Oregon Department of Transportation

Region 4 Data Warehouse

Data Warehouse Action Plan

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Prepared by

DKS

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1 EXECUTIVE SUMMARY

This project is being managed by Oregon Department of Transportation (ODOT) Region 4 working together with key regional partner agencies including the City of Bend, Bend MPO, and Deschutes County. This project is designed to provide the ability for multiple agencies to access transportation data collected by each agency to enable agency staff to more efficiently perform work tasks, and ultimately to improve plans, policies, and decisions. The types of transportation data included in the project are performance, inventory, and maintenance records, with a focus on performance data.

Regional data sharing is desired for day to day operational efforts, regional planning efforts and to support Federal reporting requirements. Large initiatives such as the Bend Parkway Plan and the Transportation System Plan (currently being updated) would also benefit significantly from better inter-agency data sharing. Partners indicated a strong desire to tie performance measurement into research and evaluation process, ultimately to ensure that projects are more data driven.

This project included local stakeholder outreach, a look at statewide efforts around the implementation of the Transportation Systems Management and Operations (TSMO) Performance Measures, an evaluation of alternatives and the development of a Framework for Implementation. This final document provides the Action Plan to implement the recommendations.

1.1 Recommended Alternative

The recommended alternative is that the region proceed with utilizing a limited number of existing agency tools to combine already existing data sources and work towards building in downloadable and analysis features. The primary goal is that data sharing partners are required to utilize as few systems as possibly, preferably migrating over time to a single solution.

Upon initial evaluation, ODOT's TransGIS appears to be the most advanced existing platform that works towards the goals of the data warehouse. Therefore, the recommended alternative is to build an implementation plan and action plan focused around expanding TransGIS to incorporate multiple agency data and incorporate downloadable and analytics tools into the existing platform.

It is further recommended that a full time position of Regional Data Manager be added by ODOT to manage the implementation of these recommendations, for at least two years. The role will be assessed over time to determine if it becomes a full time regional position. Ensuring that all regional partners have access to the data available through TransGIS will be a critical part of this role. Regional partners may find a more expeditious approach to staffing this position and ultimately, a local decision may be made that another agency lead this effort.

City of Bend's BOOM (Bend Oregon Online Mapper), is also a GIS platform that can be utilized for regional data analysis if/when ODOT is not able to incorporate specific local data or functionality into TransGIS. This may include local consultant traffic data counts or local 911, Bend PD and Deschutes County Sherriff crash data for example. City of Bend may also determine that a half time to full time FTE is required to manage this new development.

The City of Bend has recently adopted policy to migrate to more Open Data platforms wherever possible. Traffic and transportation data has been identified as a key set of data that multiple agencies and other partners could benefit from. As the region works through these data sharing issues, effort should be made to ensure compliance with these Open Data policies.

There are new systems that are and will be coming on-line over the next couple years that will be data sources for traffic count, signal system and third party data solutions. Implementation of these systems should be considered in the timeline and level of investment in some of the recommendations in this Action Plan and should ***not*** slow down the implementation of this initiative, i.e., it is not recommended that the regional partners wait for these projects to be finalized before beginning this effort. It is recommended that these implementations be monitored and that appropriate R4/Bend region partners are trained in how to utilize the new solutions for data extraction and their analytics capabilities.

One of the responsibilities of the Regional Data Manager will be to develop, manage and maintain a detailed Implementation Timeline Map similar to the table illustrated below. This example table is provided for illustrative purposes and is not intended to be complete or comprehensive.

Implementation Timeframe	Data Integration	Analysis Tool Development
0-6 month	Crash Turn Movement Counts Roadway Traffic Volumes	CEV at intersections Growth rates
6-12 month	Pedestrian and Bicycle Volumes	Worst corridor identification
1 year to 2 year	Weather data Bluetooth data Travel time data (iPems or similar)	Crash rate causes by key factors
Long-term	SPAT data Lighting data	Crash rate causes by key factors Project ideas (i.e., install new lighting, add more green time)

Note: Data integration assumes ability to view but also download in .xls format

The following section provides the summarized Action Plan for the Region 4 Data Warehouse project. Each action item is included later in the document, with relevant content and background information. The Action Plan below also includes a representative timeframe for the particular action and the identification of a responsible party to lead the action.

1.2 Data Warehouse Action Plan

ODOT R4 Data Warehouse Action Plan	Timeframe	Responsible Party
Action Item #1: Form R4/Bend Region Data Sharing Consortium: beginning with a subset of the project team managing this effort, begin by meeting monthly to formalize data sharing priorities as documented in this project and identify existing resources and tools to access the data.	Immediate (Committee Kick-off Meeting)	ODOT R4 (Lead)
Action Item #2: Identify Expanded Data Sharing Stakeholders: identify specific individuals at other partner agencies, including Cascades East Transit, local public safety agencies, Oregon State University-Cascades, other regional jurisdictions including Redmond, Sisters, Madras and other communities throughout Region 4 that could eventually participate in data sharing coordination activities. Schedule a workshop with all participants once initial activities and roles and responsibilities have been defined.	On-going	Data Sharing Committee
Action Item #3: Implement a full time position within ODOT R4 as Regional Data Manager for minimum of two years: Budget, develop job description and hire a Regional Data Manager to implement the recommendations in this plan. Initial implementation is anticipated to take up to two years, and the position can be evaluated to determine if it is a full time, on-going position as it evolves.	On-going (ODOT escalate discussion internally)	ODOT R4
Action Item #4: Manage a Contacts List of Existing System Manager: create, manage and maintain a contact list for each subsystem documented below and as regional data sharing needs continue to be identified. For each system, identify both an ODOT Primary Point of Contact (PoC), as well as a local R4/Bend PoC. See Appendix A for a preliminary list.	On-going	ODOT R4 Lead Committee Update
Action Item #5: Develop R4 Data Warehouse Program Timeline Map: reviewing the data sharing needs identified throughout this document and Appendices, the Data Sharing Manager will develop a comprehensive Implementation Timeline Map similar to the table illustrated below. This will be a living document that will be reviewed with the data sharing consortium on a regular basis and modified as priorities change and actions are completed.	Immediate (Kickoff Meeting) & Ongoing	ODOT R4

Implementation Timeframe	Data Integration	Analysis Tool Development
0-6 month	Crash Turn Movement Counts Roadway Traffic Volumes	CEV at intersections Growth rates
6-12 month	Pedestrian and Bicycle Volumes	Worst corridor identification
1 year to 2 year	Weather data Bluetooth data Travel time data (iPems or similar)	Crash rate causes by key factors
Long-term	SPAT data Lighting data	Crash rate causes by key factors Project ideas (i.e., install new lighting, add more green time)

Note: Data integration assumes ability to view but also download in .xls format

Action Item #6: Review the Mobility Section of the TSMO Performance Management plan: included in this document as Appendix B for ease of reference, the Mobility section of the TSMO Performance Management Plan documents an extensive list of data sharing needs and prioritizes near and long term activities. As the Region 4 Data Sharing Committee meets to continue to implement this plan, Appendix B will provide a valuable reference for additional and on-going data sharing needs.	On-Going	Committee
Action Item #7: Identify local public safety data sources, contacts and issues: identify the local agency contacts at 911, Bend Police Department, Deschutes County Sherriff and other local agencies with relevant data. Document the existing data sources, procedures to collect the data and challenges with the data such as potential duplication with ODOT Crash data or accuracy of location information. Develop procedures for automating (as much as possible) the collection and "cleaning" of this data from partner agencies.	Underway and Continual	Bend MPO

Action Item #8: Determine if and how to utilize Waze data for safety analysis: identify the Waze point of contact at ODOT and R4/Bend, discuss terms of contract with Waze (e.g. acceptable uses of the data, ways to access the data), schedule a tutorial for training on how to access and use the data and present to the committee to determine applicability specifically for use in Safety analysis.	Continual	ODOT R4 And City of Bend
Action Item #9: Determine viability of coordinated pavement maintenance program and establish process: meet with maintenance staff from ODOT R4 and local partner agencies to determine viability of coordinated pavement resurfacing and other coordinated maintenance projects. If partner agencies determine that this is viable and valuable, develop procedures for data sharing between agencies that best support processes for interagency coordination on planning, budgeting and managing interagency maintenance efforts. See ODOT Project Tracker tool discussed below as an example approach for information sharing.	Intermediate	ODOT R4 & City of Bend
Action Item #10: Identify data sources for other Asset Management systems, prioritize interagency coordination needs and develop systems for data sharing: Identify data sources for each agency that owns and maintains traffic signals, bridges, sidewalks, bike lanes and multi-use trails within the region. Determine appropriate platform for managing the sharing of this data and develop automated solutions for aggregating this information based on interagency coordination requirements.	Intermediate	Committee
Action Item #11: Work with ODOT's Transportation Data Section to track and utilize data sharing tools: Coordinate with Transportation Data Section Manager Chris Wright and Strategic Data Program Manager Denise Whitney Dahlke to track and utilize data sharing tools as they are developed. Replace static contact list for different data sets (Appendix A) with online tools as they are developed. Identify other opportunities for Region 4 to lead/pilot interagency data sharing solutions that come out of this work.	Intermediate	Committee
Action Item #12: Develop contacts and working relationship with TransGIS: Contact TransGIS Department and begin developing a working relationship with the TransGIS Team. Ensure that	Immediate (Pre-Committee Meeting)	ODOT R4

TransGIS team understands that this is intended to be a multi-year, on-going relationship, not a project specific engagement. Oregon Department of Transportation Geographic Information Services (GIS) Unit Map Counter Phone: (503) 986-3154 Email: odot.maps@odot.state.or.us		
Action Item #13: Determine if all required ATR Data is available in TransGIS: Review the full set of ATR data available through TCM System and compare to regional data sharing needs. Determine if all of the required data is already currently available through TransGIS or if enhancements can be made to meet regional needs. Revisit this same discussion once new TCM system has been implemented through the active procurement.	Intermediate	ODOT R4
Action Item #14: Develop local Intelight data plan : Identify regional Intelight migration strategy, including number of existing old ODOT signals, number of new Intelight signals and ODOT's timeline for upgrade. Get training in data/reporting capabilities of Intelight system. Determine if ODOT has plans already to develop access to signal data through TransGIS and if not, develop strategy with TransGIS to access signal data.	Underway and Ongoing	ODOT R4
Action Item #15: Review existing data available through Third Party data and explore TransGIS opportunities: Review full set of data that ODOT and regional partners have access to in iPEMS system. Compare data to regional data sharing requirements and explore opportunities to share easily accessible, high value data through TransGIS.	Immediate	ODOT R4 & Committee
Action Item #16: Track new third party data procurement: Continue to work with ODOT Data Management group to track the procurement of the new third party data system. Ensure that regional data sharing needs are address, including access to data through new system (licensing, etc.) Revisit TransGIS collaboration as required.	Long Term	Committee
Action Item #17: Participate in ODOT Performance Measures and Indicators Technical Team Meeting: The Region 4 Data Sharing Consortium should attend	Immediate	ODOT R4 & Committee

(at least virtually), one or more of the ODOT Performance Measures and Indicators Technical Team Meetings. New regional Data Sharing Manager should attend all of the ODOT Performance Measures and Indicators Team Meetings.		
Action Item #18: Develop third party data validation process: Consortium should look at new Third Party Data sources, and determine different processes for data validation, to determine when and if a given agency is ready to replace an existing data source (such as loop or bluetooth) with a new third party data source. Feedback from ODOT HQ, Region 1, and the TSMO Performance Measures and Indicators Technical Team could inform these decisions.	Intermediate	Committee
Action Item #19: Explore opportunities with Waze Data: Continue to work with ODOT Data Management group determine opportunities with Waze data, including determining if data can be used for other types of historical analysis projects beyond the safety analysis discussed in Action Item #8. Get training on how to access available data and work with TransGIS for development of tools to access this data.	Long Term	Committee
Action Item #20: Explore opportunities with ODOT's RWIS Data: Continue to work with ODOT Data Management group determine opportunities with RWIS data. Get training on how to access available data and work with TransGIS for development of tools to access this data.	Long Term	Bend MPO & Committee
Action Item #21: Make connections between BOOM team and TransGIS Team: Introduce appropriate resources at BOOM team with TransGIS resources to identify opportunities for more direct data sharing between agencies, based on local agency data sharing needs particularly for integration with local Bend area data.	Immediate	Committee
Action Item #22: Work with PSU to identify opportunities to utilize analytics: Work with the PSU team for both the PORTAL and the Bike/Ped Portal to determine opportunities to "port over" analytics code and utilize in both TransGIS and BOOM as applicable for different agency analysis requirements.	Intermediate	ODOT R4

2 PURPOSE OF DOCUMENT

This Data Warehouse action plan is intended to provide a series of steps for ODOT Region 4 and partner agencies to implement to achieve the data sharing goals identified in the ODOT Region 4 Data Warehouse Project. It describes regional goals and the scope of this project, existing data, data storage and sharing tools. Finally, this document provides a phased series of implementable steps toward achieving these data sharing objectives.

The remainder of this document will define the purpose and objectives of the identified system, and will include the following:

- Describe the system boundaries and identified scope;
- Identify stakeholder roles and responsibilities;
- Describe potential system architecture;
- Document systems operational needs;
- Document user needs including functions the interagency stakeholder identified the system to perform;
- Document system support and operational environments;
- Describe operational scenarios; and
- Create an Action Plan for Implementation

3 SCOPE OF PROJECT

This project is designed to provide the ability for multiple agencies to access transportation data collected by each agency to enable agency staff to more efficiently perform work tasks, and ultimately to improve plans, policies, and decisions. This project is being managed by ODOT Region 4 and key participants include the City of Bend, Bend MPO, and Deschutes County. The types of transportation data included in the project are performance, inventory, and maintenance records, with a focus on performance data.

Regional data sharing is desired for day to day operational efforts, regional planning efforts and to support Federal reporting requirements. Large initiatives such as the Bend Parkway Plan and the Transportation System Plan (currently being updated) would also benefit significantly from better inter-agency data sharing. Partners indicated a strong desire to tie performance measurement into research and evaluation process, ultimately to ensure that projects are more data driven.

Locally, there is a strong desire to better utilize tools (such as the Travel Demand Model) and GIS systems for meeting current needs and to get ready for new emerging technologies such as Connected and Autonomous Vehicles and new partnerships with transit including development of Mobility as a Service solutions.

There is also a strong desire to begin building more "dashboard like" tools, to better correlate data that isn't currently being looked at together, such as crash locations, traffic volumes and speed data—all in the same window and analysis tool.

The regional partner agencies recognize that the scope of data sharing will expand to additional partner agencies over time, including Cascades East Transit, local public safety agencies, Oregon

State University-Cascades, other regional jurisdictions including Redmond, Sisters, Madras and other communities throughout Region 4 and beyond.

Regional partners also desire all of the above be made available in as user friendly and intuitive solutions as possible, including making commonly referenced reports available with limited steps for the user. Finally, it was recognized that data governance policies need to be adhered to, especially around the use of third party data, and that personal privacy issues and possible tort requirements be considered.

Agencies are also interested in leveraging existing data sources to use Business Intelligence and other analytical tools to inform work tasks. For example, if requisite data is available, an analyst could link data from a crash at an intersection with traffic signal timing data to determine whether traffic signal timing modification could provide a safety improvement.

4 BACKGROUND & SYSTEM BOUNDARIES

The geographical boundary of ODOT Region 4 spans central Oregon from the Columbia River in the north to the California border in the south. It extends from the crest of the Cascade Range in the west to the high desert in the east. Region 4 includes portions of 13 counties.

Figure 1: ODOT Region 4
Source: www.fhwa.dot.gov

Within Region 4, cities, counties, Bend MPO, and ODOT collect transportation data. The types of data collected can be grouped into three functional categories: inventory, performance, and management. In general, this transportation data is collected by relevant departments within each agency for agency-specific facilities, equipment, and activities.

Some work activities relating to performance management are becoming more data intensive as time progresses. The *Fixing America's Surface Transportation (FAST) Act* requires States to report specific transportation system performance measures, which necessitates agencies to establish data collection, management, and reporting systems. The FAST Act requires states and MPOs to establish goals for and report these performance measures:

- Pavement condition on the Interstate System and on remainder of the National Highway System (NHS)
- Performance of the Interstate System and the remainder of the NHS
- Bridge condition on the NHS
- Fatalities and serious injuries—both number and rate per vehicle mile traveled--on all public roads
- Traffic congestion
- On-road mobile source emissions
- Freight movement on the Interstate System

5 IDENTIFY STAKEHOLDER ROLES AND RESPONSIBILITIES

System stakeholders include people who interact with the system during any phase of the project including design, construction, configuration, operation, maintenance, and use. Stakeholders are described in Table 1 with roles and responsibilities of each. The roles and responsibilities that are required to meet the operational needs of the data warehouse include:

- **User**: a person or organization that uses the system. This is further classified as:
  - **Provider:** a user that provides data to the system.
  - **Consumer**: a user who accesses data, downloads data, analyzes data, and/or generates reports through the system.
- **Owner**: the agency that is responsible for the assets of the data warehouse and pays for the operational costs.

- **Manager**: the agency that controls access to the system and determines what the standard form that data will be transformed into.
- **Vendor**: the entity that operates the servers, hosts the interface, establishes database links, transforms data to a common format, generates reports, archives data, backs up data, and ensures that data is secure and in a form that protects privacy.
- **Maintainer**: the entity that is responsible for ensuring that the servers storing the data are operational.
- **Trainer**: the entity that trains partner agency personnel how to enter, analyze and access data; generate reports; and maintain the system.

Table 1: System Stakeholders

Stakeholder	Role	Responsibility
ODOT (Statewide)	User (provider and consumer)	• Provide Data
ODOT Region 4	Owner, Manager, User (provider and consumer)	• Provide Data • Access Data • Pay Operations Cost • Manage Access
City of Bend	User (provider and consumer)	• Provide Data • Access Data
Bend MPO	User (provider and consumer)	• Provide Data • Access Data • Pay Operations Cost
Deschutes County	User (provider and consumer)	• Provide Data • Access Data
Cascade East Transit	User (provider and consumer)	• Provide Data • Access Data
Agency IT departments[1]	Maintainer	• Maintain Servers • Establish Database Links
Data Warehouse Service Provider	Vendor, Maintainer	• Host interface • Maintain Servers • Establish Database Links • Transform Data • Report Generation • Data Archive • Data Backup
Public	User (Consumer)	• Access Limited Data

The stakeholders in this project have the option to form a consortium to administer and manage the sharing of data between agencies. A consortium may facilitate:

- Developing policies and procedures for inter-agency access and system management
- Gathering and managing resources needed to implement and operate the data warehouse
- Expanding the system to include additional agencies in the future

If a consortium is chosen as the direction for system management, the roles and responsibilities listed in Table 1 should be revised accordingly.

Action Item #1: Form R4/Bend Region Data Sharing Consortium: beginning with a subset of the project team managing this effort, begin by meeting monthly to formalize data sharing priorities as documented in this project and identify existing resources and tools to access the data. Schedule ongoing meetings as agreed by the consortium, e.g. quarterly, monthly, etc.

Action Item #2: Identify Expanded Data Sharing Stakeholders: identify specific individuals at other partner agencies, including Cascades East Transit, local public safety agencies, Oregon State University-Cascades, other regional jurisdictions including Redmond, Sisters, Madras and other communities throughout Region 4 that could eventually participate in data sharing coordination activities. Schedule a workshop with all participants once initial activities and roles and responsibilities have been defined.

6 POTENTIAL SYSTEM ARCHITECTURE

The recommended alternative is that the region proceed with utilizing a limited number of existing agency tools to combine already existing data sources and work towards building in downloadable and analysis features. The goal is to have data sharing partners have to utilize as few systems as possibly, preferably migrating over time to a single solution.

Upon initial evaluation, ODOT's TransGIS appears to be the most advanced existing platform that works towards the goals of the data warehouse. Therefore, the recommended alternative is to build an implementation plan and action plan focused around expanding TransGIS to incorporate multiple agency data and incorporate downloadable and analysis tools into the existing platform.

It is further recommended that a full time position be added by ODOT to manage the implementation of these recommendations, for at least two years. The role will be assessed over time to determine if it becomes a full time regional position.

Action Item #3: Implement a full time position within ODOT R4 as Regional Data Manager for minimum of two years: Budget, develop job description and hire a Regional Data Manager to implement the recommendations in this plan. Initial implementation is anticipated to take up to two years, and the position can be evaluated to determine if it is a full time, on-going position as it evolves.

City of Bend's BOOM (Bend Oregon Online Mapper), is also a GIS platform that can be utilized for regional data analysis if/when ODOT is not able to incorporate it into TransGIS. This may include local consultant traffic data counts, and local 911, Bend PD and Deschutes County Sherriff crash dart for example. City of Bend may also determine that a half time to full time FTE is required to manage this new development.

There are new systems that are and will be coming on-line over the next couple years that will be data sources for traffic counts, signal system and third party data solutions. Implementation of these systems should ***not*** slow down the implementation of this initiative, i.e., it is not recommended that the regional partners wait for these projects to be finalized before beginning

this effort. It is recommended that these implementations be monitored and that appropriate R4/Bend region partners are trained in how to utilize the new solutions for data extraction and their analytics capabilities.

Action Item #4: Manage a Contacts List of Existing System Manager: create, manage and maintain a contact list for each subsystem documented below and as regional data sharing needs continue to be identified. For each system, identify both an ODOT Primary Point of Contact (PoC), as well as a local R4/Bend PoC. See Appendix A for a preliminary list.

NOTE: ODOT Primary Point of Contact refers to an individual that works with a given existing system and may work in Salem, Portland or some other office outside of Region 4. It is recognized that R4/Bend Point of Contact may also be an ODOT employee, but this nomenclature is intended for brevity.

7 OPERATIONAL & USER NEEDS

This section identifies the operational and user needs including functions the interagency stakeholders identified that the system or systems need to perform.

7.1 Data Types and General Functionality of the Data Warehouse

Table 2 identifies some examples of the different data functional categories and data types that have been identified by ODOT Region 4 and regional partner agencies.

Table 2: Data Types and Functional Categories

Inventory	Performance	Management
Field equipment	Volumes	Maintenance orders
Signs	Crashes	Signal timing
Striping	Speeds	Road sweeping / plowing
Lighting	Percent trucks	Information systems
Signals	AVL	Citizen complaints
	Trip length	Speed zone orders

The data sharing requirements for Region 4 and partner agencies are based on the ability to collect, transform, archive, analyze, and report data. Each agency will perform some of these functions to achieve an integrated data sharing platform. The functions are described below. It should be noted that some of these features may not exist initially with some of the solutions that stakeholders will be working with, but the goal is to have all of the following functionality available in the tools that R4 and partner agencies are working with over time.

7.1.1 Collect

Every agency that constructs and maintains the transportation system collects data. The Region 4 Data Sharing effort may involve one or more central storage repositories or centralized access points for all data that should be available to other agencies. Collected transportation data may include:

- Traffic volume
- Vehicle classification
- 24 hour count data
- Traffic signal data
- Asset data (and inter-agency tie-ins)
- Weather data
- Chain up requirements
- Land use data
- Vehicle speeds
- Turning movement counts
- Multi-modal volumes
- Crash data
- Pavement conditions
- Bridge conditions
- Observed road conditions
- Census data
- VMT data (via gas tax receipts)

7.1.2 Transform

Data is not collected in a standard format by each agency. When other agencies need to access the data, it may not be in the stored in the units that are needed by the agency accessing the data. Therefore, it is necessary for the data sharing tools including any data warehouse(s) to transform data into a common form for analysis and reporting.

7.1.3 Archive

After collecting and transforming data, the warehouse(s) will archive and back-up data to efficiently store historical records and ensure its secure storage. In some circumstances, archiving data can reduce the amount of server storage that is necessary for the system while still allowing agencies to access historical data.

7.1.4 Analyze

The data warehouse(s) can support various analysis tools to provide meaningful insights to agencies about the regional transportation system. Agencies will be able to perform analysis that will inform them about progress towards their goals as well as understanding the impacts of a project by comparing before and after measurements.

7.1.5 Report

The data warehouse(s) can support the generation of periodic and on-demand reports that summarize analysis outputs and create documentation for agency projects. These reports can be in the form of traditional report or an online dashboard.

7.1.6 FHWA Performance Measures

The FAST Act requires states and MPOs to create performance measures and track performance measures progress towards targets.[2] In collecting and transforming the data from each agency, the data warehouse(s) will facilitate state and MPO compliance with the Fast Act.

7.2 Data Sharing Vision, Goals and Objectives

A vision, goals, and objectives for the interagency data sharing are presented in Table 3. The vision provides the purpose for the system and describes the desired outcomes. Goals identify what the system should accomplish in alignment with the vision. Objectives describe specific items that satisfy goals when achieved.

Table 3: Vision, Goals, and Objectives of the System

Vision: Allow agencies to access region-wide data to improve design decisions, planning documentation, policies, decision making, and reduce redundant data collection

Goal: Improve region-wide access to transportation data	**Objective:** Collect region-wide data
	Objective: Transform collected data into consistent format
	Objective: Archive data in an accessible way
	Objective: Share and exchange data with others in a common format
Goal: Improve transportation data analysis capabilities in the region	**Objective:** Implement data management and reporting software
	Objective: Support data-driven decision making processes
	Objective: Improve non-FHWA performance measures
Goal: Help the region prepare for FHWA Performance Management reporting requirements under the FAST Act	**Objective:** Ensure that all FHWA performance measures are collected and stored consistently with the rest of the state
Goal: Collect additional performance measures that help the state and region understand the degree to which their transportation investments meet statewide, region, and local goals	**Objective:** Support development of performance measures separate from those that are part of the FAST Act FHWA Performance Management program that are meaningful to local, regional, and statewide goals.

7.3 Specific Agency Data Sharing Needs

ODOT Region 4 and partner agencies have identified a desire to strike a balance between most immediate data sharing needs and most readily available data and tools when identifying priorities for data sharing between agencies. The following specific areas of data sharing needs were identified in the Data Sharing Prioritization Workshop held on December 17, 2018 and through the earlier Stakeholder Interviews summarized in Appendix C.

Specific local data sharing needs include:

- Ability to support future deployment of connected and automated vehicles.
- Ability to assess infrastructure (asset management) for interagency collaboration.
- Ability to make informed decisions on safety investments and associated projects based on crash data.
- Ability to improve existing tools like GIS and integration with travel demand model.

[2] §1203; 23 USC 150(c)

- Ability to analyze signal operations, including performance evaluation and reporting.
- Ability to utilize crowd sourced data along with agency data, specifically the Waze data though ODOT's partnership.
- Ability to use speed, travel time and other similar metrics for pre and post analysis, to ensure that project prioritization is properly assessed.

Action Item #5: Develop R4 Data Warehouse Program Timeline Map: reviewing the data sharing needs identified throughout this document and Appendices, the Data Sharing Manager will develop a comprehensive Implementation Timeline Map similar to the table illustrated below. This will be a living document that will be reviewed with the data sharing consortium on a regular basis and modified as priorities change and actions are completed.

Implementation Timeframe	Data Integration	Analysis Tool Development
0-6 month	Crash Turn Movement Counts Roadway Traffic Volumes	CEV at intersections Growth rates
6-12 month	Pedestrian and Bicycle Volumes	Worst corridor identification
1 year to 2 year	Weather data Bluetooth data Travel time data (iPems or similar)	Crash rate causes by key factors
Long-term	SPAT data Lighting data	Crash rate causes by key factors Project ideas (i.e., install new lighting, add more green time)

Note: Data integration assumes ability to view but also download in .xls format

Through this projecty, ODOT Region 4 and partner agencies identified the following key areas of specific data sharing needs:

7.3.1 Mobility

Many mobility data sharing needs were identified by project stakeholders throughout this project. This section highlights the highest priority data sharing needs as discussed by project stakeholders. For a more comprehensive list of mobility data sharing needs, readers can review Appendix B, which is an excerpt of the ***ODOT Transportation System Management & Operations (TSMO) Program Performance Management Plan,*** completed in February 2017.

Action Item #6: Review the Mobility Section of the TSMO Performance Management plan: included in this document as Appendix B for ease of reference, the Mobility section of the TSMO Performance Management Plan documents an extensive list of data sharing needs and prioritizes near and long term activities. As the Region 4 Data Sharing Committee meets to continue to implement this plan, Appendix B will provide a valuable reference for additional and on-going data sharing needs.

Action Item Note: the Action items associated with the remainder of the Mobility data sharing needs discussed here are in the following section under "Existing Systems."

7.3.1.1 Traffic Volumes

Traffic Volumes were identified as one of the highest priorities for data sharing amongst the agencies.

7.3.1.2 Local Agency Bike & Ped Volumes

Local agency multi-modal data collection including the new bike and pedestrian detection program was determined to be a much lower data sharing need in the near term. However, as this data become increasingly available, regional partners should continue to explore opportunities for collection and sharing of data.

7.3.1.3 Other Volume Data

Traffic count and turning movement data that is collected for both specific corridor assessment projects and for private development projects, should be stored in a shared database, using standardized data sets. Currently, these are largely stored by agencies and consultants as stand-alone spreadsheets, and are frequently only available as PDF documents and addenda to project studies.

7.3.1.4 Travel Time Reliability

ODOT (Hwy 97 and Hwy 20) and City of Bend (Empire, 27th and Reed Market) corridors are both requiring Travel Time Reliability reporting, and increasingly, this performance measure will be utilized for federal reporting, as well as, local and regional planning and investment decision making. Currently, there is only intermittent use of Bluetooth detection for this performance measure, and ODOT has not yet standardized on the approach to Bluetooth.

7.3.1.5 Trend Analysis

One key area of analysis that partner agencies identified within some of the data sets identified above, is the ability to analyze different trends, year to year, season to season and other time frames as appropriate. This includes volume, speed, travel time reliability and other data sets.

7.3.2 Safety

Crash data was identified as one of the next highest priorities for data sharing between agencies and the highest under the safety category. ODOT's historical crash data is already widely available and widely utilized. However, it is usually incomplete (fatal and serious injury are captured, but many smaller crashes are not), and it is not timely (often 2-3 year old data is the most recent available.

Incident data from other sources, including 911 reports, Bend police reports, Deschutes County Sherriff, etc., of incidents that did not trigger ODOT crash reports was deemed valuable in the long run, but not the highest priority. Figure 2 illustrates an example of consolidated crash data that is available as referenced for public viewing on Tableau's open site.

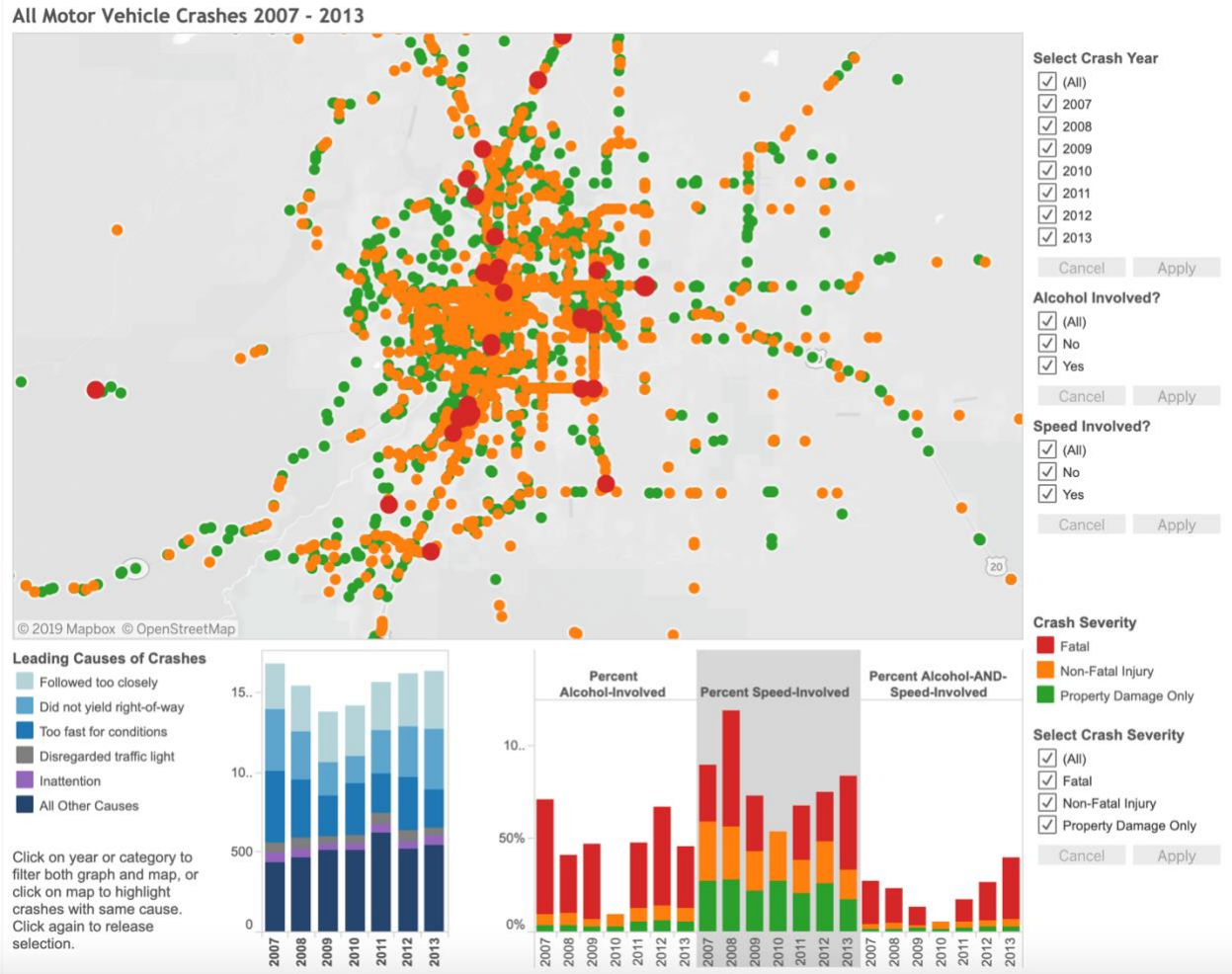


Figure 2: Bend Area Consolidated Crash Data[3]

[3] Posted on: https://public.tableau.com and posted by Bill Clingman, Senior GIS Analyst, Lane Council of Governments

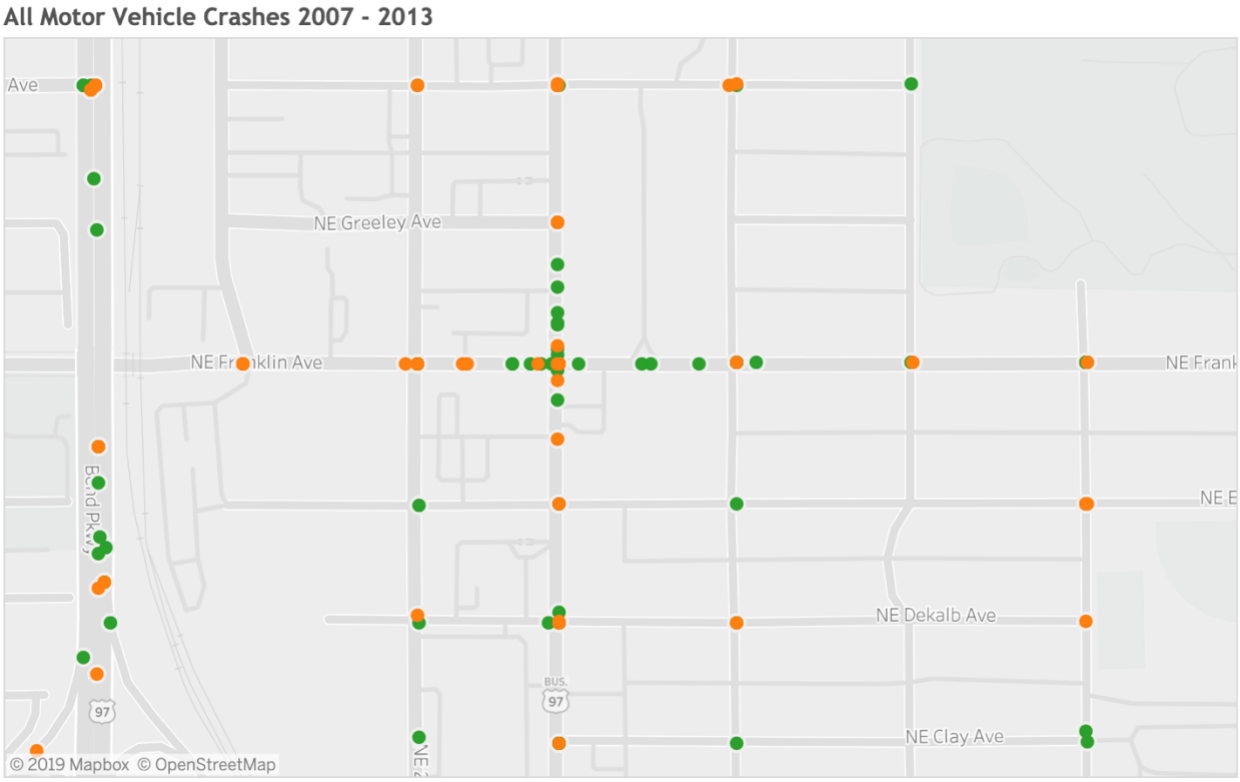


Figure 3: Zoom Map of Bend Crash Data[4]

Figure 3 illustrates a "zoom in" of the crash data shown in Figure 2, to demonstrate both the interactive nature of the site (individual layers can be turned off or turned on with the check boxes and the map can be zoomed in and out) as well the level of granularity of the location information.

Action Item #7: Identify local public safety data sources, contacts and issues: identify the local agency contacts at 911, Bend Police Department, Deschutes County Sherriff and other local agencies with relevant data. Document the existing data sources, procedures to collect the data and challenges with the data such as potential duplication with ODOT Crash data or accuracy of location information. Develop procedures for automating (as much as possible) the collection and "cleaning" of this data from partner agencies.

Action Item #8: Determine if and how to utilize Waze data for safety analysis: identify the Waze point of contact at ODOT and R4/Bend, discuss terms of contract with Waze (e.g. acceptable uses of the data, ways to access the data), schedule a tutorial for training on how to access and use the data and present to the committee to determine applicability specifically for use in Safety analysis.

[4] Posted on: https://public.tableau.com and posted by Bill Clingman, Senior GIS Analyst, Lane Council of Governments

7.3.3 Asset Management

Asset management data sharing was determined to be a lower requirement, ***unless*** the data is readily available in common standards and in an existing system that can be easily shared.

For example, pavement condition might be valuable information to share between agencies, as it tends to be kept by all agencies in generally standard formats.

Pavement Condition Index (PCI) data could help agencies look for opportunities to partner on road improvement projects across jurisdictional boundaries when shared or adjacent facilities require improvement. As PCI is a long established standard, the data should be consistent between agencies and this could be one set of GIS data. Programmed and Planned upgrade projects could then become another set of standard set of data for GIS entry so that agencies can identify opportunities to coordinate projects and get better regional return on investment.

In addition to pavement conditions, partner agencies also identified the following other assets as desirable for data sharing between agencies:

- Signal Asset Data
- Bridge Conditions
- Sidewalks and Bike Lanes
- Multi-use Trail Conditions

Action Item #9: Determine viability of coordinated pavement maintenance program and establish process: meet with maintenance staff from ODOT R4 and local partner agencies to determine viability of coordinated pavement resurfacing and other coordinated maintenance projects. If partner agencies determine that this is viable and valuable, develop procedures for data sharing between agencies that best support processes for interagency coordination on planning, budgeting and managing interagency maintenance efforts. See ODOT Project Tracker tool discussed below as an example approach for information sharing.

Action Item #10: Identify data sources for other Asset Management systems, prioritize interagency coordination needs and develop systems for data sharing: Identify data sources for each agency that owns and maintains traffic signals, bridges, sidewalks, bike lanes and multi-use trails within the region. Determine appropriate platform for managing the sharing of this data and develop automated solutions for aggregating this information based on interagency coordination requirements.

8 SYSTEM SUPPORT AND OPERATIONAL ENVIRONMENTS

For the recommended approach on data sharing to continue to be useful and continue to work towards more analysis features, a standing quarterly meeting at minimum would be required (and a monthly coordination meeting is initially recommended). The region may want to consider a subcommittee of the on-going ITS implementation team (or potentially a stand-alone data sharing group) to focus specifically on interagency data sharing and the implementation of this plan.

To implement a useable system, there will also need to be a full time position fully dedicated to:

- gathering data from existing systems
- combining data into one resource
- setting up the system for automatic updates
- converting data to downloadable formats
- setting up analysis tools in the system
- maintaining coordination with internal and external agencies to:
    - make sure data is in the right format
    - ensure new data contracts obtain the right data
    - identify new opportunities for data

To support this will require getting a full-time person dedicated to the project. A full time ODOT Region 4 position is recommended, however, the regional partners may choose to consider the following three options with their timeline and budget:

- Hire a person within ODOT located in Region 4 Traffic
- Hire a person within Bend MPO with access to ODOT's system
- Hire a private consultant with access to ODOT's system

ODOT is in the process of putting in place foundational data management and governance tools and guidance, organizational roles and groups. Examples of this work include:

- The development of an agency data set and data product inventory that also identifies related responsible parties and subject matter experts,
- Standing up a data stewardship program that delineates agency data related roles and responsibilities and provides a mechanism for making improvements.
- Also under consideration are an agency Chief Data Officer, and the role of the new Data Council and Technology and Data Sub-Committee to the Agency Leadership Board.

In addition, ODOT HQ will be developing its response to the state Open Data Standard which became law in 2018, including development of an Open Data Plan. It is recommended that the Region 4 team stay closely apprised of the status of each these efforts and consider acting as a pilot region or participant for those activities in which this is an option. There may also be potential for regional partners to participate in ODOT's response to the Open Data Standard.

Action Item #11: Work with ODOT's Transportation Data Section to track and utilize data sharing tools: Coordinate with Transportation Data Section Manager Chris Wright and Strategic Data Program Manager Denise Whitney Dahlke to track and utilize data sharing tools as they are developed. Replace static contact list for different data sets (Appendix A) with online tools as they are developed. Identify other opportunities for Region 4 to lead/pilot interagency data sharing solutions that come out of this work.

8.1 Existing Systems

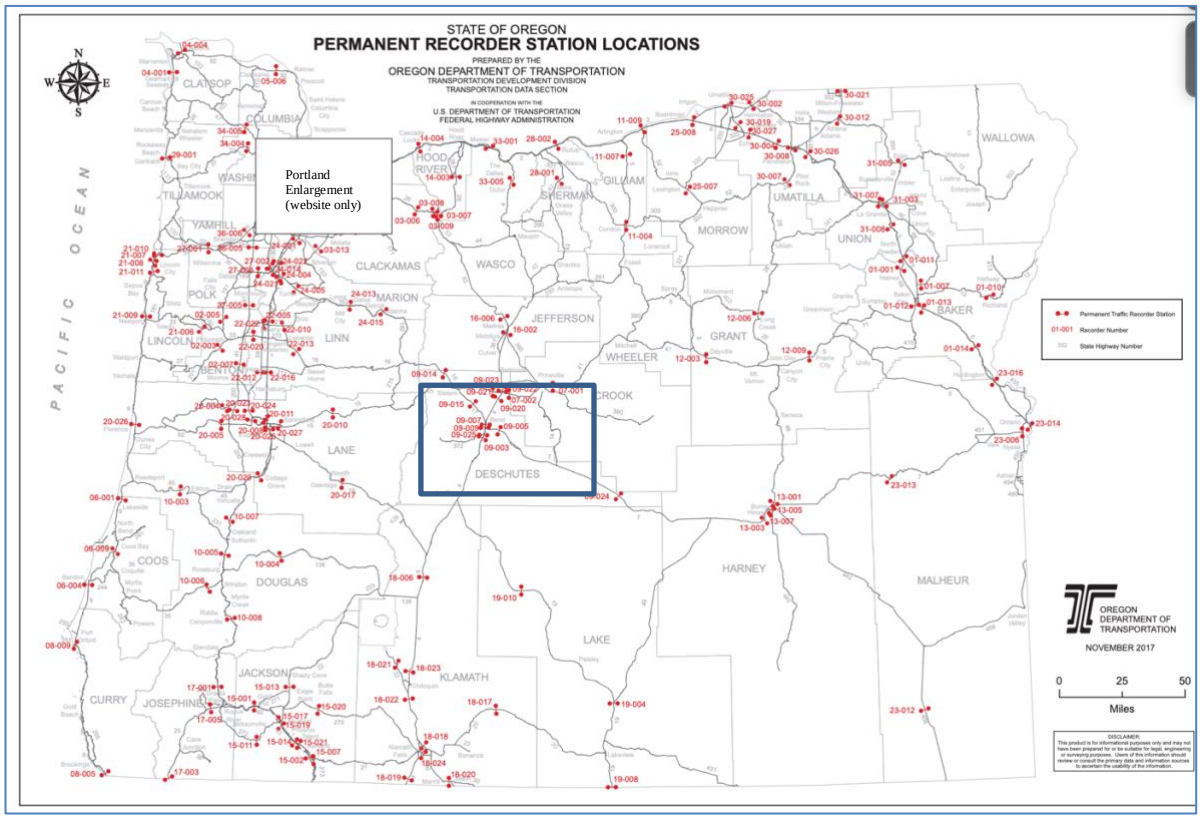
ODOT and regional partners have invested heavily over the years, in various data collection, storage and analysis tools and systems. The recommended alternative is to consider utilizing these existing systems more effectively and efficiently in sharing data between partner agencies. To support this analysis, many of these existing systems are introduced in this section.

8.1.1 ODOT Data Systems

8.1.1.1 Traffic Volume and Flow Data

ODOT operates a number of Automate Traffic Recorders (ATRs) including both Permanent Automated Traffic Recorders (see Figure 4) and temporary traffic recording equipment. ODOT publishes Transportation Volume Tables and a number of other volume and flow tables (see Figure 5) available at:
https://www.oregon.gov/ODOT/Data/Pages/Traffic-Counting.aspx

ODOT's current count database is the Traffic Count Management System (TCM) which was developed by PTV in 2008. PTV has stopped supporting the TCM software. ODOT is currently in the process of procurement of a new off the shelf commercial software packages to replace TCM.



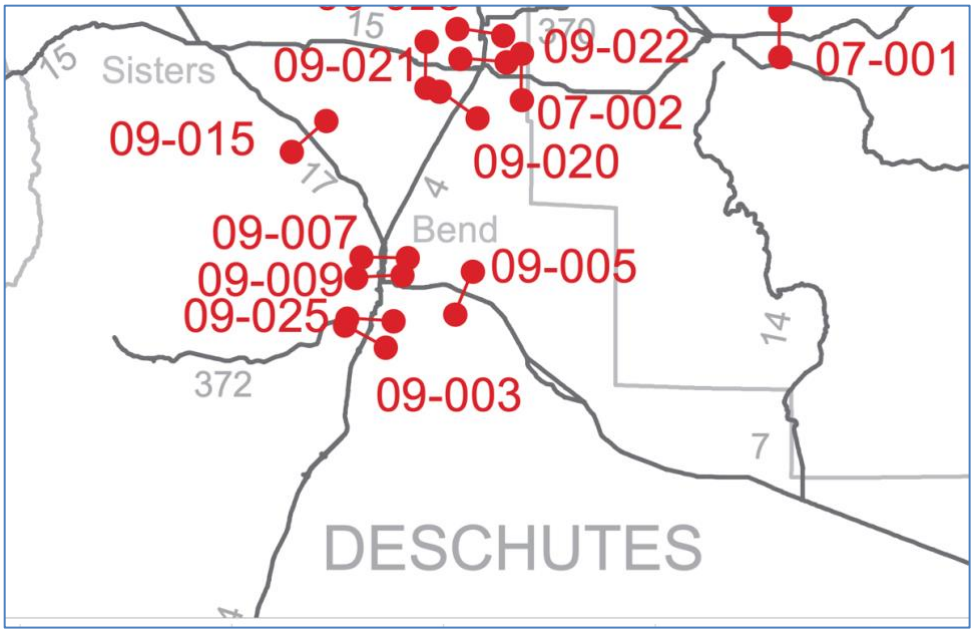


Figure 4: ODOT Permanent Traffic Recorders- Statewide and Bend Metro

https://www.oregon.gov/ODOT/Data/Documents/ATR_Map_2017.pdf

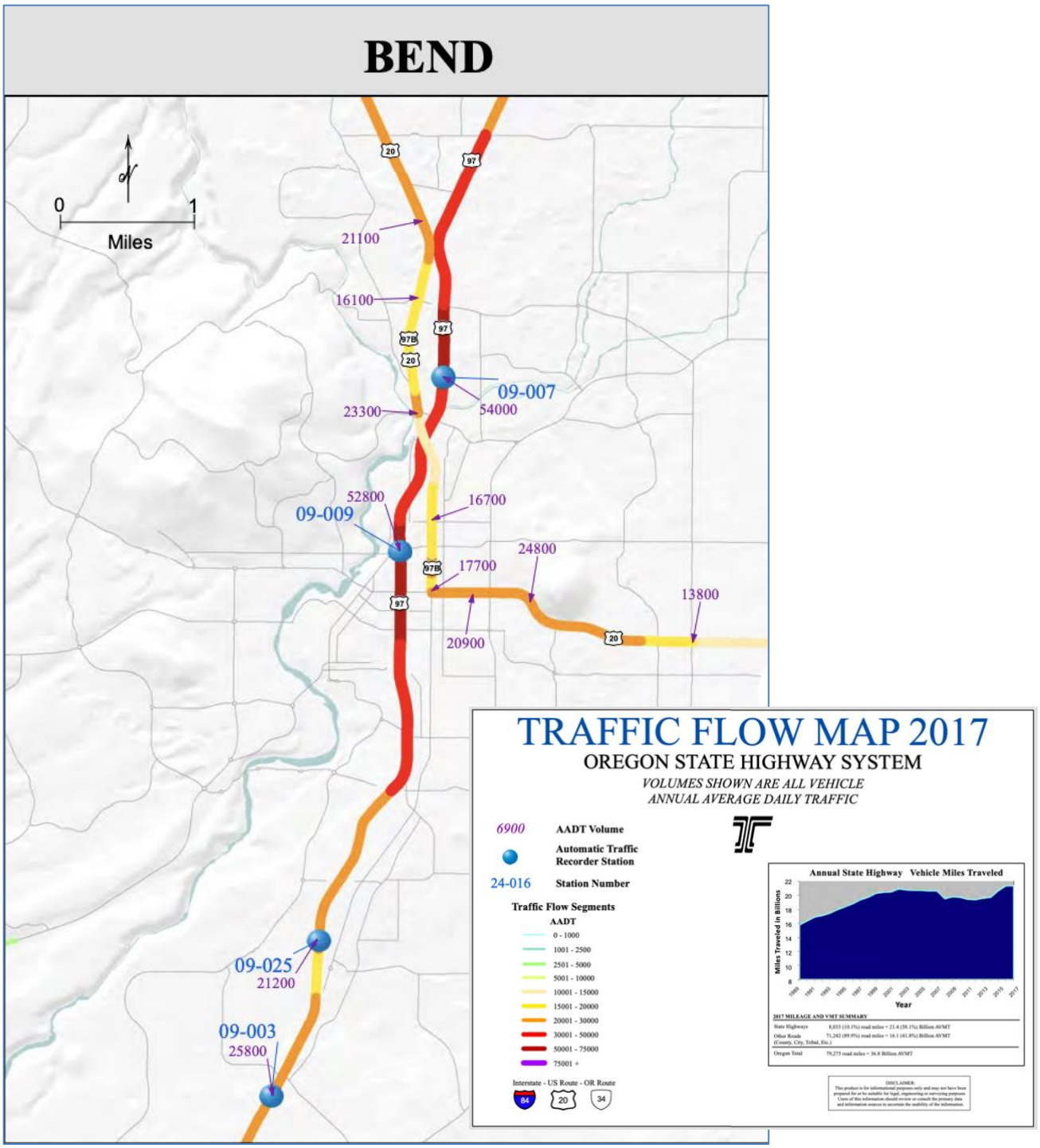


Figure 5: Bend Area Traffic Flow Data from ODOT Traffic Recorders

https://www.oregon.gov/ODOT/Data/Documents/Flow_Map_Enlargements_2017.pdf

8.1.1.2 ODOT TransGIS

ODOT TransGIS is a web mapping tool designed for users of various GIS skill levels. It presents many data levels in an interactive map format in multi-level views. This mapping tool provides information on many types of safety, volume and crash data on a state map. The user can choose which information layers are displayed, and can zoom in on the map to examine a location in detail as well as display city and county boundaries along with other data.[5]

ODOT's TransGIS site can be accessed at:
https://gis.odot.state.or.us/transgis/

Figure 6 and Figure 7 illustrate a small sample of the data currently available in ODOT TransGIS for the Bend area. Multiple layers can be individually turned on or off in a very user friendly interface. Figure 6 illustrates the ability to combine city boundary, ITS, traffic signals and ATR as well as traffic flow data, all on the same map.

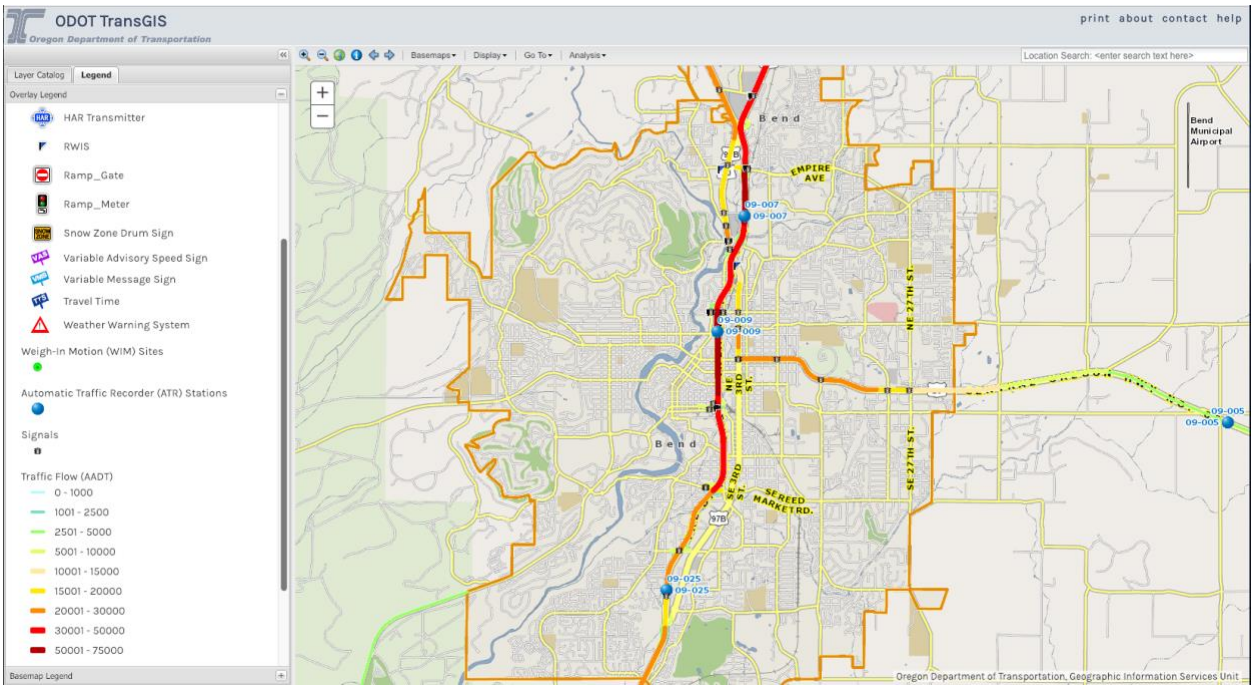


Figure 6: ODOT TransGIS with Local Bend Area Info

Figure 7 illustrates the combination of both ODOT and local AADT combined on the same map to show regional traffic flow on City, County and State infrastructure.

[5] Source: ODOT Analysis Procedures Manual Version 2 Last Update: November, 2018

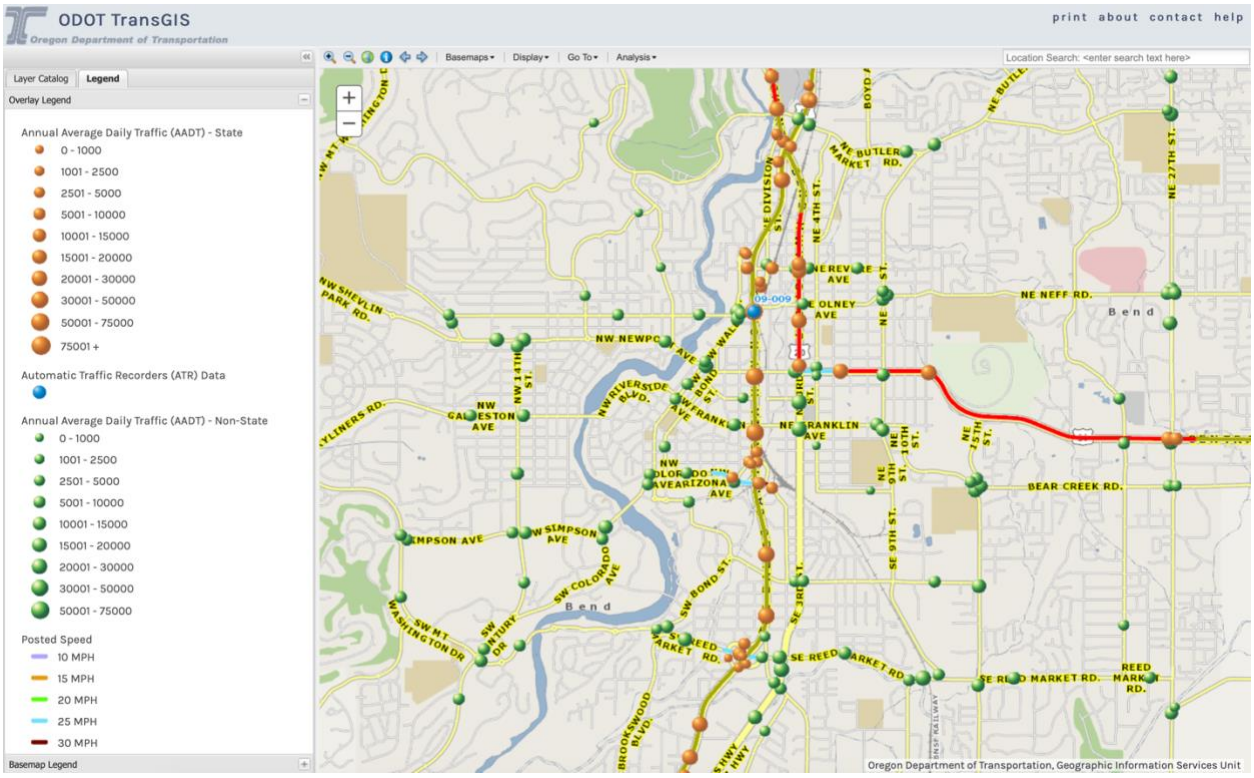


Figure 7: ODOT TransGIS AADT Data for Bend region

As documented in the ODOT Analysis Procedures Manual:

"The ODOT GIS Unit may be able to produce custom maps or applications in some cases, depending on the nature of the request and work priorities. GIS maps or web applications may be possible, as well as additions to TransGIS. A web application is a custom TransGIS website with pre-defined layers. GIS software is not required. The user can zoom in/out and turn layers on/off as desired. The application may be permanent or temporary, as needed for the duration of the project. Examples are located on the GIS Unit Applications Webpage[6].

All requests for mapping products are submitted to the ODOT GIS Unit (GISU) from ODOT staff. Consultants may initiate a request through ODOT staff. Requests should be clearly defined prior to submittal to avoid re-work. Contact the GIS Unit for further information. Custom mapping requests need to use the GIS Project Request form which is available by contacting the GISU."

An example of a recently added TransGIS mapping and information sharing tool is ODOT Project Tracker[7] or OPT, as illustrated in Figure 8. Figure 9 demonstrates the level of project detail that OPT provides on road segment and location specific projects.

[6] Note: Access to the "GIS Unit Applications Webpage" is currently restricted to ODOT employees with permission.

[7] ODOT Project Tracker can be found at: https://gis.odot.state.or.us/transgis/opt/

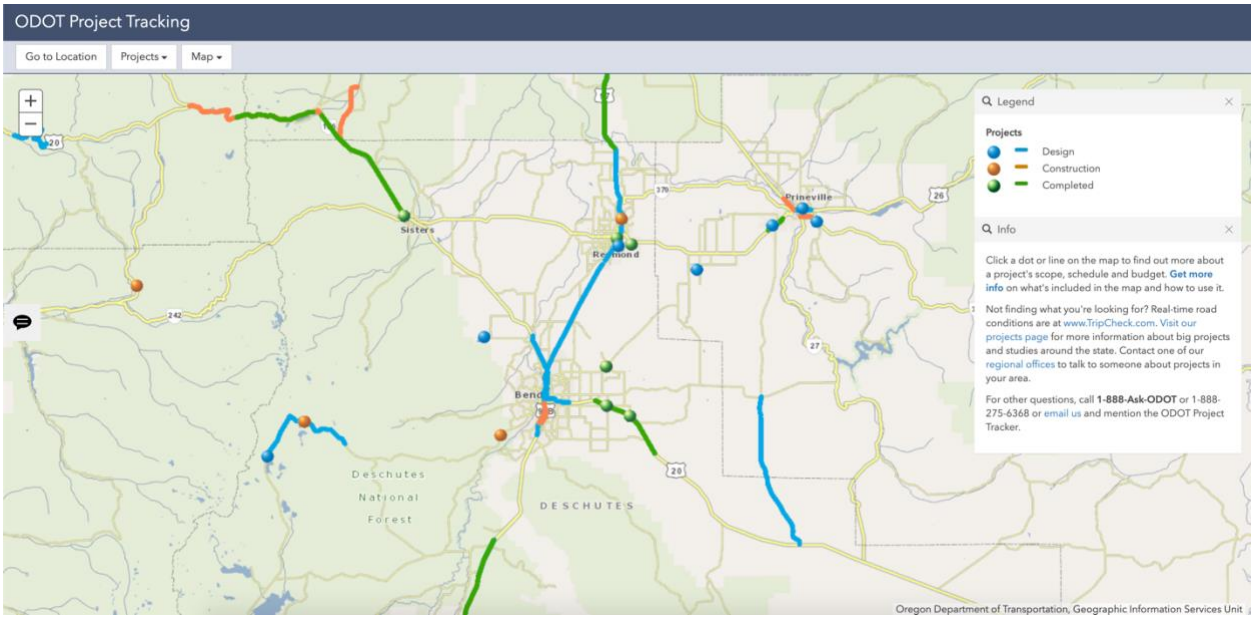


Figure 8: ODOT Project Tracker from TransGIS with Bend Area Projects

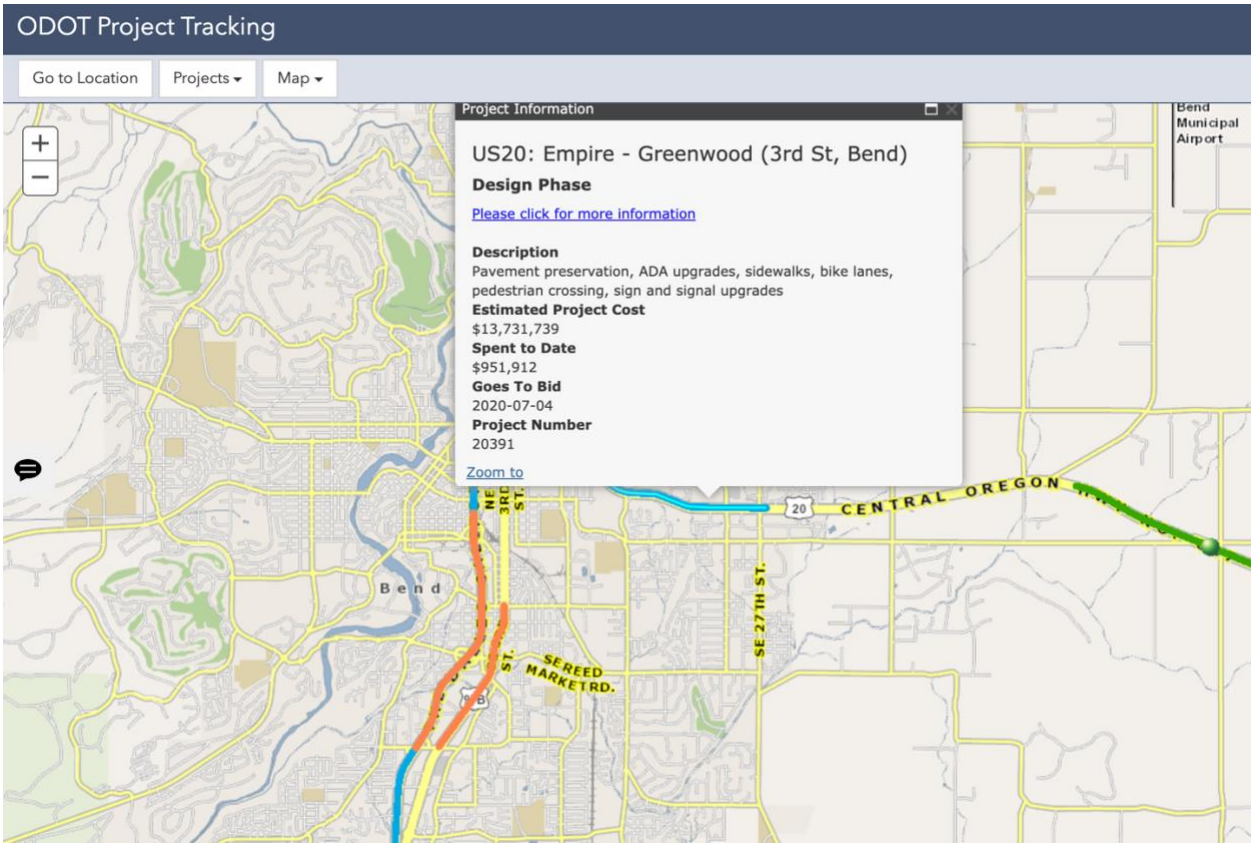


Figure 9: Example of Project Description Detail Provided in ODOT Project Tracker

Action Item #12: Develop contacts and working relationship with TransGIS: Contact TransGIS Department and begin developing a working relationship with the TransGIS Team. Ensure that TransGIS team understands that this is intended to be a multi-year, on-going relationship, not a project specific engagement.
Oregon Department of Transportation Geographic Information Services (GIS) Unit
Map Counter Phone: (503) 986-3154
Email: odot.maps@odot.state.or.us

Action Item #13: Determine if all required ATR Data is available in TransGIS: Review the full set of ATR data available through TCM System and compare to regional data sharing needs. Determine if all of the required data is already currently available through TransGIS or if enhancements can be made to meet regional needs. Revisit this same discussion once new TCM system has been implemented through the active procurement.

8.1.1.3 Intelight MaxView

ODOT went through an evaluation of new Central Signal software and selected Intelight's MaxView® Advanced Traffic Management System (ATMS) software. MaxView is a client/server application utilizing Graphical User Interface (GUI) for user interaction and report development. As ODOT continues to migrate more of their field controllers to Intelight Advanced Traffic Controllers (ATC) hardware and Intelight software, MaxView will provide increasingly valuable signal system reporting capabilities.

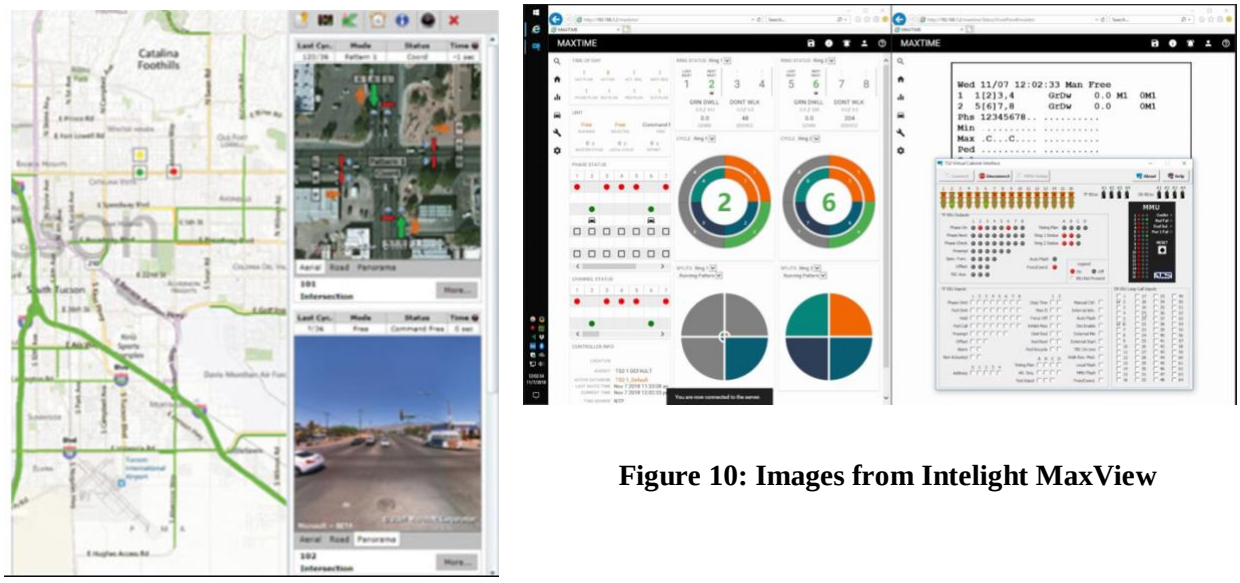


Figure 10: Images from Intelight MaxView

Action Item #14: Develop local Intelight data plan : Identify regional Intelight migration strategy, including number of existing old ODOT signals, number of new Intelight signals and ODOT's timeline for upgrade. Get training in data/reporting capabilities of Intelight system. Determine if ODOT has plans already to develop access to signal data through TransGIS and if not, develop strategy with TransGIS to access signal data.

8.1.1.4 Oregon Motor Vehicle Traffic Crash Database

ODOT's Crash Analysis and Reporting (CAR) Unit provides the official motor vehicle crash data through database creation, maintenance and quality assurance, information and reports and limited database access. Crash data since 1985 is maintained at all times. Vehicle crashes include those coded for city streets, county roads and state highways. The CAR Unit website offers a variety of publications containing information on monthly and annual crash summaries.

https://www.oregon.gov/ODOT/Data/Pages/Crash.aspx

No specific actions were identified for crash data.

8.1.1.5 Third Party Data Management

ODOT uses third party data from HERE similar to how other agencies use the National Performance Management Research Data Set (NPMRDS). ODOT's contract includes the ability to use some features of the iPeMS[8] product for managing and analyzing data. ODOT is considering working together with Iteris (the company that develops and supports iPeMS) to further enhance the product suite to meet agency specific data management and reporting desires. However, the contract for iPeMS will expire in the next year (ODOT may opt for one more year of contract extension) and ODOT will need to go out to bid.

Competing with the iPeMS product is the Regional Integrated Transportation Information System (RITIS)[9] product that is maintained by Center for Advanced Transportation Technology Laboratory (CATT Lab) at the University of Maryland. The RITIS product provides customers access to NPMRDS data provided by Inrix.

One challenge that ODOT is considering, is whether to continue to work together with Iteris to develop functionality for data management and analytics, with the chance that this investment of time and resources will be lost if ODOT decides to select a different Third Party Data Management solution in the next procurement.

At the time of this analysis, ODOT indicated that they would likely extend the IPeMS contract for one more year (this is the last extension available on the contract) and that ODOT would

[8] More information at: https://www.iteris.com/products/performance-analytics/ipems

[9] http://www.cattlab.umd.edu/?portfolio=ritis

continue to proceed with development of high-priority iPeMS functionality, while continuing to monitor progress and investment.

ODOT has a Technical Advisory Committee (TAC) called the ***Performance Measures and Indicators Technical Team*** that meets on a monthly basis to focus on data sharing and systems between different departments within the agency. This group includes representatives from ODOT's Transportation and Planning Analysis Unit, Intelligent Transportation Systems and ODOT's Transportation Data Section. The Regional Data Manager will need to be a part of this committee and make sure that the data needs for the system are represented at each of these.

Action Item #15: Review existing data available through Third Party data and explore TransGIS opportunities: Review full set of data that ODOT and regional partners have access to in iPEMS system. Compare data to regional data sharing requirements and explore opportunities to share easily accessible, high value data through TransGIS.

Action Item #16: Track new third party data procurement: Continue to work with ODOT Data Management group to track the procurement of the new third party data system. Ensure that regional data sharing needs are address, including access to data through new system (licensing, etc.) Revisit TransGIS collaboration as required.

Action Item #17: Participate in ODOT Performance Measures and Indicators Technical Team Meeting: The Region 4 Data Sharing Consortium should attend (at least virtually), one or more of the ODOT Performance Measures and Indicators Technical Team Meetings. New regional Data Sharing Manager should attend all of the ODOT Performance Measures and Indicators Team Meetings.

Action Item #18: Develop third party data validation process: Consortium should look at new Third Party Data sources, and determine different processes for data validation, to determine when and if a given agency is ready to replace an existing data source (such as loop or bluetooth) with a new third party data source. Feedback from ODOT HQ, Region 1, and the TSMO Performance Measures and Indicators Technical Team could inform these decisions.

8.1.1.6 ODOT Waze Data

Waze is a crowd sourced (or community-based) traffic and navigation smart phone application owned by Google. Over the last several years, the app has been growing steadily and more recently, has been providing congestion data to city governments through a partnership that Waze used to call Connected Citizens Program and which is now branded as Waze for Cities. Information about this program can be found in detail at:

https://www.waze.com/ccp

ODOT entered into partnership with Waze a few years ago, and the region could potentially benefit from sharing this data for safety, travel time reliability and other data sharing needs discussed above.

Action Item #19: Explore opportunities with Waze Data: Continue to work with ODOT Data Management group determine opportunities with Waze data, including determining if data can be used for other types of historical analysis projects beyond the safety analysis discussed in Action Item #8. Get training on how to access available data and work with TransGIS for development of tools to access this data.

8.1.1.7 Weather Data

Partner agencies get weather data from third party systems, such as the National Oceanic and Atmospheric Administration (NOAA). However, this data could potentially be augmented with data from ODOT's Road Weather Information System (RWIS) equipment. ODOT has 8 RWIS stations in the greater Bend area including in Bend, Redmond, Sisters, other stations on Hwy 97 and Hwy 20. These collect temperature, relative humidity, dew point, wind direction, wind speed (average and gusts).

Action Item #20: Explore opportunities with ODOT's RWIS Data: Continue to work with ODOT Data Management group determine opportunities with RWIS data. Get training on how to access available data and work with TransGIS for development of tools to access this data.

8.1.2 Bend MPO

The Bend Metropolitan Planning Organization provides crash data (following ODOT reporting standards) and some local vehicle count data. Currently this data is collected and analyzed by the MPO directly and some of the data is shared publicly via the City of Bend website. Currently Traffic Count data locations are illustrated as a layer on the Bend Oregon Online Mapper (BOOM.)

https://maps.ci.bend.or.us/html5viewer/?viewer=publicviewer#

It does not appear that traffic count data is available through this site, but simply traffic count locations.

Action Item #21: Make connections between BOOM team and TransGIS Team: Introduce appropriate resources at BOOM team with TransGIS resources to identify opportunities for more direct data sharing between agencies, based on local agency data sharing needs particularly for integration with local Bend area data.

8.1.3 City of Bend

In addition to the data that the MPO has made available with the City of Bend on the BOOM site, the City of Bend has begun a program to capture some limited vehicle count data and some pedestrian and bike count data.

The city has set up 5 permanent count locations and has portable equipment to collect data at other locations. The city has begun a process of collecting data at around 30 locations every May. This data will be shared using Tableau and/or Power BI tools in the future.

8.1.4 Portland State University Traffic Data Portals

Portland State University (PSU) operates two different transportation data portal or data sharing and dissemination systems, through the Transportation Research and Education Center (TREC). TREC is home to the U.S. DOT funded National Institute for Transportation and Communities (NITC) consortium, the Initiative for Bicycle and Pedestrian Innovation (IBPI), and other transportation grants and programs.

The two data portals are:

- **PORTAL**: A web accessible site developed by PSU in 2004. PORTAL collects and shares freeway and arterial data throughout the Portland Metropolitan region. Starting in 2004 with just one data source (Oregon freeway loop detectors), over the past 14 years, it has developed into a multimodal data archive, incorporating freeway data, transit data, traffic signal data, now including eight data sources spanning two states and multiple agencies.

- **Bike-Ped Portal**: coordinated under the Initiative for Bicycle and Pedestrian Innovation, the Bike-Ped Portal is still in early stages of development, but has become a national archive for bicycle and pedestrian data.

8.1.4.1 PORTAL

According to Portland State's PORTAL website:

"PORTAL is the official transportation data archive for the Portland-Vancouver Metropolitan region.

PORTAL provides a centralized, electronic database that facilitates the collection, archiving, and sharing of data and information for public agencies within the region. The data stored in Portal includes 20-second granularity loop detector data from freeways in the Portland-Vancouver metropolitan region, arterial signal data, travel time data, weather data, incident data, VAS/VMS message data, truck volumes, transit data, and arterial signal data. Many of these data feeds are received by PORTAL in real time or on a daily basis and for most, the retrieval and archiving process is fully automated.

PORTAL's multi-modal transportation data archive aims to support Metro's Regional Transportation Plan, the production of regional performance measures, support for regional

transportation agencies and their consultants, and researchers at Portland State and elsewhere. Project objectives include producing tools and performance measures useful to local transportation professionals, exploring new and innovative uses of the data, and making the PORTAL data and system more accessible to agency personnel."

https://portal.its.pdx.edu/index.php

Regional stakeholders queried whether PORTAL data analytics tools could potentially be "ported over", i.e., can the underlying code be shared, if we want to build similar analytics tools with a different system such as BOOM (Bend Oregon Online Mapper), ODOT's TransGIS or a third party tool.

8.1.4.2 Bike-Ped Portal

PSU's Bike-Ped Portal is a more recently developed data access system. According to PSU's website:

"Bike-Ped Portal, [is] the national archive for bicycle and pedestrian count data. Check bicycle and pedestrian traffic volumes around the U.S. and add your own count data. Bike-Ped Portal supports counts collected on road and path segments, recorded by hand as well as machine."

http://bikeped.trec.pdx.edu/bp/

City of Bend is a project partner of the Bike-Ped Portal, and Jovi Anderson from the Bend MPO is on the Technical Advisory Committee.

Figure 11: Example (Beta) Dashboard from Bike-Ped Portal

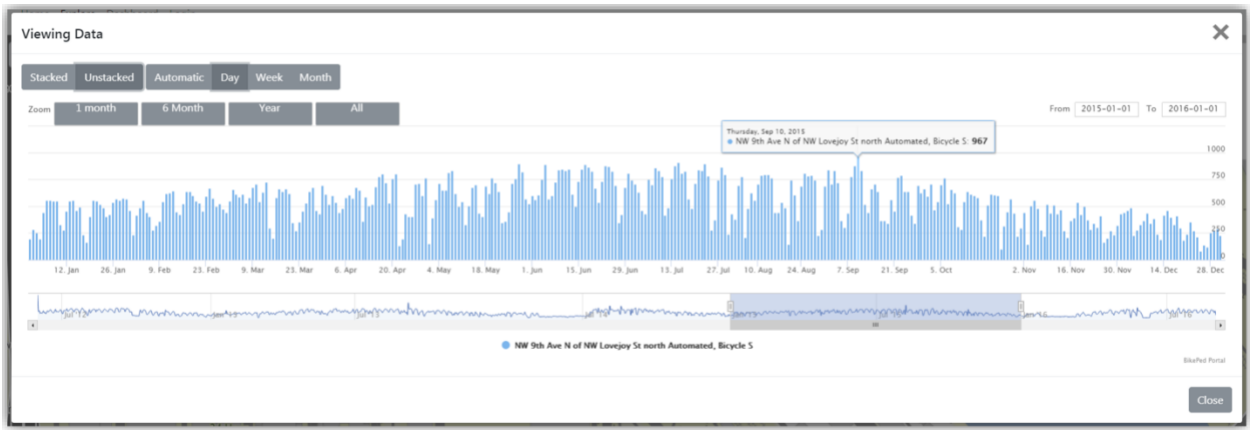


Figure 12: Example Aggregated Daily Count from Single Station (Beta) Bike Ped Portal

Action Item #22: Work with PSU to identify opportunities to utilize analytics: Work with the PSU team for both the PORTAL and the Bike/Ped Portal to determine opportunities to "port over" analytics code and utilize in both TransGIS and BOOM as applicable for different agency analysis requirements.

8.1.5 Asset Management Data

Partner agencies all have their own Asset Management systems to track status of roads, signs, ITS devices, roadway infrastructure, and perform work order management, etc. For the most part, data sharing between these systems and between agencies is not required. However, certain asset information can prove valuable for coordination amongst partner agencies for planning, scheduling and budgeting upcoming projects. Pavement condition and upcoming construction/improvement projects, for example, were cited as desirable data to share between agencies, particularly if readily available.

Figure 13 illustrates City of Bend's Street Preservation Map and Figure 14 illustrates ODOT's Pavement Condition map (along with other roadway assets) as an example of how readily available to data is for sharing between partner agencies.

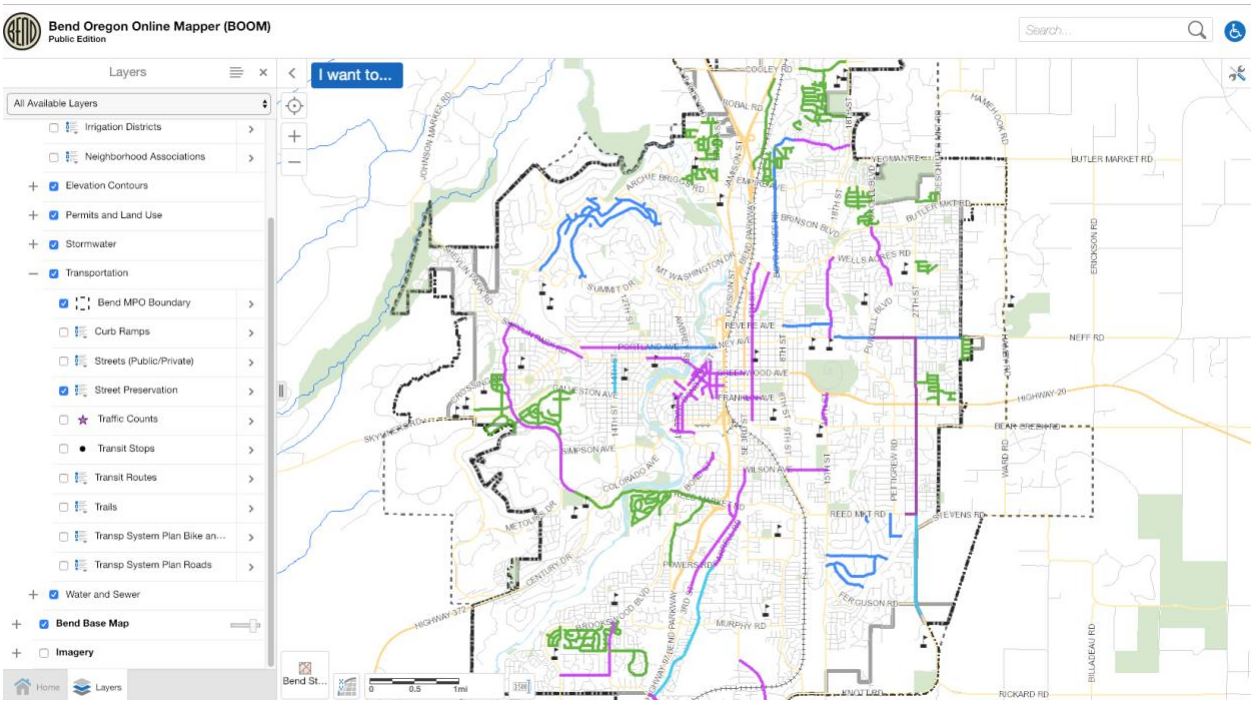


Figure 13: City of Bend Street Preservation Map

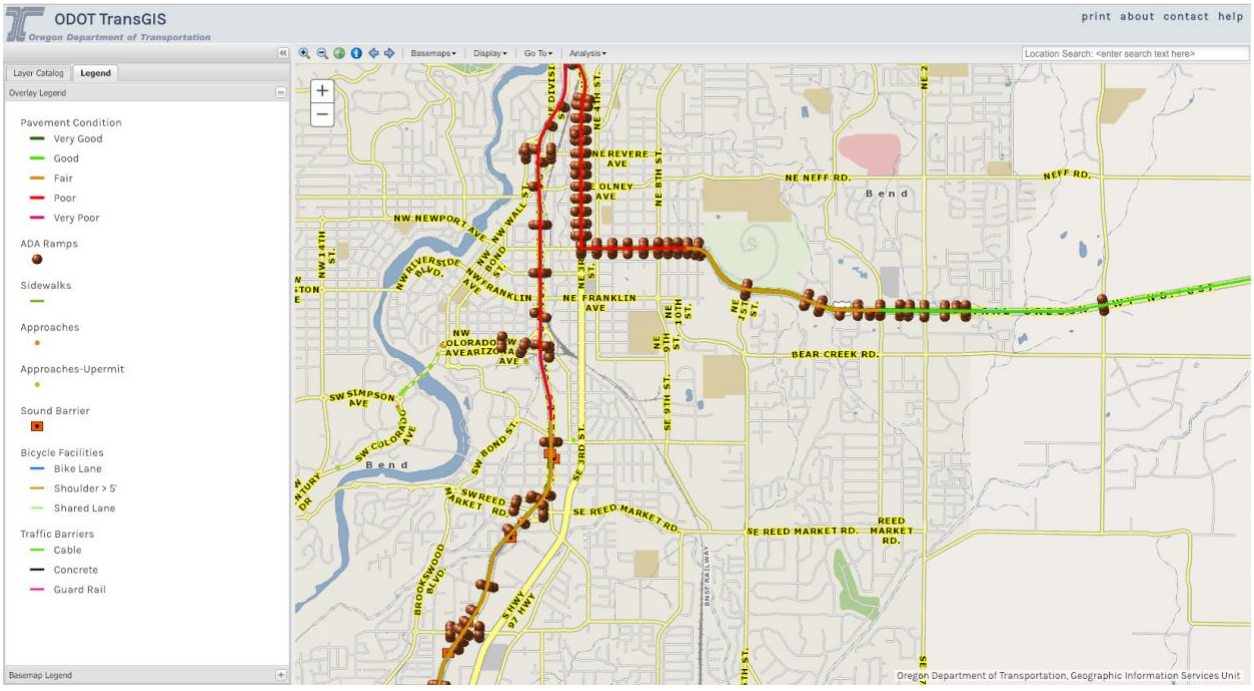


Figure 14: ODOT Pavement Condition and Asset Map

9 DESCRIBE OPERATIONAL SCENARIOS

The following high level, example use cases describe ways that different system stakeholders could interact with a future data warehouse solution. These can be valuable when looking at implementation alternatives and for consideration when configuring any new or existing systems.

9.1 Planners

For transportation planning projects, agencies collect traffic volume counts, turning movements, and many other types of data to understand transportation patterns and needs of a given community. This information can be useful to more jurisdictions than the one collecting it. A data warehouse could enable planners to share data with inter-agency users and provide access to supplementary data that may otherwise be too costly to obtain.

An example use would be for planning is a Transportation System Plan (TSP) update project. TSP update projects require gathering multi-agency data about historical trends and operational characteristics of transportation facilities. Planners updating the TSP would be able to use a data warehouse as a centralized repository to access the multi-agency data like functional classification, traffic volumes, and bicycle and pedestrian counts. This information is typically needed to define existing conditions in a TSP.

9.2 Scoping

With the data warehouse, agencies could have the opportunity to more efficiently scope projects. Cost savings and better allocation of public dollars may be achieved when projects in similar areas are combined, by reducing the need to administer separate efforts in the same geographical area.

For example, a project manager at ODOT has a street preservation project in the scoping phase. The project manager logs into the data warehouse and opens an interactive map view of pavement conditions. The pavement conditions layer shows data from multiple agencies on ODOT and local agency streets. The project manager notices that many side streets intersecting the ODOT roadways to be repaved are in poor condition. The manager toggles on a bike volume layer and sees high bike volumes on one of the main ODOT roadways and some of the side streets. With this information, the project manager adds bike lane restriping to the street preservation project and starts a discussion with the local agency about interest in contributing to the project so that more streets can be repaved under the same mobilization.

9.3 Trend Analysis

The data warehouse's historical data archive will allow agencies to track and analyze trends more easily. Since data from multiple agencies will be stored in the data warehouse, analysts will be able to compare data from their organization to others in the region. This can be useful for tasks like spot-checking data accuracy from individual data collection efforts, assessing model assumptions, and conducting trend analyses.

An example of a trend analysis enabled by the data warehouse is on a corridor safety plan project. In preparing the corridor safety plan, the analyst needs to determine current traffic volumes on the roadway of interest, a rural collector. However, no traffic volume data are available. The analyst uses the regional data warehouse to find historical and current traffic

volumes on nearby roadways in Region 4 of the same functional classification, calculates a rate of change over time for these volumes, and applies it to the rural collector of interest to estimate a current count. This method is likely more accurate than using historical Permanent Automated Traffic Recorder (ATR) station data to calculate a volume trend, as ATR stations are only located on state highways.

9.4 Research and Evaluation

The data warehouse will facilitate before/after studies and allow agencies to better understand whether projects yield their intended results. The multiple types of data in the system can expand the depth of analysis possible for these kinds of studies.

An example of this kind of evaluation is a maintenance manager who tested a new de-icer product for a winter season. The manager is setting a budget for de-icer for the coming winter and seeks to understand whether the product used last year is worth using again. The manager can supplement his or her own information on maintenance staff hours and de-icer costs with information from the data warehouse to answer these kinds of questions in an evaluation:

- During snowy or icy conditions, was using the new de-icer product associated with a reduction in crashes or crash rate?
- Did the product affect the ratio of number of maintenance staff hours spent plowing/de-icing to inches of snow accumulation?

APPENDIX A: PRELIMINARY DATA SHARING CONTACT LIST

Mobility Program Area

Core Performance Measure	Subcategory	New or Existing Systems
Traffic Volumes Responsible Party: Chris Wright Subject Matter Expert: Don Crownover	Vehicle Counts (ATR)	New Traffic Count Management (TCM) System[10] procurement will address data management of this data set.
Responsible Party: Galen McGill	Vehicle Counts (Traffic signals)	Through TCM System procurement, investigate potential for adding this data set to the new system.
Responsible Party: Galen McGill	Vehicle Counts (ramp meters, ATM/ITS Systems)	Through TCM System procurement, investigate potential for adding this data set to the new system.
Responsible Party: Brian Dunn	Vehicle Counts (New Third Party)[11]	Investigate accuracy of third party vehicle data count products. ODOT may procure a new Third Party data provider for NPMRDS which may further impact this Performance Measure area.
	Vehicle Counts (Local Agency)	Through TCM System procurement, investigate potential for adding this data set to the new system.
Responsible Party: Chris Wright Subject Matter Expert: Don Crownover & Jessica Horning	Bike & Pedestrian	Through TCM System procurement, investigate potential for adding this data set to the new system.
Travel Time Reliability Responsible Party: Brian Dunn		TPAU to continue review of how Region 1 are using these Performance Measures and how the data is being collected, analyzed, reported and stored as part of the Portland Region Traffic Performance Report.
Trend Analysis		Partner agencies identified the desire to be able to perform analysis of all of the data sharing above using time based trend analysis, allowing the comparison of year over year and seasonal trends.

[10] ODOT is currently in the process of procuring a new software solution for the storage, analysis, reporting and archiving of Automated Traffic Recorder Data.

[11] This new Subcategory of Traffic Volumes does not currently exist as third party providers do not provide these yet.

Safety Program Area

Core Performance Measure	New or Existing Systems
ODOT Crash Data Responsible Party: Robin Ness Subject Matter Expert: Theresa Heyn	ODOT's Crash Analysis and Reporting (CAR) Unit provides the official motor vehicle crash data through database creation, maintenance and quality assurance, information and reports and limited database access.
Local Incident Data	Bend region 911, City of Bend Police Department, Deschutes County Sherriff and other local law enforcement have crash data for smaller accidents that could augment ODOT's Crash Data to help identify safety issues on corridors and intersections.
Third Party Crowd Sourced Data Responsible Party: Galen McGill	Project stakeholders inquired as to whether Waze third party crowd sourced data could be further utilized to augment ODOT's crash data.

Asset Management Program Area

Core Performance Measure	New Subcategory	New or Existing Systems
TSMO Asset Inventory and Location Responsible Party: Galen McGill	ITS	ODOT currently uses Micromain Asset Management system (Collect), Data warehouse (transform) and tools like GIS & Power BI (analyze and report) tools.
Responsible Party: Doug Bish Subject Matter Expert: Scott Cramer	Traffic Signals	ODOT currently uses Intelight (newer signals) and "Scott's Spreadsheet"[12] system (Collect) and tools like GIS & Power BI (analyze and report) tools
Responsible Party: Doug Bish Subject Matter Expert:	Sign Data	ODOT currently uses ODOT Sign Inventory System (Collect), TransInfo (transform) and tools like GIS & Power BI (analyze and report) tools
Responsible Party: Doug Bish Subject Matter Expert: Scott Jollo	Major Traffic Structures	ODOT currently uses BRM, Bridge Data System (Collect) and Power BI (analyze and tools like GIS & report) tools

[12] This internally developed tool is used by ODOT to manage traffic signal asset management for older signals. This spreadsheet is slowly being phased out as more signals are converted to newer Intelight ATCs and are being managed int eh Intelight MaxView system.

Contact Information

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10 APPENDIX B: MOBILITY SECTION OF STATEWIDE TSMO PERFORMANCE MEASURES

11 APPENDIX C: SUMMARY MEMO OF STAKEHOLDER INTERVIEWS