traffic from the original facility that may divert to the ACM route. This information can be used to help determine the preferred diversion route based on incident location and the resulting signal timing adjustments needed.

9.2.1 Incident A: I-84 Westbound between 181st Avenue and I-205

Table 2 : Operational Scenario Diversion Routes for Incident A

Scenario	Constraints	Predicted % of Diverted Traffic
A1	•Single shared left turn from I-84 onto 181st •Single shared right turn from 181st onto Halsey •Single lane entrance from Halsey onto I-84 WB •Signals on 181st run SCATS	20-30%
A2	•Single shared left turn from I-84 onto 181st •Single shared right turn from 181st onto Glisan •Single turn lane from Glisan onto I-205 SB or I-84 •Signals on 181st run SCATS	10-20%
A3	•Single right turn lane from I-84 onto 181st •Single left turn lane from 181st onto Sandy •Single right turn lane from Sandy onto I-205 N •Signals on 181st run SCATS	15-25%
A4	•Single shared left turn from I-84 onto 181st •Single right turn lane from 181st onto Stark •Single left turn lane from Stark onto I-205 SB •Signals on 181st run SCATS	10-20%
A5	•Single shared left turn from I-84 onto 181st •Single right turn lane from 181st onto Division •Signals on 181st run SCATS	10-20%

Table 3 below shows the intersections, approaches, and movements affected by scenario, as well as the predicted percentage of diverted traffic for Incident A. This table will help prioritize intersections to retime during Incident A

Table 3 : Intersections Affected by Incident A

Intersection	Approach	Movement	Scenario	% Diverted Traffic
I-84/181st	WB	Left	A1, A2, A3, A4, A5	100
181st/I-84 EB	SB	Through	A1, A2, A3, A4, A5	75-85
181st/San Rafael	SB	Through	A1, A2, A3, A4, A5	75-85
181st/Halsey	SB	Right	A1	20-30
		Through	A2, A4, A5	30-60
181st/Glisan	SB	Right	A2	10-20
181st/Burnside	SB	Through	A4, A5	20-40
181st/Stark	SB	Right	A4	10-20
		Through	A5	10-20
181st/Yamhill	SB	Through	A5	10-20
182nd/Division	SB	Right	A5	10-20
Halsey/162nd	WB	Through	A1	20-30
Halsey/148th	WB	Through	A1	20-30
Halsey/132nd	WB	Through	A1	20-30
Halsey/122nd	WB	Through	A1	20-30
Weidler/111th	WB	Through	A1	20-30
Weidler/102nd	WB	Through	A1	20-30
Halsey/100th	WB	Through	A1	20-30
Halsey/92nd	WB	Through	A1	20-30
Halsey/Jonesmore	WB	Through	A1	20-30
Glisan/172nd	WB	Through	A2	10-20
Glisan/162nd	WB	Through	A2	10-20
Glisan/148th	WB	Through	A2	10-20
Glisan/122nd	WB	Through	A2	10-20
Glisan/102nd	WB	Through	A2	10-20
Glisan/99th	WB	Through	A2	10-20
Glisan/I-205 NB	WB	Right	A2	10-20
181st/3000 Block	NB	Through	A3	15-25
Sandy/181st	NB	Left	A3	15-25
Sandy/162nd	WB	Through	A3	15-25
Sandy/158th	WB	Through	A3	15-25

Sandy/148th	WB	Through	A3	15-25
Sandy/138th	WB	Through	A3	15-25
Sandy/122nd	WB	Through	A3	15-25
Sandy/121st Pl	WB	Through	A3	15-25
Sandy/112th	WB	Through	A3	15-25
Sandy/105th	WB	Through	A3	15-25
Sandy/102nd	WB	Through	A3	15-25
Sandy/I-205 NB	WB	Right	A3	15-25
Stark/148th	WB	Through	A4	10-20
Stark/139th	WB	Through	A4	10-20
Stark/130th	WB	Through	A4	10-20
Stark/122nd	WB	Through	A4	10-20
Stark/117th	WB	Through	A4	10-20
Stark/108th	WB	Through	A4	10-20
Stark/102nd	WB	Through	A4	10-20
Stark/99th	WB	Through	A4	10-20
Stark/I-205NB	WB	Through	A4	10-20
Stark/I-205 SB	WB	Left	A4	10-20
Division/162nd	WB	Through	A5	10-20
Division/148th	WB	Through	A5	10-20
Division/145th	WB	Through	A5	10-20
Division/136th	WB	Through	A5	10-20
Division/130th	WB	Through	A5	10-20
Division/122nd	WB	Through	A5	10-20
Division/119th	WB	Through	A5	10-20
Division/112th	WB	Through	A5	10-20
Division/99th	WB	Through	A5	10-20
Division/I-205 NB	WB	Through	A5	10-20
Division/I-205 SB	WB	Left	A5	10-20

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Tables 4, 5, and 6 describe the routes, constraints, and predicted percentage of diverted traffic for Incidents B, C, and D.

9.2.2 Incident B: I-84 Eastbound between I-205 and 181st Avenue

Table 4 : Operational Scenario Diversion Routes for Incident B

Scenario	Route Description	Constraints	Predicted % of Diverted Traffic
B1	Halsey to 181st to I-84 EB	•Single exit lane from I-84 to Halsey •Single left turn lane from Halsey onto 181st •Shared right turn lane from 181st onto I-84 EB •Signals on 181st run SCATS	15-20%
B2	Halsey to 122nd to I-84 EB	•Single exit lane from I-84 to Halsey •Single left turn lane from Halsey onto 122nd •Shared right turn lane from 122nd onto I-84 EB •Signals on 181st run SCATS	15-20%
B3	82nd to Halsey to 181st to I-84 EB	•Single exit lane from I-84 onto 82nd •Shared right turn lane from 82nd onto Halsey •Shared right turn lane from 181st onto I-84 EB •Signals on 181st run SCATS	15-20%
B4	I-205 N to US30 to 181st to I-84 EB	•Single exit lane from I-84 onto I-205 N •Single exit late from I-205 onto Sandy •Single right turn lane onto 181st from Sandy •Single left turn late onto I-84 from 181st •Signals on 181st run SCATS	20%
B5	I-205 S to Glisan to 181st to I-84 EB	•Single exit lane from I-84 onto I-205 S •Single exit lane from I-205 S onto Glisan •Single left turn lane from Glisan onto 181st •Shared right turn lane from 181st onto I-84 EB •Signals on 181st run SCATS	30-35%

9.2.3 Incident C: I-205 Northbound between US 26 (Powell Blvd) and US 30 Bypass (Sandy Blvd)

Table 5 : Operational Scenario Diversion Route for Incident C

Scenario	Route Description	Constraints	Predicted % of Diverted Traffic
C1	Division to 122nd to I-84 EB or to Airport Way and I-205 NB	•Single exit lane from I-205 N to Division •Single left turn lane from Division onto 122nd •Shared right turn lane from 122nd onto I-84 EB •Signals on 181st run SCATS	30-40%
C2	Stark to 122nd to I-84 EB or to Airport Way and I-205 NB	•Single exit lane from I-205 to Stark •Single left turn lane from Stark onto 122nd •Shared right turn lane from 122nd onto I-84 EB •Signals on 181st run SCATS	30-40%
C3	Glisan to 122nd to I-84 EB or Sandy to I-205 NB or to Airport Way and I-205 NB	•Shared exit lane from I-205 onto Glisan •Single left turn lane from Glisan onto 122nd •Shared right turn lane from 122nd onto I-84 EB •Single left turn lane from 122nd onto Sandy •Signals on 181st run SCATS	30-40%

9.2.4 Incident D: I-205 Southbound between US 30 Bypass (Sandy Blvd) and US 26 (Powell Blvd)

Table 6 : Operational Scenario Diversion Routes for Incident

Scenario	Route Description	Constraints	Predicted % of Diverted Traffic
D1	Sandy to 102nd to Glisan to I-205 SB	•Shared right turn lane from Sandy onto 102nd •Shared right turn lane from 102nd onto Glisan •Single left turn lane from Glisan onto 1-205 SB •Signals on 181st run SCATS	25-35%
D2	Sandy to 102nd to Stark to I-205 SB	•Shared right turn lane from Sandy onto 102nd •Single right turn lane from 102nd onto Stark •Single left turn lane from Stark onto 1-205 SB •Signals on 181st run SCATS	25-35%
D3	Sandy to 122nd to I-84 EB	•Shared right turn lane from Sandy onto 122nd •Shared right turn lane from 122nd onto I-84 EB •Signals on 181st run SCATS	30-35%

9.2.5 General Actions for All Incidents

Table 7 shows the general actions for the city to take for all incidents, which follow the Traffic Incident Management activity areas: verification of incident, informing the public of the incident, responding, verifying the end of the incident, and reverting to normal operations[3].

Table 7 : Agency Actions for Incidents

Steps	Description	Action	Responsible Agency	System
1	Verify incident and effects	a) Operator to check arterial flow on alternate routes	PBOT	CCTV
		b) Operator to check travel time on arterials	PBOT	Bluetooth Sensors
		c) Operator to check volumes	PBOT	System Detectors
2	Inform public of incident	a) Operator to display message on VMS signs	ODOT	Traffic Management Operations

[3] *Best Practices in Traffic Incident Management*. U.S. Department of Transportation, Federal Highway Administration, Sept 2010. http://ops.fhwa.dot.gov/publications/fhwahop10050/fhwahop10050.pdf

				Center
		b) Operator to post information to TripCheck	PBOT	Internet
3	Respond to incident	a) Operator to adjust signal timings to favor throughput on detour routes*	PBOT, Gresham	TransSuite
		b) Ramp meter adjustments to accommodate heavier volumes	ODOT	Automated
4	Verify end of incident	a) Operator to verify clearing of incident and return to normal flow	PBOT	CCTV, Bluetooth, System Detectors
5	Revert to normal operations	a) Operator to revert timings back to normal TOD plan	PBOT	TransSuite, automated

*See specific movements and intersections detailed in Table 2

9.3 Pedestrian and Truck Use During Off-Peak Periods

When there are low vehicle volumes, traffic signals should respond more actively to pedestrians and trucks. These operations can be assigned to time of day plans and can be programmed to respond quickly to the pedestrian or truck. For example, if a pedestrian places a call to cross the main street, the controller should be able to determine if there are any conflicting vehicles in the area and if not, serve the pedestrian as soon as it can. Likewise, if a truck is approaching a red indication, the controller should be able to determine if it can end the phase to serve the truck sooner, thus reducing truck delay and emissions.

10. SUMMARY OF IMPACTS

In order to determine the impacts of this city project, metrics are used to assess the system performance. One of the primary objectives of this project is to improve operations throughout the various corridors. Operational improvements are commonly determined by comparing before and after data for performance metrics such as travel time and delay.