

# **Bend Metropolitan Planning Organization**

## ***2007-2030 Metropolitan Transportation Plan***

*Adopted June 27, 2007  
BMPO Policy Board*

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**Resolution Number 2007-04**  
**For the Purpose of Adopting the 2007-2030 Metropolitan Transportation**  
**Plan for the Bend Metropolitan Planning Organization**

**WHEREAS**, the US Department of Commerce, Bureau of Census has declared that the City of Bend and the adjoining areas in Deschutes County form an Urbanized Area, named the Bend Urbanized Area; and

**WHEREAS**, the US Department of Transportation and the Oregon Department of Transportation (ODOT) have designated representatives of the said areas, together with a representative of ODOT, as the Bend Metropolitan Planning Organization (BMPO) to carryout the Metropolitan Transportation Planning Process; and

**WHEREAS**, a project identification and selection process was carried out through the development of the 2007-2030 Metropolitan Transportation Plan (MTP); and

**WHEREAS**, public involvement was secured through meetings of the Citizen Advisory Committee, Technical Advisory Committee, Policy Board, electronic notification, and through the internet; and

**WHEREAS**, a public hearing on the draft components of the MTP was held on June 21, 2007, and continued to June 27, 2007; and

**WHEREAS**, the comments received at the committee meetings, Board meetings, the public hearing, and through regular mail and e-mail were explicitly considered; and

**WHEREAS**, the projects in the 2007-2030 MTP demonstrate financial constraint;

**NOW, THEREFORE, BE IT RESOLVED**, that the Policy Board of the Bend MPO approves and adopts the 2007-2030 Metropolitan Transportation Plan.

Adopted by the Bend Metropolitan Planning Organization the 27<sup>th</sup> day of June, 2007.

Yes: 5

No: 0

Authenticated by the Chair this 21<sup>st</sup> day of June, 2007.



\_\_\_\_\_  
William Friedman, Chair

Attest:

  
\_\_\_\_\_  
Tyler Deke, MPO Manager

**Copies of this document are available:**

**On-line at the City of Bend website:**

[http://www.ci.bend.or.us/depts/community\\_development/bend\\_metropolitan/mtp.html](http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/mtp.html)

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**Resource Section**

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# Chapter 1: Introduction

## The Bend Metropolitan Planning Organization

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Based on the results of the 2000 US Census, the Bend Urbanized Area exceeded 50,000 in population. Upon surpassing this milestone, federal regulations (23 CFR part 450) mandate that a Metropolitan Planning Organization (MPO) be designated. The primary function of a MPO is to conduct a *continuing, cooperative* and *comprehensive* transportation planning process that will result in plans and programs that consider all transportation modes and will support metropolitan community development and social goals. The Bend Metropolitan Planning Organization (BMPO) was designated on December 18, 2002, by the Governor of Oregon. Local jurisdictions involved in the planning activities of the BMPO include the City of Bend and Deschutes County. In addition, the Oregon Department of Environmental Quality, Oregon Department of Transportation, Oregon Department of Land Conservation and Development, Federal Highway Administration, and Federal Transit Administration participate in the MPO process.

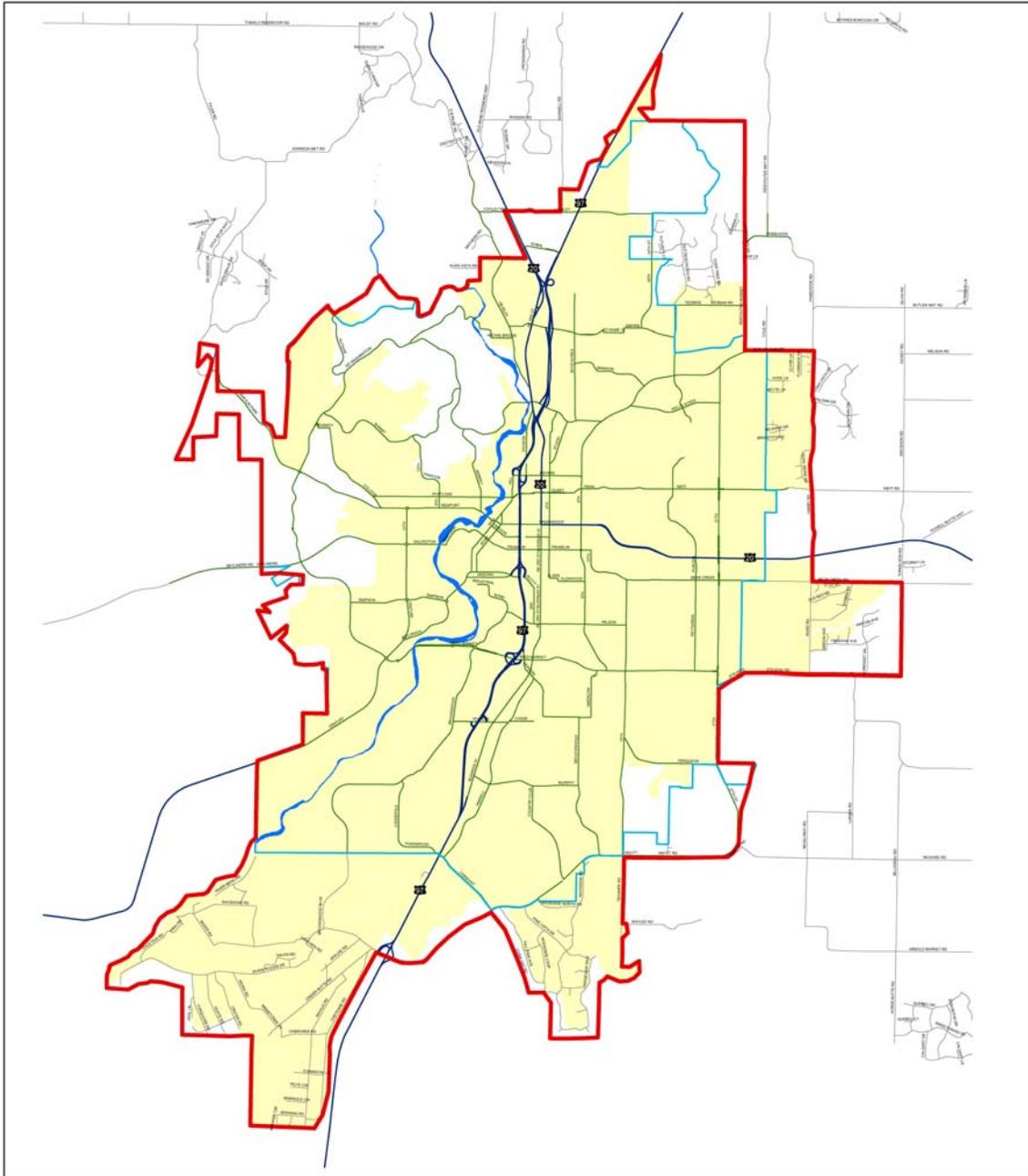
The BMPO organizational structure has been designed so that it operates as an entity separate from the participating jurisdictions so that no single entity dominates the organization's decision-making processes. A Policy Board has been established to oversee the process of the BMPO. The Policy Board is comprised of three members of the Bend City Council, one member of the Deschutes County Commission, and the ODOT Region 4 manager. As future major transportation providers form, such as a Transit District, they will be added to the Policy Board. The intergovernmental agreement specifies that no decisions shall be made by the BMPO Policy Board without representation from all parties. The agreement also states that all decisions shall be made by consensus. Consensus of the parties refers to consensus among the one ODOT representative, the one Deschutes County representative, and at least two of the three City of Bend representatives. The BMPO planning boundary is shown in Figure 1-1.

Federal and state transportation planning responsibilities for the BMPO can generally be summarized as follows:

- Develop and maintain a Metropolitan Transportation Plan (MTP) and Metropolitan Transportation Improvement Program (MTIP) consistent with state and federal planning requirements.
- Review specific transportation and development proposals for consistency with the MTP.
- Coordinate transportation decisions among local jurisdictions, state agencies, and area transit operators.
- Develop an annual work program (known as the Unified Planning Work Program [UPWP]).
- Maintain the regional travel-demand model for the purposes of assessing, planning, and coordinating regional travel demand impacts. (NOTE: The BMPO currently contracts with ODOT's Transportation Planning Analysis Unit for modeling support services).

The BMPO entered into an intergovernmental/interagency agreement with the City of Bend establishing the City of Bend as the administrative and fiscal agent for BMPO. This agreement will be reviewed and renewed as appropriate.

Figure 1-1: Study Area Map



Bend Metropolitan Planning Organization Boundary

<ul style="list-style-type: none"><li><span style="color: red;">—</span> MPO Boundary</li><li><span style="border: 1px solid blue; display: inline-block; width: 10px; height: 10px;"></span> Bend UGB</li><li><span style="border-bottom: 1px solid blue; width: 10px; display: inline-block;"></span> State Highways</li><li><span style="border-bottom: 1px solid green; width: 10px; display: inline-block;"></span> Arterial/Collector Streets</li><li><span style="border-bottom: 1px solid grey; width: 10px; display: inline-block;"></span> County Roads</li><li><span style="background-color: yellow; width: 10px; height: 10px; display: inline-block;"></span> Urbanized Area</li><li><span style="background-color: blue; width: 10px; height: 10px; display: inline-block;"></span> Deschutes River</li></ul>	 Not To Scale		<p><small>DISCLAIMER: Urbanized area information was obtained from the U.S. Census Bureau. All other information on this map was derived from digital databases on Deschutes County's GIS. Care was taken in the creation of this map, but is provided "as is".</small></p> <p><small>Prepared by City of Bend GIS/Engineering Department 1-03-06 v.8.1 UFMPO 0916</small></p>
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## **The Importance of Transportation**

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Transportation is a key contributor to the Bend area's quality of life and economic viability. Generally, the need for transportation stems from our need to access goods, services, and other people within and beyond the region. The ease by which we are able to get from home to school, to a job, to medical services, to shopping and back again is dependent upon the efficiency and effectiveness of the region's transportation system. As the region grows, additional demands are put on the system. With limited resources, determining the best means for improving the system and meeting future demand is challenging. The framework for making decisions on the future of the region's transportation system has become more complex in recent years. Federal, state, and local policy calls for consideration of a wide range of factors in the preparation of a regional transportation plan, including:

- Identifying the means to reduce reliance on the automobile by increasing the transportation choices available in the region,
- Consideration of the interrelationships among the region's land use patterns and transportation system,
- Consideration of the financial, environmental, and neighborhood impacts of future plans, and
- Identifying strategies to maintain and improve the safety of the transportation system.

Ultimately, the most successful transportation plan will be one that enables us to minimize the time and resources required in the future to access the goods and services we need.

## **Trends and Issues**

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The region is anticipating significant population and employment growth. From the base year of 2003, the population of the Bend metropolitan area is expected to grow by 78 percent by 2030. Employment in the region is expected to grow by 68 percent during that same period. A forecast of trends during the planning period points to several issues should land use patterns and travel behavior continue as they exist today.

- Congestion would rise dramatically, increasing the cost of travel and reducing the efficiency of the region's roadway network.
- Without a balanced approach to the development of future improvements, little change will be made in the transportation choices available to the region. With little improvement in choices, the proportion of trips using alternative modes will not see significant changes.

## **Overview of the MTP**

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The Metropolitan Transportation Plan (MTP) is a multi-modal transportation plan designed to meet the anticipated 20-year transportation needs within the BMPO planning area boundary. The MTP serves as a guide for the management of existing transportation facilities and for the design and implementation of future transportation facilities through the year 2030. The plan is intended to provide the framework and foundation for the transportation future in the metropolitan area. Policies and project descriptions are provided to enable the governments and citizens of the metropolitan area to understand and track projects that will be needed within the next 20 to 25 years. As a plan, this document does not provide designs for individual projects. Such details are not within the scope of a metropolitan plan and will be completed on a project-by-project basis with the necessary community involvement and environmental analyses.

The MTP provides a coordinated framework for identifying and meeting the regions transportation needs for the next 20-25 years. It provides the best projection for future growth and development based on current trends and approved land uses, policies and ordinances. The MTP looks at the different types of transportation opportunities that are available and what would be beneficial and useful in the future. It looks at how all the pieces should fit together and what other opportunities are available for a coordinated and contiguous system. The plan focuses on intra-regional (within the region) travel, but also addresses inter-regional (through the region) travel. The roadway element of the plan is emphasized in recognition that automobiles and trucks are the predominant mode of transportation today; however, the roadway element also plans for connectivity to other modes of travel. The roadway system provides for bicycle travel through the addition of upgraded urban streets with sidewalks and bike lanes or other provisions for safe bike travel. Throughout the urban area, sidewalks are proposed for accessible and safe pedestrian travel. In many cases, there are transit needs within the improvements designated for roadway improvements. All of these factors are critical when describing the transportation system. Other elements of the plan cover important aspects of the overall system including transportation system management (TSM), transportation demand management (TDM), freight, safety, and security.

The plan identifies the basic assumptions through the year 2030, including forecasts of future population and employment, and the resulting demand on the metropolitan arterial and collector street system. The resulting travel demand was determined through a “best practices” travel demand model. The model is a sophisticated planning tool and will be continually refined and updated to ensure that it serves as an effective tool for future updates. The demographic assumptions used with the model are presented in the Land Use Chapter (to be completed at a later date). Other aspects of the model are described in the technical reports and memoranda summarized in the Appendices.

A significant requirement of the MTP is that it must be financially constrained. The MTP must identify projects and recommended policies that can be implemented within the current funding trends of the metropolitan area. Ultimately, a 2030 financially constrained transportation system improvement strategy was developed to meet the transportation needs of the metropolitan area. The transportation system improvement strategy was reviewed by the Technical Advisory Committee, Citizen Advisory Committee, and Policy Board.

Reports and memoranda were prepared to document the details of the planning process, and to provide background information, data, and explanations of assumptions and technical work. Much of the final product of the MTP was directed and developed from research and decisions based on these reports and memoranda.

## **Regulatory Framework**

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Federal, state, regional, and local requirements comprise the regulatory framework that shapes the Bend area’s transportation planning process. The two most influential pieces of legislation are the federal Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) (successor to the Transportation Equity Act for the 21<sup>st</sup> Century [TEA-21]) and the Oregon Transportation Planning Rule (TPR). Urbanized areas with a population of 50,000 or more people are required by federal statute to have a regional transportation plan that demonstrates consideration of several factors, such as system preservation and efficiency, energy conservation, and congestion relief.

The plan must be constrained to financial resources reasonably expected to be available. The entire plan provides the overall vision for the Bend region, taking into consideration the needs anticipated because of planned growth. To meet federal and state requirements, the plan includes the present financial capabilities of the region's implementing agencies. Thus, the funded project list contains only those projects within the present financial capabilities of the agencies. The illustrative list identifies projects that are beyond current financial capabilities.

In compliance with provisions in SAFETEA-LU and the TPR, the MTP contains transportation goals and policies. The MTP includes a description of the plan amendment process.

The ongoing nature of regional transportation planning allows the MTP to be a dynamic plan of action for the future transportation system, rather than a static snapshot in time. The range of policies and plan amendment and update processes ensure that the MTP will adapt to meet changing conditions within the region, as well as adapt to residents' changing needs. The plan's implementation and further refinement will continue through the collaborative efforts of citizens and organizations that own, operate, regulate, and use the transportation system.

The MTP is particularly important for guiding transportation public policy and investment decision making over the three- to five-year period following plan adoption, until the next plan update. The federal metropolitan planning regulations require the transportation plan to be reviewed and updated at least every five years.

Completing and adopting the MTP provides the building blocks for a comprehensive guide for the future and allow us to make wise use of limited financial resources. Although this process is new, it is expected to provide a solid foundation for continuing our transportation system planning. We must use this foundation to strive for the implementation measures that will make a difference for the region as a whole.

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## **Using the MTP**

Based on this plan, the member jurisdictions and agencies should integrate the policies and recommendations into their own comprehensive planning documents, incorporate local needs with the pending regional strategies, and coordinate project completion with other affected agencies. The MTP provides support and validation of some of the local transportation needs. It is anticipated that each BMPO member jurisdiction will adopt this MTP and will then tailor its comprehensive plan updates to meet the goals and policies identified in the MTP.

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## **The MTP in the Future**

The BMPO Policy Board guides the development, updates, and amendments of the Plan and serves as the coordinating and problem-solving body during the MTP planning processes. The Policy Board is in a position to help as the agencies seek to implement essential MTP provisions and to seek ways to build the projects listed in it. Because of the strong implications for funding our transportation needs, we must ensure this document remains alive and is not just a reference or study. Taking current information and priorities into consideration, this document will be adjusted over time under the guidance of our community leaders.

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## **MTP Update Cycle**

At a minimum, the MTP must be reviewed, validated, and updated every five years. Plan updates give the BMPO the opportunity to evaluate past projections for growth and anticipated

use of the system. During the plan update process, a comparison of existing land use, recent development trends, and the use of the different modal components of the transportation system will be evaluated. This new data will be used to refine growth projections and determine their implications. This provides a basis on which to modify the plan. These minor changes are essential to protecting the accuracy of the plan. In addition, planning sometimes requires a change of direction, including updated goals, policies, or other fundamentals. Such changes require a more in-depth planning process, and, therefore, constitute a major plan update.

Amendments to the Plan can be made between the five-year updates. Each time a major amendment is made to the MTP, it must go through the rigors of a financial-constraint determination. It is anticipated that only large projects that would conceptually change the MTP would require a plan amendment.

The region also has the Metropolitan Transportation Improvement Program (MTIP) that dovetails with the Statewide Transportation Improvement Program (STIP), which is updated every two to three years. The STIP primarily sets the short-term funding direction for transportation projects using federal and state funds.

## **Summary**

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Change is inevitable. The question is not if growth will occur, or even when it will occur. The question is how best to manage the impact of growth as it happens. Can we progress from potential gridlock toward a systematic and affordable plan to keep people and goods moving efficiently from one place to another? The MTP represents many hours of community, staff, and elected officials' time. It provides a coordinated, comprehensive look into the future as the area continues to grow.

The Plan takes the ideas, potential growth factors, and the desires from the community and various entities, and provides a sense of structure. The MTP is guide for the Bend Metropolitan Planning Organization. Not just a road and highway plan, the MTP looks at all of the transportation opportunities -cars, buses, bicycles, pedestrian paths, air travel, rail, and various combinations of transportation methods. The MTP is not just a wish list, but instead, it is financially constrained, meaning that the projects proposed can be financed with existing and anticipated resources. Although not all of the needs can be funded, the MTP identifies concerns and projects beyond the immediate availability of known funding trends.

The MTP provides answers and potential solutions, yet places the burden of implementation back into the hands of the community and our elected officials. Individual project designs are left to the respective communities to develop over time according to their needs and opportunities. Policies are identified throughout the plan that address alternative transportation uses, agency coordination, system management, and other transportation related concerns.

# Chapter 2: The Planning Process

## Introduction

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The 2007-2030 MTP builds upon a series of technical analyses documented in technical reports from this planning process and other planning processes. The process was guided by systematic input and reviewed by member agency staff, various advisory committees, and the public. The steps of the planning process are summarized below.

## Process

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### Determine Transportation System Plan Requirements

The MTP is designed to meet the requirements of the federal legislation and regulations encompassed in SAFETEA-LU and the Statewide Planning Goal 12 and its implementing division, the Transportation Planning Rule (OAR Chapter 660, Division 12). In addition, the regional plan must be consistent with the Oregon Transportation Plan.

### Determine Transportation System Needs

Using population and employment forecasts for the year 2030, the travel-forecasting model was used to estimate transportation needs of the Bend metropolitan planning region for a 20+ year horizon. The Forecast Land Use and Future Travel Demand chapter summarizes the growth and development assumptions used for the year 2030.

A new “best practices” travel demand model was developed for the MTP. The Transportation Planning and Analysis Unit (TPAU) at ODOT developed the travel demand model with the assistance of BMPO and member agency staff. The model is sophisticated and requires significant data definition and input to produce accurate results.

A travel demand model is a tool that can accurately replicate existing transportation conditions and evaluate a variety of future year scenarios. To replicate base year conditions, the essential transportation inputs include the existing roadway and public transportation networks, recent traffic counts, and current population and employment information. Once this data has been entered and adjusted, the model simulates base year traffic movements within a small percentage of error of those observed.

The next step in the modeling process involves projections for future population distribution, employment locations, and any changes in travel behavior. Using these inputs, the model is able to derive future capacity limitations relative to the current roadway system. Once these deficiencies are identified, potential improvements are evaluated by rerunning the model with the “improved” transportation system. A range of different street networks, expansions of the public transportation network, and different land use scenarios can be tested this way. Although this is greatly over simplified, it

demonstrates the usefulness of the model as a tool. Future year traffic projections are based on numerous assumptions about population, employment, automobile operating costs, and other factors that will change over time. As such, future year forecasts are only as good as the assumptions that are made. Every effort has been made to ensure that the assumptions used in the development of the BMPO travel demand model are as reasonable and accurate as possible.

Transportation improvement projects needed within the planning horizon were identified during the needs assessment. This list of improvement projects was then assessed using the evaluation criteria. Once completed, this list became the financially unconstrained project list and vision beyond the present financial limitations of the MTP.

### **Develop Funding Plan and Project Lists**

A financial analysis was conducted to support development of the MTP. The analysis included a review of past transportation expenditures for Deschutes County, the City of Bend, and ODOT. The financial analysis estimated the level of transportation-related funding that jurisdictions could reasonably expect to be available over the planning horizon. A summary of the financial analysis is discussed in the Financial Chapter.

The financial limitations described by the financial analysis were merged with the project lists from the various systems (streets, transit, bicycle, pedestrian, transportation demand management, and transportation system management). Taking the financial limitations into consideration, funded and illustrative (unfunded) project lists were prepared. The funded list includes only those projects that are within the present financial limitations of the implementing agencies. The funded list consists of a combination of the following five components to help meet the area's transportation needs for the next 20-25 years:

- (1) roadway improvements;
- (2) transportation system management (TSM);
- (3) transportation demand management (TDM);
- (4) transit service; and
- (5) bicycle and pedestrian facilities.

The funded project list meets the definition of a financially constrained transportation plan and forms the basis for the MTP.

The projects in the illustrative list may not be relied upon as planned improvements until a funding source has been identified. Projects included in this currently unfunded category are identified in the Appendices.

## **The Committee Process**

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### **Policy Board**

The BMPO Policy Board is composed of elected officials from each of the affected jurisdictions including City of Bend, Deschutes County, and ODOT. The BMPO Policy

Board makes the final approval decision regarding the MTP.

### **Technical Advisory Committee**

The Technical Advisory Committee (TAC) is responsible for gathering, reviewing, and validating technical information and data that were used in the update of MTP. The TAC includes staff members from the City of Bend, Deschutes County, ODOT, the Bend-La Pine School District, Commute Options for Central Oregon, Central Oregon Community College, the Department of Environmental Quality (DEQ), the Department of Land Conservation and Development (DLCD), the Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA).

### **Citizen Advisory Committee**

The Citizen Advisory Committee (CAC) makes recommendations to the Policy Board from the public's perspective on proposed long-range transportation plans and priorities for state and federal funding and other transportation issues.

### **Freight Advisory Committee**

The Freight Advisory Committee (FAC) makes recommendations to the Policy Board from the freight industry's perspective on proposed long-range transportation plans and priorities for state and federal funding and other transportation issues.

### **Traffic Safety Advisory Committee**

The City of Bend Traffic Safety Advisory Committee (TSAC) makes recommendations, as needed, to the Policy Board regarding specific safety issues.

### **Bicycle and Pedestrian Advisory Committee**

The Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC) makes recommendations, as needed, to the Policy Board regarding bicycle and pedestrian issues.

## **Public Involvement**

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The draft public participation plan outlines a process for involving the public in the transportation planning process. The plan also allows for the BMPO to meet the requirements of SAFETEA-LU, which calls for a "proactive public involvement process that provides complete information, timely public notice, full public access to key decisions, and supports early and continuing involvement of the public in developing plans."

Through the public involvement program and detailed technical analysis, transportation needs were identified and consensus was developed on system improvement strategies. Local agency staff and the Policy Board guided the planning effort for the 2007-2030 MTP. The Technical Advisory Committee and Citizen Advisory Committee had equally important participation.

The CAC served as the community forum to gather information from their constituent

base and to help develop public consensus on the plan and the planning process. They also helped the BMPO define local issues and potential solutions to transportation problems. Recommendations from CAC meetings were provided to the Policy Board. BMPO staff made presentations at various meetings to discuss the plan and receive input from community members. The public participation program also included public notices of all CAC and Policy Board meetings during plan development. The public involvement process, in addition to being a federal and state planning requirement, is a priority of BMPO and the local agencies involved in development of the MTP. With future updates of the MTP, the BMPO will strive for a more robust public participation process.

# Chapter 3: Existing Conditions

## Overview

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The Bend Metropolitan Planning Organization (BMPO) is the regional transportation planning organization for the City of Bend urban area. It is formed of local governments and is responsible for overseeing transportation related planning decisions such as the approval of federal transportation funding for the Bend region in order to meet current and future transportation needs. Other responsibilities include creating and maintaining a comprehensive Metropolitan Transportation Plan (MTP) for the MPO area. The Bend MPO area is slightly larger than the City of Bend Urban Growth Boundary (UGB) and includes areas that are anticipated to develop into urbanized areas over the next 20-year horizon.

The MTP is designed to serve as the Bend metropolitan area's long term transportation plan. It addresses all travel modes, including pedestrians, bicycles, public transit, motor vehicles, freight, water, air, and pipelines, in an effort to address the region's long term projected transportation needs associated with future population growth. Projects identified in the MTP must be within projected levels of available financial resources and must also meet federal and state planning requirements. The primary objective of the plan is to identify both short-term and long-term actions in order to maintain the efficient movement of people and goods.

This chapter summarizes existing transportation operations and infrastructure within the Bend MPO boundary. Note that only highway, arterial, and collector roadways are discussed within this MTP. Field inventories conducted in spring 2006 and existing City of Bend and Deschutes County inventories were used to map existing transportation facilities in an effort to establish base year conditions. This existing inventory provides a framework (basis of comparison) for future assessment of transportation performance and needs within the Bend urban area transportation network relative to desired policies and goals.

## Pedestrians

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Figure 3-1 shows the existing sidewalk coverage along arterial and collector roadways in addition to existing trail inventory within the Bend MPO area. Network connectivity is typically carried out by means of collector and arterial roadways; therefore it is important to have sidewalk coverage along these roadways to provide pedestrians with continuous connections. The existing sidewalk and trail infrastructure was assembled using City of Bend inventory<sup>1</sup> and field observations. As can be seen, significant portions of the arterial and collector roadway network currently have sidewalks on at

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<sup>1</sup> Paved and unpaved sidewalk GIS data provided by Bend MPO.

least one side of the roadway, particularly in the downtown area and near residential land uses. Downtown Bend currently has fairly dense sidewalk coverage and is made up of mostly commercial, industrial, and residential land use that is characterized by a variety of small specialty retail shops, store front businesses and a historic grid roadway network. This dense sidewalk coverage therefore provides easy access to these small local businesses.

As mentioned, the majority of local streets in medium to high density residential areas feature sidewalks, which provide connections to major roadways and surrounding neighborhoods. This is likely due to the fact that the City currently requires sidewalks to be constructed on both sides of the roadway in new residential areas<sup>2</sup>.

Overall, there is an estimated 60 miles of sidewalk coverage throughout the study area which is equivalent to approximately one-quarter of major roadway frontages<sup>3</sup>. In general, sidewalks are provided near and around schools and parks as illustrated in Figure 3-1. Sidewalks promoting access to local parks provide the public comfortable access to outdoor recreational facilities. Additionally, sidewalks leading to and surrounding school frontages is essential to ensure students have a safe route to school. With respect to this, the City of Bend is currently conducting a Safe Routes to School study. This program is intended to ensure children, grades kindergarten through twelve, have safe walking and biking routes within two miles of their respective school facility. The program helps communities target and reduce the number of hazards imposed on children while on their route to school. At this time, two schools in the City of Bend have participated in the program. The Safe Routes to School program stems from two pieces of legislation passed in 2005 (SAFETEA-LU and House Bill 2742).

While there is a significant amount of sidewalk coverage on arterial and collector roadways throughout the study area, there are considerable sidewalk coverage gaps that could be more in-filled to provide greater and safer pedestrian connectivity. Coverage gaps were defined where there is discontinuous sidewalk coverage along a single side of the roadway segment. Sidewalk coverage gaps were determined by visual inspection with no empirical analysis used. Table 3-1 lists several collector and arterial roadway segments which contain several sidewalk gaps. These sidewalk gaps are furthermore highlighted in Figure 3-1. Sidewalk gaps total to an estimated 61 miles in length.

Of note, the City of Bend has planned to conduct an assessment of existing sidewalks to verify whether they comply with current American with Disabilities Act criteria<sup>4</sup>.

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<sup>2</sup> Bend Urban Area Transportation System Plan, City of Bend, page 32, Adopted October 11, 2000.

<sup>3</sup> *Ibid*

<sup>4</sup> *ADA Revised Draft Guidelines for Accessible Public Rights-Of-Way*, Department of Justice, November 2005.

### Figure 3-1: Existing Pedestrian Facilities

**Table 3-1: Existing Sidewalk Deficiency Areas**

<b>Roadway</b>	<b>Limits</b>	<b>Functional Classification</b>
Reed Market Road	3rd Street to 27th Street	Major Arterial
Empire Avenue	O.B. Riley to Purcell Boulevard	Major Arterial
27th Street	Bear Creek Road to Ferguson Road	Major Arterial
Bear Creek Road	Craven Road to east MPO boundary	Minor Arterial
Butler Market Road	Revere Avenue to east MPO boundary	Minor Arterial
Cooley Road	O.B. Riley to 18th Street	Minor Arterial
Boyd Acres Road	Ross Road to Empire Avenue	Minor Arterial
15th Street	Knott Road to King Hezekiah Way	Minor Arterial
Knott Road	Highway 97 to Ferguson Road	Minor Arterial
Galveston Avenue	14th Street to west MPO boundary	Minor Arterial
Century Drive	Mount Washington Drive to west MPO boundary	Minor Arterial
Baker Road	Brookwood Boulevard to Highway 97	Minor Arterial
Brookwood Boulevard	Hollygrape Street to Parkwood Court	Minor Arterial
Brookwood Boulevard	South city limits to China Hat	Minor Arterial
9th Street	Wilson Avenue to Reed Market Road	Minor Arterial
Neff Road	Eagle Road to east MPO boundary	Minor Arterial
Shelvin Park Road	McClain Drive to west MPO boundary	Minor Arterial
Brosterhous Road	Knott Road to Murphy Road	Major Collector
Brosterhous Road	American Lane to 3rd Street	Major Collector
American Lane	Brosterhous Road to Reed Market Road	Major Collector
O.B. Riley Road	North MPO boundary to Highway 20	
Murphy Road	3rd Street to Paulina Lane	Major Collector
Parrel Road	Grand Targhee Drive to Brosterhous Road	Major Collector
Ponderosa Street	Highway 97 to Poplar Street	Major Collector
Lodgepole Drive	Poplar Street to Mahogany Street	Major Collector
Country Club Drive	Knott Road to Murphy Road	Major Collector
Putnam Road	Mount Washington Drive to north MPO boundary	Major Collector

Roadway	Limits	Functional Classification
Chase Road	3rd Street to east end of roadway	Major Collector
Pettigrew Road	Reed Market Road to Twin Knolls Drive	Major Collector
Brinson Boulevard	Boyd Acres Road to Butler Market Road	Major Collector
Archie Briggs Road	Mount Washington Drive to O.B. Riley Road	Major Collector
Awbrey Road	Wilmington Avenue to Saginaw Avenue	Major Collector

### Pedestrian Collisions

When looking at pedestrian travel, it is important to consider the safety aspects of the pedestrian system. Careful attention must be directed towards pedestrian crossings and where they are subject to high vehicle volumes. Using City of Bend<sup>5</sup> records, locations of collisions involving pedestrians spanning the years 1995-2004 were identified and are illustrated in Figure 3-2. There were 80 collisions reported involving pedestrians during the 10-year span, yielding an average of 8 collisions per year. It appears that the majority of these collisions occurred on arterial roadways in the downtown area where pedestrian and traffic volumes are typically higher. Additionally, it appears that collisions occurred where sidewalks are currently present.

Interestingly, 56-percent of these crashes occurred at mid-block locations with the remaining 44-percent occurring at intersections. Of note, approximately 40-percent of the mid-block (23-percent of total collisions) collisions involving pedestrians occurred on 5-lane roadway segments. This may suggest the need for enhanced pedestrian crossings. Enhanced pedestrian crossings may include roadway lighting, signing, striping, textured crossings, medians, flashers, and curb extensions. Samples of enhanced pedestrian crossings within the study area are located at the intersections of Colorado Avenue/Arizona Avenue and Bond Street/Wall Street which both feature curb extensions and textured crossings.

<sup>5</sup> Pedestrian collision data provided by Bend MPO.

## Figure 3-2: Pedestrian Crashes

## Bicycles

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Figure 3-3 shows the existing and proposed bicycle facilities in the Bend MPO area. These facilities were compiled using Deschutes County records<sup>6</sup> in addition to field observations. The majority of the collectors and arterials in the study area provide on-street paved bike lanes. Bike lanes currently connect the north, south, east, and west city limits, providing cyclists a wide number of through route options. For the most part, bike lanes are provided on both sides of roadways totaling an estimated 83.5 miles in length<sup>7</sup>. In addition to the already large inventory of bike lanes, the City of Bend has proposed many additional paved bike lanes to ensure adequate connectivity throughout the city. The proposed bike lanes are also shown in Figure 3-3 and add an estimated total of 36.7 miles to the bike system<sup>8</sup>.

In addition to on-street bike lanes, the Bend MPO area features many paved and unpaved trails and walkways that are also displayed in Figure 3-3. As shown, trails are provided almost along the entire extent of the Deschutes River within the study area providing a scenic route for walkers and bicyclists. Additionally, trails are provided leading to many of Bend's hilltops. There are approximately 28 miles of public trail facilities in the study area<sup>9</sup>. These trails serve as recreational facilities for walkers and bikers.

Overall, the existing bike lane and trail system provides substantially adequate connections to and from neighborhoods and schools, parks, and retail centers. Cyclists desiring to travel through the study area can select from the many designated routes on the major roadways or can share the road with motor vehicles on the lower volume, neighborhood streets to reach appropriate destinations.

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<sup>6</sup> Deschutes County GIS, Deschutes County GIS Service Center

<sup>7</sup> *Ibid*

<sup>8</sup> *Ibid*

<sup>9</sup> Bend Urban Area Transportation System Plan, Adopted October 11, 2000, page 32, City of Bend.

**Figure 3-3: Existing Bicycle Facilities**

## Transit

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### Existing Transit Services

Transit service is provided throughout the study area by means of a Dial-A-Ride program. There is currently no fixed route public transportation system within the MPO boundary. The Dial-A-Ride program provides demand responsive transportation to the general public including seniors and those that are disabled. The 17-vehicle fleet, each wheelchair ready, offers service seven days a week with scheduled operating hours Monday through Friday from 7:15am to 7:15pm and Saturday and Sunday from 8:30am to 4:15pm. Single trips (per direction) are available for a fee of \$1.25 to the general public, \$1.00 for youths (ages 10-17), and \$0.75 for honored citizens. Free service is provided for youths ages 10 and younger when accompanied by an adult<sup>10</sup>. Table 3-2 summarizes the Dial-A-Ride ridership for the 2005 calendar year, aggregated by rider type<sup>11</sup>. Rider type, as defined by Bend Dial-A-Ride is provided in Appendix C.

**Table 3-2: Bend Dial-A-Ride Ridership Summary (2005)**

Rider Type	Total Riders
General Public	15,038
Youth	4,460
Disabled	25,226
Honored Citizen	32,015
Senior	17,094
Other	7,137
Low Income	2,454
Medicaid	1,398
<b>Overall</b>	<b>104,822</b>

Note: Rider type based on Bend Dial-A-Ride classification. Each rider is classified as one rider type.

A total of 104,822 riders were transported via the Dial-A-Ride system in 2005. This is a significant increase since the opening to the general public in 2002, when a total of 88,738 passengers were transported. Prior to 2002, service was only provided to seniors and those that were disabled. Since offering service to the general public in 2002, there has been an average 5 percent increase in ridership per year. This is comparable to the average increase in population over the same time period for the City of Bend which was approximately 6 percent per year<sup>12</sup>. The average trip length per

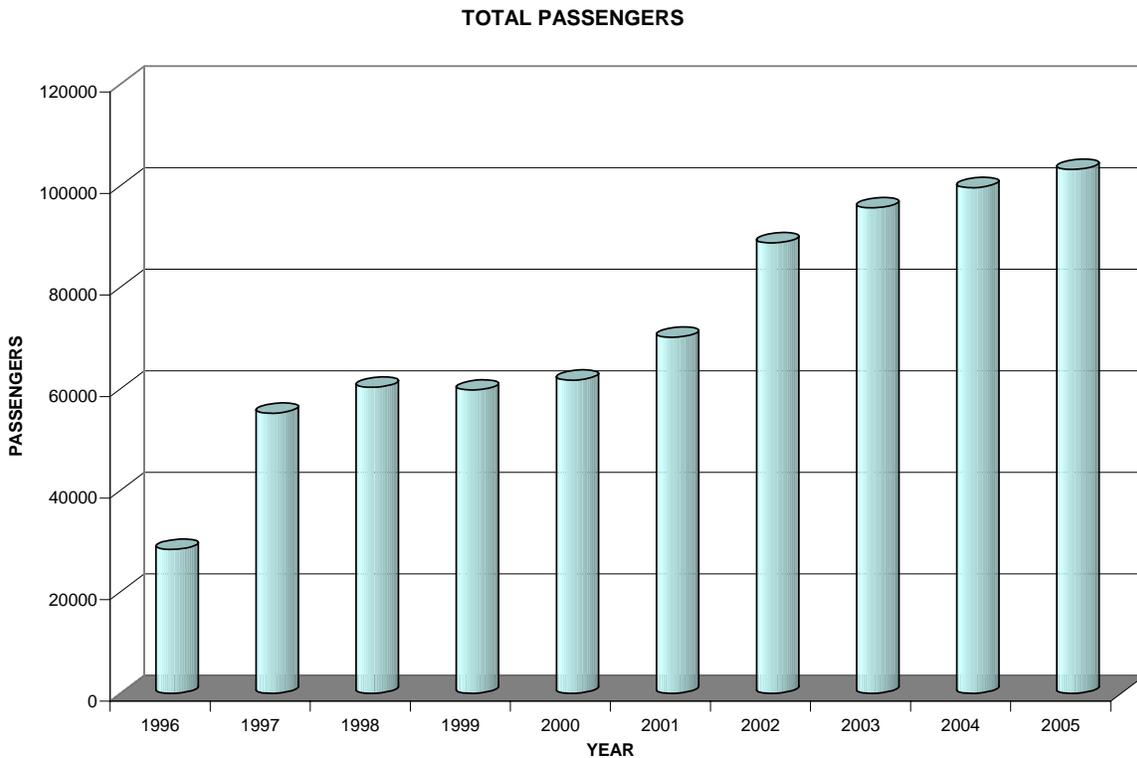
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<sup>10</sup> City of Bend Dial-A-Ride, [http://www.ci.bend.or.us/depts/public\\_works/\\_dial\\_a\\_ride\\_\\_public\\_transportation.html](http://www.ci.bend.or.us/depts/public_works/_dial_a_ride__public_transportation.html), accessed May 19, 2006.

<sup>11</sup> Email from Kathy Ostrom, City of Bend Dial-A-Ride, April 12, 2006.

<sup>12</sup> Economic Development for Central Oregon, <http://www.edforco.org/>, accessed June 7, 2006.

passenger on the system is just over 3 miles. Figure 3-4 illustrates the trend of increasing ridership on Bend's Dial-A-Ride system for the previous ten years.



**Figure 3-4: Bend Dial-A-Ride – Total Annual Ridership**

Additionally, there are several commercial bus and airport taxi services within the study area. Porter Stage Lines offers daily scheduled bus service to and from Bend at 1315 NE 3rd Street (K Walker Enterprises Inc.). This station's operating hours are Monday through Friday 8:00am to 4:00pm and Saturday through Sunday from 8:30am to 2:00pm. Three Amtrak thruway buses currently pass through the study area. They are operated by Amtrak, Porter Stage Lines, and Valley Retriever Bus lines respectively. The nearest Amtrak station is in the city of Chemult, Oregon located approximately 65 miles south of Bend where Amtrak's Coast Starlight (Seattle-Portland-Los Angeles) passenger train passes through. Furthermore, People Mover offers bus service between Bend and John Day while C-A-C Transportation, Inc. provides daily shuttle service between Bend and Portland via the Central Oregon Breeze shuttle.

Transportation to Bend's Mount Bachelor ski resort is provided via Mount Bachelor's Super Shuttle. Service is provided between the ski resort and their park and ride located at Colorado Avenue and Simpson Avenue during the winter season.

### **Planned Transit Services**

A fixed-route transit feasibility study conducted in 1996 by the City of Bend found that fixed-route transit was feasible. However, when the option reached voting ballots in November 2000, the general public voted against the transit system. Voters again rejected the ballot for fixed route transit in the City of Bend in November 2004.

Recently, a Draft Service Plan<sup>13</sup> for fixed route transit in the City of Bend was completed as an update to the previous feasibility study. This plan investigated three fixed route alternatives and four service level options (operating frequency level). Based on the draft plan, an all day 30 minute operating service level was recommended for weekdays along with a 60 minute operating service level on Saturday, and no service Sunday. The recommended route alternative would require a minimum 6 fixed-route vehicles. Revision of this plan is currently in progress with the preferred fixed route service options anticipated to begin September, 2006.

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<sup>13</sup> City of Bend Draft Service Plan, Nelson/Nygaard consulting associates, May 2006

## Motor Vehicles

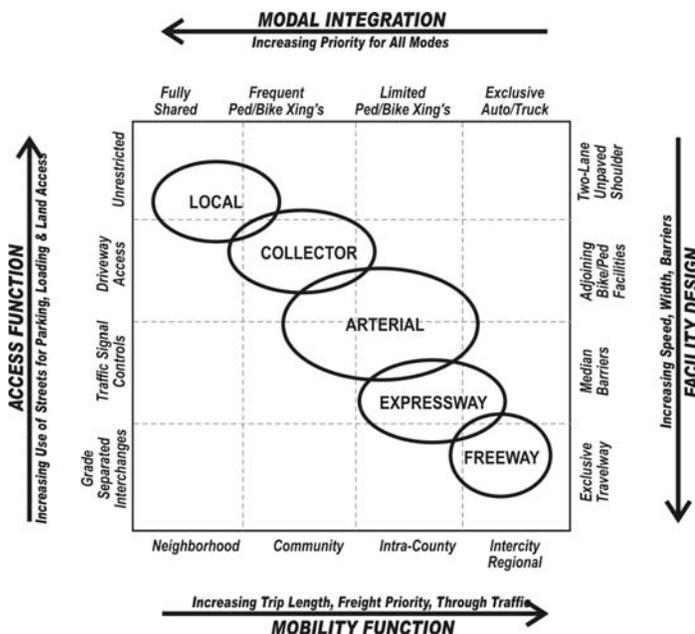
This section discusses the physical roadway infrastructure and motor vehicle travel characteristics within the study area. Summary of the existing roadway classifications set forth by the City of Bend and ODOT in addition to roadway characteristics, traffic operations, and traffic safety within the study area is included. These all play substantial roles in determining the existing conditions of the roadway network and help to target deficient areas. Key roadway characteristics such as speed limits, roadway cross-section, intersection control, and traffic volumes are addressed as these elements play key roles in defining the capacity and efficiency of the roadway network.

### Functional Classification

The roadway functional classification system is designed to serve varying transport needs within the community. The schematic diagram shown below illustrates the competing functional nature of roadway facilities as it relates to access, mobility, multi-modal transport, and facility design. The diagram is useful to understand how competing objectives can have opposing effects. For example, as mobility is increased (bottom axis), the provision for non-motor vehicle modes (top axis) is decreased accordingly. Similarly, as access increases (left axis), the facility design (right axis) dictates slower speeds, narrower travel lanes, and non-exclusive facilities. The primary goal of selecting functional classes for particular roadways is to provide a suitable balance of these competing objectives.

The diagram shows that as roadway classes progress from local to collector to arterial to expressway (top left corner to bottom right corner) the following occurs:

- *Mobility Increases* – Longer trips between destinations, greater proportion of freight traffic movement, and a higher proportion of through traffic.
- *Integration of Pedestrian and Bicycle Decreases* – Provisions for adjoining sidewalks and bike facilities are required up through the arterial class, however, the frequency of intersection or mid-block crossings for non-motorized vehicles steadily decreases with higher functional classes. The expressway and freeway facilities typically do not allow pedestrian and bike facilities adjacent to the roadway and any crossings are grade-separated to enhance mobility and safety.



- *Access Decreases* – The shared uses for parking, loading, and direct land access is reduced. This occurs through parking regulation, access control and spacing standards (see opposite axis).
- *Facility Design Standards Increase* – Roadway design standards require increasingly wider, faster facilities leading to exclusive travel ways for autos and trucks only. The opposite end of the scale is the most basic two-lane roadway with unpaved shoulders.

The existing City of Bend functional classification system, as set forth in the City's Transportation System Plan (TSP)<sup>14</sup>, is shown in Figure 3-5. Both ODOT and Deschutes County roadway classifications are additionally shown in the figure. Roadway classifications are summarized in tabular form in Appendix C. The classification system is intended to allow for the safe and efficient movement of people and goods while optimizing certain objectives as noted earlier. There are a total of nine roadway classifications defined in the Bend TSP (expressway, principal arterial, major arterial, minor arterial, frontage road, major collector, local street, industrial street, and alley). This classification system is intended to serve the city over the next 20-year horizon.

Bend for the most part consists of a series of minor arterials which are responsible for the connection between large trip generators such as commercial and residential areas and consist of two to four travel lanes. These arterials provide a balance between access, mobility, multi-modal transport, and facility design within the study area. The collector roadways are intended to provide access and circulation to nearby arterial roadways in a multi-modal fashion. The Highway 97 and Highway 20 expressways traveling north/south and east/west through the city are intended to carry large vehicle volumes both through the city and to urban areas. These facilities have limited access and higher speeds and interestingly contain some bike lanes and sidewalks.

Roadway ownership and maintenance responsibilities of the various roadways in the study area are carried out by the City of Bend's Public Works Department and Deschutes County, with the exception of Highway 97 and Highway 20. These facilities are state routes and are under the jurisdiction of the Oregon Department of Transportation (ODOT).

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<sup>14</sup> Bend Urban Area Transportation System Plan, City of Bend, page 25, Adopted October 11, 2000.

**Figure 3-5: Existing Functional Classification**

## **Roadway Characteristics**

Field inventories and existing documentation were used to determine major roadway features within the study area. These features included posted speed limits, number of lanes per roadway segment, and intersection controls. Each of these features play key roles in defining roadway capacity and operating efficiency throughout the roadway network, which can influence travel path choices for drivers in Bend.

Figure 3-6 shows an illustration of posted speed limits on arterials and collectors within the Bend MPO boundary. The data were extracted from the City's existing inventory of speed limit signs. The majority of local roadways in Bend are posted at 20-25 miles per hour (mph). Major arterial roadways such as Reed Market Road and 27th Street have a speed limit ranging from 35-45 mph, while minor arterial roadways such as Newport Avenue, Butler Market Road, Mount Washington Drive, and Century Drive have a posted speed ranging from 25-45 mph. Collector roadways, including Portland Avenue and Parrell Road, have posted speeds ranging from 20-40 mph. Highway 97 as well as Highway 20 both have a posted speed limit of 55 mph outside of city limits. Within city limits, Highway 97 (Bend Parkway) maintains a 45 mph speed posting while Business 97 (3rd Street) and Highway 20 feature speed limits ranging between 35-45 mph.

Figure 3-7 shows the existing number of lanes on selected roadway segments in the study area. Highway 97, Highway 20, and Business 97 (3rd Street) maintain a cross-section of 4-5 travel lanes throughout the study area. For the most part, arterial roadways consist of 2-3 travel lanes featuring a shared center turn lane, while collector roadways maintain a two lane cross section. Local and County roads are 2 lane roadways.

**Figure 3-6: Existing Speed Limits**

**Figure 3-7: Existing Roadway Lanes**

## Motor Vehicle Volume

The City of Bend maintains an active traffic counting program in which they conduct 24-hour directional traffic counts along selected roadway segments. This program began in 2003 with counts now being conducted yearly. These traffic counts are conducted on weekdays between the months of April through October. Figure 3-8 presents the bi-directional existing traffic volumes collected by the City of Bend during 2004-2005.

As expected, Highway 97, Business 97 (3rd Street), and Highway 20 carry the majority of traffic within the study area. Reed Market Road and 27th Street, both classified as major arterials, transport high levels of traffic throughout the day (20,000-30,000 vehicles). These two facilities join to connect downtown Bend and Highway 97 to high residential land uses. Arterial and collector roadways carry approximately 2,000-20,000 vehicles per day.

## Traffic Operations Performance Standards

It is important to note that both Highway 97 and Highway 20 are classified as state facilities therefore they are subject to ODOT operational standards as set forth in the 1999 Oregon Highway Plan<sup>15</sup>. This plan states that these facilities must operate at a v/c ratio equal to or less than 0.80. The City of Bend additionally sets forth various intersection operational standards based on the type of intersection control. These standards are listed below and are based on measurements of v/c ratios and magnitude of delay<sup>16</sup>.

- Two-Way Stop Control
  - Total delay for individual lane groups must be less than or equal to 50 seconds, and
  - Volume to capacity ratio for individual lane groups must be less than or equal to 1.0, and
  - 95th percentile queuing must be less than or equal to available storage length.
- All-Way Stop Control
  - Total delay for the intersection must be less than or equal to 80 seconds.
- Roundabout
  - Volume to capacity ratio for individual approaches must be less than or equal to 1.0.
- Signalized Intersection
  - Total delay for the intersection must be less than or equal to 80 seconds, and
  - Volume to capacity ratio for the intersection must be less than or equal to 1.0, and
  - 95th percentile queuing must be less than or equal to available storage length.

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<sup>15</sup> Oregon Department of Transportation, Oregon Highway Plan, 1999.

<sup>16</sup> City of Bend, Street Policy No. 6, Section 6.3, Adopted May 7, 2003

**Figure 3-8: ADT**

## Traffic Operations

Level of Service (LOS), delay, and volume to capacity (v/c) ratios are typically used as measures of effectiveness for intersection operations. LOS is similar to a “report card” rating based upon average vehicle delay. Level of Service A, B, and C indicate conditions where traffic moves about without significant delays during periods of peak hour travel demand. Level of Service D and E are progressively worse peak hour operating conditions. Level of Service F represents conditions where average vehicle delay exceeds 80 seconds per entering vehicle at a signalized intersection and demand has exceeded capacity ( $v/c > 1.0$ ). This condition is typically evident in long queues and delays. Unsignalized intersections provide levels of service for major and minor street turning movements. For this reason, LOS E and even LOS F can occur for a specific turning movement; however, the majority of traffic may not be delayed (in cases where major street traffic is not required to stop). LOS E or F conditions at unsignalized intersections generally provide a basis to study intersections further in efforts to determine the availability of acceptable gaps, safety and traffic signal warrants.

A volume to capacity ratio (v/c) is the peak hour traffic volume at an intersection divided by the maximum volume that intersection can handle. For example, a v/c ratio equivalent to 0.80 indicates that peak hour traffic is using 80 percent of the intersections capacity. If traffic volumes exceed capacity, queues will form and will lengthen until demand subsides below the available capacity. When v/c is less than, but close to 1.0, intersection operation becomes unstable and small disruptions can cause traffic flow to break down.

Intersection turn movement counts conducted during peak periods by the City of Bend were used in addition to intersection volumes documented in recent traffic analysis reports<sup>17</sup> were used to determine the existing intersection capacity levels based on the *2000 Highway Capacity Manual* methodology for signalized and unsignalized intersections<sup>18</sup>. Analysis for modern roundabouts is based on the Federal Highway Administration’s (FHWA) guidelines. Seasonal adjustments were applied to Highway 97 and Highway 20 traffic volumes to reflect 30th highest hourly volumes based on 2004 records gathered from ODOT’s Automatic Traffic Recording (ATR) stations located on these facilities.

Study intersections and intersection control are highlighted in Figure 3-9. These intersections were selected based on consultation with Bend MPO staff. Study intersections are a representation of where traffic volumes are highest and where operations and capacity may be of concern. Table 3-3 summarizes the existing weekday peak hour intersection operational levels at the study intersections that either fail to meet operational requirements or are nearing capacity. Intersection operational levels for remaining study intersections are included in Appendix C.

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<sup>17</sup> 1) Newport Bridge Conceptual Design, Kittelson & Associates, Inc., December 2004. 2) Juniper Ridge Master Plan, Kittelson & Associates, Inc., January, 2006. 3) Reed Market Corridor Study, Parametrix, June 2005. 4) US 97 & US 20 Refinement Plan, Kittelson & Associates, November 2005.

<sup>18</sup> *2000 Highway Capacity Manual*, Transportation Research Board, 2000.

**Figure 3-9: Study Intersections**

**Table 3-3: Existing Weekday PM Peak Hour Intersection Level of Service**

<i>Intersection</i>	<i>Level of Service</i>	<i>Delay (sec./veh)</i>	<i>Volume / Capacity</i>
<b>Unsignalized Intersections</b>			
<b>ODOT Jurisdiction</b>			
Highway 97/Ponderosa Road – China Hat Road	F/B	>100	0.88
<b>Bend Jurisdiction</b>			
Empire Avenue/Boyd Acres Road (all-way stop)	F	>100	>1.00
Empire Avenue/18th Street	F/B	>100	>1.00
Reed Market Road/American Lane	F/B	>100	>1.00
<b>Roundabout</b>			
<b>Bend Jurisdiction</b>			
Reed Market Road/Brookwood Boulevard	C	19.2	0.94
<b>Signalized Intersections</b>			
<b>ODOT Jurisdiction</b>			
Highway 20/Greenwood Avenue	D	51.8	0.93
Highway 20/27th Street	D	43.9	0.85
Highway 97/Cooley Road	C	25.1	0.86
<b>Bend Jurisdiction</b>			
3rd Street/Reed Market Road	D	47.4	0.90
27th Street/Neff Road	E	69.5	>1.00
Reed Market Road/15th Street	D	45.0	0.89
Portland Avenue – Olney Avenue/Wall Street	D	37.5	0.85
Olney Avenue – Neff Road/8th Street	D	43.3	0.88

Notes: Unsignalized Intersections:

A/A = Minor Street turn LOS/Major street turn LOS

V/C = Individual lane groups

Delay = Individual lane groups

Roundabouts:

V/C = Individual approach

Delay = Individual approach

Signalized and All-Way Stop Intersections:

Delay = Average vehicle delay in the peak hour for entire intersection in seconds.

Currently, four unsignalized study intersections (listed below) do not meet operational standards. Three of these intersections fall within City of Bend jurisdiction, while the intersection of Highway 97/Ponderosa Road-China Hat Road is under ODOT jurisdiction.

- Reed Market Road/American Lane
- Empire Boulevard/18th Street
- Empire Boulevard/Boyd Acres Road
- Highway 97/Ponderosa Road – China Hat Road

The northbound single lane approach at the intersection of Reed Market Road/American Lane suffers excessive delay (>100 seconds/vehicle) and has a v/c ratio of >1.0 which is greater than the maximum v/c ratio of 1.0 addressed as the City of Bend standard. This is due to minimal gaps on Reed Market Road during the PM peak hour which prohibits vehicles wishing to make a left turn onto Reed Market Road from doing so. The intersection of Empire Boulevard/18th Street also does not meet the city's standards with a v/c ratio >1.0 and delay of >100 seconds/vehicle on the southbound single lane approach. The all-way stop intersection of Empire Boulevard/Boyd Acres Road additionally does not currently meet city requirements yielding an average intersection delay of >100 seconds/vehicle, which is greater than the 80-second standard. The unsignalized intersection of Highway 97/Pondersa Road -China Hat Road yields a v/c ratio greater than the ODOT standard of 0.80 as set forth in the Oregon Highway Plan. The minor street consists of single lane stopped approaches which experience high levels of delay when attempting to access Highway 97, especially left turning vehicles. All remaining study unsignalized intersections meet specified operational criteria set forth by ODOT and the City of Bend.

All study intersection roundabouts are located within the City of Bend jurisdiction and currently meet city operational standards. The southbound approach at the roundabout located at Reed Market Road/Brookwood Boulevard is however nearing capacity. One study signalized intersection under City of Bend jurisdiction and three signalized intersections under ODOT jurisdiction do not currently meet traffic signal operations criteria and are listed below.

- Highway 20/Greenwood Avenue
- Highway 20/27th Avenue
- Highway 20/Cooley Road
- Neff Road/27th Street

The intersection of Neff Road/27th Street currently has a v/c ratio of >1.0 which is greater than the City of Bend standard. Moreover, the ODOT maintained signalized intersections of Highway 20/Greenwood Avenue, Highway 20/27<sup>th</sup> Avenue, and Highway 20/Cooley Road currently have v/c ratios greater than the 0.80 standard. All remaining signalized intersections meet both ODOT and City of Bend operations criteria.

There are five signalized intersections that are nearing capacity as listed below, four of which fall under City of Bend jurisdiction and one under ODOT jurisdiction.

- 3rd Street/Reed Market Road
- Reed Market Road/15th Street
- Portland Avenue – Olney Avenue/Wall Street
- Olney Avenue – Neff Road/8th Street
- Highway 20/27th Street

Attention should be directed towards these intersections in order to maintain efficient operations and maximize throughput.

### **Traffic Safety**

Collision data for the previous five years (2001-2005) was obtained from the Oregon Department of Transportation (ODOT) for selected corridors within the study area<sup>19</sup>. Analysis focused on the identification of existing high collision segments by fusing 2004 Average Daily Traffic (ADT) volumes conducted by the City of Bend and ODOT with the provided collision records and respective segment length. Equivalent collision rates per million vehicle miles traveled (MVMT) were then determined for each respective segment and used as the basis of identifying high collision segments within the study area. The use of MVMT reflects the level of exposure relevant to each roadway segment. Table 3-4 summarizes the average collision rates per MVMT over the previous five years.

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<sup>19</sup> Oregon Department of Transportation, Collision data provided for 2001-2005. Note that 2005 collision data may be subject to change.

**Table 3-4: Bend Roadway Segment Collision Rates (2000-2005)**

Roadway Segment	Collision Type				Collision Severity			Total	Rate (per MVMT)	ODOT 2004 Rate (per MVMT) similar facilities
	Rear	Angle	Turn	Other	PDO	Injury	Fatal			
<b>Reed Market Road</b>										
Bond St. to Silver Lake Blvd.	0	2	2	3	7	0	0	7	0.84	2.04
Silver Lake Blvd. to American Ln.	37	27	46	10	70	50	0	120	<b>3.24</b>	2.04
American Ln. to SE 27th St.	43	2	11	19	40	34	0	74	<b>2.14</b>	2.04
<b>27th Street</b>										
Butler Market Rd. to Conners Ave.	8	4	12	4	18	10	0	28	1.06	2.04
Conners Ave. to Copperfield Ave.	34	15	27	13	54	35	0	89	1.81	2.04
Copperfield Ave. to Reed Market Rd.	8	1	5	1	2	13	0	15	<b>2.09</b>	2.04
<b>Empire Avenue</b>										
OB Riley Rd. to Boyd Acres Rd.	17	5	22	2	26	20	0	46	<b>2.77</b>	2.04
Boyd Acres Rd. to Purcell Blvd.	0	3	7	3	11	2	0	13	1.09	2.04
<b>Business 97 (3rd Street)</b>										
Greenwood Ave. to Brosterhaus Rd.	82	31	89	27	128	100	1	229	<b>2.84</b>	2.04
Brosterhaus Rd. Hwy 97/3rd St. (south)	22	21	54	15	61	50	1	112	1.29	2.04
<b>Highway 97</b>										
North MPO boundary to Nels Anderson Rd.	80	5	18	22	63	62	0	125	<b>1.54</b>	0.76
Nels Anderson Rd. to Greenwood Ave.	36	2	19	26	51	32	0	83	0.46	0.76
Greenwood Ave. to Reed Ln.	30	1	7	17	25	30	0	55	0.46	0.76
Reed Ln. to Hwy 97/3rd St. (south)	73	16	29	9	69	57	1	127	<b>2.24</b>	0.76
Hwy 97/3rd St. (south) to south MPO boundary	2	7	5	2	5	11	0	16	<b>0.92</b>	0.76
<b>Highway 20</b>										
North MPO boundary to Hwy 20/Hwy 97 (north)	8	0	2	3	5	8	0	13	0.27	0.76
Hwy 20/Hwy 97 (north) to	1	0	1	0	2	0	0	2	0.02	0.76

<b>Roadway Segment</b>	<b>Collision Type</b>				<b>Collision Severity</b>			<b>Total</b>	<b>Rate (per MVMT)</b>	<b>ODOT 2004 Rate (per MVMT) similar facilities</b>
	<b>Rear</b>	<b>Angle</b>	<b>Turn</b>	<b>Other</b>	<b>PDO</b>	<b>Injury</b>	<b>Fatal</b>			
Railroad track										
Railroad track to Greenwood Ave.	45	19	51	17	72	60	0	132	<b>2.60</b>	0.76
3rd St. to Pilot Butte Summit Dr.	38	17	59	22	79	57	0	136	<b>3.59</b>	0.76
Pilot Butte Summit Dr. to Purcell Blvd.	41	3	13	12	32	36	0	68	<b>1.83</b>	0.76
Purcell Blvd. to East MPO boundary	17	3	12	4	24	12	0	36	<b>1.54</b>	0.76

Notes:

- Other types of collisions include backing, pedestrian, head-on, sideswipe, parking, fixed object, non-collision, and miscellaneous.
- Injury includes A, B, and C type injuries
- PDO = Property damage only
- MVMT = Million vehicle miles traveled

These measured collision rates were compared to those of similar facilities as indicated in ODOT's 2004 Oregon State Highway Crash Rate Tables<sup>20</sup>. The basis of comparison for similar facilities is based on urban city arterials and urban city expressways which had respective collision rates of 2.04 and 0.76 per MVMT in 2004.

It is important to note that the criterion for mandatory collision reporting was revised effective after December 31, 2003. Collisions before December 31, 2003 were required to be reported if they met the following:

- Death
- Bodily injury or damage to any one's property in excess of \$1,000

The revision consisted of changing legally reportable collisions to ones in which met the following for the driver:

- Death
- Bodily Injury
- \$1,500 damage to your vehicle
- \$1,500 damage to any one's property
- If any vehicle is towed from the scene due to damage.

This revision poses less stringent guiding principles for collision reporting which would attribute to an expected decrease in reported collisions. This is supported by 2004

<sup>20</sup> 2004 State Highway Crash Rate Tables, Oregon Department of Transportation, Transportation Data Section, August, 2005.

ODOT collision records where collision rates decreased by 54-percent and 17-percent for urban city arterials and expressways respectively.

Table 3-4 indicates that five collector/arterial roadway segments and seven highway/expressway segments analyzed have collision rates higher than similar state facilities. It must be noted that collision data analyzed contain data for three years under the previous mandatory collision reporting criteria and two years data under the new collision reporting criteria which is anticipated to yield a lower total number of reported collisions than previous criteria.

#### Reed Market Road

The segment between Silver Lake Boulevard and American Lane has an average collision rate over one-and-a-half times that of similar facilities. The majority of collisions occurring on this segment were a result of turn movements which is a reflection of vehicles turning onto Reed Market Road from minor street approaches. A significant number of these collisions occurred at the intersection of Reed Market Road/American Lane. The single lane approach at American Lane suffers excessive delay during peak periods and it is likely that drivers attempt to turn onto Reed Market Road when there are insufficient gaps. The intersections of Reed Market Road/Division Street and Reed Market Road/3rd Street, also in this same segment, were additionally engaged in numerous collisions. With respect to the segment between American Lane and SE 27th Street, the majority of collisions occurred at the intersections of Reed Market Road/SE 15th Street and Reed Market Road/SE 27th Street.

#### 27th Street

There is one segment on 27th Street that experienced a collision rate higher than the compared normal. This segment is between Copperfield Avenue and Reed Market Road. This section yields a higher crash rate when compared to similar facilities due to lower traffic volumes which in turn yields a lower level of exposure.

#### Empire Boulevard

Empire Boulevard between O.B. Riley Road and Boyd Acres Road also has a higher than average collision rate. This section passes through the Highway 97 and Highway 20 interchanges which both experience high levels of traffic during peak periods. These collisions consisted mainly of rear end and turning movement collisions. Of note, Bend Parkway (Highway 97) opened in 2001, the first year of the analysis period.

#### Business 97 (3rd Street)

There are two study segments on Business 97 (3rd Street) that hold higher collision rates than similar facilities. Both of these segments are located within downtown Bend where 3rd Street consists of a 5-lane cross section and contains many traffic signals. Collision trends reveal a large number of rear end and turn movement collisions which are typically expected with traffic signals and turn

movements from minor streets onto a busy principal arterial. Of note, there was one fatality recorded over the previous five years on 3rd Street.

### Highway 97

There are two study segments on Highway 97 where average collision rates are respectively two and three times higher than average. The segment between the north city limits and Nels Anderson Road experienced a significant number of rear end collisions. The intersections of Highway 97 and Cooley Road and Robal Road are signalized where the majority of collisions along this segment occurred. Recently, a shopping mall was introduced on the west side of Highway 97 between Cooley Road and Robal Road which in turn generated higher traffic volumes within the area. This high collision rate is likely attributed to the increase in traffic volumes associated with the shopping mall. The segment between Reed Lane and 3rd Street also experienced a large amount of rear end collisions. Highway 97 has a posted speed of 45 mph within this section and traffic signals are located at 3rd Street, Pinebrook Boulevard, and Powers Road. Of importance, there was one fatality experienced within this section. The sections of Highway 97 north and south of this segment do not contain any traffic signals. With this, these traffic signals are probable sources to the large number of rear end collisions along this segment.

### Highway 20

Four segments analyzed along Highway 20 yielded higher collision rates than similar facilities. Three are all located on the east section, stemming from Business 97 (3rd Street). The segment between Business 97 (3rd Street) and Pilot Butte Access maintains a 5-lane cross section and has a posted speed of 25-35 mph. Throughout this segment are a large number of busy cross streets which is likely the source for the majority of collisions being the result of turn movements. The remaining two sections of highway 20 have a 4-lane cross section and have a posted speed of 45 mph. The largest percentage of collisions along these segments are rear ends. This is likely due to that both of these segments contain moderately spaced traffic signals.

The majority of crashes occurring on the northern section of Highway between the railroad tracks and Greenwood Avenue occurred at the busy intersection of Highway 20/Greenwood Avenue. The majority of these collisions were the result of turning movements and rear-ends.

### **Deschutes County High Crash Locations**

Deschutes County currently maintains a listing of high crash locations within the county. The County has identified a total of 16 intersections that they have designated as high crash locations in Bend which are shown in Figure 3-10.

### **ODOT SPIS**

Furthermore, ODOT maintains a Safety Priority Index System (SPIS) that ranks high collision locations along state facilities. The system provides a weighted score based on

the severity, frequency, and rate of collisions over the previous three years. Locations are aggregated into 0.10-mile segments. Only segments experiencing three or more collisions or one fatality over the three year analysis period are considered to be a SPIS site. The most recent ODOT SPIS data indicate that 21 one-tenth of a mile segments along Highway 97 and Highway 20 made the SPIS list for the 2001-2003 analysis period<sup>21</sup>.

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<sup>21</sup> ODOT, [http://www.oregon.gov/ODOT/TD/TDATA/gis/odotmaps.shtml#SPIS\\_SIP\\_Maps](http://www.oregon.gov/ODOT/TD/TDATA/gis/odotmaps.shtml#SPIS_SIP_Maps)

**Figure 3-10: High Collision Locations**

## Truck Freight

The movement of raw and furnished goods plays a vital role in our economy. The majority of these goods are transported via motor carrier; therefore efficient truck mobility is crucial to economic survival. The designation of through truck routes provides for this efficient movement while at the same time maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. ODOT<sup>22</sup> identifies Highway 97 (Bend Parkway) as a designated federal truck route and a state freight route. Highway 20 is designated a federal truck route through the entire study area. The following two sections of Highway 20 are designated state freight routes: 1) from the west study area limits to Empire Avenue and 2) from NE 11<sup>th</sup> Street to the east study area limits. These routes are identified in Figure 3-11. The surrounding arterial roadway system links these highways with nearby businesses located in the industrial and commercial zoning regimes. Table 3-5 summarizes available 2004 truck traffic as a percentage of ADT at several permanent ODOT ATR stations within the City of Bend.

**Table 3-5: Existing Truck Volumes**

Route	Automatic Traffic Recorder Location	2004 Average Daily Traffic	Truck ADT	Truck %
Highway 97	south of Revere Avenue	38,600	2,740	7.1
Highway 97	south of Empire Boulevard	41,300	3,550	8.6
Highway 97	0.9 miles south of Bend	22,150	1795	8.1
Highway 20	5 miles east of Bend	2,750	650	23.5

<sup>22</sup> 1999 Oregon Highway Plan, Oregon Department of Transportation, May 1999.

**Figure 3-11: Truck Routes/RR Crossings**

## Other Travel Modes

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There are four other modes of transportation in Bend included in this MTP: rail, pipeline, air, and water. The Deschutes River flows through the center of Bend and serves as a scenic and recreational waterway. There is no freight activity along this waterway within the study area therefore it will be left out of the remaining discussion. These remaining modes of transportation can all be seen in the previous Figure 3-11 with the exception of pipelines.

### Rail Freight

Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) currently operate manifest trains through the City of Bend. The rail track, owned by BNSF, runs parallel to Highway 97 at the north city limits before veering east just south of Colorado Avenue towards the industrial zone. The rail track is regulated under the Federal Railroad Administration's (FRA) class 2, 3 and 4 track standards. In this, there are no weight or dimensional restrictions for freight movements through the study area.

BNSF and UP combined for an estimated 13 million gross ton miles being transported through the study area in 2002<sup>23</sup>. In 2005, BNSF was operating approximately 12-15 trains per 24 hours through the study area, while UP was operating one train daily in each direction. Additionally, BNSF operates a switch engine which transports freight to and from local businesses within the study area. The majority of freight being transported through the study area consists of various forest products, cement, diesel fuel, liquefied petroleum gas, wallboard, and other construction supplies<sup>24</sup>.

With rail freight passing through the study area, attention needs to be directed towards the intersection of the rail track and the roadway. Railroad crossings were shown in Figure 3-11. Currently, there are a total of seventeen crossings. Of these, eleven are at-grade crossings featuring active traffic control devices (automatic gates). Of the remaining grade-separated crossings, three are over grade crossings where the railway travels over the roadway and two are under grade crossings where the roadway spans over the railway. For the most part, grade separated crossings are preferred so as to provide sufficient safety and eliminate large traffic delays. A review of the Reed Market Road at grade crossing over three consecutive weekdays yielded an average gate downtime of almost four minutes. Vehicle queues westbound on Reed Market extended back to 15th Street and beyond.

### Gas Pipelines

Gas Transmission Northwest Corporation (TransCanada) currently operates high-pressure natural gas pipelines that run near Bend city limits. This pipeline extends between Kingsgate, British Columbia and Malin, Oregon thus traversing a distance of 612 miles. The pipeline currently passes through the southeast corner of the city limits and consists of 36-inch and 42-inch diameter pipeline that is capable of delivering up to

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<sup>23</sup> Email from Bob Melbo of ODOT Rail Division to Tyler Deke of Bend MPO, January, 2006.

<sup>24</sup> *Ibid*

1 billion cubic feet (BCF) of gas per day to the Pacific Northwest; however typical daily operations are in the range of 600-700 million cubic feet per day<sup>25</sup>. Cascade Natural Gas holds the role of distributing natural gas to the City of Bend through a series of 2-6 inch diameter piping. The maximum allowable operating pressure for the pipeline system is 911 pounds per square inch (psi).

## **Airport**

The Bend Municipal Airport (Airport Identifier BDN) is located at 63136 Powell Butte Highway, approximately five miles northeast of city limits. It is a non-towered airport and classified as a Category 2 – Business or High Activity General Aviation Airport. In this, there is no scheduled passenger service to/from the airport. The existing single asphalt runway measures 75 feet in width and 5,005 feet in length serving approximately 42,000 annual aircraft operations (departures and arrivals) with an approximate average of 110 operations per day thus making it the 14th busiest airport in the state<sup>26</sup>. The existing asphalt runway has been noted to be in fair condition. Approximately 180 aircrafts in combination with 18 aviation type businesses are currently based at the airport. The airport was established in 1942 in response to World War II training efforts.

The Oregon Aviation Plan<sup>27</sup> found runway length/width and weather reporting to be key needs for this particular airport in order to preserve the airport system over the next twenty years. Recently, an automated weather observation system capable of announcing wind speed, wind direction, day versus night, current temperature and dew point, precipitation, cloud layers (up to three) and ceiling (up to 12,000 feet above ground level), density altitude, barometric pressure, visibility (1/4 mile to 10+ miles), and lightning strikes/activity within and beyond 10 miles<sup>28</sup>. Moreover, a new runway is anticipated to be completed in October 2007 which will replace the existing runway.

Pilot Butte Airport (Airport Identifier 8OR5) is a private use airstrip located south of Pilot Butte in the City of Bend. It consists of a 20 foot wide by 2400 foot asphalt runway.

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<sup>25</sup> Phone conversation with Robert Latimer, TransCanada GTN & NBP System, May 9, 2006.

<sup>26</sup> Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

<sup>27</sup> *Oregon Aviation Plan*, Oregon Department of Transportation, February 2000.

<sup>28</sup> Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

## **Land Use**

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Land use plays a large role in driving transportation choices. Consequently, land use within the City of Bend is a key ingredient to understanding current transportation patterns and roadway traffic volumes. Industrial and commercial land uses are found within the central core of the city along Highway 97 and Highway 20, while residential land uses make up most of urban and rural Bend. Bend's Zoning Ordinance (NS 1178) and Subdivision Ordinance (NS 1349) control and regulate the most appropriate use of land within the City.

Currently, the Bend Area General Plan (BAGP) is the key source for setting forth goals, objectives, and policies linking transportation and land use within the City of Bend. This document is intended to provide guidance to local, state, and federal agencies, neighborhood and community groups, and anyone interested in development with making appropriate land use decisions with regards to future development that will help meet the future needs of the state, community, and citizens. The plan consists of a package of goals, text, exhibits, policies, and illustrative maps in an effort to lay out where and how changes should happen in order to accommodate the rapid population and economic growth. Both the City's zoning and subdivision ordinance are designed in compliance with the goals, objectives and policies as stated in the BAGP and are intended to implement the general plan.

It should be noted that the BAGP is subject to changes over time and should be revised to reflect new information and attitudes towards future transportation and land use needs.

## **Intelligent Transportation Systems**

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In efforts to further examine the existing transportation infrastructure in Bend, a review of existing Intelligent Transportation Systems (ITS) was carried out. These systems are intended to better manage the existing roadway system. The Deschutes County ITS Plan<sup>29</sup> was used as the basis for this section.

### **ITS Systems**

Bend currently houses several ITS systems including remote weather information systems (RWIS), automatic traffic recorders (ATR), video detection cameras, closed circuit television (CCTV) cameras, and an oversize vehicle closure telephone system. Figure 3-12 provides an overview of current ITS deployments within the City of Bend. These are all monitored and managed by the Bend Traffic Operations Center (TOC) which is currently suited to successfully carry out tasks in incident management, emergency management, traffic management, traveler information, winter operations, and maintenance operations.

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<sup>29</sup> Deschutes County ITS Plan, DKS Associates, March 2005.

Six CCTV cameras are currently installed along Highway 97 (Bend Parkway). These cameras are used to monitor current traffic conditions and aid with incident, emergency, and traffic management strategies. Currently there are five ATR recorder stations within Bend city limits. These are all located on Highway 97 and Highway 20. Weather stations are used in an effort to aid travelers and maintenance crews of adverse weather conditions. There are two weather stations located in Bend in the northern part of the city. Typical measurements include air and pavement temperature, precipitation, wind speed and direction, and humidity. With the addition of new traffic signals and modifications, video detection systems are becoming more common. These units take the place of inductive loop detectors to allow for actuated traffic signal operations. A large sum of information reported from these field devices is broadcasted to the public via ODOT's Trip Check website.<sup>30</sup>

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<sup>30</sup> Oregon Department of Transportation, Tripcheck, (<http://www.tripcheck.com>)

**Figure 3-12: ITS**

# Chapter 4: Goals and Objectives

## Introduction

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The Goals and Objectives for the Bend MPO area reflect the transportation priorities of the jurisdictions within the MPO, the goals established by the state of Oregon and the guidelines set by the Federal Government for metropolitan regions.

The Goals and Objectives guided the development and evaluation of alternatives for the MTP. The Goals and Objectives will also serve to guide implementation of the MTP. They were used as a measuring stick to judge how well the alternatives and the final plan reflect values expressed by the community.

The Policy Board, with recommendations and suggestions from the TAC, developed and adopted the Goals and Objectives in July 2006. As the MTP is updated in the future, the goals and objectives will be reviewed to assure that they reflect current regional priorities for the MTP.

## Goals and Objectives

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### Mobility and Balance

#### Goal 1

Provide a variety of practical and convenient means to move people and goods to, from and within the MPO area.

#### Objectives:

- 1) Expand opportunities for rail and air transportation for passengers and freight
- 2) Promote the development of a comprehensive public transportation system that is proportional to the scale and economy of the Bend MPO area
- 3) Promote non-motorized modes of transportation by constructing a system of safe and efficient transportation and recreation routes for pedestrians, bicyclists, and equestrians.
- 4) Identify and support the development of local evacuation routes for wildfire, seismic events and national security events
- 5) Identify and support the development of local freight routes
- 6) Support the through movement of goods and people on the state transportation system

#### Goal 2

Develop a transportation system that serves the needs of all travel modes, provides intermodal connectivity, and provides a range of transportation options throughout the MPO area

### Safety and Efficiency

#### Goal 1

Address traffic congestion and problem areas by evaluating the broadest range of transportation solutions, including but not limited to:

- Operational improvements to maximize the efficiency of existing facilities;

- Construction of new transportation corridors;
- Transportation Demand Management (TDM) - bicycle, pedestrian and carpool strategies; and
- Transportation Systems Management (TSM) – Intelligent Transportation Systems (ITS), intersection operations and access management.

Goal 2

Serve the existing, proposed and future land uses with an efficient and safe transportation network

Goal 3

Design and construct the transportation system to enhance safety for all modes.

Objective

- 1) In cases where improving safety will also improve efficiency, these projects should receive funding priority

**Accessibility and Equity**

Goal 1

Provide people of all income levels with a wide range of travel options within the MPO area

Goal 2

Support all Americans with Disabilities Act (ADA) requirements and policies

**Land Use**

Goal 1

Integrate land use and transportation by encouraging land use patterns that provide efficient, compact uses of land that facilitate a reduced number and length of trips

Goal 2

Promote development patterns that preserve the life of the existing transportation system

Goal 3

Promote development that does not rely on primary access to the state transportation system

**Environment and Livability**

Goal 1

Recognize and respect the natural and historical features over which transportation improvements pass to minimize adverse impacts

Goal 2

Design transportation improvements that protect the environment by preserving air and water quality, minimizing noise impacts and encouraging energy conservation

Goal 3

Use context sensitive design principles when designing and locating transportation facilities

**Economic Development**

Goal 1

Implement transportation improvements that foster economic development and business vitality

Goal 2

Develop a transportation network with transportation options that enhance linkages between centers of employment, education, medical facilities and neighborhoods

Goal 3

Recognize the importance of intermodal connections and maintain adaptable approaches to trends and opportunities that enhance intermodal connections

## **Financially Responsible**

### Goal 1

Coordinate and design transportation improvements to assure the expenditure of resources in the most cost-effective manner

#### Objective:

- 1) Ensure that the costs of planned improvements are commensurate with the benefits

### Goal 2

Maximize the ability to leverage alternative and multiple funding sources for transportation system improvements

#### Objectives:

- 1) Develop innovative and sound funding policies to implement the Plan, including cost-sharing and other partnership arrangements with the public and private entities when appropriate
- 2) Increase the diversity of funding sources to provide greater stability, predictability and flexibility for funding transportation facilities and services.
- 3) Investigate the user pays concept to leverage resources when transportation improvements will benefit specific properties planned for development

# Chapter 5: Forecast Land Use

## Introduction

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Population and employment forecasts are developed to assist in planning for land use, transportation, infrastructure, and other needs. Forecasts are as good as the data and assumptions they are based on and require updates as new information becomes available.

Population and employment in the Bend area has shown cycles of slow and fast growth over the decades. During the 1970s, the population in Bend grew by almost 26 percent, while growth slowed somewhat in the 1980s. The 1990s saw another population surge that included the annexation of the entire area contained in the city's Urban Growth Boundary. Rapid population growth continued into the first half of the 2000s. The vast majority of the area's recent population growth is due to in-migration and is intertwined with the region's economic health. Long-term forecasts reflect national trends and show an eventual slowing of this growth.

The number and location of workers and housing have a significant impact on regional travel. Population and employment are essential inputs to the computer-based transportation model. Estimates of base year dwelling unit and employment, and future projections of these same variables are needed to forecast future traffic.

The population of the Bend area is expected to increase by nearly 60% over the next 20-25 years. This increase in population will have a significant impact on the transportation system. The transportation needs of the population, however, will be changing as well. An aging population will be more reliant on alternative modes of transportation. At the same time, the rapid growth of the Internet and other technologies may affect travel patterns and behavior. Therefore, not only is the amount of growth important, but also the forecast characteristics of the population.

## Population Growth

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Historical Census data for Bend, Deschutes County and the state of Oregon is illustrated in Table 5-1. Central Oregon has seen high population growth rates for much of the last 45 years. As shown in Table 5-1, the growth has been especially high in the last 10-15 years.

**Table 5-1: Population Growth Summary**

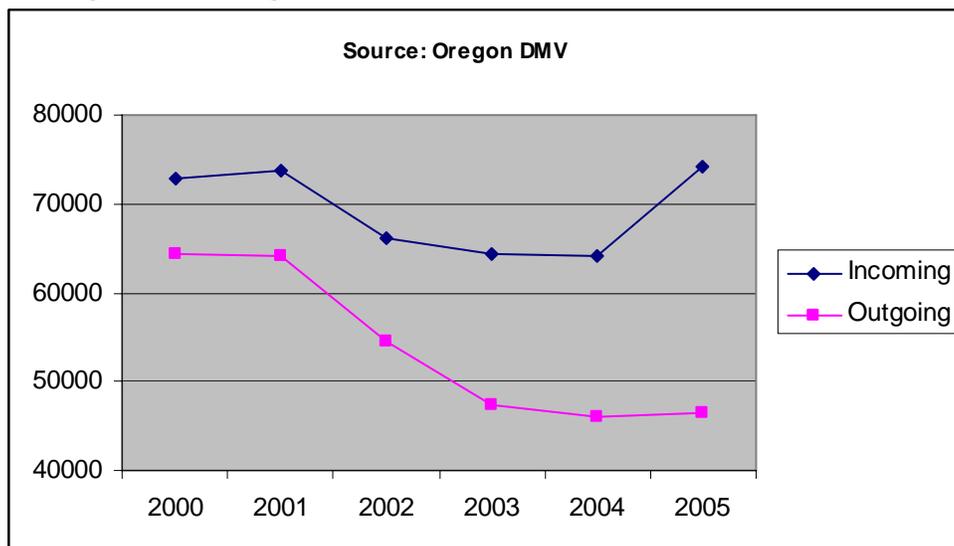
Year	1960	1970	1980	1990	2000	2006**
<b>Oregon</b>	1,768,687	2,091,533	2,633,156	2,842,321	3,421,399	3,690,505
Change	---	322,846	541,623	209,165	579,078	269,106
% Change	---	18%	26%	8%	20%	8%
<b>Deschutes County</b>	23,100	30,442	62,142	74,958	115,367	152,615
Change	---	7,342	31,700	12,816	40,409	37,248
% Change	---	32%	104%	21%	54%	32%

<b>Deschutes County*</b>	11,137	16,732	31,700	54,489	63,338	77,325
Change	---	5,595	14,968	22,789	8,849	13,987
% Change	---	50%	89%	72%	16%	22%
<b>Bend</b>	11,963	13,710	17,263	20,469	52,029	75,290
Change	---	1,747	3,553	3,206	31,560	23,261
% Change	---	5%	26%	19%	154%	45%

\*Deschutes County excluding the Bend population total. Source: US Census Bureau (data for 1960, 1970, 1980, 1990, and 2000). \*\*Portland State University Population Research Center.

Information about migration into and out of Oregon over the past few years is illustrated in Figure 5-1. The figure is based on DMV data of new and surrendered driver's licenses. Over the past several years, total in-migration to Oregon surpassed out-migration with the gap widening since 2003. California migration has been about 35 percent of total migration since 2003.

**Figure 5-1: Oregon Drivers License Data**



One aspect of particular interest to the future transportation needs of the region is the growth in the population of people age 65 and over. The central Oregon region is an attractive location for retirees. Between 1990 and 2000, this age group more than doubled in Deschutes County. In Bend, the 65 and over group comprises 12% of the population.<sup>1</sup>

### County Population Forecasts to 2040

In 1997, the Oregon Office of Economic Analysis (OEA) released their long-term population and non-agricultural payroll employment forecasts. The statewide population forecasts are linked to the national projections of population growth, but with a slightly higher rate for Oregon than the nation as a whole. Later that year representatives from Deschutes County, Bend, Redmond, and Sisters – in cooperation with OEA – agreed

<sup>1</sup> Source: US Census Bureau (data for 1990 and 2000)

upon a coordinated County population forecast through the year 2020. In the fall of 2001, the Deschutes County Community Development Department led an effort to coordinate a local population forecast to year 2025. This effort was completed in 2004. The City of Bend then applied average annual growth rates to generate a forecast through year 2030 for use in the transportation analysis for the urban growth boundary expansion process. The long-range population forecasts are shown in Table 5-2.

**Table 5-2: Deschutes County 2000-2025 Coordinated Population Forecast**

Year	Bend UGB	Redmond UGB	Sisters UGB	Unincorporated County	Total County
2000	52,800	15,505	975	47,320	116,600
2005	69,004	19,249	1,768	53,032	143,053
2010	81,242	23,897	2,306	59,127	166,572
2015	91,158	29,667	2,694	65,924	189,443
2020	100,646	36,831	3,166	73,502	214,145
2025	109,389	45,724	3,747	81,951	240,811
2030	119,009	---	---	---	---

## Employment Trends

In recent years, the central Oregon region has undergone a dramatic shift in its economic structure. Due to a reduction in commercial timber available from federal lands, employment in the lumber industry has declined sharply. The region, however, has seen a sizable increase in overall employment. The employment base has greatly diversified over the past 10 years.

Growth in tourism has had a significant impact on both the statewide and local economies. Central Oregon is a major tourist destination. In 2004, Deschutes County ranked fifth in the state for total travel expenditures. Because of its central location to many cultural and recreational activities, the MPO area frequently serves as the home base for tourists during their stay in Central Oregon.

Structural changes in the local economy impact the demand placed on the transportation system. For example, industrial employment generates very few trips per employee while retail employment generates a large number of trips per employee. If, for example, 100 industrial employees are shifted to new retail sector positions, there would be a large increase in trips placed on the transportation system.

In addition, the geographic distribution of retail and service employment is typically more dispersed than traditional, large industrial sites. Because of these factors, future travel demand will change significantly as the economy continues to evolve.

Growth in total employment is forecast to increase steadily over the next 20 years. Much of this growth is expected to occur in the trade and service sectors. Employment in wholesale and retail trade is expected to grow by 78 percent. Service industry employment is projected to grow by 65 percent. Additionally, manufacturing employment is forecast to grow 68% and F.I.R.E. (Finance, Insurance, Real Estate) is forecast to grow 119%. The long-range employment forecasts are shown in Table 5-3.

**Table 5-3**

Year	Agriculture/ Forestry	Mining	Construction	Manufacturing	Transportation, Communications, Utilities	Wholesale Trade
2003	84	74	3,404	4,601	978	981
2030	146	114	4,490	7,726	2,148	1,831
Change	+ 62	+ 40	+1,086	+3,125	+1,170	+850

(cont)

Retail Trade	FIRE	Service	School Staff	Government	Non- Covered	Total Employment
6,881	2,141	16,766	1,337	1,936	1,937	41,120
12,159	4,689	27,691	2,156	3,921	2,670	69,741
+5,278	+2,548	+10,925	+819	+1,985	+733	+28,621

Further details on population and employment data and projection methods are available from the Bend MPO.

## **Vehicular Travel Demand**

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Locations with high traffic volumes today are expected to be the locations with the highest traffic volumes in the future. The highest traffic volumes in the region are forecast to occur on Highway 97 (the Parkway). High traffic-volumes are also expected on Highway 20 (3<sup>rd</sup> Street/Greenwood Avenue), Reed Market Road, Empire Avenue, and 27<sup>th</sup> Street. Vehicle miles of travel (VMT) in the study area are currently (year 2003) estimated to be approximately 49,500 miles during the PM peak hour. By 2030, PM peak hour VMT within the study area is expected to be approximately 85,000 miles (a 70 percent increase).

Trends in population and employment in the Bend area mirror those of the nation. A variety of societal changes has had a significant impact on transportation demand. Over the last 30 years, an increasing percentage of women have entered the labor force. This contributes to increased demands on the transportation system. National statistics from the Census indicate that over the last 30 years, many transportation-related factors have grown much more rapidly than has the nation's population, which increased by less than 40 percent. The number of workers increased by almost 80 percent, but the number of vehicles per household increased by almost 180 percent. The number of vehicles per household increased by more than 60 percent, while the number of persons per household fell by 20 percent.

## **Land Use - Transportation Connection**

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In recent years, several studies have been undertaken to identify the linkages between transportation and land use issues. These studies have generally focused on changing land use distributions along regional transit networks to help decrease automobile travel and increase the convenience of walking, biking, and public transportation. These

studies have demonstrated that projected travel demand could potentially be accommodated through means other than building new freeways and adding lanes to existing roads.

The Oregon Transportation Planning Rule (OAR 660, Division 12) was adopted in 1991 to implement Statewide Planning Goal 12 (Transportation). Specific provisions of the TPR include reducing reliance on the automobile, improving mobility and accessibility for bicyclists, pedestrians, and public transportation users, and avoiding air quality problems associated with traffic congestion. While the overall success of the TPR is still being debated, it has helped provide for a coordinated approach to transportation planning in Oregon. Because of the Transportation Planning Rule, multi-modal needs and land use issues are now routinely part of local transportation planning activities.

# Chapter 6: Motor Vehicles

## Introduction

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Motor vehicles remain the primary mode for transporting goods and people within the BMPO planning area. The physical roadway infrastructure and the motor vehicles it supports play a vital role in the BMPO planning area's social and economic livelihood. Efficient movement of motor vehicles supports the economic vitality of the region and maintains the mobility of its residents. Identifying needs and deficiencies in the roadway system is an important step in maintaining and improving the flow of motor vehicles. Most new motor vehicle projects also have provisions for bicycles and pedestrians facilities which enhance the multi-modal transportation system.

This chapter outlines the basic assumptions through the future year (2030), including forecasts of future population and employment and the resulting demand on the regional arterial and collector roadway network. Four different future scenarios were evaluated including:

- 2030 Committed Improvements
- 2020 Transportation System Plan (TSP) Improvements
- 2030 Capacity Enhancing
- 2030 Transit/Transportation Demand Management (TDM)

The Metropolitan Transportation Plan (MTP) is a financially constrained plan; the Preferred Scenario includes projects recommended for implementation that can be financed with existing and anticipated funding resources. The Preferred Scenario identifies regionally significant projects, primarily on arterial road segments and generally excludes local and collector streets. Some collector street projects have been included due to their impacts on the regional transportation system, other collector street deficiencies that were identified and corresponding improvement projects will be addressed in the Bend Transportation System Plan (TSP).

Although the majority of projects included within this plan have funding sources, some additional projects are identified that go beyond the immediate availability of known funding trends. The designation and inclusion of these extra projects are important to future planning efforts, as they allow right-of-way needs to be preserved and allow opportunities for new funding that becomes available to be applied to projects that have been already been identified as addressing future deficiencies in the regional transportation network. These extra roadway projects are included in an "Illustrative" list near the end of the chapter.

Several other planning studies are underway that will influence the expected transportation conditions in the greater Bend Planning Area. These studies include:

- Highway 97/Highway 20 NEPA

- Highway 20 Refinement Plan
- South Parkway Interchange Area Management Plan
- Bend Urban Growth Boundary (UGB) Expansion Traffic Analysis

Findings and recommendations that result from these ongoing planning efforts will be amended into the Bend MTP and incorporated into future MTP updates. A more rigorous alternatives analysis will also be conducted after the Urban Growth Boundary analysis is complete as part of subsequent MTP and TSP updates.

## Goals and Policies

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The goals and policies of the Bend MTP were developed based on a review of the existing goals outlined in other regional and local plans. The Oregon Highway Plan provides guidance on the standards of performance necessary for motor vehicles on the state highway facilities. The region also has specific goals and policies outlined within the local transportation plans (Deschutes County Comprehensive Plan, Deschutes County Transportation System Plan, and the City of Bend Transportation System Plan) that are specifically related to motor vehicles. The goals that were created and adopted will help guide the future development of the roadway network and select specific projects for implementation. The motor-vehicle goals are included in Chapter 4 of this plan.

## Performance Standards

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A variety of performance measures have been developed and adopted by governing jurisdictions to evaluate how well the transportation system operates under existing and future conditions. The most common standards utilized for transportation analysis include level of service (based on average intersection delay) and volume-to-capacity (v/c) ratios. The operational standards provide quantitative measures for the evaluation of the transportation network, primarily at an intersection level.

Both Highway 97 and Highway 20 are state facilities; therefore they are subject to ODOT operational standards outlined in the Oregon Highway Plan<sup>1</sup>. This plan states that these two facilities within the Bend MPO planning area must operate at a v/c ratio equal to or less than 0.80 for most intersection level operations.

The City of Bend and Deschutes County also have various intersection operational standards based on the type of intersection control. The City of Bend standards are outlined in Table 6-1 and are based on measurements of v/c ratios and the magnitude of delay<sup>2</sup>.

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<sup>1</sup> Oregon Department of Transportation (ODOT), Oregon Highway Plan, 1999 - *Amendment*, July 2005.

<sup>2</sup> City of Bend, Development Code, Chapter 4.7, Adopted July 5, 2006.

**Table 6-1: City of Bend Transportation Performance Standards**

Traffic Control	Performance Characteristics	
<b>Two-Way Stop Control</b>	<ul style="list-style-type: none"> <li>Average delay for the critical lane group must be less than or equal to 50 seconds during the peak hour on approaches with more than 100 peak hour trips</li> </ul>	
<b>All-Way Stop Control</b>	<ul style="list-style-type: none"> <li>Average delay for the intersection must be less than or equal to 50 seconds during the peak hour</li> </ul>	
<b>Roundabout</b>	<ul style="list-style-type: none"> <li>Volume-to-capacity ratio for the intersection as a whole is less than or equal to 1.0 during the peak hour</li> </ul>	
<b>Signalized Intersection</b>	Built to TSP/Master Plan; within Central Business/historic district	<ul style="list-style-type: none"> <li>Volume-to-capacity less than or equal to 1.0 for hour preceding and following peak hour</li> </ul>
	Built to TSP/Master Plan; outside Central Business/historic district	<ul style="list-style-type: none"> <li>Volume-to-capacity less than or equal to 1.0 for hour preceding and following peak hour</li> </ul>
	Not Built to TSP/Master Plan; within Central Business/historic district	<ul style="list-style-type: none"> <li>Volume-to-capacity less than or equal to 1.0 for hour preceding and following peak hour</li> </ul>
	Not built to TSP/Master Plan; outside of Central Business/Historic District	<ul style="list-style-type: none"> <li>Volume to Capacity less than or equal to 1.0 for peak hour</li> </ul>

The Deschutes County standards for signalized and unsignalized intersections are LOS D for existing facilities and LOS C for new facilities.

## Forecasts and Needs

The existing conditions analysis is summarized in Chapter 3 of this plan and identified a series of transportation needs and existing deficiencies. These needs, along with the adopted goals and policies developed for the future direction of the transportation network, provide the starting point for the future year analysis.

### Forecasted Land Use

Land use is a key factor in developing a functional transportation system. The amount of land that is planned to be developed, the type of land uses and how the land uses are mixed together have a direct relationship to expected demands on the transportation system. Understanding the amount and type of land use is critical to taking actions to maintain or enhance transportation system operation.

The Bend MPO travel demand model was developed by the Transportation Planning Analysis Unit (TPAU) at ODOT (Oregon Department of Transportation). The travel demand model was used to determine future traffic volumes within the study area.

Complete land use data sets were developed by City and County staff and TPAU for the following conditions.

- Existing 2003 Conditions (base travel forecast for the region)
- Future 2030 Conditions

For transportation forecasting, the land use data is stratified into geographical areas called transportation analysis zones (TAZs), which represent the sources of vehicle trip generation. There are 463 TAZs within the BMPO planning area model; each TAZ represents land use and the access to the transportation system within the planning area. This land use database includes the population, the number of residential dwelling units (households), and employees within specific TAZs. The totals that were assumed for each category in the Bend MPO travel demand model for the base (2003) and future year (2030) are summarized in Table 6-2.

**Table 6-2: Land Use Summary**

Land Use	2003	2030	Increase	Percent Increase
Population	80,884	143,481	62,597	77%
Households	32,443	57,770	25,327	78%
Employees	41,119	69,783	28,664	70%

\* Note: The Bend MPO model extends significantly beyond the BMPO boundary. The land use totals shown in Table 8-2 are for the entire model area.

In Table 6-2, the employee category only includes the total number of employees, though the travel demand model utilizes a range of employment types (retail, service, industrial, and other). All three category areas exhibit significant growth during the planning horizon. This growth was converted to forecasted travel demand and then applied to the existing transportation network to determine the future deficiencies of the motor vehicle system, as explained in the next section.

### Forecasted Travel Demand

The determination of future transportation needs in the BMPO planning area requires the ability to accurately forecast travel demand resulting from estimates of future population and employment. The objective of the transportation planning process is to provide the information necessary for making decisions on when and where improvements should be made to the transportation system to meet the forecasted travel demand.

Traffic forecasting can be divided into several distinct but integrated components that represent the logical sequence of travel behavior. These components and their general order in the traffic forecasting process are as follows:

- **Trip Generation-** The trip generation process translates land use quantities

(number of dwelling units, number of employees) into vehicle trip ends (number of vehicles entering or leaving a TAZ).

- **Trip Distribution-** This step estimates how many trips travel from one zone (TAZ) in the model to any other zone. Distribution is based on the number of trip ends generated in each zone pair and on factors that relate the likelihood of travel between any two zones to the travel time between zones.
- **Mode Choice-** This step determines how many trips will be made by various modes (single-occupant vehicle, transit, carpool, etc.).
- **Traffic Assignment-**This step allocates trips between an origin and destination by a particular mode to a route, where each traveler is assigned to the path with the shortest travel time.

The initial roadway network used in the traffic model was the streets and roadways identified in the existing conditions chapter (Chapter 3) of this plan. A future 2030 Committed Scenario was analyzed to identify existing deficiencies and motor vehicle infrastructure needs. The Committed Scenario assumes that the BMPO planning area will experience its projected growth in population and employment and the demand for the transportation facilities will increase accordingly. The Committed street network includes TSP projects identified in the adopted plan, that have committed funding to construct, either through city transportation system development charge (SDC), the Oregon Statewide Transportation Improvement Plan (STIP), or other privately funded road improvements. The transportation improvements assumed for this scenario are listed in Table 6-3. This scenario serves as the basis of comparison for the three other future year (2030) scenarios that will be evaluated.

**Table 6-3: Motor Vehicle Transportation Improvements (Committed)**

Location	From	To	Improvement	Jurisdiction	Construction Status
27 <sup>th</sup> Street	Forum Shopping Center	Neff Road	Widen to 4 thru lanes and center turn lane	Bend	Complete (2007)
15 <sup>th</sup> Street	US20/ Greenwood	Bear Creek Road	New 2 lane connection	Bend	Complete (2006)
Empire Avenue	Lower Meadow Drive	High Desert Lane	New 2 lane connection	Bend	Complete (2006)
Hunnell Road	Robal Road	Cooley Road	Full connection-construct 3 lane arterial	Bend	Complete (2005)
Cooley Road	US 97		Short-term at-grade improvement	Bend/ODOT	Future date (TBD)
Cooley Road	US 97 Intersection		US 97 North Bend Corridor Project EIS	Bend/ODOT	

Location	From	To	Improvement	Jurisdiction	Construction Status
Empire Avenue	Purcell Boulevard	Butler Market/27 <sup>th</sup> Street	New 2 lane connection with center turn lane and roundabout at 27 <sup>th</sup> Street/Empire Avenue	Bend	2008/2009
US 97	Baker Road	China Hat Road	Install median barrier (right-in/right-out access)	ODOT	2007
Skyline Ranch Road	Skyliners Road	Century Drive	New 2-lane road	Private	2007
New E-W collector	Carmen Loop	Brosterhous Rd	New 2-lane road	Private	Future Date (TBD)
New E-W collector	Mt. Washington	Shevlin Park Rd	New 2-lane road	Private	Future Date (TBD)
New N-S collector	New E-W collector	Galveston	New 2-lane road	Private	Future Date (TBD)
Cooley Road	US 97	18 <sup>th</sup> Street	3-lane collector modernization with bike lanes and sidewalks. Intersection improvements at Cooley Road and 18 <sup>th</sup> Street	Bend	2008
Empire Avenue	Boyd Acres Rd		Install traffic signal	Bend	2007
Reed Market Road	US 97		Install traffic signal at NB off-ramp	ODOT	2008
Reed Market Road	Century Drive	US 97 (Parkway)	Construct 2-lane road extension	Bend	Complete (2004)

The Bend MPO travel demand model is a useful tool for determining future deficiencies in the transportation network. The model was created using average annual weekday daily traffic volumes. These volumes reflect average conditions, but neglect the seasonal variations that are characteristic of the area. Typically, adjustments for the 30<sup>th</sup> Highest Hour or other correctional factors are applied to traffic counts on state highways (Highway 20 and Highway 97) to reflect the higher traffic volumes that are exhibited during the summer months. The counts are adjusted based on data from Automatic Traffic Recording (ATR) devices maintained on state facilities. The travel demand model does not account for these adjustments. Based on the travel characteristics within and through the BMPO planning area, seasonal variation has a significant impact on the existing and future traffic operations and it should be noted that the model generally underestimates the future forecast traffic volumes for certain peak months throughout the year.

## Future Corridor Deficiencies

The Committed Scenario represented the base case for the forecasted 2030 growth. This scenario included transportation system improvements within the BMPO planning area that can be constructed and implemented with the current existing funding levels and identified in the Capital Improvement Plan (CIP) or the Statewide Transportation Improvement Plan (STIP). Figure 6-1 shows the forecasted demand to capacity ratio on roadways within the planning area for the 2030 Committed Scenario. The demand-to-capacity ratios illustrated here are model outputs and differ from the volume/capacity (v/c) ratios that are calculated using the *Highway Capacity Manual Methodology*<sup>3</sup>. As shown, the Committed Scenario transportation system does not have adequate roadway capacity to serve the expected future travel needs. Red roadway segments in Figure 6-1 indicate roadway segments that are over-capacity and do not meet the City or ODOT (0.80 in most of the MPO area) traffic operating standards. The demand-to-capacity ratios exceed 1.0 on multiple key corridors in the study area including:

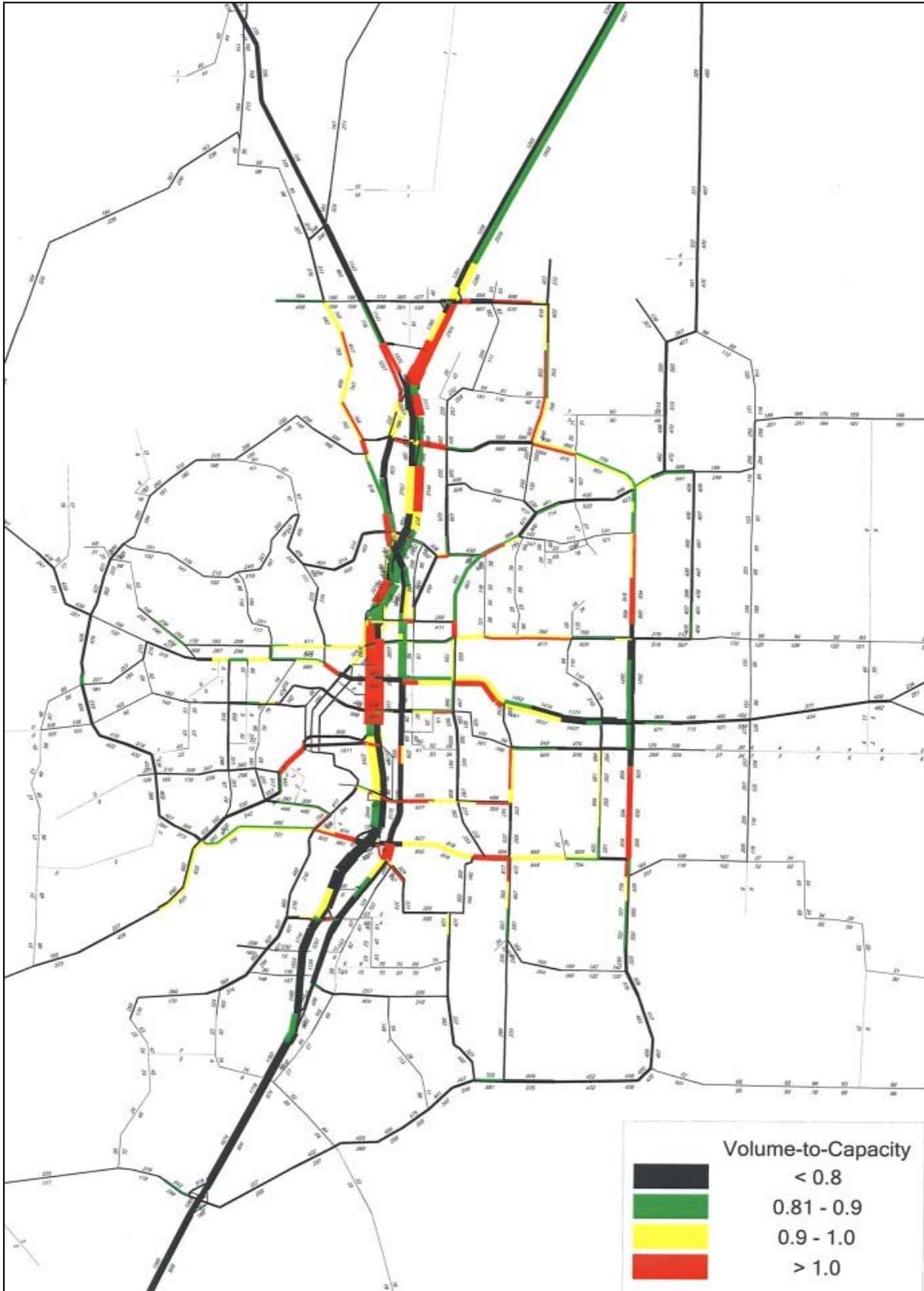
- Cooley Road (between Highway 97 and 18<sup>th</sup> Street)
- Reed Market Road (15<sup>th</sup> Street to Century Drive)<sup>4</sup>
- Highway 20
  - between Robal Lane and Highway 97
  - between 8<sup>th</sup> Street and 15<sup>th</sup> Street
- Highway 97
  - between Revere Avenue and Franklin Avenue
  - between Cooley Road and Empire Avenue
- 27<sup>th</sup> Street
  - between Reed Market Road and Bear Creek Road
  - between Neff Road and Wells Acres Road
- OB Riley Road (between Archie Briggs Road and Hardy Road)
- Colorado Avenue (between Industrial Way and Simpson Avenue)
- Neff Road (between 8<sup>th</sup> Street and Purcell Boulevard)
- 15<sup>th</sup> Street (between Bear Creek Road and Wilson Avenue)
- Empire Avenue (Boyd Acres Road and Highway 20)
- 18<sup>th</sup> Street (Empire Avenue to Egypt Drive)
- Wilson Avenue (between 15<sup>th</sup> Street and 9<sup>th</sup> Street)

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<sup>3</sup> 2000 *Highway Capacity Manual*, Transportation Research Board, 2000, Chapter 27.

<sup>4</sup> City of Bend TSP street policy #19 prohibits widening Reed Market Road from Century Drive to Bond Street.

**Figure 1- 2030 Committed Scenario System Performance Plot**



**Figure 6-1: 2030 Committed Scenario System Performance Plot**

Within the planning area, Highway 97 and Highway 20 generally have an operational v/c standard of 0.80. This standard is more stringent than the City's standard. In addition to the red segments shown in Figure 6-1, the green and yellow segments of Highway 97 and Highway 20 also fall below the jurisdictional standards. The most congested area on Highway 20 is generally concentrated between 3<sup>rd</sup> Street and Purcell Boulevard and does not meet operational standards for a significant portion of the corridor. Highway 97 also exhibits high congestion levels and does not meet jurisdictional standards for the majority of the corridor between Cooley Road and Reed Market Road under the 2030 Committed Scenario.

### Peak Hour Travel Speeds

PM peak hour travel speeds were also extracted from the future year (2030) model for the Committed Scenario along four corridors including:

- Reed Market Road (Bond Street to 27<sup>th</sup> Street)
- 27<sup>th</sup> Street (Butler Market Road to Reed Market Road)
- 3<sup>rd</sup> Street (Greenwood Avenue to Murphy Road)
- Highway 20 (3<sup>rd</sup> Street to 27<sup>th</sup> Street)

The model output provided average travel speeds by direction of travel. The comparison of travel speeds for existing and future years indicate general deficiencies in the roadway network; reduced travel speeds are attributed to increases in traffic flow. Table 6-4 summarizes the existing travel speeds extracted from the 2003 base model and the future 2030 Committed Scenario for the PM peak hour. As shown in the table, the travel speeds along the key roadways are to forecast to decrease by at least 17% in the future year (2030).

**Table 6-4: Corridor Travel Speeds<sup>5</sup> (PM Peak Hour)**

<b>Corridor</b>	<b>2003 (Existing)</b>	<b>2030 (Committed)</b>	<b>% Change</b>
Reed Market Road (eastbound)	30.6 mph	24.1 mph	-21%
Reed Market Road (westbound)	28.7 mph	23.7 mph	-17%
27 <sup>th</sup> Street (northbound)	39.5 mph	31.1 mph	-21%
27 <sup>th</sup> Street (southbound)	21.5 mph	15.9 mph	-26%
3 <sup>rd</sup> Street (northbound)	36.3 mph	29.6 mph	-18%
3 <sup>rd</sup> Street (southbound)	34.0 mph	28.2 mph	-17%
Highway 20 (eastbound)	35.8 mph	26.1 mph	-27%
Highway 20 (westbound)	34.8 mph	28.2 mph	-19%

<sup>5</sup> Corridor travel speeds were calculated based on methodology outlined in National Cooperative Highway Research Program (NCHRP) Report #387, Transportation Research Board. Washington D.C. 1987.

## Roadway System Improvements

The projected roadway directional volumes were reviewed to identify locations where capacity improvements might be required between intersections. The three locations identified were:

Highway 97 from Colorado Avenue to Highway 20 – through volumes are too high for conventional 4-lane arterial service and a separate refinement plan is needed to examine local capacity improvements and congestion management measures.

Reed Market from Parkway to 3rd Street—through volumes are too high for conventional 4-lane arterial service. The City has completed a corridor study and potential solutions include widening or other supplemental capacity on parallel routes to accommodate future volumes.

Highway 97 from Highway 20 to Cooley Road – through volumes are too high for conventional 4-lane arterial service. The US 97 North Bend Corridor Project is currently underway and will identify a long term solution for this section of Highway 97.

## **Future Intersection Capacity Analysis**

In addition to corridor level analysis, select intersections were evaluated for future year (2030) operations. The study intersections represent locations where traffic volumes are highest and where operations and capacity may be of concern. The capacity analysis included 67 intersections throughout the planning area and identified additional deficiencies and corresponding street improvements that would be necessary during the planning horizon. Year 2030 traffic volume forecasts were applied to existing intersection geometries and analyzed to identify locations where evening peak hour performance will drop below minimum desirable operational levels. Evaluating the transportation system at the intersection level highlights locations where the planned system does not meet the performance standards established for State, County and City facilities and identifies locations where roadway network improvements are needed to better serve the planned community growth.

Tables 6-5 and 6-6 summarize the existing weekday peak hour intersection operational levels at the study intersections for the 2030 Committed Scenario that either fail to meet operational requirements or are nearing capacity. Due to the number of intersections, only the intersections that do not meet jurisdictional standards are included in these tables, the remaining intersections are included in Appendix E.

## State Facilities

As shown in Table 6-5, nearly all of the state intersections controlled by traffic signals will fall below their minimum acceptable performance standards with only the committed improvements. Additionally, several of the intersections controlled by stop signs on the minor streets will require mitigation to meet performance standards. A few intersections

meet or exceed standards without any further improvements. Those include Highway 97 at 3<sup>rd</sup> Street and Highway 97 northbound ramps at Powers Road.

**Table 6-5: Future (2030) Committed Intersection Operations (ODOT)<sup>6</sup>**

<b>Intersection</b>	<b>LOS</b>	<b>Delay</b>	<b>v/c</b>	<b>Operational Standard (v/c ratio)</b>
<b><i>Unsignalized Intersections</i></b>				
Highway 20/Cooley Road	B/F	-	>1.0	0.80
Highway 97 SB/Empire Avenue	C/F	-	0.95	0.80
<b><i>Signalized Intersections</i></b>				
Highway 20/Greenwood Avenue	F	>80.0	>1.0	0.80
Highway 20/27th Street	F	>80.0	>1.0	0.80
Highway 20/Olney Avenue	D	54.1	>1.0	0.80
Highway 20/Empire Avenue	E	65.9	>1.0	0.80
Highway 20/Butler Market Road	E	66.7	>1.0	0.80
Highway 97 NB/Empire Avenue	E	65.9	>1.0	0.80
Highway 97/Cooley Road	C	28.2	0.96	0.80
Highway 97/Powers Road	F	>80.0	>1.0	0.80
Highway 97 SB Ramps/Reed Market Rd	E	58.4	>1.0	0.80
Highway 97/Robal Road	E	56.3	>1.0	0.80
Highway 97/Pinebrook Blvd	C	27.2	0.89	0.80

Notes: Unsignalized Intersections:

A/A = Minor Street turn LOS/Major street turn LOS

V/C = Individual lane groups

Delay = Individual lane groups

Signalized and All-Way Stop Intersections:

Delay = Average vehicle delay in the peak hour for entire intersection in seconds.

\*\*A complete list of study intersection operations is included in the Appendix of the report.

### City of Bend and Deschutes County Facilities

Table 6-6 summarizes the intersections that fall below the jurisdictional performance standard for the 2030 Committed Scenario on City of Bend and Deschutes County facilities. Several intersections (both signalized and unsignalized) fall below operational standards on City of Bend facilities. Generally, the recommended improvements include additional turn lanes, or upgrading of existing traffic signal controls to better serve higher peak hour demands above the committed projects included in this base case scenario. All of the Deschutes County intersections operate within the standards.

<sup>6</sup> Intersections that fall below the minimum performance standard.

**Table 6-6: Future (2030) Committed Intersection Operations  
(City of Bend and Deschutes County)<sup>7</sup>**

<b>Intersection</b>	<b>LOS</b>	<b>Delay</b>	<b>v/c</b>	<b>Operational Standard (v/c ratio)</b>
<b><i>Unsignalized Intersections</i></b>				
15 <sup>th</sup> Street/Knott Road	A/F	-	>1.0	-
Brosterhous Road/Knott Road	A/F	-	>1.0	-
Brookwood Blvd/Powers Road	A/F	-	>1.0	-
Cooley Road/Hunnell Road (east)	D/F	-	>1.0	-
Cooley Road/OB Riley Road	A/F	-	0.83	-
18 <sup>th</sup> Street/Empire Avenue	A/F	-	>1.0	-
<b><i>Signalized Intersections</i></b>				
3rd Street/Reed Market Road	F	>80	>1.0	1.0
27th Street/Neff Road	F	>80	>1.0	1.0
Reed Market Road/15th Street	F	>80	>1.0	1.0
Portland Ave – Olney Avenue/Wall Street	E	80.0	>1.0	1.0
Olney Avenue/8 <sup>th</sup> Street	F	>80	>1.0	1.0
Boyd Acres Road/Empire Avenue	F	>80	>1.0	1.0
3 <sup>rd</sup> Street/Franklin Avenue	E	61.9	>1.0	1.0
3 <sup>rd</sup> Street/Wilson Avenue	E	63.1	>1.0	1.0
Notes: Unsignalized Intersections:				
A/A = Minor Street turn LOS/Major street turn LOS				
V/C = Individual lane groups				
Delay = Individual lane groups				
Signalized and All-Way Stop Intersections:				
Delay = Average vehicle delay in the peak hour for entire intersection in seconds.				
**A complete list of study intersection operations is included in the Appendix of the report.				

In addition to the signalized and unsignalized intersection performance evaluated in the previous sections, intersections controlled as roundabouts were also evaluated. The resulting conditions for the existing and proposed roundabouts were acceptable in the future year (2030).

The corridor and intersection capacity deficiencies that were identified from the future travel demand model and operational analysis was focused primarily on arterial facilities and regionally significant collectors. Although extensive analysis was conducted on key regional roadway segments, there are limitations to the model and every intersection within the BMPO planning area was not analyzed. Operational issues not identified as part of this analysis but identified and documented in other planning studies have been considered and evaluated for inclusion within this plan.

<sup>7</sup> Intersections that fall below the minimum performance standard.

## Scenarios

As summarized in the previous section, the Committed Scenario has significant roadway system deficiencies in the future year (2030). Three additional future 2030 scenarios were developed that incorporated various system improvements to mitigate the poor performance of motor vehicle traffic growth identified in the Committed Scenario. These three scenarios were analyzed to determine the impact of additional projects on the transportation network and their ability to accommodate the future demand within the BMPO planning area for the future year (2030). The scenarios include:

- Bend Transportation System Plan (TSP)
- Capacity Enhancing
- Transit/Transportation Demand Management (TDM)

The assumptions that were included for each scenario are discussed in more detail below. A table was created for each scenario that outlines the location of the project, the project, the jurisdiction and a preliminary planning level cost estimate for the projects.

### Transportation System Plan (TSP)

The TSP scenario includes the completion of all proposed roadway projects identified in the City of Bend's Transportation System Plan<sup>8</sup>. The City's plan outlines a series of recommended motor vehicle projects needed by the year 2020 to accommodate the projected growth in the City's planning area. The BMPO planning area shares a similar study area with the City's TSP boundaries. The list of future year 2020 projects that were applicable to the regional study area is summarized in Table 6-7 and includes a number of new roads and roadway extension projects along with planning-level cost estimates for each project.

**Table 6-7: Transportation System Plan (TSP) Projects**

Location	From	To	Improvement <sup>9</sup>	Jurisdiction	Planning Level Cost (\$1000s) <sup>10</sup>
Cooley Road	18 <sup>th</sup> Street	Deschutes Market Road	Construct 3-lane road extension	Bend/Deschutes County	\$11,867

<sup>8</sup> Bend Urban Area Transportation System Plan, City of Bend. Adopted October 2000.

<sup>9</sup> Roadway improvement costs include the construction of sidewalks and bicycle lanes.

<sup>10</sup> System Development Charge Inventory (City of Bend) Amended DRAFT, June 2006. The costs identified for these TSP projects include the construction of sidewalks and bicycle lanes

Location	From	To	Improvement <sup>9</sup>	Jurisdiction	Planning Level Cost (\$1000s) <sup>10</sup>
Reed Market Road	US97	15 <sup>th</sup> Street	Widen roadway to 5 lanes, including multi-lane roundabouts at Division Street and 3 <sup>rd</sup> Street, and a bridge over the railroad.	Bend	\$37,515
Reed Market Road	15 <sup>th</sup> Street	27 <sup>th</sup> Street	Widen roadway to 5 lanes	Bend	\$8,365
Reed Market Road	15 <sup>th</sup> Street		Construct multi-lane roundabout	Bend	\$1,500
27 <sup>th</sup> Street	Butler Market Road	Neff Road	Widen roadway to 5 lanes	Bend	\$10,580
Reed Market Road	27 <sup>th</sup> Street Intersection		Realign Stevens Rd to connect directly to Reed Market	Bend	\$5,210
27 <sup>th</sup> Street	Reed Market Road	Bear Creek Road	Widen roadway to 5 lanes	Bend	\$7,790
Cooley Road	OB Riley Road	OB Riley Road	Construct 2-lane loop extension	Bend	\$10,863
Murphy Road Extension	Brosterhous Road	15 <sup>th</sup> Street	Construct 3-lane road extension	Bend	\$3,240

### Capacity Enhancing

The Capacity Enhancing Scenario includes the projects assumed for the Committed Scenario (Table 6-3), all of the 2020 TSP projects (Table 6-7) plus additional capacity projects to address the future demands of the BMPO planning area. The additional projects enhance the transportation system, primarily by adding capacity to the roadway including the following types of improvements:

- Roadway Expansion;
- Roadway Extension; and
- Intersection Capacity Improvements

The specific list of projects assumed for this scenario is outlined in Table 6-8.

**Table 6-8: Motor-Vehicle Capacity Enhancing Transportation Improvements**

<b>Location</b>	<b>From</b>	<b>To</b>	<b>Improvement</b>	<b>Jurisdiction</b>	<b>Planning Level Cost (\$1,000s)<sup>11</sup></b>
Empire Avenue	3 <sup>rd</sup> Street	US 97 (Parkway)	Add one travel lane in each direction	Bend/ODOT	\$4,620
Empire Avenue	US 97 (Parkway)	Boyd Acres Road	Add one travel lane in each direction	Bend/ODOT	\$2,235
Empire Avenue	Boyd Acres Road	18 <sup>th</sup> Street	Add one travel lane in each direction	Bend	\$5,960
Empire Avenue	18 <sup>th</sup> Street	Purcell Boulevard	Add one travel lane in each direction	Bend	\$2,980
Empire Avenue	Purcell Boulevard	Butler Market Road	Add one travel lane in each direction	Bend	\$7,325
Murphy Road	15 <sup>th</sup> Street	Rickard Road	Roadway extension	Bend	\$10,215
Murphy Road	15 <sup>th</sup> Street		Construct roundabout	Bend	\$800
Empire Avenue	18 <sup>th</sup> Street		Construct multi-lane roundabout	Bend	\$1,200
Empire Avenue	Purcell Boulevard		Construct roundabout	Bend	\$1,200
27 <sup>th</sup> Street	Neff Road		Construct multi-lane roundabout	Bend	\$1,200
Empire Avenue	Parkway SB Ramp		Install traffic signal	Bend/ODOT	\$250
Colorado Avenue	US 97 Parkway east ramps		Install traffic signal at NB ramps	Bend	\$250
O.B. Riley Road	Empire Avenue		Install traffic signal	Bend	\$250
Powers Road*	US 97 (Parkway)		Construct interchange and remove signal	ODOT/Bend	\$5,000
Powers Road*	Interchange	3 <sup>rd</sup> Street	2 lanes in each direction	ODOT/Bend	\$1,345
Powers Road*	Interchange	Brookwood Boulevard	2 lanes in each direction	ODOT/Bend	\$2,235
US 97*	Badger Road		Close intersections	ODOT	\$50

<sup>11</sup> Costs estimated by DKS Associates, January 2007

Location	From	To	Improvement	Jurisdiction	Planning Level Cost (\$1,000s) <sup>11</sup>
US 97*	Pinebrook Boulevard		Remove signal and close west leg access	ODOT	\$50
Murphy Road	North Frontage Road	Parrell Road	Construct 2 lane minor arterial with raised median, left turn lanes and roundabout	Bend	\$11,225
Murphy Road	Brookwood Boulevard	South Frontage Road	Construct 2 lane minor arterial	Bend	\$3,625
Murphy Road	South Frontage Road	North Frontage Road	Construct 3 lane minor arterial and roundabout	Bend	\$1,880
Murphy Road	3 <sup>rd</sup> Street		Remove old traffic signal and install traffic signal at new intersection alignment	Bend	\$275
US 97*	3 <sup>rd</sup> Street	Parkway	Remove signal and add single-lane flyover connection from SB 3 <sup>rd</sup> Street to SB US 97	ODOT	\$6,625
US 97 NB off-ramp*	Empire Avenue		Add one ramp lane	ODOT	\$1,140
US 97 SB off-ramp*	Empire Avenue		Add new single lane ramp	ODOT	\$1,325
Murphy Road	3 <sup>rd</sup> Street	NB US 97	Single lane ramp	ODOT	\$515
Murphy Road	SB US 97	New collector	Single lane ramp	ODOT	\$1,790
3 <sup>rd</sup> Street	Pinebrook Boulevard		Install traffic signal	Bend	\$250
Powers Road*	NB Ramp and SB Ramp		Install traffic signal at each ramp terminal	ODOT	\$500

*\*Prior to a final decision on which Parkway intersections and ramps should be improved, modified, or closed, a comprehensive modeling effort should be conducted to determine the net effect on the City and State system of these corridor modifications. The South Parkway/Murphy Interchange Area Management Plan is currently being developed to identify alignments and timing for South Parkway projects.*

## Transit/Transportation Demand Management (TDM)

Both the Capacity and TSP Scenarios evaluate the impacts of enhancing the transportation system by adding new roadway capacity, extending existing roadways or improving intersections. Transportation Demand Management (TDM) is the general term used to describe any action that reduces single occupant vehicle trips from the roadway network especially during peak travel demand periods. As growth in the BMPO planning area occurs, the number of vehicle trips and travel demand in the area will also increase. The ability to change a user's travel behavior and provide alternative mode choices will help accommodate this growth.

The Transit/TDM Scenario includes projects related to future transit service improvements, park-and-ride lots and other techniques aimed at reducing the demand on the transportation infrastructure. This scenario included six new transit routes including: 1) 14<sup>th</sup> Street/3<sup>rd</sup> Street loop, 2) Neff Road/Empire Avenue loop, 3) Brookwood Boulevard/S US97 loop, 4) Murphy Road/15<sup>th</sup> Street loop, 5) US20/Reed Market Road loop, and 6) Boyd Acres Road/Cooley Road loop. Additionally, several new park-and-ride lots were identified. The park-and-ride projects included in this scenario are summarized in Table 6-9.

**Table 6-9: New Park-and-Ride Lots**

Location	Improvement	Jurisdiction
Cascade Village	Park-and-Ride	Bend
Forum Shopping Center	Park-and-Ride	Bend
Wal-Mart	Park-and-Ride	Bend
Country Store (Baker Road)	Park-and-Ride	Bend
ODOT (3 <sup>rd</sup> Street)	Park-and-Ride	Bend

## Evaluation Process

Evaluation criteria were developed to help guide the selection of future roadway projects within the BMPO planning area and provide qualitative and quantitative measures for each goal category developed at the onset of the planning process. The evaluation criteria are categorized into two levels; the first level of evaluation includes criteria that can be used for general screening purposes and evaluates how well potential projects meet the established goals and policies. The second level of evaluation includes a more detailed system-wide analysis that evaluates specific projects included in the travel demand model. Table 6-10 outlines the first level of recommended evaluation criteria categorized by goal category. The table includes both quantitative and qualitative measures of effectiveness that are applied to the future (2030) scenarios and roadway improvement projects to prioritize projects for inclusion in the Preferred Scenario.

**Table 6-10: Recommended Evaluation Criteria**

Goal Category	Measure of Effectiveness	Type of Criteria
<b>Project Level Criteria</b>		
<b>Mobility and Balance</b>	<ul style="list-style-type: none"> <li>▪ Level-of-service (intersections)</li> <li>▪ Volume-to-capacity ratio</li> <li>▪ Travel speeds</li> <li>▪ Provides balance of modes of travel</li> </ul>	<ul style="list-style-type: none"> <li>●</li> <li>●</li> <li>●</li> <li>○</li> </ul>
<b>Safety and Efficiency</b>	<ul style="list-style-type: none"> <li>▪ Ability to address existing safety issues</li> <li>▪ Ability to support TSM measures</li> <li>▪ Supports ITS corridor</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> <li>○</li> </ul>
<b>Environment and Livability</b>	<ul style="list-style-type: none"> <li>▪ Impact to environmentally sensitive land</li> <li>▪ Impact to resource land</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> </ul>
<b>Economic Development</b>	<ul style="list-style-type: none"> <li>▪ Provision for economic revitalization</li> <li>▪ Supports freight mobility</li> <li>▪ Supports ITS corridor</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> <li>○</li> </ul>
<b>Program Level Criteria</b>		
<b>Accessibility and Equity</b>	<ul style="list-style-type: none"> <li>▪ Ability to provide Transportation Demand Management (TDM)</li> <li>▪ Connectivity of travel modes</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> </ul>
<b>Land Use</b>	<ul style="list-style-type: none"> <li>▪ Ability to support multi-modal transportation development</li> <li>▪ Improve street connectivity</li> <li>▪ Provide alternatives to state route system for local travel</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> <li>○</li> </ul>
<b>Financially Responsible</b>	<ul style="list-style-type: none"> <li>▪ Capital cost of alternatives</li> <li>▪ Opportunity to promote public / private partnership</li> </ul>	<ul style="list-style-type: none"> <li>●</li> <li>○</li> </ul>

- Notes**
- = Quantitative (Absolute value from technical methods)
  - = Qualitative (Relative value based on judgment)

The Bend MPO travel demand model (developed by TPAU) was used to analyze several quantitative measures. This section describes the system performance measures used to evaluate the different scenarios and presents the results of the overall system wide performance evaluation.

### Model Scenario Post-Processing

Each model scenario was post-processed to evaluate the impacts of the scenarios on the regional transportation system. These criteria are most relevant during the initial stages of project development for general screening purposes and planning purposes. The criteria have been refined by the BMPO and are used to determine the projects to be selected for inclusion in the plan.

A system-wide evaluation for the future year (2030) of the BMPO planning area was conducted on the post-processed model data. The evaluation criteria and results are discussed below.

- **Travel times during the PM peak hour** -- Traffic flow can be measured by computing the time it takes to complete a trip during the PM peak hour (which is

typically the most congested period of the day). The measure can be determined for specific corridors or the average for the entire planning area transportation system.

- **Vehicle Miles Traveled (VMT) during the PM peak hour** -- This measure evaluates the total miles traveled by all vehicles over a selected transportation corridor during the PM peak hour.
- **Vehicle Hours Traveled (VHT) during the PM peak hour** -- This measure evaluates the total hours traveled by all vehicles over a selected transportation corridor during the PM peak hour.
- **Total Lane Miles** -- This measure evaluates the length of driving lanes multiplied by the number of driving lanes for the total transportation roadway network.
- **Demand/Capacity Ratio** -- The measure of congestion can be measured by the demand/capacity ratio which determines the ratio of vehicles over the capacity of a roadway. The travel demand model has the capacity of evaluating the overall flow of traffic over the length of a specified corridor. D/C ratios that are higher than 0.80 affect driving decisions due to the presence of other vehicles. A D/C ratio of 1.0 indicates significant congestion.
- **Number/Percentage of Congested Lane Miles during the PM peak hour** -- Congestion on the roadway network is defined by a threshold of the demand over capacity ratio. The number and percentage of lane miles that operate with a D/C ratio over 0.80 are characterized by “congested conditions”. The level of congestion can also be determined by a scale of D/C ratios that include free flow, moderately congested, and congested.

The following tables (Table 6-11 thru Table 6-14) compare numerous evaluation measures that were calculated from the base year (2003) and future year (2030) model output. The evaluation of these scenarios will guide the selection of a Preferred Scenario.

**Table 6-11: System-wide Performance Measures (PM Peak Hour)**

PM Peak Hour Performance Measures	EXISTING	FUTURE			
	Base Year (2003)	Committed (2030)	TSP (2030)	Capacity (2030)	Transit/TDM (2030)
<b>City of Bend Facilities</b>					
Vehicle Miles Traveled (VMT)	49,493	84,842	85,723	86,865	84,859
Vehicle Hours Traveled (VHT)	1,325	2,389	2,352	2,353	2,387
<b>Deschutes County Facilities</b>					
Vehicle Miles Traveled (VMT)	17,095	29,196	27,564	27,902	29,247
Vehicle Hours Traveled (VHT)	350	626	579	582	628
<b>ODOT Facilities</b>					
Vehicle Miles	56,150	82,573	82,649	81,202	82,353

Traveled (VMT)					
Vehicle Hours Traveled (VHT)	1,124	1,857	1,836	1,790	1,850
<b>Total (All Facilities)</b>					
Average Travel Time (minutes)	6.09	6.83	6.65	6.59	6.80
Vehicle Miles Traveled (VMT)	122,728	196,661	195,936	225,969	196,459
Vehicle Hours Traveled (VHT)	2,799	4,872	4,767	4,725	4,865

Table 6-11 outlines critical evaluation measures such as the peak hour average travel time, vehicle miles traveled and vehicle hours traveled for City of Bend, Deschutes County and ODOT facilities. These measures are quantitative measures that are typically used to evaluate the transportation network and effectively indicate future travel patterns compared to the base year (2003) and future year Committed Scenario (2030). Compared to the Committed Scenario, the Transit/TDM scenario exhibits minimal changes to the transportation network for the city, county and state facilities. The average travel times for the PM peak hour stay the same for each facility type and are most improved with the Capacity (2030) Scenario, as compared to the Committed Scenario.

**Table 6-12: Percentage of Congested Lane-Miles (PM Peak Hour)**

	EXISTING	FUTURE			
	Base Year (2003)	Committed (2030)	TSP (2030)	Capacity (2030)	Transit / TDM (2030)
<b>City of Bend Facilities</b>					
Total Lane Miles	235	240	260	272	240
Congested Lane Miles	2	31	25	21	30
% of Congested Lane Miles	1%	13%	10%	8%	13%
<b>Deschutes County Facilities</b>					
Total Lane Miles	226	234	243	247	236
Congested Lane Miles	0	2	1	1	2
% of Congested Lane Miles	0%	1%	0%	<1%	1%
<b>ODOT Facilities</b>					
Total Lane Miles	118	116	116	119	116
Congested Lane Miles	1	20	19	17	21
% of Congested Lane Miles	1%	17%	16%	14%	18%

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Note: Congestion defined as model links with demand/capacity ratio  $\geq 0.90$   
ODOT operational standard:  $v/c = 0.80$

Table 6-12 illustrates a similar trend of evaluation results; the Capacity Scenario has the most significant effects on the future roadway network. There are more total lane miles due to the number of roadway extension and expansion projects, but the percentage of congested lane miles decreases by 3%-5% for City of Bend and ODOT facilities with the improvements included in the Capacity Scenario.

Table 6-13 and Table 6-14 provide a summary of future year (2030) congested conditions. D/C ratios that are greater than 1.0 indicate congested conditions on the roadway network. The City of Bend maintains the highest percentage of roadway facilities within the BMPO planning area.

**Table 6-13: Percentage of Total Lane Miles by Demand/Capacity Ratio (PM Peak Hour)**

Demand/ Capacity Ratio	EXISTING		FUTURE							
	Base Year (2003)		Committed (2030)		TSP (2030)		Capacity (2030)		Transit/TDM (2030)	
	Lane Miles	%	Lane Miles	%	Lane Miles	%	Lane Miles	%	Lane Miles	%
<b>City of Bend Facilities</b>										
0.0-0.59	209	89%	162	68%	181	69%	190	70%	161	67%
0.60-0.69	10	4%	16	6%	19	7%	25	9%	16	7%
0.70-0.79	8	3%	15	6%	19	7%	21	8%	15	6%
0.80-0.89	5	2%	15	6%	15	6%	14	5%	16	6%
0.90-0.99	3	2%	16	7%	17	7%	15	5%	16	7%
≥1.0	0	0%	16	7%	9	4%	8	3%	16	7%
<b>Total</b>	<b>235</b>	<b>100%</b>	<b>240</b>	<b>100%</b>	<b>260</b>	<b>100%</b>	<b>273</b>	<b>100%</b>	<b>240</b>	<b>100%</b>
<b>Deschutes County Facilities</b>										
0.0-0.59	226	100%	218	93%	236	97%	240	97%	218	93%
0.60-0.69	0	0%	10	4%	2	1%	3	1%	10	4%
0.70-0.79	0	0%	2	1%	2	1%	2	1%	3	1%
0.80-0.89	0	0%	2	1%	2	1%	1	1%	2	1%
0.90-0.99	0	0%	1	1%	0	0%	1	0%	2	1%
≥1.0	0	0%	1	0%	1	0%	0	0%	1	0%
<b>Total</b>	<b>226</b>	<b>100%</b>	<b>234</b>	<b>100%</b>	<b>243</b>	<b>100%</b>	<b>247</b>	<b>100%</b>	<b>236</b>	<b>100%</b>
<b>ODOT Facilities</b>										
0.0-0.59	87	74%	55	47%	55	47%	65	55%	55	47%
0.60-0.69	18	15%	12	10%	11	7%	7	6%	9	8%
0.70-0.79	8	7%	10	9%	11	9%	13	11%	12	10%
0.80-0.89	4	3%	18	16%	19	17%	16	13%	18	16%
0.90-0.99	1	1%	10	9%	10	9%	7	6%	10	9%
≥1.0	0	0%	11	10%	10	8%	11	9%	12	10%
<b>Total</b>	<b>118</b>	<b>100%</b>	<b>116</b>	<b>100%</b>	<b>116</b>	<b>100%</b>	<b>119</b>	<b>100%</b>	<b>116</b>	<b>100%</b>

As shown in Table 6-13, ODOT facilities exhibit a higher percentage of congested roadway conditions for the PM peak hour for each of the future year (2030) scenarios (indicated by D/C ratios greater than 1.0). According to the model analysis, the TSP scenario and Capacity scenario resulted in similar levels of congested facilities for the City of Bend, Deschutes County and ODOT facilities.

**Table 6-14: Percentage of VMT by Demand/Capacity Ratio (PM Peak Hour)**

Demand/ Capacity Ratio	Existing		Future							
	Base Year (2003)		Committed (2030)		TSP (2030)		Capacity (2030)		Transit/TDM (2030)	
	VMT	%	VMT	%	VMT	%	VMT	%	VMT	%
<b>City of Bend Facilities</b>										
0.0-0.59	34,128	69%	32,286	38%	33,250	39%	34,014	39%	31,922	38%
0.60-0.69	4766	10%	7947	9%	9596	11%	12,783	15%	8258	10%
0.70-0.79	4611	9%	9067	11%	11,737	14%	12,985	15%	8736	10%
0.80-0.89	3512	7%	9965	12%	10198	12%	9329	11%	10,271	12%
0.90-0.99	2074	4%	11410	13%	12,822	15%	10,989	13%	11,933	14%
≥1.0	402	1%	14167	17%	8120	9%	6765	7%	13,739	16%
<b>Total</b>	<b>49,493</b>	<b>100%</b>	<b>84,842</b>	<b>100%</b>	<b>85,723</b>	<b>100%</b>	<b>86,865</b>	<b>100%</b>	<b>84,859</b>	<b>100%</b>
<b>Deschutes County Facilities</b>										
0.0-0.59	16,901	99%	20,085	69%	23,408	85%	23,579	85%	20,077	69%
0.60-0.69	0	0%	4736	16%	1098	4%	1771	6%	4614	16%
0.70-0.79	0	0%	1257	4%	890	3%	1045	4%	1419	5%
0.80-0.89	0	0%	1442	5%	1440	5%	407	1%	1291	4%
0.90-0.99	0	0%	1116	4%	194	1%	777	3%	1395	5%
≥1.0	194	1%	560	2%	534	2%	323	1%	451	1%
<b>Total</b>	<b>17,095</b>	<b>100%</b>	<b>29,196</b>	<b>100%</b>	<b>27,564</b>	<b>100%</b>	<b>27,902</b>	<b>100%</b>	<b>29,247</b>	<b>100%</b>
<b>ODOT Facilities</b>										
0.0-0.59	32,039	57%	22,184	27%	22,269	27%	26,742	33%	22,134	27%
0.60-0.69	12,936	23%	8667	10%	8406	10%	5158	6%	6697	8%
0.70-0.79	6865	12%	9066	11%	9109	11%	10,349	13%	11,252	14%
0.80-0.89	3,462	6%	17,736	21%	19,141	23%	16,992	21%	17,826	22%
0.90-0.99	705	2%	10,194	12%	9967	12%	7694	9%	9563	12%
≥1.0	143	0%	14,726	19%	13,757	17%	14,267	18%	14,881	17%
<b>Total</b>	<b>87,350</b>	<b>100%</b>	<b>82,573</b>	<b>100%</b>	<b>82,649</b>	<b>100%</b>	<b>81,202</b>	<b>100%</b>	<b>82,353</b>	<b>100%</b>

As noted previously, the Capacity Scenario has a higher number of total lane miles due to a number of roadway projects modeled in the scenario, but it still yields the lowest percentage of congested vehicle miles traveled compared to the three scenarios.

Another system-wide performance measure that was evaluated includes speeds through the transportation network. PM peak hour speeds were extracted from the future year (2030) model for each of the four scenarios along four select corridors including:

- Reed Market Road (Bond Street to 27<sup>th</sup> Street)
- 27<sup>th</sup> Street (Butler Market Road to Reed Market Road)
- 3<sup>rd</sup> Street (Greenwood Avenue to Murphy Road)

- Highway 20 (3<sup>rd</sup> Street to 27<sup>th</sup> Street)

Table 6-15 summarizes the PM peak hour speeds along these corridors. Compared to the Committed Scenario, the speeds along the corridors increase for each of the other three scenarios and indicate that the roadway improvement projects improve the operations on these specific corridors. The Transit/TDM scenario has the least impact on the select corridors and although there are some improvements, they are relatively small compared to the Capacity Enhancing and TSP scenarios which have more significant roadway improvements included in the model. Travel speeds represent one system-wide measure of evaluating the changes to the roadway network and comparing differences between each scenario.

**Table 6-15: Future (2030) Corridor Speed Summary (by direction)**

<b>Corridor</b>	<b>Committed</b>	<b>TSP</b>	<b>Capacity</b>	<b>Transit/TDM</b>
	<i>Speed (mph)</i>	<i>Speed (mph)</i>	<i>Speed (mph)</i>	<i>Speed (mph)</i>
Reed Market Road (eastbound)	24.1	30.2	31.5	27.7
Reed Market Road (westbound)	23.7	30.5	31.2	27.3
27 <sup>th</sup> Street (northbound)	31.1	36.6	34.7	32.2
27 <sup>th</sup> Street (southbound)	15.9	18.1	17.6	16.8
3 <sup>rd</sup> Street (northbound)	29.6	34.4	36.9	35.9
3 <sup>rd</sup> Street (southbound)	28.2	31.7	32.0	31.6
Highway 20 (eastbound)	26.1	29.8	29.8	28.3
Highway 20 (westbound)	28.2	31.7	32.1	31.2

## Preferred Scenario

The preferred scenario includes the recommendations for the Bend Metropolitan Transportation Plan for the future year (2030). The Preferred Scenario for the future year was selected based on the system-wide system performance evaluation, the adopted goals and policies and the results of the financial analysis. The Preferred Scenario includes a list of projects that have been prioritized based on the established evaluation criteria outlined above and the financial constraints of the existing and future budget. The project list includes projects from all three of the scenarios that address the future capacity issues throughout the Bend MPO planning area. As mentioned previously, the project list only includes projects that have regional significance (generally arterials and above). All other projects are the responsibility of the City and County for implementation and they are not included in the Bend MTP list of preferred projects.

Numerous collector roadway projects were identified in each of the scenarios but were not included in the project lists due to the fact that many of projects that have little or no impact on the regional transportation system. The financial analysis that was developed

in coordination with the Bend MTP examined revenues for the arterial and collector systems. For the purpose of this regional analysis, a total cost for the collector project list over the MTP time period is included in Table 6-16, though several of the individual projects are not identified.

Powers Road and Murphy Road are both classified as collectors; however, due to the future connections to Highway 97, these roadways should be reclassified as minor arterials. This recommendation will be made in the next TSP update, but for the purpose of this document, projects on these roadways will be included in the preferred project list.

Table 6-16 summarizes the recommended roadway improvement projects under three jurisdictions: City of Bend, Deschutes County or ODOT. For most projects, the location includes a street segment defined by the street name with the project limits. This list is preliminary and the specific limits and location may be refined as further analysis is conducted and more information is obtained before construction occurs. The projects identified are at the planning level and many of the details were assumed based on the time-frame of construction and may be modified prior to construction. All of the projects identified in the preferred scenario have a project number that is mapped on Figures 6-2 and 6-3. Roadway expansion and extension projects are illustrated in Figure 6-2; intersection improvements and roundabouts are illustrated in Figure 6-3.

Table 6-16 also includes total project costs for Intelligent Transportation System (ITS) projects identified and outline in Chapter 10 for deployment throughout the BMPO planning area. The ITS projects recommended for implementation have already been prioritized into short-term, medium-term and long-term and have shared cost responsibility between agencies. These details are included in Chapter 10, but it is important that the cost be included as part of the Preferred Scenario motor vehicle project list to secure funding for implementation.

### **Project Priority**

The projects were selected and prioritized based on funding availability, the established evaluation criteria, and the impact of the projects within the BMPO planning area. The evaluation criteria were introduced in the previous section and include a series of quantitative and qualitative project level criteria. An evaluation matrix was developed with each of the roadway improvement projects and all of the evaluation criteria. The qualitative measures were given a score of -1 (negative), 0 (neutral), or +1 (positive) to reflect how well the potential roadway improvement project meets the evaluation criteria. The change in the V/C (volume-to-capacity ratios) before and after the construction of the project was also determined; this change was then multiplied by the future volume to determine a value of utility for comparison between different roadway improvement projects. These values were determined from model output from the future (2030) Committed scenario and the future (2030) Capacity scenario. Limited travel speed output was also obtained from the model; long segments of roadway improvements have cumulative gains in travel speeds. A few corridor projects that were evaluated fit this category and were given a score of +1 to reflect the benefit. The total

scores for each project were then compared and ranked to determine the final project priority. Each criterion was weighted equally. The highest numerical score equates to the highest project ranking (short-term projects). The evaluation matrix is included in the Appendix.

Table 6-16 outlines the prioritized projects into 3 categories, including short-term, medium-term, and long term. As a general guide, the short-term projects are expected to occur between 2007 and 2012; the medium-term projects between 2012 and 2017; and the long-term projects include projects that will occur more than ten years after the plan has been adopted.

These potential roadway improvement projects are needed to comply with adopted policies and standards within the BMPO area. The project priority listed in the table serves only as a guide for implementation. Changes in development patterns, funding availability and other factors may influence the order that projects are constructed throughout the BMPO planning area.

**Table 6-16: Financially Constrained / Preferred Scenario-Project List**

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)*
1	Cooley Road (Bend/ Deschutes County)	18 <sup>th</sup> Street	Deschutes Market Road	Construct 3 lane road extension	Short	\$11,870
11	Reed Market Road (Bend)	15 <sup>th</sup> Street	27 <sup>th</sup> Street	Widen roadway to 3 lanes	Short	\$4,800
31	Reed Market Road (Bend)	15 <sup>th</sup> Street		Construct multi-lane roundabout	Short	\$1,500
7	Empire Ave (Bend/ Deschutes County)	18 <sup>th</sup> Street	Purcell Boulevard	Add one travel lane in each direction	Short	\$2,980
26	Empire Avenue (Bend)	18 <sup>th</sup> Street		Construct multi-lane roundabout	Short	\$1,200
8	Empire Avenue	Purcell Boulevard	27 <sup>th</sup> Street extension	Construct two-lane roadway & construct multi-lane roundabout at 27 <sup>th</sup> St/Empire Ave	Short	\$9,025
27	Empire Ave (Bend)	Purcell Boulevard		Construct multi-lane roundabout	Short	\$1,200
32	Brookwood Boulevard	Powers Road		Construct multi-lane roundabout	Short	\$2,500
	US 97 Corridor	Study		Planning Study & Access Mgmt Plan	Short	\$120
<b>Total Short-Term Project Cost: \$35,195</b>						
9	27 <sup>th</sup> Street (Bend)	Butler Market Road	Neff Road	Widen roadway to 5 lanes	Medium	\$10,580

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)*
10	Reed Market Road (Bend)	27 <sup>th</sup> Street Intersection		Realign Stevens to connect directly to Reed Market	Medium	\$5,210
12	Reed Market Road (Bend)	15 <sup>th</sup> Street	American Lane	Widen to 4 lanes and construct RR crossing	Medium	\$13,920
15	Powers Road (Bend/ODOT)	Interchange	3 <sup>rd</sup> Street	2 lanes in each direction	Medium	\$1,345
16	Powers Road (Bend/ODOT)	Interchange	Brookwood Boulevard	2 lanes in each direction	Medium	\$2,235
6	Empire Ave (Bend)	Boyd Acres Road	18 <sup>th</sup> Street	Add one travel lane in each direction	Medium	\$5,960
21	Murphy Road (Bend)	Brookwood Blvd	S. Frontage Road	Construct 2 lane minor arterial	Medium	\$3,625
20	Murphy Road (Bend)	S. Frontage Road	N. Frontage Road	Construct 3 lane minor arterial and roundabout	Medium	\$1,880
2	Empire Ave (Bend)	3 <sup>rd</sup> Street	Parkway	Add one travel lane in each direction	Medium	\$4,620
3	Empire Ave (Bend)	US 97 (Parkway)	Boyd Acres Road	Add one travel lane in each direction	Medium	\$2,235
39	Murphy Road (Bend)	15 <sup>th</sup> Street		Construct roundabout	Medium	\$800
29	27 <sup>th</sup> Street (Bend)	Neff Road		Construct multi-lane roundabout	Medium	\$1,200
24	Empire Avenue (Bend/ODOT)	Parkway SB Ramps		Install traffic signal	Medium	\$250
30	Colorado Avenue (Bend)	US 97 Parkway NB ramps		Install traffic signal at NB ramps	Medium	\$250
23	O.B. Riley Road (Bend)	Empire Avenue		Install traffic signal	Medium	\$250
22	Murphy Road (Bend)	Brosterhous Road	15 <sup>th</sup> Street	Roadway extension	Medium	\$3,240
<b>Total Medium-Term Project Cost: \$57,600</b>						
7,8	Empire Avenue	Purcell Boulevard	27 <sup>th</sup> Street extension	Add one travel lane in each direction	Long	\$7,320
14	Powers Rd (Bend/ODOT) **			Construct interchange	Long	\$5,000
40	27 <sup>th</sup> Street	Reed Market Road	Bear Creek Road	Widen roadway to 5 lanes	Long	\$7,790
11	Reed Market Road (Bend)	15 <sup>th</sup> Street	27 <sup>th</sup> Street	Widen roadway to 5 lanes	Long	\$8,365
13	Reed Market Road (Bend)	US97	American Lane	Widen roadway to 5 lanes, including multi-lane roundabouts Division Street, 3 <sup>rd</sup> Street and 4 <sup>th</sup> Street.	Long	\$23,595

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)*
35	US 97 (ODOT)**	Badger Road (East & West)		Closure of both right/in, right/out intersections	Long	\$50
36	US 97 (ODOT)**	Pinebrook Blvd		Remove signal and close west leg access	Long	\$50
38	Murphy Road (ODOT)	3 <sup>rd</sup> Street		Remove old traffic signal and install traffic signal at new intersection alignment	Long	\$275
5	US 97 NB off-ramp (ODOT)**	Empire Avenue		Add one ramp lane	Long	\$1,140
4	US 97 SB off-ramp (ODOT)**	Empire Avenue intersection		Add new single lane ramp	Long	\$1,320
19	US 97 (ODOT)**	3 <sup>rd</sup> Street		Remove signal and add single-lane flyover connection from SB 3 <sup>rd</sup> Street to SB US 97	Long	\$6,625
17	Murphy Road (Bend)	North Frontage Road	Parrell Road	Construct 2 lane minor arterial with left turn lanes, and roundabout. Construct single lane ramps between 3 <sup>rd</sup> Street and NB US 97 and between the new arterial and SB US 97	Long	\$11,225
37	3 <sup>rd</sup> Street (Bend)	Pinebrook Boulevard		Install traffic signal	Long	\$250
33,34	Powers Road (ODOT)	NB Ramp & SB Ramp		Install traffic signal at each ramp terminal	Long	\$500
<b>Total Long-Term Project Cost: \$73,505</b>						
<b>ITS Deployment Projects for Bend MP0<sup>12</sup>: \$17,330</b>						
<b>Total Project Cost (Collector Improvements): \$74,490</b>						
<b>TOTAL COST: \$258,120</b>						

*\*The project cost estimates do not include right-of-way costs. Right-of-way costs vary significantly with each project. Right-of-way costs will be addressed in the development/engineering phases of each project.*

*\*\*Prior to a final decision on which Parkway intersections and ramps should be improved, modified, or closed, a comprehensive modeling effort should be conducted to determine the net effect on the City and State system of these corridor modifications.*

## Revenue Analysis

A funding analysis<sup>13</sup> was conducted to determine the available funding resources for

<sup>12</sup> Projects have been identified and included in Chapter 10 of this plan.

transportation capital projects and public transportation operations in the Bend MPO area over the planning period for the MTP (2006-2030). Several road-related funding sources were identified at the federal, state, and local level for the planning period including:

- ODOT capital spending through the STIP from federal and state revenue sources and programs
- Federal Surface Transportation Program (STP) allocation (Bend MPO and Deschutes County)
- Federal High Priority Projects Program (HPPP) (ODOT)
- State Highway Fund (SHF) (ODOT, Deschutes County, and City of Bend)
- National Forest Reserve Revenue (Deschutes County)
- System Development Charges (SDC) (City of Bend)
- Transfers from Other Funds (City of Bend)
- Special Area Assessments, including Local Improvement Districts (LIDs) (Deschutes County and City of Bend)
- Other Miscellaneous Revenue (Deschutes County and City of Bend)

Funding resources were divided between capital (construction) projects and operation and maintenance (O & M). As part of the funding analysis, future projections for operations and maintenance costs were determined to estimate the amount of funding that will be available for capital projects. Table 6-17 includes the road-related capital funding that is reasonably available in the Bend MPO over the planning horizon. Two scenarios were identified; the low scenario and high scenario. Under the Low scenario for state highway fund revenues, no increase in gas tax or vehicle registration fees was assumed. For the High scenario, an increase in both the gas tax and vehicle registration fee was assumed.

**Table 6-17: Bend MPO Road-related Capital Funding 2007–2030**

<b>Jurisdiction</b>	<b>Low</b>	<b>High</b>
<b>ODOT</b>	<b>\$40.4</b>	<b>\$42.2</b>
STIP	\$17.6	\$19.4
STP	\$12.8	\$12.8
Discretionary	\$10.0	\$10.0
<b>Deschutes County</b>	<b>\$1.0</b>	<b>\$1.0</b>
<b>City of Bend</b>	<b>\$212.0</b>	<b>\$228.5</b>
SDC	\$197.6	\$197.6
Private	\$6.4	\$6.4
Unrestricted	\$8.0	\$24.6
<b>Total</b>	<b>\$253.3</b>	<b>\$271.7</b>

<sup>13</sup> Bend MTP Revenue Analysis, *ECONorthwest*. January 2007.

Note: The results are denoted in millions of 2006 dollars  
 Source: ECONorthwest

Based on the funding analysis, the amount of available funding ranges between 253 and 272 million dollars, for the low and high funding scenario respectively. The total cost estimate for the Preferred Scenario for the arterial network and state highway system is approximately 184 million dollars over the time period of the MTP (23 years). Additionally, 75 million dollars in improvements were identified for the collector system. With the addition of the collector projects, the total cost of the preferred scenario is approximately 258 million dollars. [Note: the project cost estimates do not include right-of-way (ROW) costs. Right-of-way costs vary significantly with each project and estimating those costs is very difficult. ROW costs will likely increase the overall cost of most projects.]

**Illustrative Project List**

Although the majority of projects included within this plan have available funding, most of the projects identified were of regional significance but did not address many deficiencies on the state system. Planning studies are underway that address the long-term facility needs for several sections along both Highway 97 and Highway 20. The outcomes of these plans will identify the general location, function and operational needs for the state system within the MPO. Given current funding trends for state facility improvements, any new state projects would require a fundamental change in funding opportunities and priorities to achieve many of them. The cost of these added improvements on state facilities will likely be very significant and it is expected that they will require a local match to implement. The impact on the MTP budget will need to be addressed through future plan amendments, once these new projects decisions have been concluded.

An illustrative list of potential new state facility projects was developed, as summarized in Table 6-18, that will serve as placeholders until the various planning studies and environmental reviews have been completed to provide better definition of the scope and scale of anticipated projects. As more funding becomes available, the Bend MPO would consider the implementation of these projects.

**Table 6-18: Illustrative Project List for State Facilities**

Project Description	Limits	Estimated Cost
US 97 Corridor Improvements	Juniper Ridge Planning Area to Empire Avenue	\$120-\$180 million
US 97 Corridor Improvements	Empire Avenue to Colorado Avenue	Unknown
US 20 Corridor Improvements	3rd Street to 27th Street	Unknown

## Further Study/Additional Analysis

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The projects listed in Table 6-16 address many of the intersection and corridor deficiencies that were identified for the future year (2030) within the Bend MPO planning area. Some of the identified deficiencies (based on ODOT's, City of Bend's and Deschutes County operational standards) were not resolved with the Preferred Scenario project list. The following intersections fail to meet operational standards in the future year with the Preferred Scenario project list:

- Highway 20/15<sup>th</sup> Street
- Highway 20/27<sup>th</sup> Street
- Highway 20/Revere Avenue
- Highway 20/Robal Road
- Highway 20/OB Riley Road
- Highway 97/Robal Road
- Highway 97 NB Ramps/Empire Avenue
- 3<sup>rd</sup> Street/Greenwood Avenue
- Highway 97 NB/SB Ramps/Colorado Avenue
- Highway 97 SB Ramps/Powers Road
- Highway 97 NB/SB Ramps/Butler Market Road

For many of these locations, the mitigation measures that were required were not feasible at the specified locations due to the following characteristics:

- The nature of mitigation (i.e. what was required may not have a significant impact on the actual overall operations of the intersection)
- Land/right-of-way constraints
- Existing condition of the intersection (already built-out to capacity)

Several intersections were identified on Highway 97 that will not meet operational standards in the future year, in addition to intersection capacity constraints the Average Daily Traffic (ADT) volumes along this four-lane facility for the future year (2030) are projected to be between 45,000–50,000 vehicles<sup>14</sup> per day. Additional north-south capacity, in the form of parallel local improvements should be considered in future analysis and MTP and/or TSP update. The Urban Growth Boundary (UGB) Expansion Study also includes the analysis of several different alternative roadway networks, including a network of arterial and collector improvements on the east side of Bend. This network will be evaluated further and included as part of the MTP update, along with other findings and recommendations from the UGB Expansion study.

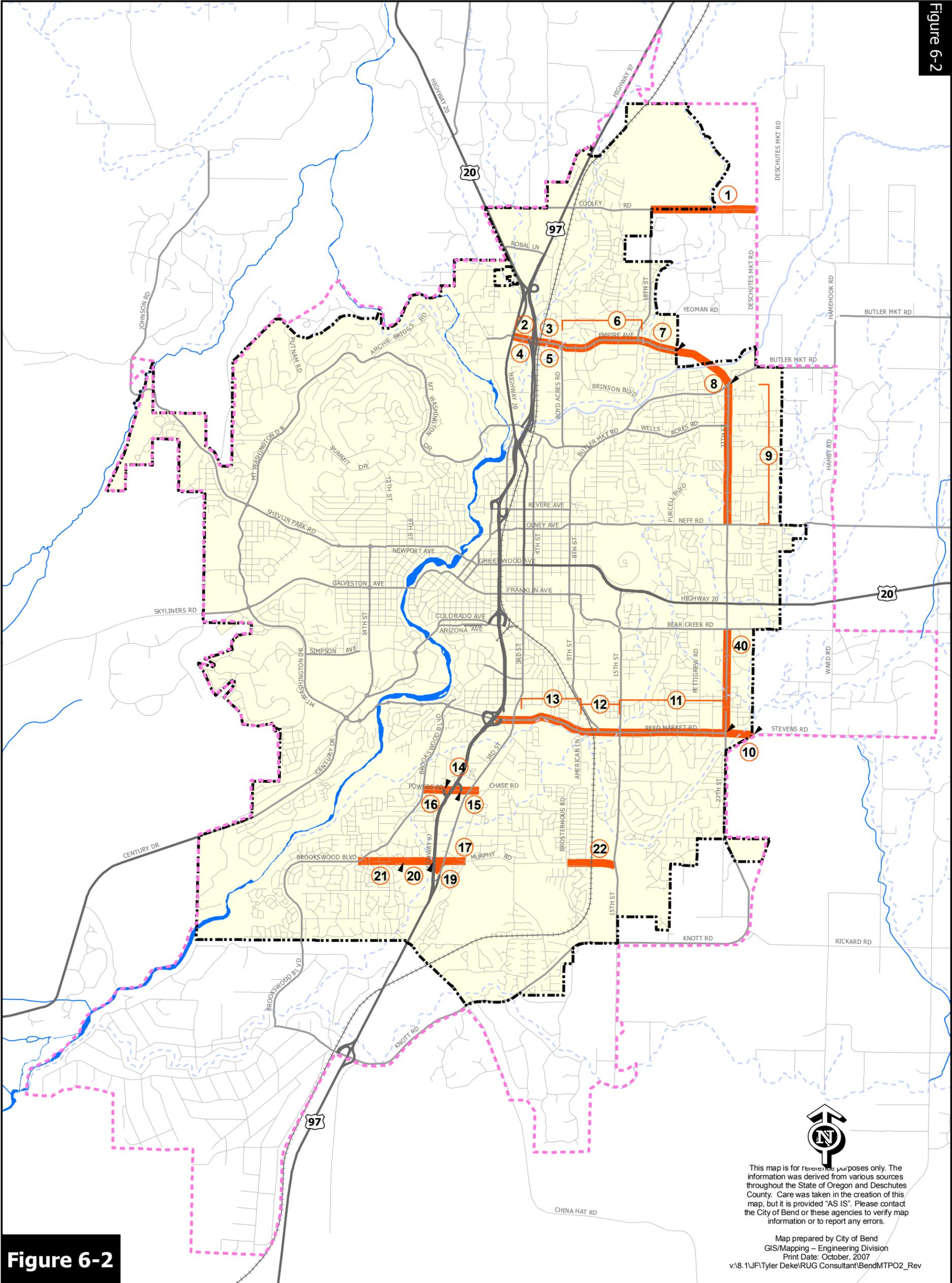
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<sup>14</sup> Based on 2030 travel demand model output.

Some operational issues on other City facilities on the west side of Bend have been understated, which could be a result of limitations to the travel demand model. Previous traffic studies indicate operational issues at Century Drive/Mt. Washington Drive and insufficient capacity on the Colorado Bridge and OB Riley Road. The west side arterial street system should be studied further to identify deficiencies and recommend potential regionally significant projects to be included in future updates of the MTP.

Additional improvements in the North Bend section of the metropolitan planning area will be evaluated through the Highway 97 Refinement Plan, the 97-20 NEPA process and a possible NE Bend Study. The project list developed in the Preferred Scenario will be amended to include projects identified as a result of these studies.

There are numerous highway segments and intersections that will not meet ODOT's mobility standards by the MTP's horizon year of 2030, consequently there will need to be additional analysis of options to address these deficiencies. Given the constraints and high costs which would be needed to provide sufficient capacity improvements to meet mobility standards, Transportation System Management (TSM) options such as access management and ramp metering should be considered. Alternate mobility standards may be considered for highway sections on Highway 20, but this will require additional evaluation and approval by ODOT. ODOT will not likely support or approve alternate mobility standards for Highway 97.



This map is for reference purposes only. The information was derived from various sources throughout the State of Oregon and Deschutes County. Care was taken in the creation of this map, but it is provided "AS IS". Please contact the City of Bend or these agencies to verify map information or to report any errors.

Map prepared by City of Bend  
 GIS/Mapping – Engineering Division  
 Print Date: October, 2007  
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Figure 6-2

# Bend MTP Future Proposed Roadway Improvements

June 2007

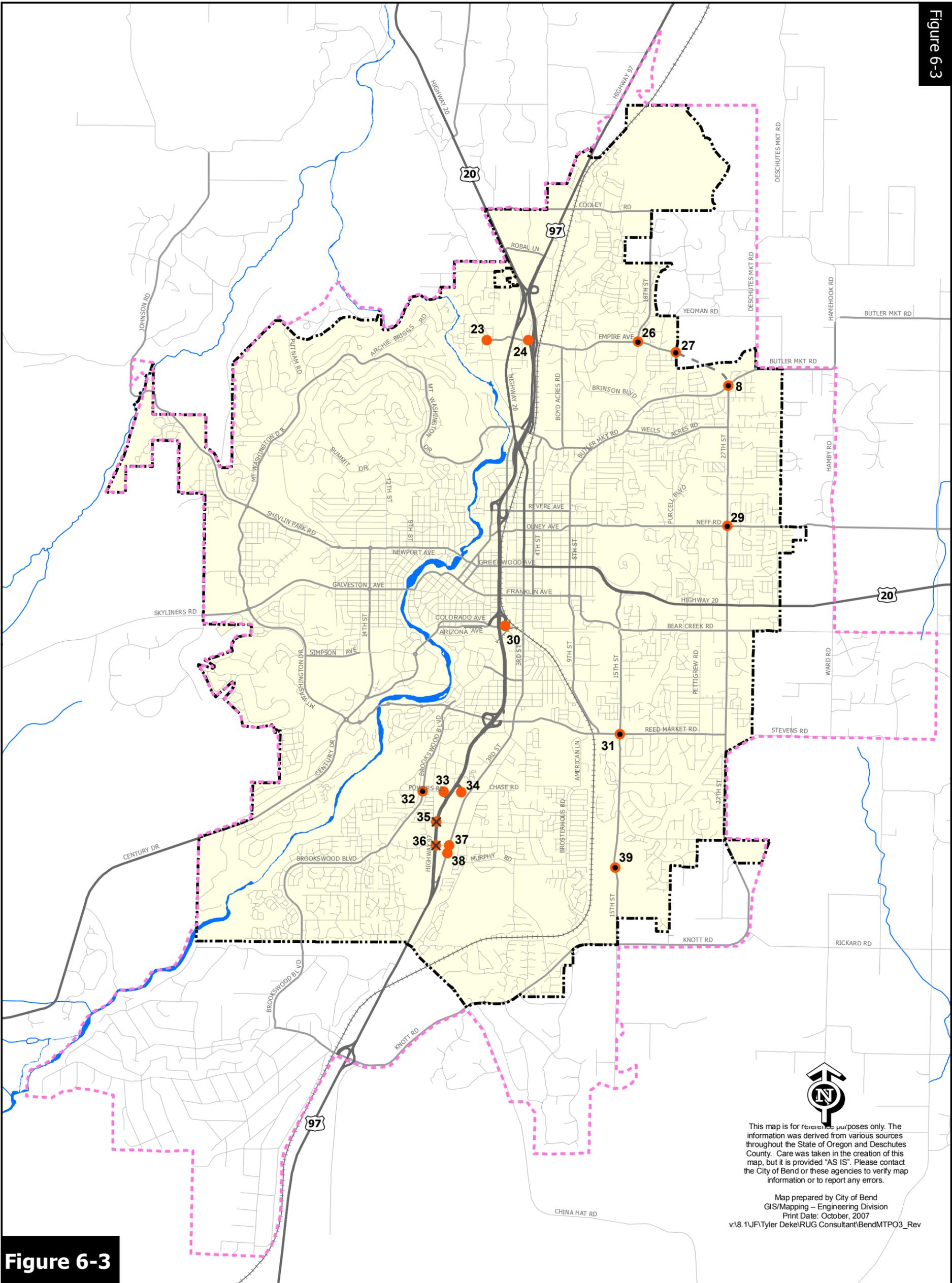
Data sources include:  
 City of Bend  
 Deschutes County GIS  
 ODOT  
 DKS Associates



## Legend

- State Highways
- Arterial Streets
- Roads
- Railroad
- MPO Boundary
- Roadway Expansion/ Extension Location
- Bend Urban Growth Boundary
- City Limits
- Streams
- Canals
- River





This map is for reference purposes only. The information was derived from various sources throughout the State of Oregon and Deschutes County. Care was taken in the creation of this map, but it is provided "AS IS". Please contact the City of Bend or these agencies to verify map information or to report any errors.

Map prepared by City of Bend  
 GIS/Mapping – Engineering Division  
 Print Date: October, 2007  
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**Figure 6-3**

# Bend MTP Future Proposed Roadway Improvements

June 2007



Data sources include:  
 City of Bend  
 Deschutes County GIS  
 ODOT  
 DKS Associates



Legend	
	Add Traffic Signal
	Construct Roundabout
	Closure of Intersection
	State Highways
	Arterial Streets
	Roads
	Railroad
	MPO Boundary
	Bend Urban Growth Boundary
	City Limits
	Streams
	Canals
	River

# Chapter 7: Pedestrian and Bicycle System

## Introduction

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Pedestrian and bicycle facilities are integral elements of the transportation system and valuable components in the strategy to reduce reliance on automobiles. The community benefits in many ways from adequate pedestrian and bicycle facilities including reducing traffic congestion, supporting tourism, and providing accessibility to all parts of the community. Further, the segment of the population without automobile access, benefits from quality pedestrian and bicycle facilities. The year 2000 US Census data show that approximately four percent of households in Deschutes County have no vehicles.

### Trip Potential

Travel by bicycle and foot has tremendous potential in the Bend urban area. A large part of this is attributable to the region's predominantly sunny weather and relatively flat terrain. In addition, the outdoor spirit of the citizenry, the desire to engage in healthy exercise and the interest in alternative modes of travel provide a strong population base for generating non-automobile trips. The visibility of pedestrian and bicycle traffic throughout the year confirms the importance of these travel options.

Bend's relatively small size makes travel by bicycle or foot fairly feasible. Depending on the type of trip, studies indicate a willingness of people to walk between a quarter and a half mile, and bicycle upwards to 2 or 3 miles. In 2006, the Oregon Department of Transportation (ODOT) funded the *Individual Transportation Options Pilot Project*. The project evaluated the transportation behavior of a random sample of persons in Bend. The results of the project showed that 16 percent of all automobile trips are one mile or less and 56 percent are three miles or less. These data suggest that many trips could possibly be made on bicycle or on foot.

The 2000 census data shows walking and bicycling accounted for about six-percent of trips to work in the city of Bend. Throughout Deschutes County, about four-percent of trips to work are made on bicycles or on foot. Throughout Deschutes County, travel time to work for all trips was less than five minutes for four-percent of workers, less than ten minutes for 21 percent and less than 15 minutes for 45 percent. Short trip lengths and travel times are part of the equation for encouraging non-auto trips. A complete and safe network of trails, sidewalks and bicycle facilities will further encourage these trips.

### Other Benefits

In addition to reducing traffic, non-motorized trips conserve fossil fuels, reduce noise, protect air and water quality, reduce the demand for parking spaces, and improve personal health. The air quality issue is particularly important to Central Oregonians, as the pristine mountain views and clean air are cherished resources of the community. A concerted effort to reduce automobile trips and the resultant exhaust emissions will be valuable in diminishing the impact on air quality. Non-motorized trips can also directly

address the obesity crisis facing the United States. Getting people to walk or bicycle directly benefits personal health.

### **Community and Site Design**

An adequate bike and pedestrian system requires a complete network of walkways and bikeways that connect parks, schools and activity centers. Orienting buildings to the street and providing safe and easy connections from stores to the sidewalk, and providing convenient bike parking all help make bicycling and walking more desirable trip choices.

### **Maintenance and Repair**

Maintenance and repair of the bicycle and pedestrian system are critical to the use of these transportation modes. Timely snow removal, sweeping, cinder removal, patching, surface repair and striping are all necessary to maximize the use of bike lanes and sidewalks as alternative transportation modes. Property-tight sidewalks may require less maintenance than curb-tight sidewalks because the landscape strip provides a place to pile snow and separates the sidewalk from road debris accumulation.

In general, responsibility for sidewalk maintenance and repair is assigned to the adjacent property owners. This system may not adequately assure timely maintenance and repair of the sidewalk network.

The use of cinders can negatively impact the bicycle lane and pedestrian system. The city of Bend has implemented a street sweeping system that helps remove the cinders as soon as weather conditions allow. Chip sealing can also have a negative impact on bicycle safety. The city of Bend and Deschutes County have worked with bicyclists in recent years to minimize the impacts of chip sealing on the bicycle system.

## **The Pedestrian System**

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Walking is the most basic form of transportation, undertaken by almost every citizen. Sidewalks are an essential element of the transportation system since every trip involves at least one walking segment. Because the primary function of sidewalks is to provide a safe place for pedestrians, facilities need to be designed accordingly. Sidewalks also need to be constructed to Americans with Disabilities Act (ADA) requirements. The requirements are meant to insure that everyone, regardless of mobility issues, can safely travel on sidewalks.

In the city of Bend, sidewalk construction has been required in all new residential and commercial developments since the late 1980s. Sidewalks are normally located on both sides of the street and separated from the street by a curb and a landscape strip. In steep topography or unusual topography, sidewalks may be allowed on only one side of the street and may be curb-tight. Sidewalks are normally constructed with a concrete material although special paver blocks may be utilized in high-use pedestrian areas, such as downtown Bend, to enhance surface aesthetics. Sidewalks vary in width depending on anticipated pedestrian volumes but have certain minimum widths

established to meet ADA requirements. Minimum sidewalk widths are established in the implementing ordinances of the city and county.

The existing and proposed sidewalk system is delineated in the *Bend Urban Area - Bicycle and Pedestrian System Plan – TSP: Map Exhibit B*. A copy of this map is included in Appendix F of this document. The system as proposed should be considered general in nature. Flexibility should be permitted during the development and design of roadways and private lands to locate these planned sidewalks to fit the context of the natural terrain, to minimize sidewalk grade, to consider street crossings and other safety issues, and consider any other topographic or geographic barriers or issues. It is the intent of the sidewalk system to provide direct and convenient walking connections to parks, schools, open spaces, employment areas, shopping destinations, and the like.

### **The Landscape Strip**

The area located between a sidewalk and the curb serves many important functions and is commonly referred to as the planting or landscape strip. The landscape strip creates space for a variety of underground utilities such as telephone, cable television, fiber optic cables, etc. The landscape strip is also beneficial for locating utility poles, fire hydrants, benches, bus shelters and other features that might otherwise block or obstruct pedestrian travel along sidewalks.

Landscaping helps to soften the hard edge created by pavement and curbs. Large trees can also provide cooling summer shade for parked cars and pedestrians. A canopy of street trees can help to slow traffic and enhance the beauty of the community. The physical separation from the street also improves the design of sidewalks by maintaining a constant grade without dipping at driveways, and makes American with Disabilities Act compliance easier. During winter months, snow can be plowed into these areas from the street and not block sidewalks. The landscape strip provides a physical separation from the adjacent roadway, providing enhanced pedestrian comfort and improved walking experience.

### **Street Crossings**

Crossing local street intersections is normally not difficult because of lower traffic volumes and because the distances are relatively short. Crossing arterial streets can be much more challenging because of street widths, high traffic volumes and speeds. Minimizing crossing distances required for pedestrians is important to reduce the psychological barrier created by wide streets and to increase pedestrian safety.

Construction of curb extensions is one method to improve the visibility of pedestrians and reduce the crossing distance of the street. These extended “bulb-outs” add valuable pedestrian space and can help facilitate a quicker movement of pedestrians across busily traveled roadways. The additional space can also provide a location for bike parking or other sidewalk amenities. Downtown Bend is an excellent example of where this type of design has been used very successfully.

Another solution to addressing conditions where traffic volume is high, or roadways are wide, is the construction of raised medians, islands or refuges. Medians can significantly improve pedestrian visibility and provide a place to wait for safe gaps in the traffic stream while crossing busy roadways. Medians can also improve the aesthetics of a community with added landscaping. Islands and refuges are especially important at large intersections to reduce the crossing distance and improve pedestrian comfort by minimizing exposure to motor vehicles.

One important function of traffic signals is providing for the movement of pedestrians across busy intersections. Where large radius corners have been constructed at the intersection to accommodate higher speed turn or truck movements, building a dedicated turn lane with a raised island for pedestrians is important. This significantly improves the comfort of pedestrians by reducing the amount of uninterrupted pavement to cross.

### **Rural Walkways**

In sparsely populated areas, the shoulders of rural roads usually accommodate pedestrians. There are, however, roadways outside urban areas where the developing urban character creates a need for sidewalks, such as on highly developed commercial strips or in residential clusters along county roads or state highways.

### **Multi-Use Trails**

Trails provide important transportation connections and shortcuts to destination points that make travel by foot or bicycle safe, pleasant and convenient. Recreational activity is also a common use of the trail system, with scores of residents and tourists using these areas for walking, jogging, bicycling and other activities.

Trails also provide citizens and visitors with links to the natural environment. One special quality of a trail is the opportunity they provide to escape the bustle of the city - while remaining within the city. This is particularly evident along the Deschutes River trail system. Public opinion supports this sentiment, as people cite the ability to depart from traffic congestion, noise and exhaust as a prime factor in their enjoyment of trails.

The first trail plan in the area was established in the Bend Area General Plan in 1981. This has been the policy tool that has provided some protection of trail corridors and has promoted the construction of the current limited system. Several additions were adopted by the City and County and incorporated into the General Plan in 1996. The current "primary" trail plan is illustrated in the City of Bend Transportation System Plan (Bicycle and Trail System Map). The city of Bend and the Bend Metro Park and Recreation District are working together in the planning and development of a trail system to meet the recreational and transportation needs of the community.

### *Neighborhood Accessways*

An August, 2006, report provided an assessment of the city of Bend's neighborhood accessways. The neighborhood accessway system is comprised of a wide range of

facilities that include; a variety of trail types and on-street facilities, that are collectively referred to as “accessways”.

The purpose of these facilities is; to minimize travel distances within and between residential areas and commercial centers, major employment areas, transit stops, or within and between nearby neighborhood activity centers such as schools and parks. The greater system of proposed accessways will provide transportation and recreation mobility opportunities for non-automobile travel through out the community. This accessway plan for the City generally uses a geographic spacing for accessways on an interval of approximately every *quarter-mile*.

The Primary Trail plan is delineated on the *Bend Urban Area - Bicycle and Pedestrian System Plan – TSP: Map Exhibit B*. A copy of this map is included in Appendix F of this document. The alignments depicted as proposed should be considered general in nature. Flexibility should be permitted during the development and design of private lands to locate these planned primary trails to fit the context of the natural terrain, to minimize trail grade, to consider street crossings and other safety issues, to account for the pattern and design of the development, or consider any other topographic or geographic barriers or issues, etc. Also, while it may be suitable to locate a trail next to a street due to existing difficult to resolve issues for trail location, it is the intent of the plan to locate trails - as much as possible - away from streets to minimize conflicts with other types of conflicting traffic. It is also the intent of the trail system (both connector and primary) to provide direct and convenient walking and bicycling connections to parks, schools, open spaces, employment areas, shopping destinations, and the like. Balancing these trail design criteria may require a concerted coordination effort between the City, the Park District and new development to satisfactorily locate these trails to ensure that the intent of the plan will be fulfilled.

*Railroad Right-of-way Trails:* There has been a growing interest nationwide in developing both “abandoned” and “active” railroad right-of-ways as part of local trail systems. One recent study examined these special trail corridors in detail; *Rails-with-Trails - Lessons Learned 2002*. This report was prepared for the U.S. Department of Transportation and provides a comprehensive analysis and evaluation of current rails with trails (RWT) development practices. The report illustrates how trails can be successfully developed along railroad right-of-ways and provides valuable guidance concerning trail design and development that help to address important issues such as safety, liability and aesthetics.

The Springwater Trail in the Portland area and the bikepath in Ashland along the Central Oregon and Pacific rail line are excellent examples of this type of trail development that is located along an active railroad right-of-way within the State of Oregon.

A trail within/parallel to the Burlington Northern-Santa Fe Railroad corridor in the Bend area could provide a substantial enhancement of the Primary Trail system. The *Bend Urban Area - Bicycle and Pedestrian System Plan* illustrates the alignment of this “Rails-

with-Trails” concept. It should be acknowledged that, due to site specific railroad operational requirements, alternative parallel accessway/roadway corridors may be more suitable for avoiding problematic sections of this rail-trail corridor. Also, grade-separated rail-roadway crossings may be difficult to retrofit or may be operationally unsuitable for joint trail and rail operation and parallel alternative routes should be considered. Typically, these alternative routes, if used, should not deviate physically too far from the intended corridor alignment (i.e., follow the nearest parallel alternative corridor). Further planning and discussion with the railroad representatives, adjacent property owners and field investigations are required to determine the feasibility of this concept.

### Unpaved Paths

In general, the standard width of an unpaved path is the same as for sidewalks. An unpaved path should not be constructed where a sidewalk is more appropriate. The surface material should be packed hard enough to be usable by wheelchairs and children on bicycles (the roadway should be designed to accommodate more experienced bicyclists). Recycled pavement grindings provide a suitable material: they are usually inexpensive and easy to grade (this should be done in the summer, when the heat helps pack and bind the grindings).

## **The Bicycle System**

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Residents and tourists of all ages enjoy bicycling for both transportation and recreational use. Bend’s relatively small size and short distances encourage travel by bicycle. The majority of the current bike system is found on arterial and collector streets as bike lanes. The network of multi-use trails also serves as an important part of the planned bike system.

Based on need and road characteristics, all roads open for public use should be considered for the potential to improve bicycling and walking. Facilities should safely accommodate the majority of users. Roads designed to accommodate cyclists with moderate skills will meet the needs of most riders; special consideration should be given close to school areas, where facilities designed specifically for children should be provided. Roads designed to accommodate young, elderly and disabled pedestrians serve all users well.

The existing and proposed bicycle system is delineated in the *Bend Urban Area - Bicycle and Pedestrian System Plan – TSP: Map Exhibit B*. A copy of this map is included in Appendix F of this document. The system as proposed should be considered general in nature. Flexibility should be permitted during the development and design of roadways and private lands to locate these planned bicycle facilities to fit the context of the natural terrain, to minimize grade, to minimize safety issues, and consider any other topographic or geographic barriers or issues. It is the intent of the bicycle system to provide direct and convenient bicycling connections to parks, schools, open spaces, employment areas, shopping destinations, and the like.

## **Bike lanes**

A bike lane is a space on the road shoulder that is delineated from the adjacent vehicle travel lane by a solid white striped line. Bike lanes are provided on both sides of the street and promote travel in the same direction as the adjacent lane of traffic. This practice provides a safer place for bicycles and requires a cyclist to conform to the laws of motor vehicle travel.

Bike lanes are intended to provide a convenient and safe location for bicycles on collectors and arterials. Bike lanes provide a clear and distinctive location on the road for bikes to travel at their own speed. They improve driver expectation of bike movements and they reduce bike and auto conflicts. Bike lanes provide a benefit to all modes of travel. For pedestrians, they help separate bike movements from the sidewalk and they increase walking comfort due to the increased sidewalk separation from adjacent auto traffic. For motor vehicle traffic, the lanes add buffer space from roadside obstacles, they improve driveway and intersection sight distances and they provide a temporary place for disabled vehicles to pull out of the travel stream.

It is preferable not to permit on-street parking next to a bike lane due to the hazard of opening car doors and the conflict of cars moving in and out of the parking stalls. However, there may be locations where it is necessary to provide both parking and bike lanes. Where space is limited, one design solution is the construction of recessed parking bays to better accommodate the space requirements for both needs. In other cases, such as the commercial downtown core area where a large inventory of on-street parking is essential, the need to provide vehicle parking may take priority over the delineation of bike lanes. In that case, where lower traffic speeds can be maintained, bikes can better mix with traffic without causing significant problems.

## **Rural Bikeways**

On most rural roadways, shoulder bikeways are appropriate, accommodating cyclists with few conflicts with motor vehicles. In general, the minimum shoulder widths recommended by Oregon Bicycle and Pedestrian Plan for rural highways are adequate for bicycle travel. These standards take into account traffic volumes and other considerations. Shared roadways are adequate on low-volume rural roads, where motor vehicle drivers can safely pass bicyclists due to the low likelihood of encountering on-coming traffic. Shoulder bikeways can be added to roads with high bicycle use, such as in semi-rural residential areas or close to urban areas. It may be appropriate to stripe and mark shoulders as bike lanes near schools or other areas of high use. Even adding minimal-width shoulders can improve conditions for bicyclists on roads with moderate traffic volumes. On roads with high use, it may be necessary to add full-width shoulders in areas of poor visibility due to topography.

## Shared Roadways

There are no specific bicycle standards for most shared roadways; they are simply the roads as constructed. Shared roadways function well on local streets and minor collectors, and on low-volume rural roads and highways. The majority of rural roads in the region are shared roadways. Shared roadways are suitable in urban areas on

streets with low speeds (25 MPH or less) or low traffic volumes (3,000 ADT or less, depending on speed and land use). In rural areas, the suitability of a shared roadway decreases as traffic speeds and volumes increase, especially on roads with poor sight distance.

### Wide Curb Lanes

A wide curb lane may be provided where there is inadequate width to provide the required bike lanes or shoulder bikeways. This may occur on retrofit projects where there are severe physical constraints, and all other options have been pursued, such as removing parking or narrowing travel lanes. Wide curb lanes are not particularly attractive to most cyclists; they simply allow a motor vehicle to pass cyclists within a travel lane.

To be effective, a wide lane must be at least 14ft wide, but less than 16ft. Usable width is normally measured from curb face to the center of the lane stripe, but adjustments need to be made for drainage grates, parking and the ridge between the pavement and gutter. Widths greater than 16ft encourage the undesirable operation of two motor vehicles in one lane. In this situation, a bike lane or shoulder bikeway should be striped.

### Shoulder Bikeways

Paved shoulders are provided on rural highways for a variety of safety, operational and maintenance reasons:

- Space is provided for motorists to stop out of traffic in case of mechanical difficulty, a flat tire or other emergency;
- Space is provided to escape potential crashes;
- Sight distance is improved in cut sections;
- Highway capacity is improved;
- Space is provided for maintenance operations such as snow removal and storage;
- Lateral clearance is provided for signs and guardrail;
- Storm water can be discharged farther from the pavement; and
- Structural support is given to the pavement.

### **Bike Parking Facilities**

For a bikeway network to be used to its full potential, secure bicycle parking should be provided at likely destination points. Bicycle thefts are common and lack of secure parking is often cited as a reason people hesitate to ride a bicycle to certain destinations. Bicycle parking should also be convenient, easy to access and provide suitable protection from the weather. Bike parking needs to be designed for both short- and long-term use depending on site conditions and demands. The city of Bend has provided a number of short-term bike racks throughout the central business area. These racks have helped reduce some of the automobile parking demand in this activity center. To support the public transportation service, bike-parking facilities should be provided at all park and ride lots, major transit stops and transit center facilities. Adequate bike parking facilities need to be provided where other public facilities such as libraries, parks, recreation centers and schools are constructed.

## **Bicycle and Pedestrian Policies**

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1. Assist the City, County, State, Forest Service, Park District and public agencies to acquire, develop and maintain a series of trails along the Deschutes River, Tumalo Creek, and the canal system so that these features can be retained as a community asset. Work with these same agencies to identify and develop connections between the Bend Urban Area Bicycle and Trails System and the USFS trail system.
2. Assist the City and Park District to acquire, develop and maintain the primary trails designated on the Bend Urban Area - Bicycle and Pedestrian System Plan – TSP: Map Exhibit B.
3. Assist the City with developing safe and convenient bicycle and pedestrian circulation to major activity centers, including the downtown, schools, shopping areas and parks. Particular emphasis should be given to east-west access barriers to the downtown area (e.g. the Bend Parkway, the railroad, etc.).
4. Work with the City to facilitate easy and safe bicycle and pedestrian crossings of major collector and arterial streets. Work with the City to identify intersection designs that include pedestrian refuges or islands, curb extensions and other elements where needed for pedestrian safety and extend bike lanes to meet intersection crosswalks.
5. Work with the city and county to insure that bike lanes or bikeways are included on all new and reconstructed arterials and collectors. Add bike lanes to existing arterial and collector streets with particular emphasis to fill the gaps in the on-street bikeway system. Provide an appropriate means of pedestrian and bicyclist signal actuation at all new or upgraded traffic signal installations.
6. Work with the city to insure that property-tight sidewalks are included on both sides of all new or reconstructed arterial and collector streets except where extreme slopes, severe topographical constraints, or special circumstances exist. Add sidewalks to all existing arterial and collector streets to fill the gaps in the pedestrian system.
7. Work with the City and County to develop a program to ensure timely maintenance and repair of all sidewalks, including but not limited to assigning responsibility for maintenance and repair.
8. Work with the City and County to insure that bicycle and pedestrian facilities are maintained in a manner that promotes use and safety. Perform street repair and maintenance in a manner that does not negatively impact bicycle and pedestrian facilities and their use.
9. Work with the City to ensure that bicycle parking facilities are provided at all new multifamily residential, commercial, industrial, recreational, and institutional facilities, major transit stops, transit stations and park and ride lots.

10. Encourage the City to establish or maintain accessways, paths, or trails prior to vacating any public easement or right-of-way.
11. Work with the City, County, and State to support bicycle and pedestrian education and safety programs.
12. Work with the City and the Burlington Northern – Santa Fe (BNSF) Railroad to determine where, if possible, railroad right-of-ways could be used also as trail corridors. Provided a joint-use agreement can be reached with BNSF, work with the City to evaluate the entire Rails with Trails Corridor in light of opportunities to augment the local primary trail system.
13. Work with the City, County, and Park and Recreation District, to identify funding options for right-of-way acquisition, design, construction and maintenance of priority trails.
14. Work with the City, County, and Park and Recreation District to update sidewalk, trail and bike lane systems inventories and identify gaps and missing system segments and prioritize these for completion.
15. Work with the City to identify specific annual targets for sidewalk in-fill projects.
16. Work with the City and County to identify specific annual targets for bikeway in-fill projects.
17. Work with the City and Park and Recreation District to identify specific annual targets for securing public right-of-ways or easements for trails and constructing trails.

# Chapter 8: Public Transportation System

## Introduction

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Public transportation is an important element of multi-modal transportation planning. It provides a valuable transportation alternative for high volume travel corridors. Public transportation can improve the efficiency of arterial streets because fewer vehicles are required on the road to serve the same number of trips. When faced with costly road improvement or construction difficulties, concerted trip reduction programs can add years of life to a roadway's capacity. Improvements to air quality can also be achieved by the net reduction of motor vehicle emissions. Public transportation can also play an important role in reducing congestion and parking requirements in high demand areas such as the downtown.

Public transportation improves mobility for a wide range of the traveling public. School age children can use public transportation for trips to school, after-school activities, or recreational pursuits. Likewise, there are many other segments of the population that do not have a car (many for financial reasons), are unable to drive or would simply prefer to let someone else do the driving. Those with disabilities who cannot access fixed routes transit who need to make trips for shopping, medical or other trips have access to the paratransit system. Workers of all ages can get to their jobs without owning or relying on a car. Thus, public transportation is a valuable service that fills a much broader function than solely trip reduction. It provides mobility for those without cars as well as being an alternative to the automobile for many travel needs of the community.

## Policies

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The region has specific goals and policies outlined within the local transportation plans that are specifically related to TDM. The following goals and policies are applicable to the Bend Metropolitan planning area.

1. Work with ODOT, the city of Bend, Deschutes County, and transit service providers to study countywide rideshare facility needs, and investigate public transit possibilities including potential transit opportunities for a regional or commuter-based transit system.
2. Work with special service providers, ODOT, Deschutes County, and the city of Bend to secure additional funding as well as increase promotion of transit or transportation services that may be underutilized.
3. Work with special service providers, ODOT, Deschutes County, and the city of Bend to identify and monitor the needs of the transportation disadvantaged and attempt to fill those needs.
4. Work with the City of Bend to preserve and improve existing transit and paratransit services (efficiency, expanded ridership and routes, zone destination) and develop a strategic plan for its future expansion.
5. Work with the City of Bend, ODOT and other jurisdictions to evaluate funding alternatives and seek appropriate resources to expand the public transportation system.

6. Work with all central Oregon communities and the State to evaluate and develop inter-urban public transportation services.
7. To better accommodate a fixed-route transit system, work with the City of Bend to develop land use ordinances and other regulations that establish pedestrian and transit-friendly design along potential or existing transit routes.
8. Work with the City of Bend and other governmental agencies to develop a 20-year transit master plan. The plan should include but is not limited to routing maps, the type and location of required infrastructure, marketing/public education plan, development/ redevelopment requirements for transit, funding mechanisms, and implementing ordinances.
9. Participate in and support regional discussions and efforts to develop and improve regional public transportation services. The discussion could include development of a city- or region-wide transit district and evaluation and implementation of creative public/private sector funding techniques to accomplish this task.
10. Seek additional public transportation funding resources for public transportation.

## **Local Demand-Response Transportation**

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The region has a network of special transportation providers who serve the elderly and disabled populations. In most cases, the general public does not have access to these special transportation services. There are several providers of special transportation services in Deschutes County that provide transportation within the MPO area. These services range from public to private, both profit and non-profit. The following are the existing service providers in the County:

- City of Bend Dial-A-Ride
- Central Oregon Council On Aging (COCOA) Dial-A-Ride
- Opportunity Foundation of Central Oregon
- Residential Assistance Program (RAP)
- Disabled American Veterans
- Volunteer Services
- Central Oregon Resources for Independent Living
- Access Express

With limited funding options, no significant expansions in these demand responsive programs are planned.

## **Intercity Bus Services**

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The following intercity bus services are planned to continue as the primary (and only) public transit options in the area. The focus should be to maximize the efficiency of these services as land use changes occur. Without a local transit system to distribute trips, a commuter system linking the rural and urban areas is less likely to succeed.

- CAC Transportation
- Central Oregon Breeze

- Central Cascades Lines
- Greyhound
- Porter Stage Lines
- Valley Retriever

## **Transit System Studies**

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The feasibility of transit within the Bend urban area has been the subject of several studies over the past decade. In 1994, the City studied Bend's demographic, employment, travel and transportation system characteristics in relation to how they might support transit use. In 1996, the City hired a transit consultant to further evaluate how transit could be implemented in the community. This study augmented the previous analysis of transit feasibility by analyzing transit systems from similar sized cities, developing system evaluation criteria, conducting a public opinion survey on transit attitudes and financing methods, and evaluating capital needs and financing strategies.

In 1997, based on this comprehensive evaluation of transit feasibility, the City Council declared that transit was feasible at build-out for the city of Bend. In 2000, an additional study evaluated possible expansions and improvements to the existing Dial-a-Ride system. The report recommended that the City pursue this strategy as an initial method of providing public transportation for the general public. This strategy was not pursued.

In 2006, a review of service plan proposals for new fixed-route service was completed. This work focused on an evaluation of fixed-route design options that would meet City budget constraints, optimize resources and meet the demand for paratransit and demand response service. This plan was acted upon with a start-up 7-route system implemented in September 2006.

## **Public Transportation Facility Design**

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### **Transit Centers**

Transit centers are locations where several transit vehicles converge for the purpose of passenger transfer. This creates a very efficient, convenient and safe method of exchanging people between transit vehicles. This can also provide a location and opportunity where several intercity and intracity transportation services can meet to exchange passengers. It is desirable to coordinate public transportation operations such that all vehicles meet at a transit center at close to the same scheduled time. This allows passengers to make easy transfers without a long wait.

The existing transit center on NE Hawthorne Avenue, between 3rd and 4th streets, is currently the *interim* transit center location. Further evaluation of the effectiveness of this site should be conducted to determine whether it will meet longer-term Transit Center needs. A transit center located in the downtown can also provide a convenient connection to the many governmental, banking and shopping activities that are located in this focused business district as well as provide a good location for a central point of operation.

In designing a transit center, the location of the facility should provide for orderly circulation and accessibility of all types of transit vehicles, while minimizing the conflict with other traffic flow. The center should be located to minimize the number of pedestrian and vehicle conflicts, and be easy to access by walking or bicycling. Bicycle parking facilities should be designed and located for safe and convenient use, and provided in adequate supply to meet demand. More study will be required to determine the best long-term candidate location(s) and spatial requirements of facilities necessary to serve this important transportation system function.

### **Major Transit Stops**

Major transit stops are locations along the transit system that are important to the functioning of the system and provide a high level, volume or frequency of transit service. Additional transit related amenities and pedestrian facilities should be provided to accommodate the differing types of demand. Adjoining developments should be encouraged to provide transit-friendly design elements that facilitate bus movements and convenient pedestrian access to the major transit stop.

As the system grows, an assessment of major transit stops should be conducted. Consideration should also be given to planning for a functional regional inter-modal facility where an efficient connection between local and regional trip activity can occur. Major transit stops should be defined as the system matures and other destinations with high transit ridership potential are identified.

### **Transit Friendly Design**

Transit friendly design is an important element in the encouragement of transit trips. Access to transit stops must feel safe and be convenient. The construction of sidewalks and accessways helps to assure that the walking link of the transit trip is a safe and pleasant experience. The Bend Urban Area TSP was recently amended to ensure development of walking and bicycling corridors on approximately a one-quarter mile transportation system grid.

As routes are planned and local transit stops are located throughout the system, pullout lanes should be considered for bus stops to permit buses to pull-out of the traffic flow on heavier traveled arterial streets with travel speeds under 45 mph. Constructing suitable and convenient bike parking and providing buses equipped with bike racks will also encourage longer distance inter-modal trips to connect with transit. Providing benches, shelters and lighting at bus stops can also increase the comfort of transit users.

### **Land Use Organization**

Land use organization that situates high-density residential, mixed-use, entertainment and employment concentrations along transit routes is an important strategy that supports transit use. Additionally, site design elements such as building layout that sites structures in close proximity to the street and provides convenient pedestrian corridors, will also help to promote transit trip activity. Bend's General Plan typically designates the types of land uses; high-density, mixed-use and commercial activities, along the arterial and collector street system that is likely to have future transit service.

The city of Bend also adopted a new Development Code in 2006 that incorporated the transit friendly site design objectives of the State Transportation Planning Rule (OAR 660-012).

### **Park and Ride Lots**

Park and ride lots, when strategically located, can support both public transportation and rideshare activities. If park and ride lots are located on the edge of the city, they can conveniently serve both directions of travel into and out of the urban area. Park and ride lots also provide a meeting place for car pools and a location for motorists to access a public transportation system. Park and ride lots can either be publicly constructed facilities, or more commonly, a partnership between public and private property interests, typically requiring a cooperative use agreement with the landowner. Shopping centers, churches, or the like, commonly have large parking lots that are underutilized during the day, making park and ride activity complementary with the business demands of the property owner. Van or shuttle systems can also incorporate park and ride lots into a parking management plan by shuttling employees to the work place. This can help to minimize localized parking demand or impacts generated by employee traffic.

There are currently two existing designated Park and Ride lots in the MPO study area. Seven other lots are located throughout the central Oregon region. Work continues to identify, locate and secure other candidate park and ride lots through out the Bend area. The highest priority areas are at the north and south entries to the City along or near Highways 97 and 20.

### **Transit Trunk Routes and Transitways**

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**Trunk routes** are transit routes that normally maintain a higher level of transit service. Greater service levels are achieved by providing more frequent headways (times between buses) either by designating overlapping bus routes down the same street or by running a greater number of, or larger buses along the trunk route. In larger cities, trunk routes also deliver riders from outlying areas to activity centers where riders may need to transfer to a feeder bus that continues on to the core area. Trunk routes are also typically characterized by having multiple routes intersecting the main stop locations. Trunk routes typically provide transit service for specific high ridership demand hours of the day/days of the week. As trunk route stops or stations typically have more ridership activity, they often have greater waiting capacity (i.e., larger shelters) and other rider amenities (i.e., pay phones, drinking fountains, route information/maps, ticketing equipment, scheduling monitors, etc.).

**Transitways** are very specialized trunk routes that provide very high levels of transit service. Transit is normally given a very high priority along transitways to enhance transit service levels. This is often accomplished by making improvements for transit travel that will optimize travel speeds and/or reduce travel delay/times. Examples of typical transitway features are; exclusive transit travel lanes or shared use of High Occupancy Vehicle (HOV) lanes with other multi-passenger vehicle traffic (commonly

found in large metropolitan areas in conjunction with freeway systems), bus rapid transit systems (typically buses running along “bus only” lanes that are often located within separate right-of-ways, traffic signal/queue-bus bypass lanes and/or other transit preferential treatments.

The Bend urban area, for the most part, is not geographically large enough or experiencing the type of traffic delays or congestion points that will likely warrant the designation and/or improvement of transit trunk or transitway routes within the planning period. Should conditions warrant this form of transit operation, the most likely candidate corridors for consideration of this type of express transit service would possibly be the main east-west route between C.O.C.C. and St. Charles M.C. and a north-south route in the center of the community utilizing 3<sup>rd</sup> Street.

## **Coordinated Human Services Public Transportation Plan**

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Beginning in FY 2007, as a condition of Federal assistance, the Oregon Department of Transportation (ODOT) Public Transit Division must certify to the U.S. Secretary of Transportation that projects selected for funding derive from locally developed Coordinated Human Services Public Transportation Plans. Also in 2007, Oregon statute requires that Special Transportation Fund (STF) Agencies (counties and Tribe) must complete a plan for their STF programs. These two planning requirements are very similar in intent and timing. To meet these new planning requirements, STF Agencies must complete a single coordinated plan that meets the state and federal requirements.

Deschutes County is developing the coordinated plan with completion expected in late summer 2007. The draft plan sets forth a set of principles, goals and action items to begin to address the fundamental public transportation challenges facing the region. The draft plan is the product of a year of planning, research and deliberations involving a diverse group of stakeholders.

The success of the plan depends on a partnership of all transportation stakeholders in Deschutes County and Central Oregon. Developing and sustaining a coordinated system of transportation services is limited by available resources. The framers of the draft plan recognize that every public and private partner has a role to play in responding to the transportation challenges and pressing needs for transportation services in the county and region.

## **Transit System Implementation**

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The city of Bend is currently providing an active pilot fixed-route transit system along seven routes through-out the City and a companion paratransit, Dial-a-Ride (DAR) service. Federal law requires the paratransit service provide coverage within a 3/4 mile of any fixed-route. The City has chosen to continue to serve the entirety of the City with DAR service in order to better accommodate the needs of its low income senior citizens and the disabled population.

Long-range financial forecasts show that little, if any, expansion of the pilot system will be feasible without new funding. The financial forecasts are detailed in Chapter 19.

Expansions to this public transportation system will be considered by the City based on an evaluation of the pilot transit project and subject to the availability of funding necessary to support transit service. Expansions to the transit system could include expanded service hours, new routes in Bend, new routes connecting Bend to other central Oregon communities, and capital improvements (e.g. transit stops, park-and-ride facilities). A preliminary cost assessment to provide these additional services is included in Appendix G.

An alternative to a City funded public transportation system would be the successful formation of a local or regional transit district.

Further study to evaluate future transit system options will be needed in the future.

# Chapter 9: Transportation Systems Management

## Introduction

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The Oregon Transportation Planning Rule defines transportation systems management (TSM) as the use of “techniques for increasing the efficiency, safety, capacity or level of service of a transportation facility without increasing its size.” Examples of TSM include physical roadway improvements (e.g. access management and channelization), operational improvements (e.g. traffic signal coordination and ramp metering), and the use of intelligent transportation systems.

This chapter includes goals and policies, forecasts and future needs, and strategies for applying transportation systems management to the Bend MPO. Intelligent transportation systems (ITS) play a large role in TSM and a separate planning effort was undertaken as part of the *Deschutes County ITS Plan*<sup>1</sup> to develop a 20-year deployment plan of ITS projects that improve the operations and management of the transportation network in Deschutes County with a focus on the Cities of Bend and Redmond. In addition to ITS other TSM strategies discussed in this chapter include access management, parking management, traffic signal management and operations, speed management, geometric improvements, value engineering, systems engineering, and asset management.

## TSM Policies

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The policies for transportation system management were developed based on a review of existing policies in other state, regional, and local plans such as the *Oregon Transportation Plan*, *Deschutes County Transportation System Plan*, *Deschutes County ITS Plan*, and *City of Bend Transportation System Plan*. These policies will help guide the future development and management of the transportation system.

1. Support the access management policies of the Oregon Department of Transportation along state highways.
2. Work with member jurisdictions and agencies to adopt legislation that protects the integrity of regional roadways by managing public and private accesses.
3. Work with member jurisdictions and agencies to develop parking regulations that support land use and travel demand and that also encourage the use of alternate modes.
4. Work with member jurisdictions and agencies to implement a comprehensive intelligent transportation system program per the *Deschutes County ITS Plan*.
5. Support efforts of member jurisdictions and agencies to update traffic signal and traffic signal control system hardware and software and implement signal timing strategies to optimize system efficiency for all modes.

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<sup>1</sup> *Deschutes County ITS Plan*. Prepared for ODOT by DKS Associates and IBI Group, March 2005

6. Support efforts of member jurisdictions and agencies to remove traffic signals where an engineering study (based on *MUTCD* guidelines) demonstrates they are no longer warranted based on land use changes that have resulted in decreased travel demand.
7. Support efforts of member jurisdictions and agencies to install new traffic signals where an engineering study (based on *MUTCD* guidelines) shows they are warranted to support land use changes that have resulted in increased travel demand.
8. Work with member jurisdictions and agencies to investigate the feasibility of utilizing automated speed and red light enforcement at high accident locations to improve safety and reduce the manpower needed by law enforcement and adopt legislation as needed.
9. Support efforts of member jurisdictions and agencies to utilize traffic calming techniques to reduce travel speeds and cut-through traffic on roadways where traffic conditions do not match the roadway's intended design.
10. Encourage member jurisdictions and agencies to consider geometric improvements to enhance efficiency and provide safety for motorists, pedestrians, and bicycles.
11. Encourage member jurisdictions and agencies to consider using value engineering or systems engineering to deliver transportation projects more efficiently and cost-effectively.
12. Promote new technologies and strategies to effectively manage transportation assets including roadway pavement, bridges, right-of-way, public transportation facilities, traffic signals, ITS field devices, and other infrastructure to maximize functionality and prolong the lifetime of the transportation system.

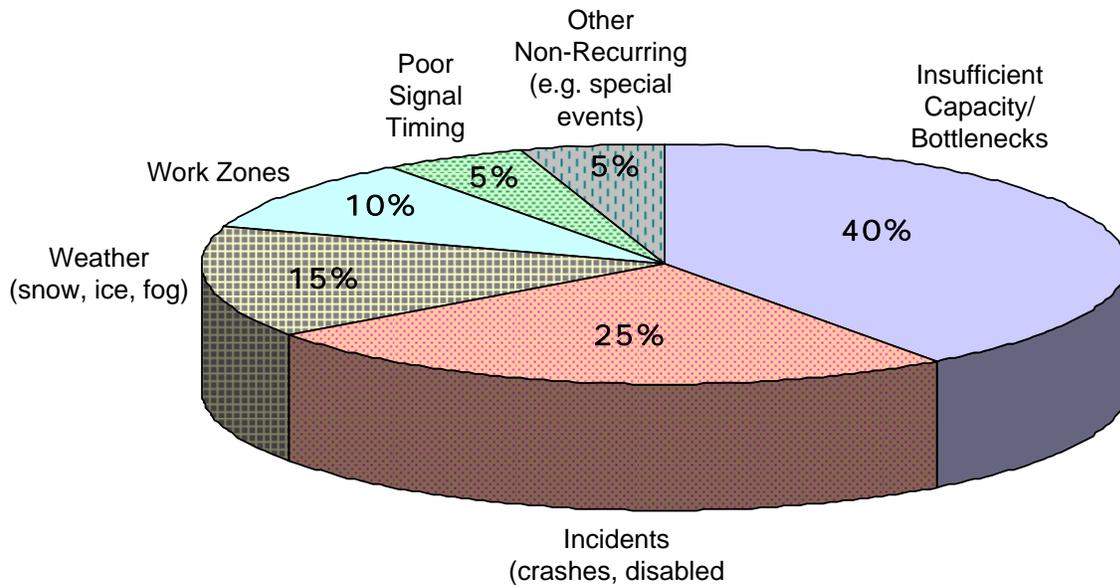
## Forecasts and Future Needs

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Traffic congestion coupled with a large expected growth in population and travel demand (see Motor Vehicle chapter) impacts the mobility of travelers and freight throughout the Bend MPO. Congestion results in travel delay, reduced productivity, and a frustrated driving public. Over half of congestion is caused by non-recurring events as shown in Figure 9.1. TSM strategies are needed to reduce non-recurring congestion, and its negative impacts, to optimize systems operations and maximize the available capacity of the existing transportation infrastructure. During the development of the *Deschutes County ITS Plan* an extensive needs assessment was conducted through stakeholder interviews, questionnaires, and a workshop to identify regional needs in the following areas of interest:

- Travel and Traffic Management
- Public Transportation Management
- Emergency Management
- Information Management
- Maintenance and Construction Management

Although these needs were ultimately used to develop a phased implementation of ITS projects, the user needs identified were very broad and may also be addressed by TSM strategies other than ITS.



**Figure 9.1 Causes of Congestion<sup>2</sup>**

## TSM Strategies

This section includes an overview of the strategies that may be used in the Bend MPO to support the transportation system management goals and policies listed earlier in this chapter. These strategies are discussed in the following management/operational areas: intelligent transportation systems, access management, parking management, traffic signal management and operations, speed management, geometric improvements, value engineering and systems engineering, and asset management.

### Intelligent Transportation Systems

ITS involves the application of advanced technologies and proven management techniques to relieve congestion, enhance safety, provide services to travelers, and assist transportation system operators in implementing suitable traffic management strategies. ITS focuses on increasing the efficiency of existing transportation infrastructure, which enhances the overall system performance and reduces the need to add capacity (e.g., travel lanes). Efficiency is achieved by providing services and information to travelers so they can (and will) make better travel decisions and to transportation system operators so they can better manage the system. ITS technologies are used by agencies in the Bend MPO today and plans are in place to expand the use of ITS applications in the future.

<sup>2</sup> *Congestion Mitigation*. Office of Operations, Federal Highway Administration.  
<http://www.ops.fhwa.dot.gov/congestionmitigation/congestionmitigation.htm>. Accessed March 29, 2006.

In 2005, the Bend MPO, Oregon Department of Transportation (ODOT), City of Bend, City of Redmond, Deschutes County 911, and the Federal Highway Administration collectively developed the *Deschutes County ITS Plan* with input from other regional stakeholders. The mission of the plan is “to improve the safety, security and movement of goods, people, and services for all modes of the transportation network by using advanced technologies, establishing agency coordination, utilizing existing system capacity and infrastructure, and providing real time traveler information.” The outcome of the plan is a phased 20-year deployment plan of ITS projects, a regional ITS architecture, and regional operational concept that all meet federal ITS requirements. Additionally, this effort is consistent with plans put together statewide and in other regions of Oregon to ensure that ITS strategies are integrated and complementary.

### **Benefits of ITS**

ITS projects are aimed at improving the safety and operational efficiency of the existing transportation infrastructure by:

- Reducing vehicle delays related to recurrent and non-recurrent congestion
- Reducing collisions and incident response times
- Providing travelers with real-time information to make informed route and mode choice decisions.

Quantifiable benefits resulting from intelligent transportation systems include:

- Reduced vehicle delays
- Reduced number of collisions
- Improved air quality
- Reduced fuel consumption
- Improved travel times

Other accrued benefits, which are more difficult to quantify, include improved travel time reliability, reduced driver frustration, and reduced driver anxiety from having real-time travel information. Additionally, improved efficiency due to coordinated and cooperative agency actions can produce long term savings, particularly in relation to coordinating regional projects and a coordinated regional response to incidents. ITS deployments around the state of Oregon have yielded many of these; some of these benefits are highlighted herein.

### **ODOT Region 2 Incident Management Program**

- 15-percent reduction in average incident duration
- 35-percent reduction in vehicle-hours incident delay

### **Traveler Information**

- 7- to 12-percent reduction in travel time
- Up to 33-percent reduction in emissions

## **ITS Projects for Bend MPO**

A list of ITS projects was developed to meet the regional needs and then phased based on a scoring exercise (criteria included items such as safety, congestion mitigation, and key traveler decision points), cost, expected benefits, technical and institutional feasibility, relativity to other planned projects, input from the Steering Committee, and equitable distribution. The resulting deployment plan includes the following phases:

- 2005 – 2009: 0 – 5 Year Plan (High Priority)
- 2010 – 2014: 6 – 10 Year Plan (Medium Priority)
- 2015 – 2025: 11 – 20 Year Plan (Low Priority)

Table 9.1 lists the projects that fall within the Bend MPO. A map illustrating the phased ITS infrastructure deployment locations for many of the ITS projects is located in Appendix H. Many of the projects will be implemented by multiple jurisdictions and several projects will deploy systems that will be shared beyond the Bend MPO. ODOT plans to pursue a number of statewide ITS initiatives that may be applied to the Bend area and will support some of the projects included in Table 9.1<sup>3</sup>.

The ITS projects included in Table 9.1 utilize the following general strategies to improve the operational efficiency and management of the Bend area transportation network:

- Central management and operations of traffic signals
- Corridor management on key corridors that includes traffic signal coordination, remote monitoring, and traveler information dissemination
- Rail warning systems
- Parking management
- Transit system management
- Multi-jurisdictional programs for traffic management, incident response, emergency management, and maintenance and construction management
- Regional traveler information dissemination

**Table 9.1 ITS Deployment Projects for Bend MPO**

<b>#/Title</b>	<b>Description (<i>stakeholders listed at end</i>)</b>	<b>Capital Cost</b>
<b>2005 – 2009 (0 – 5 Year Plan, High Priority)</b>		
<b>DC-TM-01:</b> Central Signal System	Install central traffic signal system, fiber optic communications, video monitoring, and count stations to allow traffic engineers the ability to monitor and change signal timings remotely and support future arterial management and advanced signal timing projects. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$1,422,000
<b>DC-TM-02:</b> Hwy 97 Bus. (3 <sup>rd</sup> St.) Safety & Efficiency Improvements	Deploy video monitoring cameras (pan-tilt-zoom), dynamic message signs, count stations, and advanced signal timing improvements. ( <i>ODOT, Bend</i> )	\$903,000

<sup>3</sup> *Oregon Statewide ITS Architecture and Operational Concept Plan*. Prepared for ODOT by DKS Associates, Aug. 31, 2006.

#/Title	Description ( <i>stakeholders listed at end</i> )	Capital Cost
<b>DC-TM-05:</b> Regional Traveler Information System	Develop an integrated system (coordinated with ODOT TTIP) to disseminate traveler information and install kiosks at key traveler points (Bend Parking Garage, truck stops, and rest areas). ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$588,000
<b>DC-TM-06:</b> Downtown Bend Parking Mgmt Sys.	Monitor parking garage occupancy to alert travelers if the garage is full and provide guidance to alternate available parking. ( <i>Bend</i> )	\$147,000
<b>DC-TM-08:</b> Hwy 97(Bend Parkway) Safety & Efficiency Improvements	Deploy video monitoring cameras (pan-tilt-zoom) and automatic traffic recorders along the new Hwy 97 alignment. ( <i>ODOT, Bend</i> )	\$203,000
<b>DC-TM-14:</b> ODOT Reg. 4 TOC Upgrade (Phase 1)	Expand/upgrade the existing TOC facility and equipment. Consider co-location with 911 center, EOC, or emergency response centers. ( <i>ODOT</i> )	\$95,000
<b>DC-CO-02:</b> Communication Network	Expand the communication network to support additional field devices and connect operations centers to the regional communications network. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$105,000
<b>DC-EM-01:</b> Info. Sharing Between Traffic Mgmt Systems & Emergency Service Providers	Provide a two-way information flow (i.e. CCTV camera images, congestion flow map, emergency calls) between transportation management systems and the 911 and emergency dispatch centers. ( <i>ODOT, Bend, Redmond, Deschutes Co., Deschutes Co. 911</i> )	\$550,000
<b>DC-EM-02:</b> Coordinated Emergency Response - Radio System Link	Deploy a common communication interface between stakeholders responsible for emergency management. ( <i>ODOT, Bend, Redmond, Deschutes Co., Deschutes Co. 911, US Forest Service</i> )	Funded by Reg. Comm. Consortium
<b>DC-MC-01:</b> Maintenance and Construction Coordination System	Deploy a construction activity information site that contains details about region-wide/statewide maintenance and construction activities by public agencies, and utility companies. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$100,000
<b>Capital Cost for 2005 – 2009</b>		<b>\$4,113,000</b>
<b>2010 – 2014 (6 – 10 Year Plan, Medium Priority)</b>		
<b>DC-TM-07:</b> Hwy 20/ Greenwood/Newport Safety & Efficiency Imp.	Deploy video monitoring cameras (pan-tilt-zoom), dynamic message signs, count stations, and advanced signal timing improvements. ( <i>ODOT, Bend</i> )	\$1,255,000
<b>DC-TM-09:</b> Century Drive (to Mt. Bachelor) Safety & Efficiency Improvements	Deploy video, dynamic message signs, weather stations, dynamic speed limit signs, and speed photo enforcement on Century Drive between Bend and Mt. Bachelor. ( <i>ODOT, Bend, Mt. Bachelor Inc.</i> )	\$816,000
<b>DC-TM-10:</b> Incident Response Program- Staff and Vehicles	Develop a multi-jurisdictional regional incident response program to support emergency mgmt agencies with incident mgmt. This program includes vehicles, personnel, and dispatch. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$728,000
<b>DC-TM-13:</b> 27th/ Empire/Knott Safety & Efficiency Improvements	Deploy video monitoring cameras (pan-tilt-zoom), count stations, and advanced signal timing improvements. ( <i>ODOT, Bend</i> )	\$1,571,000
<b>DC-TM-14:</b> ODOT Reg. 4 TOC Upgrade (Phase 2)	Expand/upgrade the existing TOC facility and equipment. Consider co-location with 911 center, EOC, or emergency response centers. ( <i>ODOT</i> )	\$95,000

#/Title	Description ( <i>stakeholders listed at end</i> )	Capital Cost
<b>DC-TM-15:</b> Special Event Management System (Phase 1)	Deploy traffic signal timing plans, portable dynamic message signs, parking management, and public transportation management at Deschutes County Fairgrounds and Expo Center. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$473,000
<b>DC-TM-19:</b> Advanced Rail Warning System (Phase 1)	Deploy railroad crossing train detection and warning systems and transmit information for use by the TOC and emergency management agencies. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$186,000
<b>DC-CO-01:</b> Document Communication Design Standards	Document design standards for communications to ensure standardization, compatibility, connectivity, and reliability between multiple jurisdictional agencies. ( <i>ODOT</i> )	\$75,000
<b>DC-PTM-01:</b> AVL/CAD Transit Management System	Install an automated vehicle location (AVL) system on the Bend Transit District fleet and integrate transit vehicle locations with the existing computer aided dispatch (CAD) system. ( <i>Bend Transit</i> )	\$592,000
<b>DC-PTM-02:</b> Maintenance Mgmt Sys.	Upgrade the existing dial-a-ride maintenance system to integrate AVL technology with maintenance diagnostics. ( <i>Bend Transit</i> )	\$36,000
<b>DC-EM-03:</b> Real-Time Information to Mobile Data Devices	Provide real-time traffic information to emergency responder's mobile data devices. ( <i>ODOT, Bend, Redmond, Deschutes Co., Deschutes Co. 911, Oregon State Police</i> )	\$119,000
<b>DC-EM-04:</b> Ambulance-Hospital Information System	Enable the exchange of real-time information (video, audio, and data) between first responders and hospitals through the St. Charles microwave comm. system. ( <i>Bend, Redmond, Deschutes Co., St. Charles Hospital</i> )	Funded by St. Charles & Deschutes Co.
<b>DC-EM-05:</b> Traffic Adaptive Emergency Response	Deploy an integrated emergency response system that provides for pre-trip planning, en-route guidance, and dynamic route guidance for emergency vehicles. ( <i>ODOT, Bend, Redmond, Deschutes Co., Deschutes Co. 911</i> )	\$392,000
<b>DC-EM-06:</b> Provide Traffic Management System Information at EOCs	Provide an interface between the TOC and/or other traffic mgmt systems and each of the EOCs to allow access to traffic control devices during emergency situations at the EOCs as well as to share information between agencies. ( <i>ODOT, Bend, Redmond, Deschutes Co., Deschutes Co. 911</i> )	\$76,000
<b>DC-EM-08:</b> Traffic Signal Preemption by Vehicle ID	Implement preemption equipment to provide traffic signal preemption by specific vehicle ID. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$490,000
<b>DC-EM-10:</b> Roundabout Preemption	Implement an emergency vehicle preemption system for roundabouts located on primary response routes. ( <i>Bend</i> )	\$600,000
<b>DC-MC-03:</b> Roadway Automated Treatment	Deploy environmental sensors and automated treatment (de-icing) at the planned US 97/S. Century Drive interchange. ( <i>ODOT</i> )	Funded with STIP
<b>Capital Cost for 2010 – 2014</b>		<b>\$7,504,000</b>
<b>2015 – 2025 (11 – 20 Year Plan, Low Priority)</b>		
<b>DC-TM-17:</b> Reed Market Rd. Safety & Efficiency Improvements	Deploy video monitoring cameras (pan-tilt-zoom), count stations, and advanced signal timing improvements. ( <i>ODOT, Bend</i> )	\$527,000
<b>DC-TM-18:</b> Expand the Incident Response Program - Plans	Develop plans to identify detour routes and manage traffic on Hwy 97 and Hwy 20 through Bend and Redmond to support the movement of north-south and east-west freight. The program will include incident signal timing plans, dynamic message signs, and congestion monitoring to support incident response. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$420,000

<b>#/Title</b>	<b>Description (stakeholders listed at end)</b>	<b>Capital Cost</b>
<b>DC-TM-19:</b> Advanced Rail Warning System (Phase 2)	Deploy railroad crossing train detection and warning systems and transmit information for use by the TOC and emergency management agencies. (ODOT, Bend, Redmond, Deschutes Co.)	\$160,000
<b>DC-TM-19:</b> Advanced Rail Warning System (Phase 3)	Deploy railroad crossing train detection and warning systems and transmit information for use by the TOC and emergency management agencies. (ODOT, Bend, Redmond, Deschutes Co.)	\$14,000
<b>DC-TM-21:</b> TOCS Software Upgrade	Add additional functionality to the TOCS software to interface to the central signal system for traffic signal status information. (ODOT)	\$240,000
<b>DC-TM-24:</b> Vehicle Probes	Collect travel time/traffic congestion information using vehicles as probes. (ODOT)	\$24,000
<b>DC-TM-25:</b> Vehicle Navigation System	Deploy a system to transmit regional traveler information to in-vehicle navigation systems. (ODOT)	\$32,000
<b>DC-TM-26:</b> Adv. Vehicle Sys. – Mayday to TOCS	Provide for information flow from vehicle Mayday systems to the TOC (notification of airbag deployment). (ODOT)	\$24,000
<b>DC-TM-27:</b> Roundabout Surveillance	Deploy video (pan-tilt-zoom) in Bend at roundabouts to monitor traffic. (Bend)	\$112,000
<b>DC-TM-28:</b> City of Bend Data Collection Project	Deploy video traffic counting stations at bottleneck locations (e.g. Portland Street Bridge) to monitor traffic and collect volume data. (Bend)	\$112,000
<b>DC-PTM-03:</b> Real-Time Customer Information	Deploy real-time dynamic message signs at key transit locations. Information could also be disseminated via a phone system and the Internet. (Bend Transit)	\$88,000
<b>DC-PTM-04:</b> Transit Security System	Install video monitoring equipment on the transit vehicle fleet and at transit centers. (Bend Transit)	\$105,000
<b>DC-PTM-05:</b> Transit Signal Priority	Install transit signal priority equipment and software at key intersections on transit routes and on transit vehicles. (Bend Transit, ODOT, Bend)	\$130,000
<b>DC-PTM-06:</b> Automated Passenger Counting	Install an automated passenger counting system that electronically records boardings at each transit stop. (Bend Transit)	\$105,000
<b>DC-PTM-07:</b> Electronic Fare System linked to Smart Cards	Install an electronic fare collection system that includes Smart Card support (linked to Bend Parking Garage Smart Cards). (Bend Transit, Bend)	\$25,000
<b>DC-EM-07:</b> Responder Video System	Provide emergency responders with video cell phones and develop a link to the TOC to link video to other agencies. (ODOT, Bend, Redmond, Deschutes Co., Oregon State Police)	\$30,000
<b>DC-EM-09:</b> Advanced Emergency Veh. Routing	Provide emergency vehicle priority between St. Charles Hospital and the Bend Airport. (ODOT, Bend, Redmond, Deschutes Co.)	\$70,000
<b>DC-IM-01:</b> Regional Data Management System	Implement a geospatial data management system for archiving data, collecting real-time data, and accessing data. (ODOT, Bend, Redmond, Deschutes Co.)	\$540,000
<b>DC-MC-04:</b> Portable Work Zone Equipment	Deploy moveable dynamic message signs and variable speed limit signs for use in work zones. (ODOT, Bend, Redmond, Deschutes Co.)	\$342,000
<b>DC-MC-05:</b> Maintenance Vehicle Tracking	Deploy GPS/AVL equipment in maintenance vehicles (e.g. snow plows). (ODOT, Bend, Redmond, Deschutes Co.)	\$779,000

#/Title	Description ( <i>stakeholders listed at end</i> )	Capital Cost
<b>DC-MC-06:</b> Automated Maintenance Logging System	Implement a system to automate coding of maintenance needs (e.g. potholes, wildlife removal, damaged signs) from vehicles. ( <i>ODOT, Bend, Redmond, Deschutes Co.</i> )	\$94,000
<b>DC-MC-07:</b> Portable Sidewalk Closure Message System	Develop and deploy a sidewalk closure audible message system to re-route pedestrians and meet ADA requirements. ( <i>Bend</i> )	\$35,000
<b>DC-AVS-02:</b> Congestion Warning System	Deploy warning systems devices at entry points into urban areas to warn drivers of upcoming signals/queues. ( <i>ODOT</i> )	\$302,000
<b>DC-AVS-03:</b> Intersection Collision Avoidance	Install short-range communications to transmit traffic controller information to in-vehicle collision avoidance systems. ( <i>ODOT, Bend, Redmond</i> )	\$1,400,000
<b>Capital Cost for 2015 – 2025</b>		<b>\$5,710,000</b>

Source: *Deschutes County ITS Plan*

## Access Management

The two main functions of a roadway are to:

- 1) provide access to adjacent properties, and
- 2) provide mobility to travelers.

Access management is the practice of balancing access and mobility based on a roadway's functional classification while also preserving the safety and efficiency of the transportation system. For instance, few access points are provided along interstate freeways to provide for high-speed travel while numerous access points are provided on local streets as entry points to residential properties. Research has shown that effective access management can provide the following benefits<sup>4</sup>:

- Up to 50-percent reduction of crashes
- 23- to 45-percent increase in roadway capacity
- 40- to 60-percent reduction in travel time and delay

Jurisdictions within the Bend MPO should adopt access management standards and develop access management plans along arterial and collector roadways that include some of the following strategies:

- Regulate access spacing minimums based on functional classification: between public roadways, between private approaches, and between public roadways and private approaches.
- Regulate spacing between traffic signals.
- Limit the number of approaches per property frontage based on development type and size.

<sup>4</sup> *Access Management Manual*. Transportation Research Board, National Academy of Sciences, 2003.

- Regulate the width, apron size, radii, and vertical geometry of approaches based on development type.
- Limit access to the lower functionally classified roadway for properties that abut more than one roadway.
- Require developers to provide site designs with adequate internal circulation.
- Provide incentives for adjacent properties to share access points and provide circulation between properties.
- Develop guidelines for the use of median treatments: continuous two-way left turn lanes and nontraversable medians

At a minimum ODOT's access management policies should be met along state highways. More stringent standards may be developed if deemed applicable by the local jurisdiction.

Access management plans for implementation along specific corridors should include both short-term and long-term strategies. Since strict adherence to the adopted access management standards may adversely affect or limit access to existing land uses (particularly businesses), it is extremely important to work individually with each property owner to meet their access needs. The short-term access management plan should include strategies for improving approach locations and circulation for the existing properties along a corridor while also working towards the adopted access management standards, improved safety, and better efficiency. The long-term access management plan should include strategies for access and circulation that may be applied if and when new development or redevelopment occurs in the future so that the plan may be used to gradually improve safety and roadway operations as opportunities arise.

### **Parking Management**

Parking, whether on-street (curbside) or off-street (parking lots and garages), is an important aspect of the transportation system because motorists must physically store their vehicles somewhere in between trips. The management of parking can have significant impacts on the safety and efficiency of the transportation network. Although on-street parking often provides convenient access to adjacent land uses it is responsible for approximately one out of every five non-freeway accidents in cities every year<sup>5</sup>. It also reduces the capacity of the roadway by approximately one-third because the act of parking a vehicle and the presence of vehicle passengers in the roadway before and after parking physically restricts other vehicular movements, particularly in the lane adjacent to the on-street parking. When located too close to an intersection on-street parking may also reduce intersection sight distance.

Effective parking management can help balance mobility and safety with parking demand. The following parking management strategies should be considered for the Bend MPO:

- Allow or prohibit on-street parking based on functional classification.

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<sup>5</sup> *Traffic Engineering Handbook, 5<sup>th</sup> ed.* Institute of Traffic Engineers, 1999.

- In core urban areas develop parking zoning as appropriate: short-term, long-term, no parking, no stopping or standing, loading, taxi, bus, permits, and public agency.
- Establish a minimum distance from intersections for no-parking zones based on functional classification and traffic control (e.g. stop control vs. traffic signal).
- Prohibit on-street parking adjacent to bicycle lanes where possible to reduce conflicts. Use parking bays or other designs from the *Oregon Bicycle and Pedestrian Plan* when both bicycle lanes and on-street parking need to be accommodated.
- Establish off-street parking requirements for private developments.
- Provide incentives for shared parking at commercial and retail developments.
- Establish thresholds for constructing public agency managed off-street parking facilities.
- Adhere to adopted access management standards for the location and design of approaches to off-street parking facilities.

Parking may also be managed using the following transportation demand management strategies, which are aimed at altering travel behavior by reducing the demand on the roadway network particularly during peak periods:

- Reduce the availability of long-term parking in downtown and other core urban areas.
- Develop pricing strategies that charge the true cost of parking or that vary by time of day (e.g. higher prices during peak periods).
- Develop parking fines that discourage violation of parking time limits.
- Expand parking enforcement activities.
- Provide incentives for constructing park and ride facilities outside the core urban area for use with employer ride-share programs or a public transportation system.

The *Deschutes County ITS Plan* includes a high-priority project for a downtown Bend parking management system (DC-TM-06) that monitors occupancy in the parking garage, alerts travelers if the garage is full, and provides guidance to alternate available parking.

### **Traffic Signal Management and Operations**

Approximately 60 traffic signals are used to control vehicular and pedestrian traffic in the Bend MPO and as many as 10 may be installed during the next 20 years. Traffic signals are primarily used to control the movement of traffic in an orderly manner at intersections with high volumes of vehicular traffic. They may also be used at locations with high pedestrian volumes, at school crossings, or at locations with crash histories that may benefit from a traffic signal. The management and operation of traffic signals greatly impacts the efficiency of the transportation network. It is estimated that poor signal timing accounts for five to ten percent of all traffic delay, but the good news is that traffic signal timing optimization projects typically have a 40:1 benefit-to-cost ratio<sup>6</sup>. Coordinated signal timing projects in Oregon have yielded the following benefits:

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<sup>6</sup> *National Traffic Signal Report Card, Executive Summary*. National Transportation Operations Coalition, 2005.

- 10- to 40-percent reduction in stops
- 15- to 45-percent reduction in delay
- 5- to 25-percent reduction in travel time
- Up to 15-percent increase in corridor travel speeds
- Up to 15-percent reduction in fuel consumption

To optimize system efficiency the Bend MPO should implement the following traffic signal management and operations strategies:

- Remove unnecessary traffic signals. Changes in land use, reduced travel demand, or geometric improvements may eliminate the need for a traffic signal that was once warranted. An engineering study should be conducted based on *MUTCD*<sup>7</sup> guidelines to determine whether a traffic signal should be removed and the appropriate traffic control that should be used in its place.
- Install new traffic signals when warranted. Intersections should be evaluated using the *MUTCD* traffic signal warrants to determine if and when new traffic signals should be installed. Most often new traffic signals will be warranted due to changes in land use that result in increased travel demand.
- Utilize traffic signal hardware and software that support desired functionality. Advances in technology in the past few years have led to the availability of traffic signal hardware and software with more options available than ever before. The *Deschutes County ITS Plan* identified the following key features of a traffic signal system that will help optimize traffic signal operations in the Bend MPO: remote control and monitoring capability, controller error processing, and report generation.
- Implement traffic signal preemption/priority. “Preemption” causes a traffic signal to switch from normal operations to a special mode to allow passage of a vehicle class (e.g. emergency vehicles, trains) and “priority” is the preferential treatment of a vehicle class (e.g. transit) by a traffic signal that may occur if it does not disrupt normal operations. Preemption is currently used at the majority of the traffic signals in the Bend MPO for emergency vehicles (except police) but there is room for enhancements. Preemption techniques should be used in the Bend MPO to enhance emergency vehicle operations and priority techniques should be used to enhance transit operations.
- Implement coordinated signal timing where applicable. Various signal timing methods are available for optimizing the operations of closely spaced traffic signals. Traditional time-of-day coordination uses pre-set timing plans that are activated at certain times of the day (e.g. AM peak, midday, PM peak). Traffic responsive coordination uses real-time traffic volumes to select pre-set timing plans based on volume thresholds. Traffic adaptive coordination uses advanced signal controller technology to adjust signal timings in real-time based on real-time traffic volumes. Although traffic responsive and adaptive coordination are relatively new, all methods strive to provide continuous green time to heavy volumes on the mainline while also serving side street traffic in a timely manner.

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<sup>7</sup> *Manual on Uniform Traffic Control Devices, 2003 Edition.* U.S. Department of Transportation, Federal Highway Administration, 2003.

- Periodically update signal timing. National guidelines recommend updating traffic signal timing every 3 to 5 years, or sooner, to accommodate growth and traffic pattern changes<sup>8</sup>. This includes updating timings for both coordinated and isolated traffic signals.
- Investigate the use of automated stop enforcement. Technology is available to detect when vehicles run a red light, to document this violation using cameras, and to automatically issue a ticket to offenders. The Bend MPO should evaluate the effectiveness of automated stop enforcement in other metropolitan areas in Oregon (e.g. Beaverton, Medford) and determine its applicability to Bend. The use of automated stop enforcement in Bend would require the adoption of supporting legislation.

The *Deschutes County ITS Plan* includes the following projects that support traffic signal management and operations (see Table 10.1 for more details):

- Central signal system (Project DC-TM-01)
- Preemption/priority for emergency vehicles, transit, and roundabouts (Projects DC-EM-08, DC-EM-09, DC-EM-10, and DC-PTM-05)
- Advanced signal timing improvements on Hwy 97 Business (3<sup>rd</sup>), Hwy 20, Greenwood, Newport, 27<sup>th</sup>, Empire, Knott, and Reed Market (Projects DC-TM-02, DC-TM-07, DC-TM-13, and DC-TM-17)

Additional projects or programs may be needed to review warrants for removing or installing traffic signals and for performing periodic traffic signal timing updates.

## Speed Management

Uniform travel speeds consistent with a roadway's design provide for the safest and most efficient transportation system operation. Posted speeds are used to supply guidance to drivers in unfamiliar locations, discourage unreasonable driving behavior, and provide law enforcement with a means to identify excessive speeds. In 2005 travel speeds too fast for roadway conditions contributed to approximately 13 percent of all crashes in the Bend area and were also a contributing factor in two of the area's four fatalities<sup>9</sup>. Speeding traffic can also erode the livability of neighborhood streets. The following speed management strategies should be considered for use in the Bend MPO to reduce speed-related crashes:

- Driver Feedback Speed Signs: Driver feedback speed signs provide drivers with the speed limit (static information) and the driver's actual speed (real-time information) based on radar detection or other measurement methods. These signs have proven effective in reducing speeds because often drivers are not aware they are speeding until they see their actual speed. Driver feedback speed signs can be installed permanently or can be moved around on a temporary basis using trailers.
- Variable Speed Limit Systems: Variable speed limit systems use sensors to monitor

<sup>8</sup> *National Traffic Signal Report Card, Executive Summary.* National Transportation Operations Coalition, 2005.

<sup>9</sup> *2005 Oregon Traffic Crash Summary.* Oregon Department of Transportation, Transportation Data Section, Crash Analysis and Reporting Unit, June 2006.

real-time traffic conditions (e.g. prevailing travel speeds and volumes) and/or weather conditions and post appropriate enforceable speeds on dynamic message signs. Speeds may also be set manually based on other factors such as work zone activity. ODOT has successfully been using variable speed limit signs throughout Oregon to reduce travel speeds in work zones during lane restrictions and working hours.

- **Automated Speed Enforcement:** Technology is available to detect vehicles traveling faster than the posted speed and to automatically issue a ticket to offenders. The Bend MPO should evaluate the effectiveness of automated speed enforcement in other areas of Oregon and determine its applicability to Bend. The use of automated speed enforcement in Bend would require the adoption of supporting legislation.
- **Traffic Calming:** Numerous traffic calming techniques are available and have proven effective in reducing travel speeds and cut-through traffic on collectors and local roadways. Techniques include speed humps, traffic circles, traffic barriers, narrowed travel lanes/roadway cross-sections, wider sidewalks, curb extensions, pedestrian refuge islands, planted medians, turn restrictions, or a combination of these techniques. Area wide traffic calming treatments are often needed to ensure traffic problems on one roadway are not shifted to an adjacent roadway. The use of traffic calming elements in the design of new roadways can minimize the need for future enhancements.

The *Deschutes County ITS Plan* includes speed management strategies within two of the projects. The Century Drive Safety and Efficiency Improvements project (DC-TM-09) includes variable speed limit signs and speed photo enforcement on Century Drive and the Portable Work Zone Equipment project (DC-MC-04) includes the use of variable speed limit signs in work zones.

### **Geometric Improvements**

Often geometric improvements can be a cost-effective means of improving the safety and efficiency of the existing transportation system. Changing traffic conditions and piecemeal development often impact the operation of existing roadways and intersections. The Bend MPO should consider the use of the following strategies for improving geometric design based on site specific engineering evaluations:

- Realign roadways to enhance sight distance and reduce skew at intersections.
- Trim vegetation to enhance sight distance.
- Provide channelization for left turn movements, right turn movements, and bus movements. Channelization may be provided using striping, medians, islands, and pullouts.
- Consider lane use restrictions during peak periods. For example, the prohibition of left turns when suitable alternate routes are available may improve safety and reduce travel delay at some intersections.
- Re-stripe travel lane widths.
- Add or enhance destination signing at activity centers and intersections.
- Improve or remove modal crossings (e.g. at-grade rail crossings).

Geometric improvements are included in a number of projects in the Motor Vehicles chapter and the *Deschutes County ITS Plan* includes an advanced rail warning system project (DC-TM-19) to deploy railroad crossing train detection and warning systems.

## Value Engineering and Systems Engineering

Both value engineering and systems engineering are methodical processes used during project development and design to ensure the final product effectively meets user needs in a cost-efficient means. Value engineering is "the systematic application of recognized techniques by a multi-disciplined team which identifies the function of a product or service; establishes a worth for that function; generates alternatives through the use of creative thinking; and provides the needed functions, reliably, at the lowest overall cost."<sup>10</sup> The FHWA requires a value engineering assessment on all federal-aid transportation projects with a cost greater than \$25 million and have found that value engineering provided a return on investment ranging from 116:1 to 319:1 for fiscal years 2002 through 2005<sup>1</sup>. Systems engineering is an offshoot of value engineering that focuses on projects that include technology. The FHWA requires a systems engineering analysis commensurate with the project scope for all ITS projects that use federal funds. Research has shown that projects that utilize systems engineering improve overall project cost performance (actual cost versus planned cost) whereas the actual costs on projects that do not use a systems engineering approach are 50 percent over planned costs on average<sup>11</sup>.

The following strategies should be used for efficient and cost-effective transportation project delivery in the Bend MPO:

- Use value engineering or systems engineering per FHWA guidelines on all federal-aid projects.
- Develop thresholds (e.g. overall project cost) and criteria for determining when to use a full value engineering or systems engineering approach on a project.
- Develop scaled-back value engineering and systems engineering approaches for smaller projects.
- Utilize the "ITS Systems Engineering and Architecture Compliance Checklist" that ODOT developed for use on ITS projects deployed in Oregon.

## Asset Management

"Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making."<sup>12</sup> Although not a new concept, asset management has become increasingly important because today's transportation system

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<sup>10</sup> *Value Engineering*. U.S. Department of Transportation, Federal Highway Administration. <http://www.fhwa.dot.gov/ve/>. Accessed March 19, 2007.

<sup>11</sup> Eric Honour, "Understanding the Value of Systems Engineering", 2004.

<sup>12</sup> *Asset Management: Advancing the State of the Art into the 21st Century Through Public-Private Dialogue*. Federal Highway Administration and the American Association of State Highway and Transportation Officials, 1996.

is characterized by a combination of aging infrastructure and new technologies, high system user demand, tight budgets, limited agency resources, and public accountability.

The Bend MPO should utilize the following asset management strategies to maximize the functionality and prolong the life of the MPO's assets:

- Perform preventative maintenance to prolong the life of existing infrastructure.
- Use life-cycle cost analysis to determine the useful life span of infrastructure based on all associated costs (initial, operations, maintenance) and salvage values.
- Utilize tools used at the state and federal level such as FHWA's Highway Economic Requirements System (HERS) software.
- Develop asset management programs for major infrastructure such as pavement, bridges, traffic signals, and ITS field devices.

Many of the projects included in the Deschutes County ITS Plan include aspects that help improve asset management such as remote monitoring and surveillance capabilities and automated systems (e.g. roadway treatment in winter, speed enforcement). The following *Deschutes County ITS Plan* projects focus specifically on asset management:

- Maintenance and Construction Coordination System (DC-MC-01)
- Maintenance Vehicle Tracking (DC-MC-05)
- Automated Maintenance Logging System (DC-MC-06)
- AVL/CAD Transit Management System (DC-PTM-01)

# Chapter 10: Transportation Demand Management

## Introduction & Overview

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Transportation Demand Management (TDM) strategies focus on altering traveler mode choice to lower the demand on the street system, especially during peak travel times, while encouraging a variety of mobility options.

Common measures to reduce the number or alter the timing of peak hour vehicle trips include: compressed or flexible work schedules, ridesharing, use of transit, bicycle or pedestrian commuting, parking management, mixed-use development, or actions that reduce the need to travel, such as working at home/telecommuting.

TDM programs complement other transportation planning strategies and goals that are aimed at preserving livability and reducing single occupant vehicle travel. Successful programs can be measured by an increase in vehicle occupancy rates and reduced vehicle miles traveled.

Demand management strategies often involve an education and promotion effort to encourage changes from single-occupant driving behavior. Local government and other groups can help to educate the public regarding the actual costs of travel on the transportation system and encourage TDM programs to reduce system demand. Community-wide events can also encourage employees to participate in TDM efforts by promoting alternatives to driving alone. Together, these efforts can make important strides toward improving public awareness regarding travel alternatives.

Demand management programs work best where there are heavily congested corridors, clear work trip travel patterns, limited parking, and the provision of viable alternatives to driving. Experience from successful demand management programs indicates that other important factors include development of quantifiable goals and periodic evaluation, demand management coordination, industry involvement, parking management, employee and employer incentive programs, and strong public support. Thus, transportation demand management strategies require a concerted community effort and commitment in order to fulfill the greatest trip reduction potential.

Broader mobility needs can also be addressed through TDM measures. Much of the unmet mobility need in Bend area comes from people who are currently not contributing to reduced road capacity. These are people who are "transportation disadvantaged". Many citizens of Bend are physically challenged, without a drivers' license, elderly, or too young to drive. The BMPO area would benefit from a balanced transportation system by getting the transportation disadvantaged to and from work, conducting personal business around town or participating in community activities independently. The TDM measures discussed in this chapter are a good first step. No amount of TDM measures, however, will succeed unless other modes of transportation are developed to be as safe and practical as driving.

## Travel Smart©

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The *TravelSmart* program was recently funded in the city of Bend. The intent of this program is to provide public outreach that encourages people to use alternate modes of transportation and reduce single occupant vehicle trips. Two of the fundamental differences of this program include

the direct contact with individual households to help people evaluate and choose alternate modes and the encouragement to use mobility options throughout the day for all trips (e.g. work, school, shopping, recreation, etc.), not just work trips during the peak travel periods. The TravelSmart program has been tested in the U.S. and throughout the world and has demonstrated promising results in promoting use of alternate modes.

## **Policies**

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The region has specific goals and policies outlined within the local transportation plans that are specifically related to TDM. The following and polices are applicable to the Bend Metropolitan planning area.

1. Encourage businesses to participate in transportation demand management efforts through the development of incentives and/or disincentives. These programs shall be designed to reduce peak hour traffic volumes by encouraging ridesharing, cycling, walking, telecommuting, alternative/flexible work schedules and transit use;
2. Work with member governments, business groups, large employers and school districts to develop and implement transportation demand management programs;
3. Continue to support the work of non-profit agencies working towards the same TDM goals as the BMPO;
4. Encourage programs such as van or carpooling (rideshare) to increase vehicle occupancy and reduce unnecessary single-occupant vehicle travel;
5. Encourage the development of park and ride facilities and consider the siting of a rideshare facility, based on identified needs, when rebuilding or constructing new roadways;
6. Encourage the development and utilization of telecommunication technologies that facilitate the movement of information and data;
7. Support efforts to educate the public regarding the actual costs related to travel on the transportation system and encourage transportation demand management alternatives;
8. Encourage the city of Bend to manage parking by:
  - Establishing programs to lower parking demand in commercial and business districts citywide by providing preferential parking for carpoolers, encouraging public transportation use, encouraging shuttle systems from external parking lots, and maintaining an adequate supply of strategically placed bike parking facilities.
  - Encouraging business groups and employers to develop parking management strategies that support reduced roadway system demand during the peak travel times.
9. Participate in the Commute Options for Central Oregon programs by assisting in:
  - Planning for park and ride facilities; and
  - Establishment of educational programs particularly those that will inform the public regarding the full costs of single occupant vehicle travel.
10. Encourage development and implementation of a strategy for ensuring full compliance to bicycle ordinances and the Bicycle Parking guidelines.
11. Encourage implementation of TDM measures before or in conjunction with street widening and construction projects.
12. Encourage a continuation of the Bend Downtowners efforts to reduce employee trips and develop parking guidelines to promote TDM strategies.
13. Plan for development and promotion of area Park and Ride lots.
14. Encourage removal of bicycle and pedestrian barriers (e.g. cinder and snow removal from road shoulders and sidewalks, installation of sidewalk intersection ramps).
15. Encourage the Parks and Recreation District to implement the planned trail system.

16. Encourage efforts at the Bend-La Pine Schools to reduce student and staff trips. This could be accomplished by:
  - Providing trail access to schools and safe and secure bicycle parking for students and staff
  - Developing student parking management plans
  - Encourage that new schools are sited for convenient walking and bicycling within the neighborhood and that the schools contribute to the costs for locating adjacent paths
  - Work with the school district and developers to identify school bus stops and reasonable amenities including, shelters or road enhancements to make the stops safer for children.
17. Support land development ordinances that create more bicycle and pedestrian friendly developments:
  - Encouraging a grid system of streets
  - Encouraging mixed-use developments
  - Redeveloping existing streets with pedestrian, transit and bicycle amenities
  - Separating sidewalks from roadways with appropriate landscaping
18. Support shuttle services to and from Bend
19. Support funding for sidewalks, bicycles, trails and transit by advocating for their inclusion in the city and county Capital Improvement Programs (CIP).
20. Work with member agencies and the Bicycle Pedestrian Advisory Committee to develop a prioritized list of bicycle and pedestrian projects for the Capital Improvement Programs

# Chapter 11: Truck Freight Systems

## Introduction

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Truck freight systems serve a vital role in the economy of Bend's Metropolitan planning area. The majority of movement of raw and furnished goods is moved via truck; efficient truck mobility is crucial to the economic survival of the region.

## Policies

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The importance of freight to the local economy was highlighted by the Oregon Department of Transportation in planning documents, including: "Freight Moves the Oregon Economy" and the Oregon Highway Plan. The Oregon Highway Plan provides guidance on the standards of performance necessary for freight movements. The Plan includes key policies regarding freight movement:

- Maintain and improve the efficiency of freight movement on the state highway system and access to intermodal connections.
- Balance the needs of long distance and through freight movements and local transportation needs on highway facilities in both urban areas and rural communities.

Goals and objectives were developed for the Bend Metropolitan Transportation Plan and are included in a previous section of the report. The applicable goals and objectives related to freight mobility include:

- Provide a variety of practical and convenient means to move people and goods to, from and within the MPO area.
- Identify and support the development of local freight routes
- Support the through movement of goods and people on the state transportation system
- Implement transportation improvements that foster economic development and business vitality.

Truck freight specific policies include:

- Work with the city of Bend, ODOT, and Deschutes County to identify and implement appropriate signage for designated freight routes
- Work with the city of Bend and Deschutes County to identify and implement appropriate design standards for designated freight routes
- Work with the city of Bend and Deschutes County to identify and possibly implement freight route roadway classifications

- Work with the city of Bend, Deschutes County and ODOT to identify a designated freight route on the north and east sides of Bend to allow trucks traveling on US20 to avoid coming into the city of Bend or using Empire Avenue and 27<sup>th</sup> Street.
- Evaluate opportunities to establish other designated routes in the urban area as truck volume or noise issues change.
- Support implementation of the surface transportation recommendations developed through the Oregon Clean Air Initiative

## Facilities

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The designation of through truck routes help provide for the efficient movement of goods while balancing and maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. ODOT<sup>1</sup> identifies Highway 97 (Bend Parkway) as a designated federal truck route and a state freight route. Highway 20 is designated a federal truck route through the entire study area. The following two sections of Highway 20 are designated state freight routes: 1) from the west study area limits to Empire Avenue and 2) from NE 11th Street to the east study area limits. The City of Bend’s TSP identifies Highway 97 (Bend Parkway), Business 97, and Highway 20 as designated freight routes. The TSP also identifies Century Drive as a designated truck route. Both Highway 97 and Highway 20 have either a four-lane or five-lane section throughout the urban area. Generally, truck traffic in the urban area is largely confined to roadways adjacent to industrial, commercial and surface mining zoned properties. The surrounding arterial street system provides links from these state highways with the nearby businesses.

In addition to these regional freight routes, local freight routes were also developed for freight travel through the City of Bend. A Freight Advisory Committee, comprised of local freight industry representatives, developed these local and future local route designations. The benefit of these designations is related to the potential design and operations considerations on the local routes to accommodate large vehicles (e.g. turning radii and grades). The local freight routes and future local freight routes tie into the regional system and provide additional connections, primarily on arterial roadways. Regional, local and future local freight routes are shown in Figure 11-1.

Table 11-1 summarizes the available 2004 truck traffic as a percentage of average daily traffic (ADT) at several permanent ODOT automatic traffic recorder stations within the City of Bend.

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<sup>1</sup> 1999 Oregon Highway Plan, Oregon Department of Transportation. May 1999.

**Table 11-1: Existing Truck Volumes**

<b>Route</b>	<b>Automatic Traffic Recorder Location</b>	<b>2004 Average Daily Traffic</b>	<b>Truck ADT</b>	<b>Truck %</b>
Highway 97	South of Revere Avenue	38,600	2,740	7.1
Highway 97	South of Empire Boulevard	41,300	3,550	8.6
Highway 97	0.9 miles south of Bend	22,150	1795	8.1
Highway 20	5 miles east of Bend	2,750	650	23.5

## **Freight Generators and Receivers**

The main truck freight generators in Bend are manufacturing firms that ship their products throughout the region or cross country. A few regional trucking and delivery firms are based in the city. All of Bend's existing manufacturing and shipping areas are within 1 ½ miles of US 97 or US 20. The local arterial street system links these areas to the highways to provide efficient and direct movement of freight goods through the City of Bend and onto the state highway system.

Bend's population and role as a regional center has generated the development of large retailers—including supermarkets, vehicle sales, and restaurants—that receive all of their goods by truck. The large retailers are primarily located along US 97 and US 20. Other retailers and service providers that receive large or frequent truck deliveries are on local arterial streets that connect to state highways to prevent heavy vehicle from using neighborhoods routes.

## **Forecasts and Future Needs**

The majority of the truck traffic through the Bend Metropolitan planning area is served by the state highway system. In the future, Highway 97 and 20, and 3<sup>rd</sup> Street (Business 97) will continue to serve as the desired through freight truck routes in the community.

Additionally, the completion of the City's arterial street system will improve the local movement of goods to commercial areas within the City and provide an efficient system of roads to ship products from Bend. Key improvements include the completion of Empire Avenue and planned improvements to Reed Market Road will particularly benefit the major industrial areas in the Bend Metropolitan planning area.

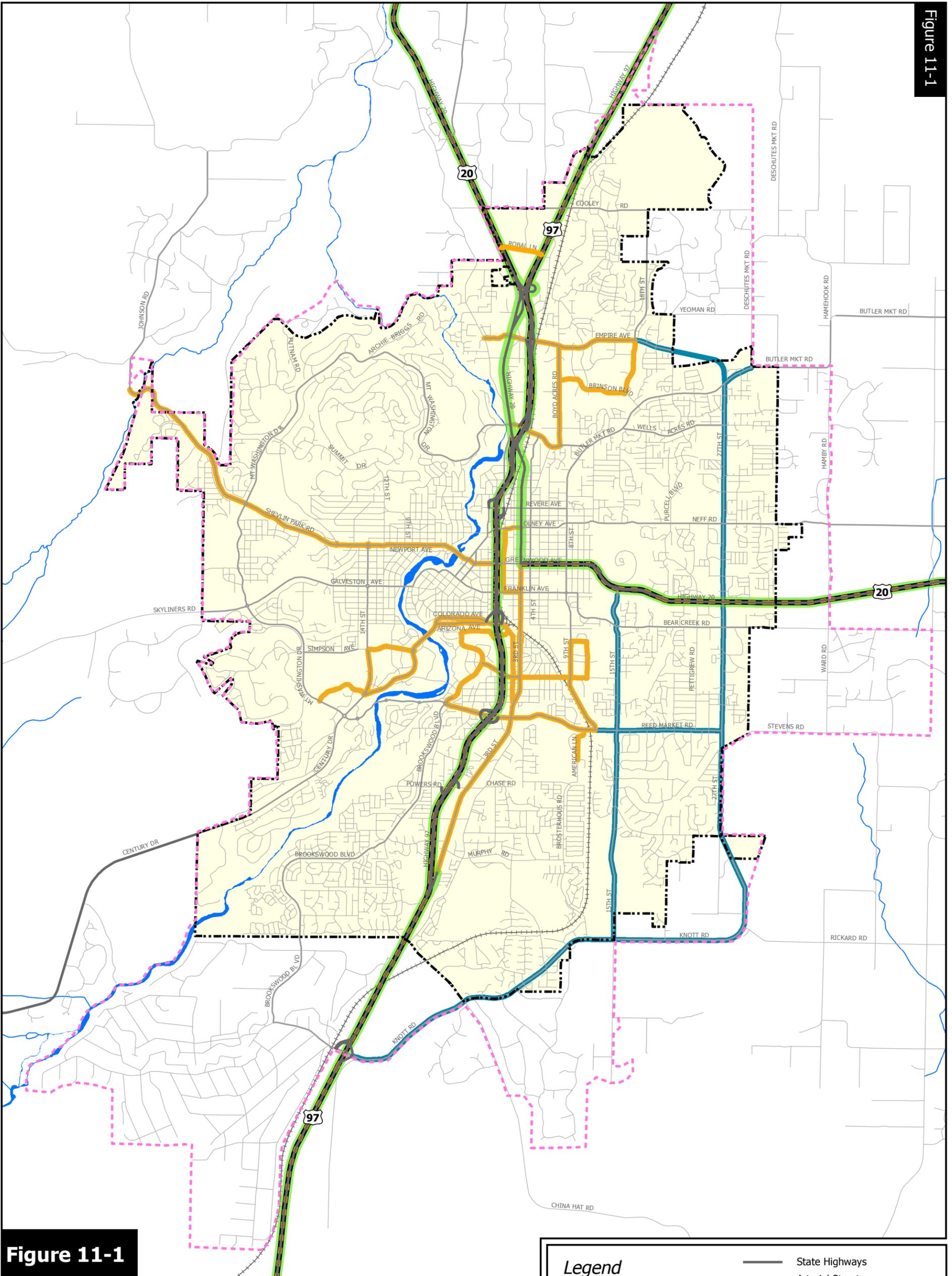
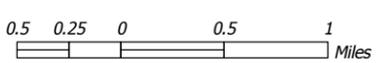


Figure 11-1

# Bend MTP

## Truck Freight Routes

April 2007



Data sources include:  
 City of Bend  
 Deschutes County GIS  
 ODOT  
 DKS Associates

### Legend

#### Freight Routes

- Federal Truck Routes
- State Freight Routes
- Local Freight
- Future Local Freight

- State Highways
- Arterial Streets
- Roads
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- Canals
- River

# Chapter 12: Transportation Safety

## Introduction

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Safety can be defined as the ability of a person to use the regional transportation system (any mode) to transport themselves, passengers, or goods in a way that does not endanger others using the system, the population or the environment. Ensuring the current and proposed regional transportation infrastructure is safe for all users and reducing the risk of transportation related crashes or incidents is an important element of the planning process and development of the Bend Metropolitan Transportation Plan.

The passage of the Safe Accountable Fair Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) has brought increased attention to addressing the safety and security of the transportation system. SAFETEA-LU requires regional plans to consider how to best increase the safety of the transportation system for motorized and non-motorized users.

This chapter presents the transportation safety element. The purpose of this chapter is to identify safety issues for all travel modes on the regional transportation network, develop and document projects, strategies and concepts to address existing and future safety deficiencies and guide future planning efforts to ensure that the regional transportation system operates in a safe manner through the planning horizon year of 2030 and beyond.

## Safety Background Information

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The purpose of this section is to provide background research and analysis to guide the role of the MTP in enhancing regional transportation safety. The evaluation of safety from a regional perspective and for all modes of travel, as well as methods for monitoring safety in the Bend Metropolitan planning area contributes to the development of recommended changes to regional policy for the MTP.

Trends affecting the regional transportation system and current regional transportation planning policies and regulatory requirements have been outlined to lay out the framework for policy gaps within the Bend Metropolitan planning area. National trends, as well as federal, state and local policies are also included in this section to outline the components that impact the regional transportation system. This information is used to develop recommended changes to regional policy for the MTP.

## Policy and Regulatory Framework

Several agencies, at the federal, state and regional level have developed plans and corresponding strategies that address the safety of their transportation facilities. These plans stress the importance of building, maintaining and operating a transportation system that is safe for all users, for all modes and provide information that will ultimately impact what elements will be incorporated into the Bend MTP.

## **Federal**

In 2005, Congress enacted SAFETEA-LU. That legislation was developed to address the many challenges facing the transportation system today, such as improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing intermodal connectivity, and protecting the environment. SAFETEA-LU promotes safety and security as factors to be included in metropolitan planning and establishes a new core Highway Safety Improvement Program that is structured and funded to make significant progress in reducing highway fatalities. It creates a positive agenda for increased safety on our highways by almost doubling the funds for infrastructure safety and requiring strategic highway safety planning, focusing on results. Other programs that target specific areas of concern, such as work zones, older drivers, and pedestrians, further reflect SAFETEA-LU's focus on safety.

## **State**

### ***Transportation Planning Rule (TPR)***

In 1991, the Land Conservation and Development Commission adopted the Oregon Transportation Planning Rule (TPR). The TPR implements State Land Use Planning Goal 12, Transportation, which was adopted by the Oregon Legislature in 1974. The TPR requires most cities and counties and the state's Metropolitan Planning Organizations to adopt transportation system plans that consider all modes of transportation, encourage a safe environment and avoid principal reliance on any one mode to meet transportation needs. By state law, local plans in MPO areas must be consistent with the regional transportation plan (RTP). Likewise, the regional TSP must be consistent with the Oregon Transportation Plan and TPR. Recent updates to the TPR do not affect the requirements for safety planning.

### ***Oregon Transportation Plan (OTP)***

The Oregon Transportation Plan, amended in September 2006 by the Oregon Transportation Commission (OTC), includes Goal 5 which addresses safety and security and details related policy and strategies. The OTP safety goal and policy is outlined below. Several key strategies were also identified in the plan to help attain the desired outcome of a safe transportation system.

#### **Goal 5 – SAFETY AND SECURITY**

**To plan, build, operate and maintain the transportation system so that it is safe and secure.**

#### **Policy 5.1 – Safety**

It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

### ***Transportation Safety Action Plan (TSAP) and Amendment 1***

ODOT's Transportation Safety Action Plan and Amendment 1, adopted in 2004 and

2006, respectively, identifies 69 actions with nine key actions for ODOT to strive for in making their road network safer, and in particular, working toward reducing the number of crashes on the state's roads. The key actions identify areas to address beyond the implementation of traditional transportation infrastructure projects (e.g. education of drivers and training of judges and traffic police). The remaining 60 actions address facility design, construction and maintenance, as well as developing a comprehensive database of incident information to assist in developing strategies and projects to address locations with a high number of incidents. The strategies outlined with the action plan provide guidance to potential safety investments within the Bend Metropolitan planning area.

Several different data sources are available for transportation accident data. Federal, statewide and local agencies maintain databases and/or GIS mapping of accident details and locations. Although data is collected continuously, agencies may publish or make results available only on a yearly basis and complete data sets may not be available for the recent time period due to the maintenance of collecting and organizing the data. Timely, accessible, and accurate crash data is critical to improving traffic, bicycle, and pedestrian safety.

Table 12-1 outlines the most recent available data for national transportation fatalities by mode, as compiled by the Bureau of Transportation Statistics (US DOT).

**Table 12-1: Nationwide Transportation Fatalities by Mode-2003 and 2004**

<b>Mode</b>	<b>2003</b>	<b>% of Total</b>	<b>2004</b>	<b>% of Total</b>
Air	698	1.57%	636	1.4%
Highway	42,884	94.2%	42,836	94.4%
Pipeline	12	0.03%	23	0.05%
Railroad	868	1.9%	897	1.9%
Transit	234	0.5%	248	0.54%
Waterborne	830	1.8%	769	1.71%
<b>Total Fatalities</b>	<b>45,526</b>	<b>100%</b>	<b>45,386</b>	<b>100%</b>

Source: Bureau of Transportation Statistics

Nationwide, highway fatalities (which include pedestrians, motor vehicles, heavy vehicles and motorcycles) comprise the largest percentage of total fatalities. The number of annual roadway fatalities has remained unchanged (40,000-42,000) for the past ten years, but is now showing an upward trend<sup>1</sup>. The impact of fatalities on the transportation system is significant.

In Oregon, the rate of fatalities per 100 million vehicle miles traveled declined from 1.76 in 1992 to 1.46 in 2003<sup>2</sup>. While the trend is encouraging, the numbers are still high. In

<sup>1</sup> FHWA-Road Safety Fact Sheet. Accessed online: [http://safety.fhwa.dot.gov/facts/road\\_factsheet.htm](http://safety.fhwa.dot.gov/facts/road_factsheet.htm)

<sup>2</sup> Oregon Transportation Plan, Oregon Department of Transportation. Adopted September 2006

2003, there were 512 fatalities and 28,256 injuries involving motor vehicles alone in the state of Oregon.

Speeding is a complex safety problem that involves numerous factors like public attitudes, driver behavior, vehicle performance, roadway design, posted speed limits and enforcement strategies. Speeding has also been estimated to be a contributing factor in approximately one third of all fatal crashes, representing a cost of more than \$40 billion<sup>3</sup>.

## **BMPO Safety Goals and Policies**

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In addition to the goals outlined in the new federal legislation, the Bend MPO has set goals and policies that emphasize the importance of building, maintaining and operating a regional transportation system (regardless of mode) that is safe for all users. The goals and policies of the Bend MTP were developed based on a review of the existing goals outlined in other regional and local plans (e.g. Oregon Highway Plan, Deschutes County TSP, and City of Bend TSP) and are outlined in Chapter 2. The goals related to safety were created and adopted to help guide the future development of the roadway network, address safety concerns in a range of areas, and select specific projects for construction. Stemming from the goals and policies, a series of evaluation criteria have been developed to rank potential projects for the regional transportation system. Evaluation criteria includes: the ability of a project to address existing safety deficiencies and the ability to support TSM/ITS strategies. Detailed crash data is available for ODOT and City of Bend facilities and can be used to identify high crash sites; projects that benefit these locations should be scored higher and given a higher priority for implementation.

## **BMPO Modal Safety Data**

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### **Motor Vehicle**

The existing motor vehicle collision data is summarized in Chapter 3: Existing Conditions, for ODOT, City of Bend and Deschutes County study area facilities.

The Oregon Department of Transportation (ODOT) maintains a comprehensive, collision database for all accidents that are reported. The criterion for mandatory collision reporting was revised in December 2003; collisions must be reported if any of the following results occur as the result of a collision:

- Death
- Bodily Injury
- \$1,500 damage to a vehicle
- \$1,500 damage to anyone's property
- If any vehicle is towed from the scene due to damage

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<sup>3</sup> "Speed Management Strategic Initiative." USDOT. June 2005. p.1.

Prior to 2003, collision reporting was required for death, bodily injury, or \$1000 worth of damage to vehicle/property. This revision poses less stringent guiding principles for collision reporting which would attribute to an expected decrease in reported collisions. This is supported by 2004 ODOT collision records where collision rates decreased by 54-percent and 17-percent for urban city arterials and expressways respectively.

The City of Bend and Deschutes County also maintains GIS database files and maps for crash and incident data for intersections within the City and county. This information provides a baseline for comparison for the evaluation of safety-related projects that are recommended and implemented. The maps also provide a useful tool for examining region-wide collision trends over time.

Collision data for the previous five years (2001-2005) was obtained from ODOT for selected corridors within the study area<sup>4</sup>. Analysis focused on the identification of existing high collision segments by combining 2004 Average Daily Traffic (ADT) volumes conducted by the City of Bend and ODOT with the collision records and respective segment length. Equivalent collision rates per million vehicle miles traveled (MVMT) were then determined for each respective segment and used as the basis of identifying high collision segments within the study area. The use of MVMT reflects the level of exposure relevant to each roadway segment. These measured collision rates were compared to those of similar facilities as indicated in ODOT's 2004 Oregon State Highway Crash Rate Tables<sup>5</sup>. The basis of comparison for similar facilities is based on urban city arterials and urban city expressways which had respective collision rates of 2.04 and 0.76 per MVMT in 2004. Five collector/arterial roadway segments and seven highway/expressway segments analyzed have collision rates higher than similar state facilities; these segment details are summarized in Table 12-2.

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<sup>4</sup> Oregon Department of Transportation, Collision data provided for 2001-2005.

<sup>5</sup> 2004 State Highway Crash Rate Tables, Oregon Department of Transportation, Transportation Data Section, August, 2005.

**Table 12-2: City of Bend Roadway Segment Collision Rates (2000-2005)**

Roadway Segment	Collision Type				Collision Severity			Total	Rate (per MVMT)	ODOT 2004 Rate (per MVMT) similar facilities
	Rear	Angle	Turn	Other	PDO	Injury	Fatal			
<b>Reed Market Road</b>										
Silver Lake Blvd. to American Ln.	37	27	46	10	70	50	0	120	<b>3.24</b>	2.04
American Ln. to SE 27th St.	43	2	11	19	40	34	0	74	<b>2.14</b>	2.04
<b>27th Street</b>										
Copperfield Ave. to Reed Market Rd.	8	1	5	1	2	13	0	15	<b>2.09</b>	2.04
<b>Empire Avenue</b>										
OB Riley Rd. to Boyd Acres Rd.	17	5	22	2	26	20	0	46	<b>2.77</b>	2.04
<b>Business 97 (3rd Street)</b>										
Greenwood Ave. to Brosterhous Rd.	82	31	89	27	128	100	1	229	<b>2.84</b>	2.04
<b>Highway 97</b>										
North MPO boundary to Nels Anderson Rd.	80	5	18	22	63	62	0	125	<b>1.54</b>	0.76
Reed Ln. to Hwy 97/3rd St. (south)	73	16	29	9	69	57	1	127	<b>2.24</b>	0.76
Hwy 97/3 <sup>rd</sup> St. (south) to south MPO boundary	2	7	5	2	5	11	0	16	<b>0.92</b>	0.76
<b>Highway 20</b>										
Railroad track to Greenwood Ave.	45	19	51	17	72	60	0	132	<b>2.60</b>	0.76
3rd St. to Pilot Butte Summit Dr.	38	17	59	22	79	57	0	136	<b>3.59</b>	0.76
Pilot Butte Summit Dr. to Purcell Blvd.	41	3	13	12	32	36	0	68	<b>1.83</b>	0.76
Purcell Blvd. to East MPO boundary	17	3	12	4	24	12	0	36	<b>1.54</b>	0.76
Notes:										
- Other types of collisions include backing, pedestrian, head-on, sideswipe, parking, fixed object, non-collision, and miscellaneous.										
- Injury includes A, B, and C type injuries										
- PDO = Property damage only										
- MVMT = Million vehicle miles traveled										

### ODOT Safety Priority Index System (SPIS)

ODOT maintains a Safety Priority Index System (SPIS) that ranks high collision locations along state facilities. The system provides a weighted score based on the severity, frequency, and rate of collisions over the previous three years. Locations are aggregated into 0.10-mile segments. Only segments experiencing three or more collisions or one fatality over the three year analysis period are considered to be a SPIS site. The most recent ODOT SPIS data indicate that 21 segments along Highway 97 and Highway 20 made the SPIS list for the 2001-2003 analysis period<sup>6</sup>.

### Deschutes County High Crash Locations

Deschutes County currently maintains a listing and GIS database of high crash locations within the county. The County has identified a total of 16 intersections that have been designated as high crash locations within the Bend Metropolitan Planning Area including:

- Highway 97/Cooley Road
- Highway 97/Robal Lane
- Highway 20/Empire Avenue
- Highway 20/Olney Avenue
- Highway 20 (3<sup>rd</sup> Street)/Greenwood Avenue
- 3<sup>rd</sup> Street/Franklin Avenue
- 3<sup>rd</sup> Street/Wilson Avenue
- Highway 20/Mt. Washington Drive
- Highway 97/Empire Avenue
- Highway 20/8<sup>th</sup> Street
- Highway 20/27<sup>th</sup> Street
- Butler Market Road/Purcell Boulevard
- 3<sup>rd</sup> Street/Reed Lane
- 3<sup>rd</sup> Street/Badger Road
- 3<sup>rd</sup> Street/Division Street
- 3<sup>rd</sup> Street/Reed Market Road

### **Pedestrian and Bicycle**

The City of Bend maintains GIS data that includes mapping for pedestrian and bicycle collisions. The most recent data set includes pedestrian and bicycle collisions occurring within the City of Bend between 1995 and 2004. Over the 10-year span, there were 80 collisions reported involving pedestrians, yielding an average of 8 collisions per year. The majority of the pedestrian collisions occurred on arterial roadways, primarily in the downtown area where pedestrian and traffic volumes are typically highest. Fifty-six percent of the crashes involving pedestrians occurred at mid-block locations; the remaining crashes occurred at intersections. Twenty-three percent of the total crashes occurred on 5-lane roadway segments. One fatality occurred in 2002.

### **Rail**

Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) currently operate trains through the City of Bend. The Federal Railroad Association (FRA) maintains a current database of rail crash and incident information. The FRA requires reports to be filed for all rail crashes and incidents that occur:

- Between railroad on-track equipment and other vehicles or pedestrians;

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<sup>6</sup> ODOT, [http://www.oregon.gov/ODOT/TD/TDATA/gis/odotmaps.shtml#SPIS\\_SIP\\_Maps](http://www.oregon.gov/ODOT/TD/TDATA/gis/odotmaps.shtml#SPIS_SIP_Maps)

- At grade rail crossings; or
- From any event arising from railroad operations that result in death or injury.

Table 12-3 summarizes rail accident and incident information for the last 10 years in Deschutes County for the two rail lines that travel within the Bend Metropolitan Planning Area. Nationally, rail accidents and highway-rail incidents<sup>7</sup> are decreasing; this can most likely be attributed to the decrease in total rail miles traveled.

**Table 12-3: Rail Accidents (Deschutes County) January 1997 - January 2007**

	Type			Severity	
	Train Accidents	Highway-Rail Incidents	Other Accidents/Incidents*	Fatal	Non-Fatal
Union Pacific Railroad	0	0	1	0	1
BNSF Railroad	0	2	1	0	3

Source: Federal Railroad Administration

Notes: \*Other accidents/incidents are events other than train accidents or crossing incidents that cause physical harm to persons

### Aviation

Two airport facilities serve the Bend Metropolitan Planning Area: Bend Municipal Airport (located within the study area) and Redmond Airport (located 16 miles north of Bend). Aviation safety is a highly regulated activity, managed by the Federal Aviation Administration. Aviation safety involves aircraft construction, repair, operations in flight, the airway system, airport design and airport operations. Federal regulations require operators to notify the National Transportation Safety Board immediately of aviation accidents and certain incidents. An *accident* is defined as an occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. An *incident* is an occurrence other than an accident that affects or could affect the safety of operations. Major contributors to aviation accidents include factors beyond the design of the airport facility and runway, such as pilot error, equipment problems, and weather. Table 12-4 summarizes the aviation accidents that occurred in the last 5 years at the Bend Municipal Airport and Redmond Airport. The Bend Municipal Airport Planning Update<sup>8</sup> and the Oregon Aviation Plan<sup>9</sup> identify the key facility needs and airport layout improvements for the airport, including any safety improvements.

<sup>7</sup> Bureau of Transportation Statistics

<sup>8</sup> *Bend Municipal Airport Planning Update (2002-2021)*, Century West Engineering, December 2002

<sup>9</sup> *Oregon Aviation Plan*, Oregon Department of Transportation, February 2000.

**Table 12-4: Airport Accidents (January 2002 - January 2007)**

	Accident Date	Event Severity	Aircraft Type
<b>Bend Municipal Airport</b>			
Bend, OR	12/2/2006	Fatal (2)	Holloway RV6A
Bend, OR	9/18/2005	Nonfatal	Eiland RAF-200 Gyro
Bend, OR	4/8/2005	Nonfatal	Shannon Lancair Legacy 2000
Bend, OR	10/8/2004	Nonfatal	Maule MT-7-420
Bend, OR	6/16/2004	Nonfatal	Cessna 421B
Bend, OR	12/30/2003	Nonfatal	Bellanca 8KCAB
Bend, OR	8/27/2003	Nonfatal	Lancair LC41
Bend, OR	8/26/2003	Nonfatal	Beech C24R
<b>Redmond Airport</b>			
Redmond, OR	2/4/2005	Nonfatal	Cessna 182G
Redmond, OR	11/13/2004	Nonfatal	Luscombe 11A
Redmond, OR	8/1/2004	Nonfatal	Piper PA-24-260
Redmond, OR	4/20/2004	Nonfatal	Mooney M-20J
Redmond, OR	2/10/2004	Nonfatal	Lancair LC42-550FG

Source: Federal Aviation Administration

As outlined within the section, existing safety issues are present for each mode of travel. For the purpose of the MTP, the focus of safety improvements on the regional system is for those modes funded with public dollars. The rail and aviation industries are private industries and the safety improvements of this plan are generally focused where these modes interact with the highway system (i.e. at-grade railroad crossings). Key safety issues include the interaction between modes (pedestrian and car, car and train, etc.), road design and/or geometry issues on regional facilities, and the negative safety implications of bottlenecks and other congested locations.

## **Safety Strategies for Bend MPO**

Strategies to address these existing safety deficiencies and guide the future of safety improvements for the Bend Metropolitan planning area include a variety of elements: engineering, education, enforcement, and policy development.

### **Engineering/Planning**

Several opportunities for infrastructure and engineering improvements exist within the Bend Metropolitan planning area to enhance the safety of the regional transportation system:

- Road safety design features (e.g. rumble strips, guardrail, retroreflective signs)
- Intersection safety design feature (e.g. traffic signal timing, exclusive turn lanes)
- Pedestrian safety design features (e.g. pedestrian signals, improved lighting, refuge islands on a median)

Roundabout construction and traffic signal installation can reduce the potential for

collision and incidents; roadway widening projects also provide better channelization of traffic movements. Other capacity improvements reduce congested conditions and can contribute to increased safety. Smaller scale improvements, such as re-timing of traffic signals and left-turn pockets have also been shown to be effective at reducing total crashes and the severity of injury crashes<sup>10</sup>. The results of these projects will need to be tracked over time to determine whether they have been successful in addressing safety issues. The preferred alternative project list includes a list of projects that contribute to mitigating existing safety issues, and include ITS solutions as well as infrastructure improvements.

### **Intelligent Transportation Systems (ITS)**

Intelligent Transportation Systems (ITS) apply advanced and emerging technologies in information processing, communications, control, and electronics to surface transportation needs. ITS safety projects, such as traveler information systems aim to give drivers necessary information to avoid hazardous conditions and prevent accidents. Similarly, improvements to traffic control devices (e.g. traffic signal coordination) seek to minimize the frequency and severity of crashes. The Deschutes County Intelligent Transportation System Plan identified a number of projects that address safety issues. Projects identified in that plan focus on providing connections between the traffic operation centers and emergency responders. Other projects include cameras at key locations to identify incidents and observe the system, dynamic message signs and advisory radio systems to inform travelers of bottlenecks, diversions and other hazards. Relevant projects are discussed in the TSM/ITS Chapter and have been incorporated into the Preferred Alternative Project List in the Motor Vehicle chapter of this report.

### **Education**

Public awareness and other educational campaigns on the negative impacts of alcohol and drugs, aggressive driving behavior, railroad safety initiatives and pedestrian/bicycle safety can be implemented on a region-wide level and may contribute to the reduction of crashes. Developing partnerships with public and private agencies is a key element to the successful implementation of such programs.

### **Enforcement**

Two common infractions that have a significant impact on traffic crash rates and severity are red light running and speeding. These can be reduced through the consistent enforcement of safety related traffic laws.

### **Policy Issues**

There are several opportunities for safety-related policy development within the Bend Metropolitan planning area. These opportunities include:

- Coordination with City of Bend, Deschutes County and ODOT for identifying and implementing safety improvement projects, with the primary focus being on

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<sup>10</sup> “Study: Better Signs reduce car crashes”, Washington, September 26, 2002.

highway and pedestrian safety improvements since those constitute the highest number of accidents.

- Working to examine the nature of highway crashes in the region and possible hazard and design-related mitigations
- Continuing Intelligent Transportation Systems planning and project programming, paying special attention to investments that will enhance safety
- Developing safety criteria for project scoring, selection and implementation
- Identifying additional transportation funding sources that are specifically targeted at safety projects to supplement the limited funds from conventional transportation sources
- Continuing to stay abreast of research on transportation safety developed by national and regional agencies around the country, seeking out best practices that can be applied within the Bend Metropolitan planning area

A number of projects have been identified and included in the Preferred Alternative Project List in Chapter 8 of this plan that address the underlying safety issues of critical locations within the Bend Metropolitan Planning Area. The purpose of these projects is to reduce the potential for collisions and incidents, using a variety of countermeasures (e.g. installing traffic signals, widening intersections to provide better channelization of traffic movements, and other capacity improvements that reduce congestion). With limited resources, focusing improvements on corridors has emerged as a way to manage the existing roadway system. Corridors are the focus of traffic safety projects that typically initiate a combination of roadway improvements, enforcement efforts, and public information and education programs. Corridor analysis can also be useful to examine trends in crashes over multiple years and to track whether or not improvements on a corridor contributed to a reduction in crashes.

Ensuring the Bend Metropolitan planning area has a transportation system that is safe to use is a complex task. Several strategies for implementation have been recommended that could potentially improve the safety for all modes of travel; however, additional data and analysis are required to better inform the decision making process where limited funds would provide the most return on investment. Future updates to the Plan will include additional data on where incidents have occurred and how successful the proposed solutions have been in addressing the underlying issues.

# Chapter 13: Security

## Introduction

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Security is one of the planning factors that must be considered in the metropolitan transportation planning. The importance of security in the planning process has gained prominence in recent years. Several national and regional research efforts have been created to address the transportation security issue in more depth, but MPO work in this area is still limited.

This chapter is a first step by the BMPO to address transportation security in more depth in the Bend area. It covers the following:

- The context for transportation security;
- A discussion of the potential role of the BMPO in transportation security planning;
- Bend area modal security data, where available; and
- Recommendations for further BMPO security work.

The chapter addresses security across all modes of transportation.

## National Background

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### Security and the Metropolitan Transportation Planning Process

Safety and security are closely related, although distinct, aspects of all transportation modes. The ideal situation is that all elements of the multi-modal transportation system are both safe and secure. That, however, is not always the case and plans must be made for prevention and readiness to address possible security issues.

A recent study summarizes the evolving awareness: “Prior to September 11th...security issues were not an issue in most state and MPO surface transportation planning processes. Transportation Improvement Programs...did not contain allocations for security related issues. Agencies are now faced with determining how security concerns should be integrated into how we plan, design, implement and operate transportation facilities and services. Is security simply another goal for our transportation system that can be integrated into our planning similarly to how we accommodate safety concerns today, or does addressing security require more radical changes including such actions as redefining organizational structures, modifying basic planning processes and developing or refining planning methods, models and tools?”

It concludes: “Over the next several years, security considerations will result in changes in how transportation is planned, designed, implemented and operated. Transportation goals, planning processes, databases, analytical tools, decision-making considerations, and organizational structures will change due to security concerns. Transportation will be on the front line in responding to security risks. The response to security concerns

will cross jurisdictional and functional lines and be among the most complex and important challenges to transportation professionals. While it may be too early to begin changing our long-range infrastructure network plans in response to security risks, there will be changes in spending priorities in the near term and most probably over a longer period of time “

**Definitions**

The simplest distinction between safety and security is that safety problems, typically vehicle crashes, are unpremeditated events. As such, they may be caused driver error or impairment, adverse weather, a temporary hazard in the right-of-way, poor infrastructure or vehicle design. By contrast, security events always connote a negative intention, whether committed by an individual or a group. In number, attacks on transportation systems are few, with the vast majority of security breaches being committed by non-political individuals. But attacks, when they do occur, can be much more dramatic, harm many people, and require much more effort to address. Figure 13-1 provides a description of various types of security problems that can arise in transportation systems.

**Figure 13-1 Types of Transportation Security Problems**

<b>Event</b>	<b>Description</b>
<b>Aggravated Assault</b>	An unlawful attack by 1 person upon another for the purpose of inflicting severe or aggravated bodily injury. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm.
<b>Arson</b>	To unlawfully and intentionally damage, or attempt to damage, any real or personal property by fire or incendiary device.
<b>Burglary</b>	The unlawful entry of a structure to commit a felony or a theft. This includes offenses known locally as burglary, unlawful entry with intent to commit a larceny or felony, breaking and entering with intent to commit a larceny and all attempts at these offenses.
<b>Larceny/Theft</b>	The unlawful taking, carrying, leading or riding away of property from the possession or constructive possession of another. This includes pocket picking, purse snatching, thefts from motor vehicles, thefts of motor vehicle parts and accessories, theft of bicycles, theft from buildings, theft from coin operated devices or machines, and all other theft not specifically classified.
<b>Trespass</b>	To unlawfully enter land, a dwelling or other real property.
<b>Vandalism</b>	The willful or malicious destruction, injury, disfigurement or defacement of any public or private property, real or personal, without consent of the owner or person having custody or control by cutting, tearing, breaking, marking, painting, drawing, covering with filth, or any other such means as may be specified by local law.
<b>Terrorism</b>	The willful or malicious destruction, injury, disfigurement or defacement of any public or private property by domestic or foreign nationals for the purpose of making a political impact.

Source: Adapted from *National Transit Database*

**Creation of the Department of Homeland Security**

The Department of Homeland Security (DHS) was created in 2003. The DHS inherited the professional workforce, programs and infrastructure of the Coast Guard, Customs

Service, Immigration and Naturalization Service, and the Transportation Security Administration among others. Collectively, these public servants are responsible for protecting the nation's transportation systems and supervising the entry of people and goods into the United States. This is no easy task given that 730 million people travel on commercial aircraft each year. Additionally, 11.2 million trucks and 2.2 million rail cars cross into the U.S. each year. Also, 7,500 foreign flagships make 51,000 calls in U.S. ports annually.

The DHS is responsible for protecting the movement of international trade across US borders, maximizing the security of the international supply chain, and for engaging foreign governments and trading partners in programs designed to identify and eliminate security threats before these arrive at U.S. ports and borders.

### **Intelligent Transportation Systems**

In the past decade, federal transportation programs have been developed that focus on information technology to address various problems. These programs, collectively known as Intelligent Transportation Systems (ITS), can make a major contribution toward transportation security.<sup>1</sup> ITS projects can assist in all phases of security.

## **Key National Issues**

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### **Aviation**

In recent years, many restrictions came into place on both commercial and general aviation. One of the most significant changes was upgraded passenger screening at all commercial airports. Other changes include implementation of new security technologies at the nation's airports<sup>2</sup>. Many other upgrades are still being developed and will be implemented in the coming years.

### **Highways**

One of the DHS's goals is ensuring that the security of drivers and cargo on the highway system are not compromised. Officials with the Federal Motor Carrier Safety Administration (FMCSA) are charged with reviewing security measures with motor carriers and shippers that may be the target of terrorist attack. Its mission is to increase the level of awareness of hazardous materials carriers to terrorist threats. FMCSA field staff will be providing information in the form of recommendations and suggestions, except those regulatory requirements affecting the actual movement of hazardous materials. Highlights of the Security Talking Points are outlined below. These recommendations may not apply to all carriers, based on their size and scope of operation. Additionally, this list is not all-inclusive and will be changed based on future priorities to address potential threats.

FMCSA will recommend to carriers that a security plan be developed and implemented. These plans should include:

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<sup>1</sup> It is also true that because of ITS installations dependence on computers and electrical power, these systems are also more vulnerable to security threats than are many other transportation elements.

<sup>2</sup> See <http://www.tsa.gov/public/display?theme=44&content=09000519800ac831>

- Personnel Security
- Hazardous Materials and Package Control
- En Route Security
- Technical Innovations
- Management Prerogatives
- Communications
- Reassessment Based Upon Current Conditions

FMCSA also recommends that management encourage input and participation in the development and implementation of these security programs. For more information, visit the Federal Motor Carrier Safety Administration website (<http://www.fmcsa.dot.gov/>).

### Transit

By law, up to one (1) percent of urbanized funds / formula funds for transit may be used for safety and security. To date, much of the focus has been on Greyhound and other intercity bus systems. Security grants are being used to enhance security for intercity bus operations by focusing on driver protections; improved monitoring and communications with over-the-road buses; implementing and operating passenger and baggage screening programs; assessing critical security needs and vulnerabilities; and training transportation personnel to recognize and respond to criminal attacks and other potential threats, as well as in improving evacuation procedures.

The security threat to bus operations, however, is not limited to intercity services. A report prepared in 2001 discusses the fact that transit-related attacks are nothing new: “Contemporary terrorists have made public transportation a new theater of operations...an individual or a group calling itself "Sons of the Gestapo" derailed a passenger train in Arizona in 1995...extremists (in 1997)..plotted suicide bombings in New York's subways.”<sup>3</sup>

Most of these reports depict a level of activity that had not been encountered in the U.S. In today’s global society, however, no country can consider itself immune from terrorism, while the traditional crimes of assault and vandalism must also be handled. A summation of security risks for modes using the surface transportation network is shown in Figure 13-2.

**Figure 13-2 Scenarios Considered in the U.S. DOT Vulnerability Assessment (Partial List)**

<b>Physical Attacks</b>	
<ul style="list-style-type: none"> <li>• Bomb at bridge approach</li> <li>• Series of small explosives on highway bridge</li> <li>• Single small explosive on highway bridge</li> <li>• Series of car bombs on adjacent bridges</li> <li>• Bomb at pipeline compressor stations</li> <li>• Bomb detonated at pipeline storage facility</li> </ul>	<ul style="list-style-type: none"> <li>• Bus bombing</li> <li>• Deliberate blocking of highway-rail grade crossing</li> <li>• Bomb detonated on train in rail station</li> <li>• Vandalism of track structure &amp; signal system</li> <li>• Bombing of rail bridge</li> </ul>

<sup>3</sup> *Protecting Public Surface Transportation Against Terrorism and Serious Crime: An Executive Overview* by Brian Michael Jenkins, Mineta Transportation Institute (MTI Report 01-14) Jose State University, October 2001

• Bomb detonated on pipeline segment	• Explosives attack on multiple rail bridges
<b>Chemical Attacks</b>	
• Physical attack on railcar carrying toxics	
<b>Cyber Attacks</b>	
• Cyber attack on highway traffic control system	• Sabotage of train control system
• Cyber attack on pipeline control system	• Tampering with rail signals
	• Cyber attack on train control center

Source: National Research Council, *Improving Surface Transportation Security, A Research and Development Strategy*, Washington D.C: National Academy Press, 1999.

## **The Potential Role of the MPO in Transportation Security Planning**

Despite the requirements in prior legislation to address security, most MPOs did little security planning until recent years. One writer sums up the overall safety and security environment: “Prior to September 11th most concerns were focused on how best to include safety considerations in the transportation planning process. For example, many MPOs and DOTs have fairly advanced methodologies for selecting projects to be included in the Transportation Improvement Program (TIP) or Statewide Transportation Program (STIP)...From a sample of 13 MPOs, it was not uncommon for safety concerns to represent 10 to 20 percent of the point allocation for highway projects, but little recognition was given to security issues...Also, it was found that safety and security were frequently ignored in the prioritization of transit, intermodal, or enhancement projects...One interesting issue is how security measures can be defined and quantified for project selection.”<sup>4</sup>

### **Recommended Approach to Transportation Security Planning**

A Transit Cooperative Research Program (TCRP) report<sup>5</sup> as well as many other sources group security planning into four subject areas:

- Prevention activities;
- Preparation activities;
- Response activities; and
- Recovery activities.

The first two of the four security steps, prevention and preparation, are the primary focus for MPOs; while transportation systems and facilities, particularly transit systems, may be called upon to help move personnel in response to a security event, such a response will be coordinated by a higher level of government. Transportation agencies are unlikely to take the lead in such situations. Furthermore, Response and Recovery are operational activities not appropriately addressed in the Metropolitan Transportation Plan.

<sup>4</sup> *The Role of Security in the Surface Transportation Programming Process* by Frederick J. Wegmann, Ph.D. and Jerry Everett, University of Tennessee

<sup>5</sup> TCRP International Transit Studies Program. *Safety and Security Issues at All-Bus Systems in Small to Medium Sized Cities in Western Europe*. Research Results Digest, June 2003.

Nevertheless, Prevention and Preparation may require substantial resources, both for training and for capital purchases, and these projects and programs, with their costs, should be considered and ranked in the MTP.

One writer raises questions about how the new focus on security will be dealt with: “Are existing planning tools and models altered? Is the process amended to incorporate security? Is security another goal to add to the list along with subsequent objectives and performance measures? Can one simply screen all the jargon in plans and replace the term safety with safety/security, or is there a distinct difference? Do security concerns merit changes in organizational charts, and how do the security responsibilities get spread across the federal, state, regional and local agencies involved in delivering transportation planning? Is security something that gets addressed in the public participation part of planning? How do the financial commitments to security initiatives get evaluated and how are tradeoffs made to reflect security concerns? And, is it premature to draw conclusions about how security impacts transportation planning?”<sup>6</sup>

This writer offers five “Simplified Planning Process Steps:”

1. Goal Development
2. Conditions Assessment
3. Needs Assessment
4. Project Identification
5. Project Programming

The same writer addresses the funding priorities that are central to an MPO’s work: “Investment Priorities -- Speculation has centered on whether security risks will have an influence on public attitudes toward transportation investments. Some have suggested that the economic value of transportation is being recognized, and this will aid efforts to increase investment in transportation. Others anticipate a renewed interest in having transportation choices; specifically enhanced funding for rail modes. Still others worry that diversions of dollars to enhance security will detract from capacity improvements...Transportation investment priority changes could result from a number of considerations.”<sup>7</sup> Transportation resource pressures resulting from security concerns could include:

- Diversion of resources to security needs outside of transportation programs
- Diversion of funds to operating security enforcement/policing/planning/training
- Diversion of funds to capital investments in security (barriers, fencing, etc.)
- Use of funds to support network redundancy/connectivity
- Use of funds to support modal choice/redundancy
- Diversion of funds to design changes/enhancements to increase security.

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<sup>6</sup> *Security Considerations in Long-Range Transportation Planning: A White Paper for the Arizona Department of Transportation* by Steven E. Polzin, P.E. Ph.D. for Cambridge Systematics

<sup>7</sup> *Security Considerations in Transportation Planning: A White Paper* by Steven E. Polzin, P.E. Ph.D. for the Southeaster Transportation Center

He continues: “Post September 11th, actions suggest a variety of possible investment needs as a result of increased sensitivity to security risks. These needs range from near-term initiatives to conduct strategic planning and assessments to supporting enhanced enforcement levels such as those found at airports, to longer-term needs to alter the physical characteristics of individual transportation investments and the system or network of investments. Changes could range from rerouting roadway alignments from sensitive sites to removing trash containers from rail station platforms. Enhancements to ITS technology as a tool to utilize in incident prevention and incident response have been contemplated and simple design changes to enable additional vehicle inspection queues at border crossings or luggage and passenger scanning capacity at airports may be necessary. Revisiting the capability of our transportation network to handle special vehicles or military equipment in response to incidents or the exploration of modifications in our roadway network to more easily enable mass exodus from an urban area in response to a crisis are among the more complex and expensive strategies that might be pursued. Other major financial obligations could occur if decisions to change the connectivity or range of modal options in our transportation system were to move forward. Several interests, for example, have proposed major investments in high-speed rail in order to provide an alternative to dependency on air travel for longer distance trips. Additionally, certain travel behavior changes could result in different demands for transportation by various modes than are currently anticipated. This could result in changes in modal priorities, shifting geographic priorities, changes in project costs due to design or other security related changes, or other shifts in long-range transportation facility and service plans.”

## **Bend Area Modal Security Data**

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A summary of Bend area modal security information is shown in Figure 13-3:

**Figure 13-3 Summary of Bend area Modal Security Information**

<b>MODE</b>	<b>PREVENTION</b>	<b>PREPARATION</b>	<b>RESPONSE</b>	<b>RECOVERY</b>
Transit – Bend Area Transit and Dial-a-Ride	Drivers receive training.	Security enhancements will likely be included with new bus acquisitions.	BAT may assist in movement of people during response.	BAT resources may be part of regional or local recovery plan.
Bend Airport	TSA is working with general aviation airports to assist them in appropriate planning.			
Rail - BNSF	Procedures for derailments in place. Emergency response planning is carried out on an ongoing basis. Reporting systems are in place for unauthorized access to hazardous materials. Hiring practices seek to ensure security through personnel screening.	See Prevention	Emergency response plans in place including a procedure to cooperate with local emergency responders.	Recovery plan is in place.
Highway	ODOT is working with local and state emergency managers, Oregon State Police, USDOT and others to identify transportation facilities that may require special consideration in planning for response to terrorist incidents.	ODOT employees are required to take terrorism awareness training.	Phase 1 is to report concerns to law enforcement & to cooperate with law enforcement. Phase 2 (consequence mgmt) is described in the ODOT Emergency Operations Plan.	ODOT will continue to provide essential services to the public by identified critical business functions. Critical Business Functions are in the ODOT Emergency Operations Plan.
Pipe (gas) and Power (electrical) lines: Central Electric Coop, Pacific Power and Cascade Natural Gas	A failure to a portion of the transmission systems leading to outages can be isolated from the entire system. There are established rules for practical safeguarding of employees and the public during installation, operations, & maintenance of systems.	Emergency response plans are in place. The plans provide guidelines regarding responses to specific emergencies to protect life, property, and the environment. The plans must also comply with OSHA regulations. Each company coordinates with other response agencies.	Crews are on call 24 hours a day.	Crews are on call 24 hours a day.

## Policies

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- Work with local agencies and jurisdictions to evaluate transportation security incident data by mode and identify appropriate policy and program directions.
- Continue Intelligent Transportation Systems planning and project programming, particularly with a view to investments that will enhance security.
- Regularly review the MTIP scoring matrix and other specific funding program scoring matrices to ensure that security projects receive appropriate weighting and priority in the MTIP.
- Regularly review the project identification and prioritization process for the Regional Transportation Plan (RTP) to ensure that security receives adequate priority in the development of the long range project list.
- Identify transportation funding sources that are specifically targeted at security projects, so that the limited funds from conventional transportation sources are not inappropriately redirected to this area.
- Support, through planning and programming, the installation, operations, upgrades, and timely maintenance of system infrastructure, including ITS applications, to provide for improved security.
- Work with local agencies and jurisdictions to analyze the transportation network for redundancies in moving large numbers of people (e.g., modeling person and vehicle flows with major links removed or reversed, accommodating street closures, adaptive signal control strategies, impact of traveler information systems), and strategies for dealing with possible “choke” points.
- Work with local agencies and jurisdictions to analyze the transportation network for emergency route planning and identification of strategic gaps in the network.

# Chapter 14: Parking

## **Parking Chapter to be completed at a Later Date**

# Chapter 15: Aviation Systems

## Introduction

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This chapter addresses activities, issues and needs at the region's airports within and near the Bend Metropolitan planning area over the 20-year planning horizon.

Airport planning is generally conducted at three levels. Individual airports do Master Plans and Airport Layout Plans under Federal Aviation Administration (FAA) guidance that addresses their 20-year future. States do airport system planning by establishing a hierarchy of public use airports within the state, setting priorities for investment and management based on different goals and policies. The FAA also does its own airport-related planning through a number of documents, including the National Plan of Integrated Airport Systems.

## Policies

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Individual airports and local jurisdictions have their own policies, goals and objectives but are also guided by nine statewide aviation goals including:

1. Preserve investment in Oregon's system of airports and its level of service.
2. Protect airports from incompatible land uses.
3. Maintain Oregon's public-use airports so that they are safe, and ensure that the airport system can fulfill its role in the state's emergency response system.
4. Support economic development by providing access to regional, state, national, and international markets.
5. Provide access to the air transportation system and its connections with other modes for people and freight throughout the state.
6. Comply with state and federal environmental protection requirements.
7. Support efforts to ensure sufficient system capacity and airport modernization.
8. Seek adequate and stable statewide funding to preserve system airports.
9. Provide advocacy and technical assistance (from the State Aviation Department) for airports and their users.

The region has specific goals and policies outlined within the local transportation plans that are specifically related to aviation and were developed to help guide the future of the airports in the region. The relevant policies include:

1. Work with member agencies and jurisdictions to protect the function and economic viability of the existing public-use airports while ensuring public safety and compatibility between airport uses and surrounding land uses for public use airports and for private airports with three or more based aircraft.
2. Continue to recognize the Redmond (Roberts Field) Airport as the major commercial/passenger aviation facility in central Oregon and an airport of regional

significance. Its operation, free from conflicting land uses, is in the best interests of the citizens of central Oregon.

3. Work with, and encourage airport sponsors to work with the FAA to enforce FAA registered flight patterns and FAA flight behavior regulations to protect the interests of County residents living near airports.
4. Encourage appropriate federal, state and local funding for airport improvements at public-owned airports.
5. Work with local jurisdictions to discourage future development of private landing fields when they are in proximity to one another, near other public airports and potential airspace conflicts have been determined to exist by the Federal Aviation administration FAA or ODOT Aeronautics.
6. Participate in and encourage adoption and update of airport master plans for the Bend Municipal Airport and Redmond Municipal Airport.
7. Work with airport sponsors, local jurisdictions and transportation providers to evaluate and enhance opportunities for improving surface transportation options to the Bend Municipal Airport and Redmond Municipal Airport.

## **Facilities**

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### **Bend Municipal Airport**

The Bend Municipal Airport is located approximately five miles northeast of the Bend Metropolitan planning area. It is a non-towered airport and classified as a Category 2 – Business or High Activity General Aviation Airport with no scheduled passenger service to/from the airport. The single asphalt runway is 75 feet wide and 5,005 feet in length serving approximately 42,000 annual aircraft operations (departures and arrivals) with an approximate average of 110 operations per day thus making it the 14<sup>th</sup> busiest airport in the state<sup>1</sup>. The existing asphalt runway is in fair condition. Approximately 180 aircrafts in combination with 18 aviation type businesses are currently based at the airport. The airport was established in 1942 in response to World War II training efforts.

### **Redmond Municipal Airport ~ Roberts Field**

Passenger air service is provided to the Central Oregon area at the Redmond Municipal Airport, located approximately sixteen miles north of Bend. The Redmond airport is classified as a Primary Service/Transport airport and is publicly owned. It provides scheduled passenger service and accommodates larger and higher performance aircraft than the Bend facility. The Redmond airport is currently served by three commercial carriers, Delta, Horizon Air, and United Airlines (including United Express). Currently, there are daily direct flights to several cities in the western U.S. This airport is not included in the Bend Metropolitan planning area.

The Bend Municipal Airport and Redmond Municipal Airport are outside of the Bend Metropolitan planning area. The Deschutes County regulations and County TSP policies govern land use issues that are associated with the use and operation of the airport. Key goals outlined in the Deschutes County TSP are related to the protection of public-

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<sup>1</sup> Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

use airports through the development of land use regulations based upon the adopted airport master plans. The purpose of these regulations is to prevent the installation of airspace obstruction, additional airport hazards and to ensure the safety of the public and guide compatible land use.

## Forecasts and Future Needs

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The Oregon State Aviation System Plan discusses five trends that will cause aviation activity growth in the state and within the Bend Metropolitan region including:

- Migration to Oregon;
- Growth in high-tech and export-oriented industries;
- Growth in tourism;
- Increase in air travel by general population; and
- Increase in number of retirees with high discretionary incomes.

### Bend Municipal Airport

According to the most recent City of Bend Municipal Airport Plan, annual operations are forecast to increase from 25,000 in 1993 to 50,000 in 2013. Even with a doubling of activity over the 20-year planning period, the airfields system (runway and taxiway) will accommodate the forecast demand. Additionally, aircraft based at the Bend Airport are forecast to increase from 110 in 1993, to 165, in 2013. Bend has adequate paved tie-down areas to meet demand but will need to add hanger space to accommodate demand for covered aircraft storage.

The Oregon Aviation Plan<sup>2</sup> found runway length/width and weather reporting to be the key needs for the Bend airport in order to preserve the airport system over the next twenty years. Since this finding, an automated weather observation system capable of announcing wind speed, wind direction, current temperature and dew point, precipitation, cloud layers and ceiling up to 12,000 feet AGL, density altitude, barometric pressure (altimeter setting), visibility (1/4 mi to 10+ mi), and lightning strikes/activity within and beyond 10 miles<sup>3</sup> has been installed. An additional runway is anticipated to be completed in October 2007.

### Redmond Municipal Airport

According to the most recent Redmond Airport Master Plan<sup>4</sup>, the number of passenger emplanements is forecast to double from 147,106 in 2003 to 300,000 in the year 2023. Following a similar growth pattern the general aviation trends are expected to increase from 36,128 in 2003 to 67,400 in the year 2023. The plan evaluated airport needs over

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<sup>2</sup> *Oregon Aviation Plan*, Oregon Department of Transportation, February, 2000.

<sup>3</sup> Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

<sup>4</sup> *Redmond Municipal Airport Master Plan*, April 2005. Accessed online: <http://www.ci.redmond.or.us/internet/content/view/104/212/>

a 20-year planning horizon and recommended a series of runway improvements to accommodate the forecast growth. The following list outlines key needs for the future:

- Longer runway length to accommodate aircraft flown by United States Forest Service. Runway 4-22 should be extended to a length of 8700 feet
- Construction of a new parallel runway (7000-8000 feet long, 150 feet wide)
- Segregated area for air cargo facilities
- Expansion of the existing terminal
- Up to 80 new storage spaces for small and large aircraft
- Taxiway modifications

The Oregon Aviation Plan cited runway length/width, taxiway access and REILS (runway end lighting system) as the primary deficiency areas for the Redmond Airport in the 20-year planning horizon. These deficiencies were also cited in the Redmond Airport Master Plan.

# Chapter 16: Rail Systems

## Introduction

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Rail service in the Bend Metropolitan planning area serves an important role to the regional transportation system moving freight north and south through the study area and serving regional connections within the State of Oregon and beyond.

## Facilities

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### Freight Rail

Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) currently operate trains through the Bend Metropolitan planning area. The rail track, owned by BNSF, runs parallel to Highway 97 at the north city limits before veering east just south of Colorado Avenue towards the industrial zone. The rail track is regulated under the Federal Railroad Administrations (FRA) class 2, 3 and 4 track standards; there are no weight or dimensional restrictions for freight movements through the study area. As a result, rail can handle much heavier loads as well as longer loads than those normally permitted on highways. A modern rail car can handle the same cargo that would require three to four semi-trucks to handle.

BNSF and UP combined for an estimated 13 million gross ton miles being transported through the study area in 2002<sup>1</sup>. In 2005, BNSF was operating approximately 12-15 trains per 24 hours through the study area, while UP was operating one train daily in each direction. Additionally, BNSF operates a switch engine which transports freight to and from local businesses within the study area. The majority of freight being transported through the study area consists of various forest products, cement, diesel fuel, liquefied petroleum gas, wallboard, and other construction supplies.

### Passenger Rail

There is currently no passenger rail service in the Bend Metropolitan planning area. The nearest connection to passenger rail service in central Oregon is in the town of Chemult, which is located about 70 miles south of Bend. The feasibility of extending AMTRAK service to the Bend area was analyzed during the development of the 1992 Oregon Rail Passenger Policy Plan. The study concluded it would be impractical to provide passenger service to Bend. In 2000, the state funded two “throughway” bus connections with AMTRAK that pass through Bend. One travels from Portland to Boise, Idaho and the other connects the Chemult rail station with the Bend area. The Oregon Rail Plan<sup>2</sup> does not currently identify any future plans for passenger rail service serving

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<sup>1</sup> Email from Bob Melbo of ODOT Rail Division to Tyler Deke of Bend MPO, January, 2006.

<sup>2</sup> *Oregon Rail Plan* Oregon Department of Transportation, 2001. Accessed online:  
<http://statelands.dsl.state.or.us/ODOT/RAIL/docs/railplan01.pdf#search=%22oregon%20rail%20plan%22>

the Bend Metropolitan planning area.

### **At-Grade Rail Crossings**

The majority of the rail crossings within the study area are at grade. There are seventeen total crossings over the freight rail line traversing the study area. Eleven of the crossings are at grade and utilize active traffic control devices; the remaining crossings are over grade or under grade. The rail crossings are shown in Figure 1-12 (from the existing conditions chapter).

### **Forecasts and Future Needs**

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Overall, rail freight in Oregon is projected to be the second fastest growing mode of transportation behind vehicle travel. Oregon's freight rail traffic totaled 63.5 million tons, handled to, from, within and through the state in 1999. Rail freight volumes, as well as truck freight volumes are forecast to double by 2020 in the state of Oregon and nationally. No regional rail forecasts for the Bend Metropolitan planning area are available.

Throughout the 20-year planning period, the railroad line through the study area will continue to haul freight. The existing railroad switching yard depot, weigh station and sidings are expected to remain unchanged and there are no planned changes to the existing pattern of short spur rail lines that serve local freight rail users.

The Bend Transportation System Plan includes two future rail crossings in the 20 year planning time frame. One future crossing is an eastward extension of Murphy Road (a collector) to 15<sup>th</sup> Street. This new road/railroad crossing will be grade separated. Another proposed railroad under crossing is proposed at Hawthorne Avenue. A detailed analysis (for the future need of the Hawthorne connection) should be evaluated when it is necessary to improve east-west capacity in the downtown to Third Street.

Historically, train delays at road/railroad crossings have not been a major traffic problem in the Bend Metropolitan planning area, with the exception of the Reed Market Road crossing. The rail crossing at Reed Market Road may warrant a grade separated crossing in the future. If this occurs, consideration should be given to improving the direct connection for motor vehicles between 9<sup>th</sup> Street (to the north) and American Lane (to the south). This may include a system of frontage roads.

As traffic volumes increase, other train crossings may contribute to increased traffic interruptions, specifically on arterial roadways. Potential solutions include coordination with railroad authorities to minimize crossings during peak driving periods or grade separation.

### **Policies**

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The region has specific goals and policies outlined within the local transportation plans that are specifically related to rail service and were developed to help guide the future of

the regional railroads. The following polices are primarily related to safety and expanded usage of the existing rail lines and are applicable to the Bend Metropolitan planning area.

1. Maintain the existing levels of freight rail activity throughout the Bend Metropolitan planning area while also encouraging expanded usage by commercial and industrial companies.
2. Increase the safety of existing at-grade crossings and work towards the eventual replacement of priority at-grade crossings with grade-separated crossings.
3. Work cooperatively with affected local jurisdictions and railroad operators to reduce land use conflicts and increase safety at all at-grade crossings;
4. Encourage efforts to improve the condition of rail lines throughout the Bend Metropolitan planning area in order to retain the effectiveness and competitiveness;
5. For rail lines being considered for abandonment, work cooperatively with the applicable parties to evaluate opportunities for converting the rail line to multi-purpose trail use. If the rail line is converted to multi-purpose trail use, the trails should be incorporated into the applicable local trail system plans;
6. Work cooperatively with the railroad operator to determine where, if possible, railroad right-of-ways could be used as trail corridors. Provided local joint-use agreements can be reached with the railroad operator, work with local jurisdictions to evaluate the entire Rails to Trails Corridor in light of opportunities to augment the local primary trail system. If trails are identified and developed, the trails should be incorporated into the applicable local trail system plans;
7. Work cooperatively with affected local jurisdictions, businesses and railroad operators to protect all rail spurs that currently serve businesses or have the potential to serve freight rail uses from abandonment or incompatible zoning; and
8. Work cooperatively with the railroad operator to develop and implement a plan for train scheduling to ensure that the current needs of the transportation system in the study area are minimally affected.
9. Work cooperatively with the railroad operator to evaluate opportunities for minimizing noise impacts associated with rail operations.

# Chapter 17: Pipeline Systems

## Transmission Pipelines

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Two major natural gas transmission lines serve the Bend Metropolitan area. Gas Transmission Northwest Corporation (TransCanada) currently operates high-pressure natural gas pipelines that run near Bend city limits. These pipelines extend between Kingsgate, British Columbia and Malin, Oregon thus traversing a distance of 612 miles. These pipelines currently pass through the southeast corner of the city limits and consist of 36-inch and 42-inch diameter pipelines that are capable of delivering up to 1 billion cubic feet (BCF) of gas per day to the Pacific Northwest; however typical daily operations are in the range of 600-700 million cubic feet per day<sup>1</sup>.

Cascade Natural Gas holds the role of distributing natural gas to the City of Bend through a system of 2-6 inch diameter piping. The maximum allowable operating pressure for the pipeline system is 911 pounds per square inch (psi). No other major utility pipelines serve, pass, or are currently planned through the Bend metropolitan area.

Other transmission lines for electricity, telephone, cable and internet services exist throughout the planning area. There is no known existing or future capacity constraints for pipeline or transmission line service within the Bend Metropolitan planning area.

## Policies

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1. Work cooperatively with the pipeline operator when planning any transportation system improvements that might impact the major gas transmission lines.
2. Work cooperatively with affected local jurisdictions to reduce land use conflicts and increase safety at all transportation system crossings of major transmission lines.

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<sup>1</sup> Phone conversation with Robert Latimer, TransCanada GTN & NBP System, May 9, 2006.

# Chapter 18: Environmental Considerations

## Introduction

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The Environmental Considerations chapter is a new requirement of the current federal transportation legislation (Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users) enacted in 2005 (Appendix I). This legislation requires that the BMPO long-range transportation plan includes a discussion of the types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the plan. In order to comply with SAFETEA-LU, this chapter:

- 1 Identifies existing environmental features within the BMPO boundary using maps and text.
- 2 Compares proposed transportation projects to the environmental conditions and identifies any potential conflicts that could result from the plan.
- 3 Identifies activities that may have the greatest potential to restore and maintain the environmental functions affected by the transportation plan.

The law requires that jurisdictions develop these analyses in discussion with Federal, State, and tribal wildlife, land management, and regulatory agencies.

This chapter is intended as a baseline of information gathered during spring of 2007 and is to be used as a starting point for analyzing transportation projects. When projects are proposed, this section should be reviewed to determine if there are any potential conflicts. If potential conflicts are identified, further information will be needed and further consultations with agencies with jurisdiction may be required.

## Chapter Organization

The BMPO Environmental Considerations Chapter is a map-based product. The chapter is divided into ten sections with numerous specially developed maps to aid in analysis of resource identification. GIS data layers have been secured from a wide variety of sources and combined into maps that illuminate resources and aid in conflict identification. The maps are located in Appendix I and the supporting metadata is in Appendix I. The chapter is divided into the following ten sections:

- Land Use & Infrastructure
- Water Resources
- Fish, Wildlife & Habitat Resources
- Hazards
- Climate Change
- Air Quality
- Scenic Resources
- Historic and Cultural Preservation

- Recreation Resources
- Environmental Justice

Each of the above sections is structured the same with the following headings: Summary, Methodology, Findings, and Recommendations. Below is an outline of what the reader can expect to learn in each section.

Summary: The purpose of summary is to give the reader a very quick overview of what the section includes and any identified conflicts and recommended actions. It includes:

- A definition of what the section includes.
- A brief summary of data collected and agencies consulted.
- Identification of other sections that should be reviewed concurrently.
- Highlights of findings – resources and impacts identified.
- Highlights of recommendations.

Methodology: This section is designed to give the reader details on the type of data collected and agencies contacted. This section has the following parts:

- List of agencies consulted
- Table of documents reviewed
- Table of maps developed with data layers and sources identified
- Missing, unavailable or inadequate data identified.

The majority of information is derived from existing available data. However, all of the maps are new compilations of existing data layered in new ways to allow for a more comprehensive look at potential impacts of the transportation plan.

Findings: This section will provide the reader with information about what resources were identified in the study area and how they might be impacted. It includes:

- Identification of environmental or cultural resources.
- Identification of regulations or protections in place.
- Identification of potential conflicts between resources and proposed transportation projects.

Recommendations: The section provides recommended activities to avoid, reduce or minimize identified conflicts with the transportation plan. This section includes:

- Identification of activities that may have the greatest potential to restore and maintain the environmental functions affected by the transportation plan
- Identification of further work to be accomplished in updates of this document.

### **Coordination**

In developing this Environmental Considerations Chapter, the BMPO coordinated with numerous agencies. Coordination involved consultations and meetings, contact via

email, phone or letter, website database searches, or presentations to the following agencies:

- Bureau of Land Management (BLM)
- Burns-Paiute Tribe\*
- City of Bend
- Confederated Tribes of Warm Springs
- Deschutes County
- Klamath Tribe\*
- Oregon Department of Environmental Quality (DEQ)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Department of Land and Conservation (DLCD)
- Oregon Department Of State Lands (DSL)
- Oregon Department of Transportation (ODOT)
- Oregon State Historic Preservation Office (SHPO)
- U.S. Army Corps of Engineers (USACE)
- U.S. Department of Commerce, National Marine Fisheries Service (NMFS)
- U.S. Department of Transportation Federal Highway Administration (FHWA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (USFWS)
- Upper Deschutes Watershed Council (UDWC)
- US Forest Service, Deschutes National Forest

\*no response to date

A presentation was given to Oregon’s state and federal transportation and environmental agencies (called CETAS, Collaborative Environmental and Transportation Agreement for Streamlining) on May 15, 2007, to share preliminary work and receive comment. The members present at the meeting are listed below and the minutes of the meeting are in Appendix I.

Hal Gard, ODOT	Susan Haupt, ODOT	Michelle Eraut, FHWA
Yvonne Vallette, EPA	Charlotte Kucera, NMFS	David Leal, USFWS
Joyce Cohen, ODOT	Eric Metz, DSL	Michael Turaski, USACE
Corey Saxon, DEQ	Mollie Manion, SHPO	Art Marin, ODFW

### Highlights of Results

The BMPO encompasses 47 square miles and includes two jurisdictions – the City of Bend and Deschutes County. The entire City and its Urban Growth Boundary are contained within the BMPO with County land forming a ring around the BMPO. The population of the area is estimated to be 83,000 in 2006. While the BMPO is highly scenic and has significant environmental resources, there are relatively few identified conflicts between the proposed transportation projects and the resources. This is primarily due to the small number of rivers, streams and wetlands; an historic absence of anadromous fish; and the nature of the transportation projects proposed. The

transportation projects proposed consist primarily of improvements to existing roads. There are few new roads proposed. This could change in the future and the information in this document and the map layers gathered should provide information necessary for analysis of future planning efforts. The major environmental conflict from transportation projects is stormwater runoff. Stormwater runoff impacts fish and wildlife, water quality, and results in flooding of major intersections. Other potential conflicts include wildlife crossings, air quality and climate change and restricted lands. Recommendations to avoid, reduce or mitigate identified conflicts include adopting the Central Oregon Stormwater Manual, maintaining wildlife linkages, adopting the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction, and identifying all 4(f) and 6 f (3) lands prior to pursuing transportation projects.

### **Overarching Recommended Policies**

*See also the specific recommendations at the end of each section of this report.*

1. Potential impacts to the environment including, but not limited to air, water resources, fish, wildlife, native plants and habitat, and scenic resources shall be identified and considered in the initial planning stages of any BMPO transportation project and prior to funding and design of the project.
2. Potential impacts to cultural resources including but not limited to recreation, environmental justice, historic sites and archeological sites shall be identified and considered in the initial planning stages of any BMPO transportation project and prior to funding and design of the project.
3. Potential impacts to either the environmental or cultural resources from proposed BMPO transportation plans shall be evaluated through consultation with appropriate federal, state, tribal and local agencies.
4. Minimizing adverse impacts shall be evaluated in the following priority order:
  - a) Avoid adverse impacts by not taking an action.
  - b) Minimizing impacts by limiting the degree of action.
  - c) Rectifying by repairing, rehabilitating, or restoring the affected environment.
  - d) Reducing or eliminating impacts over time through preservation and maintenance activities.
  - e) Compensating for an impact by replacing or providing substitute resources or environments. In most mitigation agreements, more of a resource or habitat must be provided than was originally present. Ratios greater than 1:1 are required in part to compensate for unrealized losses and the inability of technology to completely restore the natural environment.
5. All mitigation measures shall include the following items to be adopted concurrently with the mitigation measure:
  - a) A funding mechanism sufficient to provide adequate funding, calculated from an average annual budget, to support the on-going maintenance

- needs of the mitigation, for the life of the mitigation. Mechanism could include performance bonds, endowment, taxing districts or other methods.
- b) On-going funding shall include, but is not limited to, on-going facility maintenance, equipment replacement costs, personnel, public education, and monitoring costs for the life of the mitigation.
  - c) A monitoring and evaluation program with measurable goals, sufficient to determine if the mitigation is working or not.
  - d) Adaptive management protocols with milestones for implementation tied to the monitoring and evaluation program.
  - e) Enforcement mechanism with penalties sufficient to cover costs.

### **Recommendations at a Glance**

Each of the recommendations below is found at the end of the appropriate section. They are shown here for a quick overview.

#### Water Resources

To avoid or mitigate potential impacts to water quality it is recommended that the *Central Oregon Stormwater Manual* be adopted by the BMPO member jurisdictions and that the best management practices in the manual be employed when building or retrofitting transportation projects.

#### *Future Work to be Completed*

- Identify all service stations and define specific transportation routes for fuel delivery. Prioritize stormwater management along those routes.
- Identify and define specific transportation routes for transportation of hazardous materials. Prioritize stormwater management along those routes.
- Map the remaining 25 drainage areas of concern for flooding on Map 5, Water Quality.

#### Fish, Wildlife and Habitat

##### *Habitat*

Design transportation projects to avoid the destruction of habitat wherever possible. See general policies for more.

##### *Bull trout and redband trout*

Identify and explore methods to protect, restore, and maintain suitable habitat conditions for bull trout and redband trout for all transportation projects, especially those near the Deschutes River or Tumalo Creek, including the following:

- Maintain or improve water quality.
- Stabilize roads, crossings, and other sources of sediment delivery.
- Identify barriers or sites of entrainment and implement tasks to provide passage and eliminate entrainment.
- Screen water diversions and irrigation ditches.
- Restore connectivity and opportunities for migration by securing instream flows and/or water rights.

### *Invasive species*

- Develop measures that prevent invasive species from entering the area on cars, trucks, boats, boat trailers or other vehicles.
- Design transportation projects to prevent the spread of noxious weed species.

### *Wildlife Linkages*

The design of new transportation projects and the retrofit of existing projects shall include the identification of any wildlife movement issues and a review of best management practices to facilitate wildlife movement to improve human and wildlife safety, decrease habitat fragmentation and property damage. Include mapped wildlife movement areas of concern upon their completion by Oregon Department of Fish and Wildlife.

### Hazards

#### *Future Work to be Completed*

There may be additional activities recommended for specific species including bats that should be identified.

- Consideration of wildfire and other emergency evacuation routes should be taken into account in the design of transportation projects.
- Further investigation of the issues involved with railroad transport should be conducted, specifically the potential for toxic releases and railroad maintenance.
- Transportation projects near Tumalo Creek should analyze potential flooding impacts and channel migration potential and develop mitigation if impacts are identified.

### Climate Change

Adopt the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction that are appropriate for the BMPO.

Mitigations measures from the Oregon Strategy for Greenhouse Gas Reduction are designed to reduce greenhouse gas emissions from consumption of fossil fuels by displacing conventional combustion engines with hybrid, electric and other technological/fuel options, and to guide land use choices, especially in Oregon's urban areas, toward more efficient choices including higher densities, transit options, mixed-use neighborhoods, and common wall dwelling designs. Mitigations should be updated as new information becomes available. Among the recommend actions outlined in the report that may be appropriate for the BMPO are:

- Adopt Low Emission Vehicle Emission Vehicle Standards.
- Adopt greenhouse gas Tailpipe Emission Standards.
- Integrate land use and transportation decisions with greenhouse gas consequences.
- Promote biofuel use and production.
- Incorporate greenhouse gas emission impacts into transportation planning decisions.
- Adopt state standards for high efficiency/low rolling resistance tires.

- Reduce GHG emissions from government fleet purchase and vehicle use.
- Set and meet goals for reduced truck idling at truck and safety stops.
- Set up traffic flow engineering “Best Practices.”
- Set and meet goals for freight (truck/rail) transportation efficiency; achieve this through equipment, coordination and land use.
- Improve mass transit and inter-city transit links.

Other recommendations:

- Recommend the City of Bend sign the US Mayors Climate Protection Agreement.
- Work with the City of Bend to conduct a carbon inventory and consider crafting a comprehensive carbon emissions reduction plan.

### Air Quality

To analyze the impact of proposed transportation projects to air quality:

- Use the transportation demand model, the complimentary air quality models, and the emissions inventory to assess the air quality impacts of transportation system improvements.
- Participate in the Clean Air Committee to identify and implement air quality improvement strategies that will help maintain the regions clean air and avoid a federal nonattainment listing.
- Participate in the Clean Air Committee to provide education and awareness of air quality issues.

See also the recommendations in the Climate Change section of this report for other actions that will mitigate air quality conflicts.

### Scenic Resources

- For all transportation projects, review the Scenic Resources map and identify and potential conflicts.
- For the Cooley Road extension project: Design the project to avoid impacts to the State Scenic Waterway and the County Landscape Zone.

### Historic and Cultural

- Consult with the Deschutes County Historical Landmarks Commission and the State Historic Preservation Office on a case-by-case basis for each proposed transportation project to determine if there is the presence of any historical or archeological resources or Section 4 (f) lands.
- For any Section 4(f) lands identified, property boundaries shall be defined and jurisdictional responsibilities identified. The BMPO shall work with the responsible jurisdiction to avoid impacts to the 4(f) lands according to federal requirements.

### Recreation Resources

In the early stages of planning for transportation projects in the BMPO, a survey should be conducted to identify all 4(f) and 6 f (3) lands. Property boundaries defined and jurisdictional responsibilities should be identified. The BMPO should work with the

responsible jurisdiction to avoid, reduce or minimize impacts to the 4(f) or 6 f (3) lands consistent with requirements outlined in the respective regulations.

### Environmental Justice

Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

Ensure that the long-range transportation plan and the transportation improvement program comply with federal Title VI requirements.

### *Future work to be Completed*

- Conduct further analysis as new census data becomes available.
- Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.
- Develop a public outreach plan that encourages participation and engages minority and low-income populations in transportation decision-making including providing Spanish translations of printed materials and at meetings if needed.

## Land Use & Infrastructure

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### Summary

The Land Use and Infrastructure section of this chapter provides an introduction to the BMPO area. The BMPO includes only two jurisdictions – the City of Bend and Deschutes County. The entire city and its Urban Growth Boundary are contained within the BMPO with County land forming a ring around the BMPO. Three maps provide background information for this report. Map 1 is a relief map of the area; Map 2 is a zoning map with both City of Bend and Deschutes County zones; and Map 3 is a map of utilities including sewer lines and other infrastructure. While the BMPO is highly scenic and has significant environmental resources, there are relatively few identified conflicts between the proposed transportation projects and the resources. This is primarily due to the small number of rivers, streams and wetlands, historic absence of anadromous fish, and the nature of the transportation projects proposed.

### Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County

The following were the primary documents reviewed for this section:

<b>Title</b>	<b>Source</b>	<b>Date</b>
Collection System Master Plan, Final Report	City of Bend	2006
City of Bend General Plan & Zoning Code	City of Bend	1998, 2006
Deschutes County Comprehensive Plan & Zoning Code	Deschutes County	2005, 2001
Community Profile and Trends Report, Bend 2030, Our Community Vision	City of Bend	2006

Documents focused on specific parcels of land or areas within the BMPO were also reviewed including:

<b>Title</b>	<b>Source</b>	<b>Date</b>
Draft Stevens Road Tract Master Plan	Cogan Owens Cogan, LLC et. al. for the Oregon Department of State Lands	December 1, 2005
Reed Market Corridor Study, Draft Existing Conditions Technical Report	Parametrix, Inc., for City of Bend	June 2005
Juniper Ridge Concept Plan	Otak, for City of Bend	August 2005
Bend Parkway Final Environmental Impact Statement	Oregon Department of Transportation	August 1992
City of Bend Central Area Plan	City of Bend	2007
Murphy Road Corridor Project, Existing Conditions and Deficiencies	CH2M Hill, for City of Bend	December 2006

Digital data layers were combined to create maps depicting the existing information available. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix I.

<b>Map #</b>	<b>Map Name</b>	<b>Data Layer</b>	<b>Source</b>
<b>1</b>	Relief Map	Hillside Relief	Deschutes County
<b>2</b>	Zoning	City Zoning	City of Bend
		County Zoning	Deschutes County
<b>3</b>	Utilities	Proposed Gravity Interceptors	City of Bend
		Pressure Mains 10" and over	City of Bend
		Gravity Mains 10" and over	City of Bend
		Water lines over 8"	City of Bend
		Avion Water Lines Over 8"	Avion Water District

## Findings

The BMPO encompasses 47 square miles, most of which is within the City of Bend city limits with a ring of Deschutes County land surrounding the City. The area is located in the high desert, which receives 11.6 inches of rain and 34 inches of snow. The City of Bend averages about ten days per year with temperatures over 90 °F with winter lows between 20 °F and 30 °F on average. The area is defined by the Cascade Mountain range to the west (which receives a mean annual precipitation of 140 inches), the desert to the east, and the Deschutes River running north and south through the middle of the planning area. The population of the BMPO area was approximately 83,000 in 2006. The area has been among the fastest growing areas in the nation in recent years. Highway 97 runs north and south and Highway 20 runs east and west through the BMPO.

While there are significant environmental resources in the BMPO, they are relatively confined geographically. For example, there are only two water bodies in the BMPO, the Deschutes River and Tumalo Creek and no designated upland wetlands within the city limits. There are no anadromous fish (they are blocked naturally by Big Falls north of the BMPO). Bull trout and bald eagle are the only species with recovery plans in the region. Stormwater is a big concern for the area, which received a National Pollution Discharge Elimination System Stormwater Discharge Permit in February 2007. There are numerous historic districts and buildings in the BMPO but they are not impacted by the proposed projects. There are many archeological sites, only a few of which are identified on the map. Most archeological sites will have to be identified on a case-by-case basis as projects are proposed. Transportation projects proposed in the BMPO are primarily related to improvements to existing intersections and roads.

### **Recommendations**

There are no activities proposed for this section, which provides general background information.

## **Water Resources**

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### **Summary**

The Water Resources section of this chapter focuses on quality and quantity of surface and groundwater in the BMPO and includes public health issues affecting drinking water. Data was gathered from a wide variety of sources including the Department of Environmental Quality, the City of Bend Public Works Department, and the Upper Deschutes Watershed Council. Documents reviewed include stormwater plans and permits, subbasin assessments and other water-related documents. This section should be reviewed along with the section on Fish, Wildlife and Habitat, as water issues discussed in this section are closely related. There are four maps pertaining to this section. They are: Map 4 - Stormwater; Map 5 - Water Quality; Map 6 - Environmental Health; and Map 7 - Irrigation Service Areas. This is probably one of the more complex and important sections of this chapter in part due to the emerging stormwater management and water quality activities underway at this time, and the complicated nature of the interplay of surface and groundwater in the area. Impacts resulting from 100 years of stormwater discharges to the Deschutes River and underground through injection wells, along with heavy manipulation of the river flows using dams and irrigation diversions are identified in this section. To avoid or mitigate potential impacts to water quality it is recommended that the Central Oregon Stormwater Manual be adopted by the BMPO member jurisdictions and that the best management practices in the manual be employed when building or retrofitting transportation projects.

### **Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Central Oregon Intergovernmental Council
- City of Bend

- Oregon Department of Environmental Quality
- Oregon Water Resources
- Upper Deschutes Watershed Council

The following were the primary documents reviewed for this section:

<b>Title</b>	<b>Source</b>	<b>Date</b>
Central Oregon Stormwater Manual	Central Oregon Intergovernmental Council	May 2007
City of Bend Water Quality Monitoring Project: Technical Report 2004	City of Bend, Upper Deschutes Watershed Council	June 2005
City of Bend Public Works Department Stormwater Master Plan Project Fact Sheet	City of Bend	January 2007
City of Bend Stormwater Master Plan Scope of Work	City of Bend	September 2006
Integrated Stormwater Management Plan	City of Bend, Public Works Department	November 2006
National Pollution Discharge Elimination System Stormwater Discharge Permit	Oregon Department of Environmental Quality	February 26, 2007
NPDES Permit for Stormwater Discharges: Permit Evaluation Report and Fact Sheet for the City of Bend	Oregon Department of Environmental Quality	2007
Oregon Department of Environmental Quality website - Leaking Underground Storage Tank (LUST) Cleanup Site Database	Oregon Department of Environmental Quality	
Oregon's Phase II Municipal Stormwater Program - Fact Sheet	Oregon Department of Environmental Quality	November 26, 2006
The Bend Riverway, A Community Vision	Bend Park and Recreation Foundation	July 1999
United States Department of the Interior Geological Survey	US Geological Survey	2001
Upper Deschutes Subbasin Assessment	Upper Deschutes Watershed Council	August 2003

Digital data layers were combined to create maps depicting the existing environmental information for water resources. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix I.

<b>Map #</b>	<b>Map Title</b>	<b>Data Layer</b>	<b>Data Source</b>
<b>4</b>	<b>Stormwater</b>	Catch Basins, Drill Holes, Dry Wells	City of Bend; Deschutes County
		River Discharges	City of Bend
<b>5</b>	<b>Water Quality</b>	Impacted water data (303[d])	Department of Environmental Quality 2002
		Sub basin Delineation	City of Bend
		Drainage Problem Areas	City of Bend
<b>6</b>	<b>Environmental Health</b>	Public Drinking Water Wells, and Well Protection Areas	City of Bend
		Railroads	Deschutes County
		Water Service Area - Avion	Avion Water
		Water Service Area - City	City of Bend
		Water Service Area - Roats	Roats Water District
		Location of Service Stations	Deschutes County
<b>7</b>	<b>Irrigation Service Areas</b>	Canals	Deschutes County
		Irrigated Land – Arnold Irrigation District	Geo-Spatial Solutions
		Irrigated Land - Central Oregon Irrigation District	Central Oregon Irrigation District
		Irrigated Land – Swalley Irrigation District	Deschutes County
		Irrigated Land – Tumalo Irrigation District	Deschutes County

#### Notes about the Data

A data layer from 2002 from the Oregon Department of Environmental Quality is included on Map 5. The data layer does not exactly match the data in the table, which is more current than the map. The 2004 map is not yet available from the Oregon Department of Environmental Quality. The biggest change that will appear on the 2004 map is that Tumalo Creek will be shown as water quality impaired for temperature.

Only one year of water quality-monitoring data generated by the Upper Deschutes Watershed Council for the City of Bend is available in report form. Further monitoring is underway with a new report due out in June 2007. A minimum of five years of data is typically required in order to develop firm conclusions about trends in water quality.

Not all of the service stations are identified on Map 6 and areas zoned for service stations are not identified.

See Appendix I for more information on the metadata for these maps.

## **Findings**

### Surface Water

The BMPO encompasses approximately 47 square miles much of which is impervious surface. The average annual precipitation in the area is 11.6 inches with 34 inches of snowfall on average. There are only two natural surface water bodies in the BMPO: the Deschutes River which runs north and south through the middle of the area, and Tumalo Creek which crosses the northwest corner of the BMPO.

The Deschutes River is 252 miles long from its headwaters in the Cascade Mountains, with about 14 miles of the river within the BMPO boundary. The Deschutes River originates at Little Lava Lake, which is supplied with water from subsurface flows and springs. The volcanic soils in the area have a high level of permeability that allows precipitation to sink easily into the ground and eventually reach the water table. Before dams were constructed, the Deschutes had a flow regime described in 1914 by the US Reclamation Service, which stated in a report, "The flow of the river is one of the most uniform of all streams in the United States, not only from month to month, but also from year to year."

The Deschutes River is primarily a spring-fed system and the groundwater is linked to surface water, which significantly affects the surface flows. Groundwater is discharged downstream of the BMPO in very significant amounts (a 10-fold increase has been measured between river mile 138 and 120) which alters the hydrology of the surface water.

As early as 1901 irrigation diversions were beginning to be constructed on the Deschutes, and by 1920 there were four dams and five diversions within the BMPO and one diversion (Arnold Irrigation District) just upstream from the BMPO boundary. Near the headwaters of the Deschutes, Crane Prairie Dam began regulating the water flow in the river in the 1920's and Wickiup Dam began regulating water flow in 1949, disrupting the naturally stable year-round flows. Winter water storage and summer water releases at Wickiup Reservoir, in combination with downstream diversions, contribute to significant fluctuations in flow levels. In the vicinity of the BMPO, summer high flows above the BMPO boundary reach 2,100 cubic feet per second (cfs) while below the BMPO boundary flows are reduced to as low as 30 cfs. This dramatic fluctuation in flow has been linked to a variety of water quality impacts.

Irrigation canals are common throughout the BMPO. They intersect the transportation system by crossing roads in many locations and may significantly increase the cost of transportation projects over or near canals. The cost may be prohibitive and cause projects to be rerouted to other areas.

Tumalo Creek is a much smaller creek with fewer diversions than the Deschutes. It originates from springs and snowmelt in the Cascade Mountains west of Bend. The creek is a tributary of the Deschutes River joining it just outside the north BMPO boundary. Drinking water diversions from Bridge Creek (a tributary of Tumalo Creek upstream) and irrigation diversions severely limit summer streamflow. During the peak

of the irrigation season and during winter stock runs, more than 90% of the in-stream flow is often diverted (Jones, 2005). Efforts by the Deschutes River Conservancy are underway to put water back in the stream.

### Groundwater

The geology and hydrology, including the connection between surface water and the underground movement of water, is very complex and unique in Central Oregon. The report Ground-Water Hydrology of the Upper Deschutes Basin, Oregon prepared by the US Geological Survey in 2001 (Gannett, 2001) states that groundwater and surface water are directly linked in the Deschutes Basin and removal of groundwater will ultimately diminish stream flow in some parts of the river (Fick, 2007, Yake, 2003). The established link between surface and groundwater is important to consider in discussing downstream and regional impacts from transportation projects in the BMPO.

In general, the geology of the area includes lava beds that sit on top of several hundred feet of volcanic and sedimentary rocks. The subsurface geology of the upper Deschutes Subbasin defines and directs the storage and flow of groundwater. Although basalt itself is not very permeable, the fractures and joints between lava flows do allow a substantial amount of water to pass through (Bastasch, 1998). Soils in the subbasin are generally very shallow and highly permeable. In many areas, these soils are underlain by large areas of impermeable consolidated pumice, which prevents infiltration (Fick, 2007).

Adding to the complexity of this river system are the diversions of the Deschutes River and Tumalo Creek for irrigation and the many miles of unlined canals. These canals leak approximately 46% of the water diverted from the river back into the groundwater, which may contribute almost 13% to annual groundwater recharge in the area (Gannett, 2001). River flow is diminished between where the irrigation water is withdrawn and where it rejoins the river through the groundwater connection. The distance may be many miles apart.

The groundwater is recharged by a combination of precipitation, canal leakage, infiltration of applied irrigation water that percolates below the root zone, and leakage from streams. There is a strong connection between precipitation quantity and groundwater recharge rates. Approximately 84% of recharge due to infiltration of precipitation in the Deschutes Basin occurs between November and April from snowfall in the High Cascades, (Gannett, 2001).

### Drinking Water

There are two aquifers underlying the BMPO. A deep underground river-like aquifer moves from the southwest across the BMPO to the northeast. At a depth of approximately 300 feet or more, this aquifer is the source of about half of the City of Bend's drinking water (Map 6). Shallow aquifers are located above the deep or "principal" aquifer but are not a source of municipal drinking water. However, there are many non-municipal water wells that withdraw from this shallow aquifer. Many of these shallow aquifers are fed by canal leakage (Fick, 2007).

Approximately half of the City's potable water is obtained from water wells tapping the deep aquifer and this amount of withdrawal is expected to grow in the future. Yields from wells in the area may be as high as 2,000 gallons per minute. Most municipal wells have yields in the 750 to 2000 gallons per minute range (Yake, 2003). The general water table ranges from approximately 500 or more feet deep at the City of Bend rising to 200-300 feet deep near Redmond. This is due to a northerly downward sloping trend in the ground surface elevation (Gannett, 2001). Monitoring of the deep groundwater has occurred over the years and none of the data reveal a pattern of drinking water standard violations or significant groundwater quality degradation. However, data from several sources indicates that some nitrate contamination may be occurring (Fick, 2007).

Potential impacts resulting from lack of adequate control methods to prevent hazardous waste spills of fluids from getting into public wells are of concern. These spills could come from fuel deliveries to service stations (Map 6) or from other hazardous materials being transported through the BMPO on Highway 97, surface streets or on the railroad. A review of Map 4 shows the locations of drywells and catchbasins, which number in the thousands and conveys surface water underground. Work is underway to avoid this problem, but currently, if a spill occurs it will have a high likelihood of entering the groundwater and potentially wellhead protection areas. The 3<sup>rd</sup> street underpass is of particular concern because it is located in a municipal drinking water protection area. A rail car derailment at one of these overpasses (located at 3rd Street, Franklin or Greenwood) could result in a spill that could quickly drain underground and threaten groundwater. Cleanup would be difficult and expensive (Fick, 2007). More on this issue is covered in the next section on Stormwater.

### Stormwater

For the past 100 years, sewage, industrial and commercial waste water and stormwater has been discharged underground to shallow aquifers that underlie the BMPO area. This is beginning to change but some of these practices continue today. There has been very little monitoring of the shallower aquifers to determine if they are being contaminated. According to the City of Bend, stormwater injected underground may be posing a threat to the quality of groundwater (City of Bend, 2007).

Currently stormwater is collected and discharged into the Deschutes River, or underground via drywells and drill holes (Map 4). In most cases there is no pretreatment of stormwater prior to discharge. According to City of Bend Public Works Department, the City's stormwater system includes about 13 miles of storm sewers, approximately 20 river outfalls, 3,280 drywells, 1,020 drill holes, and 5,200 catch basins along with a few infiltration ponds, swales, and manufactured treatment devices. The drywells and drill holes are designed to inject stormwater underground. In addition the Department reports that, "The City does not have the flow control facilities necessary for good flood and water quality management" (Stormwater Master Plan Project Fact Sheet, 2007).

Flooding is a frequent and serious problem in the City of Bend, with 30 problem areas identified. Five areas have been identified as the City's top priority to address (Map 5).

According to the City's *Request for Proposal for a Stormwater Master Plan*, "In many locations throughout the city, systems are not capable of collecting, conveying and disposing of enough stormwater to prevent localized flooding even for 2-year storm events. For larger events, such as severe summer thunderstorms or heavy rainfall on a winter snow pack, flooding is serious enough to cause public safety problems, flood property and cause land instability. In some areas, the city pumps storm runoff to the sanitary sewer system for a few hours until runoff subsides. This can hydraulically overload the sewage treatment plant and cause operating problems.

Snowmelt and rain-on-snow are serious winter problems for the city. Snow and ice plug drainage inlets and snow that is plowed onto sidewalks and other available areas throughout the city adds to the drainage problems when the snow melts, especially during rain-on-snow events. Also, the city applies cinders to many of its roads during the winter. Although it attempts to sweep these up before they can be washed into drainage systems, the city has problems with the cinders clogging its underground injection systems. Other than catch basins, few drainage systems include sediment removal devices or any other type of pretreatment." Where the railroad passes over 3<sup>rd</sup>, Franklin, and Greenwood Streets are of particular concern for flooding. The streets below these overpasses are drained underground. These drainage systems frequently fail, causing stormwater to accumulate and block traffic.

The City is currently working on several plans to address water quantity and quality issues and comply with federal and state regulations. The City has adopted an Integrated Stormwater Management Plan which is required by the two permits held by the city: one to regulate discharges to the Deschutes River (National Pollutant Discharge Elimination System (NPDES) Phase II) and another for underground discharges. These regulations and permits require the city to use best management practices to improve stormwater quality.

A Stormwater Master Plan is expected to be completed by early 2008 and will provide a delineation of drainage areas and runoff quantities, a prioritized list of improvements needed to meet state and federal water quality requirements, design and maintenance standards, and a financing structure to support the stormwater program. A total "Water Management Plan" is tentatively planned that would address all water management issues within the Urban Growth Boundary and include water conservation. None of the permits or plans listed above applies to the Old Mill District, some subdivisions, or the approximately 2,000 acres of land owned by Bend Metro Park and Recreation District (BMPRD), although some requirements do apply to them as private property owners.

#### Water Quality

Water quality problems in the Deschutes River result primarily from untreated stormwater discharges, impoundments, and summer low-flows due to irrigation diversions. Within the BMPO, the Deschutes River is currently listed on the Oregon Department of Environmental Quality 303(d) list because portions of the river do not meet state water quality criteria for temperature, pH, dissolved oxygen, turbidity, sedimentation and chlorophyll-a (Table 18-1). The Upper Deschutes Watershed Council

began a multi-year monitoring program for the city in 2004 to provide data on the presence or absence of stormwater pollutants and to help the City of Bend comply with Clean Water Act regulations.

Because the Deschutes River is 303(d) listed for impaired water quality, the Oregon Department of Environmental Quality (DEQ) is required by the US Environmental Protection Agency to develop Total Maximum Daily Load (TMDL) plans demonstrating what needs to happen in order for the Deschutes River to meet water quality standards. As part of this process, DEQ will identify organizations or agencies that have legal authority over a sector or source that could be contributing pollutants. These entities will be identified as Designated Management Agencies (DMAs) and will be required to develop a plan identifying specific management strategies that will be implemented to help meet water quality standards. Because the Deschutes River flows through the Urban Growth Boundary, the City of Bend will likely be identified as a DMA by DEQ once TMDLs have been completed. As of the writing of this document, DEQ does not expect to have TMDLs completed until sometime after 2008 (Lamb, 2007).

The Oregon Department of Environmental Quality has been monitoring Mirror Pond since 1958 at River Mile 164.9. The results are tabulated in the Oregon Water Quality Index, which is used to indicate general trends in river quality. Results from the data gathered from 1986 to 1995 rate Mirror Pond as “good” in comparison to other rivers in the state.

Tumalo Creek is listed on the DEQ 303(d) list because portions of the creek do not meet state water quality criteria for temperature. Water quality concerns in Tumalo Creek are concentrated in the reach below the Tumalo Feed Canal diversion. Stream flow and water quality within Tumalo Creek are critically important for the health of the middle Deschutes River because Tumalo Creek is the only tributary along 36 miles of the Deschutes River between the City of Bend and Whychus Creek. Therefore, improved streamflow and water quality in Tumalo Creek will improve stream flow and water quality in the middle Deschutes River.

**Table 18-1: 303d Listings (2004/2006) in the vicinity of the BMPO Project Area**

Water Body	River Miles	Parameter	Season	Criteria
Deschutes River*	168.2 to 189.4	Chlorophyll a	Summer	0.015 mg/l
	116 to 222.2	Dissolved Oxygen	January 1 - May 15	Spawning : Not less than 11.0 mg/L or 95% of saturation
	126.4 to 162.6	pH	Fall/Winter/Spring	pH: 6.5 to 8.5
	126.4 to 168.2	pH	Summer	pH: 6.5 to 8.5
	168.2 to 222.2	Sedimentation	Undefined	Narrative**
	110.8 to 223.3	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum
	168.2 to 222.2	Turbidity	Spring/Summer	10% increase Nephelometric Turbidity Units
Tumalo Creek	0 to 12.5	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum

\* For the Deschutes River, the following descriptions indicate where each of the river mile (RM) breaks are approximately located: RM 116 – Lake Billy Chinook; RM 126.4 – Steelhead Falls; RM 162.6 – North Unit Canal diversion below Bend; RM 168.2 – Central Oregon Canal diversion above Bend; RM 189.4 – Little Deschutes River; RM 222.2 – Wickiup Dam.

\*\*The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed.

Summer high flows at the southern BMPO boundary reach 2,100 cubic feet per second (cfs) while at the northern BMPO boundary flows are reduced to as low as 30 cfs by irrigation withdrawals. This dramatic reduction in flow has been determined to result in a variety of water quality impacts (Jones 2003). One of the most important effects of this flow modification has been the increased rate of streambank erosion upstream of the BMPO. Once sediment from these eroding streambanks enters the Deschutes River, it is carried downstream to Bend where the sediment deposits behind impoundments. The sedimentation has caused impacts to aesthetics and recreational uses, and provides a substrate for algal and aquatic plant growth. It appears that these impoundments are contributing to increased temperature and increased primary productivity (i.e., algal growth) that are linked to water quality concerns.

### Underground Tanks

According to the Oregon Department of Environmental Quality's database for Leaky Underground Storage Tanks (LUST) there are 11 active sites in Bend. Ten are heating

oil leaks and one is a diesel leak. They are mostly old reports, but they have not been closed. Leaking tanks can pose a water quality concern.

### **Recommendations**

To avoid or mitigate potential impacts to water quality it is recommended that the Central Oregon Stormwater Manual be adopted by the BMPO member jurisdictions and that the best management practices in the manual be employed when building or retrofitting transportation projects.

#### *Future Work to be Completed*

- Identify all service stations and define specific transportation routes for fuel delivery. Prioritize stormwater management along those routes.
- Identify and define specific transportation routes for transportation of hazardous materials. Prioritize stormwater management along those routes.
- Map the remaining 25 drainage areas of concern for flooding on Map 5, Water Quality.

## **Fish, Wildlife & Habitat Resources**

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### **Summary**

The Fish, Wildlife and Habitat Resources section of this chapter focuses on the listed or otherwise protected species of fish, wildlife, habitat and plants in the BMPO. Data was gathered from a wide variety of sources including the Oregon Department of Fish and Wildlife, US Fish and Wildlife Service, the Oregon Department of Environmental Quality, the Upper Deschutes Watershed Council and others. Documents reviewed include sub basin assessments, species listings, conservation strategies, regulations on protected lands, recovery plans and more. Three maps pertain to the section. They are Map 8 – Fish Passage; Map 9 – Natural Resource Protection Areas; and Map 10 – Vegetation. This section should be reviewed along with the sections and maps on Water Resources and Scenic Resources because the issues discussed in that section are closely related.

There are relatively few identified fish, wildlife or habitat resources in the BMPO compared with MPO areas west of the Cascades. Historically there have never been any anadromous fish in the area due to natural barriers. Bald eagle and bull trout are the only federally listed species in the area. While bald eagles are present today in the area, bull trout have not been observed in the upper Deschutes above Steelhead Falls since the mid-1950's. There are only two naturally occurring bodies of water in the BMPO providing riparian and wetland habitat. However, there are many wildlife species seen regularly in along the Deschutes River and Tumalo Creek including river otter, beaver, muskrat, mink, osprey, heron, eagle, deer and elk. There are significant impacts to water quality that may impact fish and wildlife including temperature, sedimentation and summer low flows below the North Canal Dam and low winter flows upstream of the dam. Barriers exist to fish passage are numerous. Transportation routes are an issue for wildlife movement, especially to migrating deer and elk herds. Habitat loss has been significant as new housing developments fill in the BMPO. Avoiding impacts to fish and

wildlife and conserving habitat is the highest priority. Recommendations include improving fish passage, water quality and quantity, and habitat restoration.

**Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County
- Oregon Department of Agriculture
- Oregon Department of Fish and Wildlife
- Oregon Department of Transportation
- Oregon Natural Heritage Program
- US Fish and Wildlife Service

The following were the primary documents reviewed for this section:

<b>Title</b>	<b>Source</b>	<b>Date</b>
City of Bend General Plan and Zoning Code	City of Bend	1998, 2006
Deschutes County Comprehensive Plan and Zoning Code	Deschutes County	2005, 2001
Deschutes Subbasin Plan	Columbia River Basin Fish and Wildlife Program	June 2005
Bull Trout Recovery Plan - Chapter 7 Deschutes Recovery Unit	US Fish and Wildlife Service, Region 1	2002
Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout; Final Rule	Department of Interior	Sept. 26, 2005
Recovery Plan for the Pacific Bald Eagle	US Fish and Wildlife Service	1986
Endangered and Threatened Wildlife and Plants; Proposed Rule To Remove the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife; Proposed Rule	Department of Interior	July 6, 1999
Federally Listed Threatened, Endangered, Proposed, Candidate Species and Species of Concern Which may occur within Deschutes County, Oregon.	US Fish and Wildlife Service	Based on listing date
Fish and Wildlife Habitat Mitigation Policy	Oregon Administrative Rules	
Noxious Weed List	Deschutes County	
The Oregon Conservation Strategy	Oregon Department of Fish and Wildlife	Feb. 2006
Oregon Natural Heritage - Invertebrates Listing	Oregon Natural Heritage Program	
Oregon Natural Heritage - NonVascular Plants/Fungi List	Oregon Natural Heritage Program	

<b>Title</b>	<b>Source</b>	<b>Date</b>
Oregon Natural Heritage - Vertebrate List	Oregon Natural Heritage Program	
Oregon Natural Heritage Plan	Oregon Natural Heritage Program	2003
Oregon Wildlife Movement Strategies - Focal Species	Oregon Department of Fish and Wildlife	Jan 26, 2007
Rare, Threatened, Endangered Species of Oregon 2004	Oregon Natural Heritage Information Center	May 2004
Redband Trout Status Report	Oregon Department of Fish and Wildlife	Not available
Riparian and Wetland Vegetation of Central and Eastern Oregon	Crowe, E.A., Kovalichik, B.L., and M.J. Kerr	June 2005
Status Review Update for Deferred ESU of West Cost Chinook Salmon	West Coast Chinook Salmon Biological Review Team	July 16, 1999
The Bend Riverway, A Community Vision	Bend Park and Recreation Foundation	July 1999
Upper Deschutes Subbasin Assessment	Upper Deschutes Watershed Council	Aug 2003
USFWS Threatened and Endangered Species Systems (TESS)	US Fish and Wildlife Service	Website
Upper Deschutes River Subbasin Fish Management Plan	Oregon Department of Fish and Wildlife	Oct 1996
Section 4(f) of the Department of Transportation Act	Department of Transportation	1966

Digital data layers were combined to create maps depicting the existing environmental information available. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix I.

<b>Map #</b>	<b>Map Title</b>	<b>Data Layer</b>	<b>Data Source</b>
<b>8</b>	<b>Fish Passage</b>	Bridges	Deschutes County
		Dams, Diversions	City of Bend
		Salmonid Habitat	Oregon Department of Fish and Wildlife
<b>9</b>	<b>Natural Resource Protection Areas</b>	Bend Local Wetland Inventory	City of Bend
		City River Areas of Special Interest	City of Bend
		City Upland Areas of Special Interest	City of Bend
		City Waterway Overlay Zone	City of Bend
		County Open Space & Conservation Zone	City of Bend
		County Wildlife Area Combining Zone (Elk & Deer)	Deschutes County
		National Wetland Inventory	Deschutes County
		Rivers	Deschutes County
Streams	Deschutes County		

		Eagle Nest Vicinity	Oregon Department of Fish and Wildlife
10	Vegetation	Vegetation	Deschutes County

### Findings

The Oregon Department of Fish and Wildlife have identified six conservation issues in their Oregon Conservation Strategy. They include:

- Land use changes
- Invasive species
- Changes in flood or fire regimes
- Water quality or quantity
- Institutional barriers
- Barriers to fish and wildlife movement

Transportation projects can impact several of these conservation issues through design, construction and implementation.

### Habitat

The Deschutes River and Tumalo Creek provide the only riparian habitat in the BMPO. Much of the riparian corridor is relatively undisturbed to the north and south of the main urban core. There are no wetlands in the BMPO other than those associated with the riparian areas along the Deschutes River. Several of the riparian wetland areas are created artificially by water impoundments. There are a number of areas identified by the National Wetlands Inventory outside the Bend city limits in Deschutes County, but they are not likely to be actual wetlands but artifacts of mapping and groundtruthing is recommended. Open space, forests and desert, cliffs, caves, and lave tubes, large old ponderosa provide habitat in the uplands. Impacts to habitat include habitat loss and fragmentation from new development and roads. Instream habitat can be impacted by water quality.

Mixed conifer and ponderosa pine communities are common in the western portion of the BMPO while sagebrush, juniper, and sparse ponderosa pine communities occur on the eastern side. Riparian vegetation is dominated by willow, alder and sedges (Map 10) (ODFW, 1996).

There are no state or federal waterfowl or wildlife refuges in the BMPO and therefore no US Department of Transportation Act Section 4(f) lands were identified.

### Fish

There are no anadromous fish species in the Deschutes River above Big Falls at river mile 132, north of the BMPO. Big Falls has served as a barrier to summer steelhead, Chinook salmon, and Pacific lamprey which were historically present up to Big Falls (Map 8).

Bull trout (*Salvelinus confluentus*) is federally listed as threatened and its habitat is also federally listed (Appendix I). The redband trout (*Oncorhynchus mykiss*) is present in the BMPO and is a federal species of concern. Drastic alteration of the natural river flow regime caused by irrigation diversions, and the associated effects to aquatic and terrestrial habitat resulted in the extirpation of bull trout and has appreciably reduced the redband trout population (Columbia River Basin Fish and Wildlife Program, 2005.)

Historically, bull trout, redband trout, sculpin and whitefish were the indigenous salmonids in this segment of the Deschutes River. Wild fish species currently present are redband trout and mountain whitefish. Since the construction of the Pelton Roundbutte dam complex in 1968, salmon and steelhead have been unable to navigate past the dams. The Confederated Tribes of the Warm Springs, Portland General Electric, and many State agencies, Federal agencies, and non-governmental organizations are participating in an effort to reintroduce anadromous species above the dams. If successful, this action will help restore the historic species assemblage in the lower Deschutes (USFWS, 2002). Over \$60 million dollars is being spent to bring salmon and steelhead back into the Deschutes and other tributaries below Big Falls (PGE website). The project is expected to be complete in 2008 and smolts have already been reintroduced to Whychus Creek. While the fish will not be able to reach the Deschutes River above Big Falls or Tumalo Creek, the water quality in the BMPO area could affect the downstream fishery.

#### Bull Trout

In 1998, the U.S. Fish and Wildlife Service listed the Columbia River population of bull trout (*Salvelinus confluentus*) as a threatened species under the Endangered Species Act. Historically, the upper Deschutes provided suitable and plentiful habitat for widespread bull trout populations and they were distributed throughout the Deschutes River basin from the headwaters in the Cascades to the Columbia River. At the time of listing bull trout had been extirpated from their historic habitats in the upper Deschutes above Big Falls (River Mile 132). According to the Bull Trout Recovery Plan, this area has the necessary elements to support reestablishment of bull trout although the final rule in the Federal Register issued in 2005 did not designate any critical habitat.

According to the draft Recovery Plan (2002), the main land and water management activities that depress bull trout populations and degrade habitat include fish passage associated with dams and diversions, and water quantity and quality issues associated with stormwater. Impassable dams and diversion structures isolate and fragment bull trout local populations and adversely impact water quality and quantity. Low flows and seasonally high temperatures probably reduced the river's suitability for bull trout foraging and rearing.

#### Redband Trout

The redband trout is indigenous to the upper Deschutes subbasin. Redband trout are a subspecies of rainbow trout and steelhead, and are adapted to the arid conditions east of the Cascades. Redband trout spawn in rivers and streams during the spring and require cool, clean, well-oxygenated water for the eggs to survive. Historically, they

were found throughout the Upper Deschutes subbasin in waters connected to the Deschutes River and in Tumalo Creek (ODFW, 1996)

According to Oregon Department of Fish and Wildlife's Fish Management Plan, redband distribution in the subbasin today is "fragmented due to dams without fish passage, natural barriers, severe stream flow alterations from irrigation development, chemical treatment projects, and introduction of non-indigenous trout stocks." Redband are found throughout the BMPO on both the Deschutes River and Tumalo Creek and the species is listed as a State Sensitive Species. The introduction of non-native fishes such as brook and brown trout, and habitat changes including logging, grazing, irrigation and dam construction have caused dramatic declines in the distribution and abundance of redband trout throughout its range. Low summer flows in the Deschutes downstream from North Canal Dam and warm water temperatures greatly reduce summer rearing areas (ODFW).

Tumalo Creek once provided spawning and rearing habitat for a core redband trout population that migrated from the Deschutes River. Currently, fish passage from the Deschutes River to potential spawning and refuge areas in Tumalo Creek is restricted at the Tumalo Feed Canal diversion but small populations of redband trout occur throughout the Tumalo drainage. A fish passage project is planned to remedy the situation (Marx, 2007). Increased summer flows in the lower reach below Tumalo Feed Canal have improved summer water temperatures (Columbia River Basin Fish and Wildlife Program, 2005.)

#### Fish Passage

The fishery in the Deschutes River and Tumalo Creek was strong with a historic record showing that in 1906 four men fished for four days to harvest 3,400 fish for Bend's Fourth of July. Just a few years later, in 1912, the first hatcheries were built to support a failing fishery. By the early 1920's six irrigation diversions (one is just outside the BMPO's southern boundary) and four dams were in operation in the BMPO area (Map 8.) Most of the structures did not have adequate fish passage. There are a total of 10 identified fish passage barriers upstream of Steelhead Falls at River Mile 128 (Redband Trout Status Report.). Tables 18-2 and 18-3 list the dams and diversions within the BMPO.

**Table 18-2: Dams Within the BMPO**

Dam Name	Location / Pond Name	Built	Operator	Fish Ladder
Colorado Dam	Colorado Street Bridge / creates unnamed 5.5 acre wetland.	1916	River Bend Limited Partnership	Yes – but not effective. Installed in 1998.
Bend Hydroelectric Project	Just north of Newport Bridge / creates Mirror Pond.	1910	Pacific Power and Light	No. Historically there was a wooden fish ladder.
Steidl Dam	Above 1 <sup>st</sup> Street rapids / creates unnamed pond adjacent to Pioneer Park.	1922	Tumalo Irrigation Dist.	Yes.
North Canal Dam	South of Mt. Washington Blvd. / creates “Swan Pond” in front of Riverview Park.	1914	Jointly managed by COID & Swalley Irrigation Dist.	No. – is 33 feet high

Source: Bend Riverway 1999; updated via personal communication ODFW 2007

**Table 18-3: Diversions within the BMPO**

Diversion Name	Diversion Location	Fish Screen	Typical Summer Maximum Flows
Central Oregon Canal	East side of river ¼ mile north of River Rim development	Yes. Perforated plate screen. Fixed panel with self-cleaning brush. Black paint has camouflaged this screen.	550 cfs
Bend Feed Canal (Tumalo Irrigation Dist.)	West side of river at 1 <sup>st</sup> Street Rapids	Yes. New “state of the art” screen	140 cfs
Swalley Irrigation Canal*	East side of river at North Canal dam	Yes. Upgraded in 2005	115 cfs
North Canal or Pilot Butte Canal*	East side of river at North Canal dam	Yes. Upgraded in 2005	550 cfs
North Unit Main Canal*	East side of river at North Canal dam	Yes. Has a drum screen. Will be upgraded.	800 cfs

COID = Central Oregon Irrigation Dist. TID = Tumalo Irrigation Dist.,

ODFW = Oregon Dept. of Fish and Wildlife; cfs = cubic feet per second.

Source: Bend Riverway 1999; updated via personal communication ODFW 2007

\*shown in same location on Fish Passage Map

### Birds

The bald eagle (*Haliaeetus leucocephalus*) is listed as a Federally Threatened species in Oregon and in Deschutes County. Bald eagles are commonly seen in the BMPO.

There is a nest just outside the western boundary of the BMPO (Map 9). The species is currently under consideration for delisting.

The Northern Spotted Owl (*Strix occidentalis caurina*) is also Federally Threatened, as is its habitat. There is no habitat for Northern Spotted Owl in the BMPO. The yellow-billed cuckoo (*Coccyzus americanus*) is a federally listed candidate species that has only been seen incidentally in the BMPO. The only known sighting was about 10 years ago (Marx, 2007).

A number of birds are listed as federal Species of Concern (Appendix I) but only the olive-sided flycatcher, willow flycatcher, yellow-breasted chat and Lewis' woodpecker are expected in the BMPO area. The white-headed woodpecker, Northern goshawk and ferruginous hawk may pass through the area on occasion. There is no habitat in the BMPO for greater sage-grouse, a species being considered for listing (Carey, 2007).

Impacts to birds include habitat loss and fragmentation, vehicle movement and other human-caused disturbances.

### Mammals

Canada lynx (*Felis lynx canadensis*) is the only federally listed mammal in Deschutes County, and it is very unlikely to be found in the BMPO (Appendix I). It is listed as a Threatened species. One Candidate species, the Pacific fisher (*Martes pennanti pacifica*) is listed for the County and it is also unlikely to be found in the BMPO. The Prebles shrew (*Sorex preblei*) is a federal Species of Concern but it is not known if they are found within the BMPO (Carey, 2007).

There are also six bat species that are listed as Federal Species of Concern in Deschutes County. They are:

Pale western big-eared bat	<i>Corynorhinus townsendii pallescens</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Small-footed myotis	<i>Myotis ciliolabrum</i>
Long-eared myotis	<i>Myotis evotis</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>

No extensive bat surveys have been conducted that cover the BMPO area, but several of the listed bats are known to migrate through and/or nest in the area. There is bat habitat within the BMPO. Lava tubes, caves and bats are specifically mentioned in the Steven's Road Tract master plan on the East side of the BMPO. Other caves, rim rock cliffs, trees and bridges may also provide bat habitat. Impacts to bats may result from habitat loss and insecticide use.

Deer and elk winter range surround the BMPO, primarily to the west and south. There is significant deer migration from the Deschutes National Forest west of the Deschutes River to wintering ranges east of the river identified as the North Paulina, Devil's Garden

and Hole in the Ground Ranges (Deschutes County, 2005). Approximately 30,000 to 35,000 mule deer migrate twice a year through and around the BMPO. Elk are commonly found within the BMPO near the southern BMPO boundary. Seasonal wildlife migration and year around movement of elk and deer is a serious concern for the safety and well being of both the animals and people.

### Wildlife Movement

Roads pose several concerns including habitat fragmentation and crossing concerns for wildlife, and property damage to cars and personal injury to humans. Oregon Department of Fish and Wildlife and Oregon Department of Transportation recently held a Wildlife Movement Workshop in Bend to begin identifying areas of concern for wildlife movement. A map of these areas should be complete by fall of 2007.

As traffic volume increases, so do the numbers of wildlife crossing issues. There are approximately 23,000 vehicles passing through the BMPO on Highway 97 daily and another 12,000 – 15,000 traveling on Highway 20. The traffic is increasing annually at a rate of 2 to 2.5 percent per year. Approximately 1,250 animals were killed on roadways in Deschutes County in 2006 (Bryant, 2007). Highway 97 has been identified as barrier between summer and winter deer and elk range with 400 deer killed annually in a 50-mile stretch of highway. The deer and elk migrate using a “sheet migration,” crossing almost anywhere. In 2006, wildlife encounters with cars were spread fairly evenly up and down the highways. The Oregon Department of Fish and Wildlife has compiled a focal species list for wildlife movement that includes amphibians and reptiles in additions to mammals.

### Amphibians and Reptiles

Oregon spotted frog (*Rana pretiosa*) is a federal listed candidate species in Deschutes County and Cascade frog (*Rana cascadae*) and Northern sage lizard (*Sceloporus graciosus graciosus*) are listed as Species of Concern. There are other amphibians and reptiles listed federally for the County (Appendix I) but they are not likely found in the BMPO area. Cascade frog is most commonly found at higher elevations and the spotted frog is typically found farther south, but it is possible they could be found in the BMPO (Carey, 2007).

Impacts to amphibians and reptiles include habitat loss and fragmentation, invasive species and water quality issues.

### Invertebrates

There are no federally listed invertebrates in Deschutes County. Three native freshwater mussel species are listed by the Oregon Natural Heritage Program for Deschutes County (Appendix I). There have been no systematic mussel surveys conducted in the Deschutes River or Tumalo Creek so it is unknown if they are present or not. The mussels include:

- California floater (*Anodonta californiensis*) Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation
- Western ridgemussel (*Gonidea angulata*) Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation),
- Western pearlshell (*Margaritifera falcate*) Rare, uncommon or threatened, but not immediately imperiled.

There are two snails listed by the Oregon Natural Heritage Program for Deschutes County as critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation. It is unknown if they are present in the BMPO, but given their common names which are locations far outside the BMPO, it may be unlikely they are present. They are:

- Indian Ford juga                      *Juga hemphilli* spp. nov.
- Crater Lake tightcoil                *Pristiloma arcticom crateris*

Non Vascular Plants, Fungi

There are no federally listed non vascular plants or fungi in Deschutes County. There are, however, numerous liverworts, mosses, lichens and fungi listed by the Oregon Natural Heritage Program (Appendix I). Impacts to these species can include habitat loss, water and air quality.

Invasive species

The bullfrog (*Rana catesbeiana*), an invasive non-native species is found in the area. Invasive species such as quagga mussel (*Dreissena bugensis*), zebra mussel (*Dreissena polymorpha*) and fox squirrel (*Sciurus niger*) have not made their way to the BMPO area but their arrival is anticipated. Invasive mollusk species are transported from one area to another on boats and boat trailers towed from an infested area. The BMPO recently had the first spraying for gypsy moth (*Lymantria dispar*). Other non-native invasive insects are present or anticipated to arrive in the coming years. Invasive species common on the west side of Oregon such as nutria and opossum have not been reported in the BMPO area – most likely due to the cold winters. This could change as global climate change affects the seasonal weather.

Plants

A number of plants are listed as federal species of concern in Deschutes County (Appendix I). It is unlikely that any of these plants are found with in the BMPO (because of their habitat requirements) but as with many plant species, unexpected disjunct occurrences are often found when surveys are conducted (Gilbert, 2007). The plants are:

- |                           |  |
|---------------------------|--|
| Estes' artemisia          | <i>Artemisia ludoviciana</i> ssp. <i>estesii</i> |
| Cliff paintbrush          | <i>Castilleja rupicola</i>                       |
| Cusick's erigonum         | <i>Eriogonum cusickii</i>                        |
| Disappearing monkeyflower | <i>Mimulus evanescens</i>                        |

Little mousetail  
Peck's penstemon  
Howell's theylody

*Myosurus minimus* ssp. *apus* (var. *sessiliflorus*)  
*Penstemon peckii*  
*Thelypodium howellii* ssp. *howellii*

*Estes' artemisia* or white sage has been recently documented in the Middle Deschutes downstream of the BMPO. There have been no surveys for it in the BMPO and it is possible it could be found along the riverbanks. Descriptions and resources for identifying these plants are included in Appendix I.

There are numerous plants listed by the Oregon Natural Heritage Program for Deschutes County (Appendix I.) Impacts to plants are primarily from habitat loss from development and from being crowded out by invasive species.

### Noxious Weeds

Deschutes County Board of Commissioners has listed dozens of noxious weed species in the County (Appendix I). A noxious weed is one that is "injurious to public health, agriculture, range, recreation, wildlife, or any public or private property; any weed that impacts and displaces desirable vegetation, such as Threatened and Endangered Plant Species, wildlife habitat, and livestock" (Deschutes County Noxious Weed List). The weeds are ranked A, B, and C depending on control goals set by the County. Some of the most common include the knapweeds, toadflax, and yellow flag iris. Transportation corridors are a common way to spread noxious species.

### Protected Areas

The City of Bend has a number of codes designed to protect natural features and resources. Each of these protected areas is shown on Map 9 and is described below.

City of Bend protects water resources under Chapter 2.7.600 of the City Code in a zone called the Waterway Overlay Zone (WOZ). The code states "The Deschutes River and Tumalo Creek stream corridors within the urban growth boundary of the City of Bend are valuable economic, recreational, scenic and natural resources for the community. The WOZ is intended to conserve and enhance the natural resource values of areas along the Deschutes River and Tumalo Creek within the city."

The WOZ includes the following sub-zones, which provide various types of protection:

- Riparian Corridor – defines minimum setbacks from Deschutes River and Tumalo Creek and significant wetlands.
- Deschutes River Corridor Design Review – design review for building within 100 feet of the river; criteria and process to determine setbacks.
- River Corridor Areas of Special Interest – unique areas (primarily rimrock and canyons) with protection criteria.
- Flood Plain – criteria and process for development in the floodplain.

The City has a Local Wetlands Inventory, however there are only a few significant wetlands in the BMPO and all of them are located in the riparian corridor of the Deschutes River. There are a number of areas identified as wetlands in the upland in

Deschutes County. These are on the National Wetlands Inventory and should be ground truthed as they may be mapping artifacts.

The City of Bend also protects special features in a zone called “Upland Areas of Special Interest Overlay Zone” that is intended to protect valuable natural resources. The zone is described in Chapter 2.7.700 of the City Code as “scattered rock outcrops, stands of trees, and dominant ridges and faults that are typical of the Central Oregon landscape. These areas contain high points or changes in elevation that break the line of sight so that the area retains a feeling of undeveloped open space.” The zone defines setbacks and allowed uses of these areas, many of which are on private property.

Deschutes County also has several zones and regulations to protect natural features including the Wildlife Combining Zone and the Open Space Conservation Zone. The County adopted the National Wetlands Inventory to comply with Goal 5.

The purpose of the Open Space and Conservation Zone (Chapter 18.48 of the Deschutes County Code) is to protect designated areas of scenic and natural resources; to restrict development in areas with fragile, unusual or unique qualities; to protect and improve the quality of the air, water and land resources and to plan development that will conserve open space.

The purpose of the Wildlife Area Combining Zone (Chapter 18.88) is to “conserve important wildlife areas in Deschutes County; to protect an important environmental, social and economic element of the area; and to permit development compatible with the protection of the wildlife resource.” This zone provides protection for migrating elk and deer primarily through the type and density of allowed uses. This zone is shown on Map 9 with the animal species and herd names. The zone is only in the County jurisdiction and stops at the Bend city limits. It should be noted that the animals do not stop at jurisdictional boundaries.

State and Federal Wild and Scenic Rivers are also protected. Please see the section Scenic Resources in this chapter for more information.

## **Recommendations**

### Habitat

Design transportation projects to avoid the destruction of habitat wherever possible. See general policies for more.

### Bull trout and redband trout

Identify and explore methods to protect, restore, and maintain suitable habitat conditions for bull trout and redband trout for all transportation projects, especially those near the Deschutes River or Tumalo Creek, including the following:

- Maintain or improve water quality.
- Stabilize roads, crossings, and other sources of sediment delivery.
- Identify barriers or sites of entrainment and implement tasks to provide passage and eliminate entrainment.

- Screen water diversions and irrigation ditches.
- Restore connectivity and opportunities for migration by securing instream flows and/or water rights.

### Invasive species

- Develop measures that prevent invasive species from entering the area on cars, trucks, boats, boat trailers or other vehicles.
- Design transportation projects to prevent the spread of noxious weed species.

### Wildlife Linkages

The design of new transportation projects and the retrofit of existing projects shall include the identification of any wildlife movement issues and a review of best management practices to facilitate wildlife movement to improve human and wildlife safety, decrease habitat fragmentation and property damage. Include mapped wildlife movement areas of concern upon their completion by Oregon Department of Fish and Wildlife.

### *Future Work to be Completed*

There may be additional activities recommended for specific species including bats that should be identified.

## **Hazards**

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### **Summary**

The Hazards section of this chapter focuses on issues related to natural hazards such as earthquake fault lines, floodplains, wildfire areas and surface mines. It includes information on soils, topography and steep slopes. Data was collected from a wide variety of sources including the Federal Emergency Management Agency, Environmental Protection Agency, National Resources Conservation Service, Oregon Department of Environmental Quality and the City of Bend. There are two maps that relate to this section: Map 11: Natural Hazards and Map 12: Soil Conductivity. This section should be reviewed along with the section on Air Quality and also Water Resources, particularly the stormwater data as they are closely linked. There were no identified hazardous waste issues or areas including toxic releases to the air. Existing code addresses potential issues with earthquakes, flooding and landslides. Recommendations are made to ensure consideration of emergency evacuation routes, stream channel movement and potential issues with the railroad.

### **Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County
- Environmental Protection Agency
- Federal Emergency Management Agency

- National Resources Conservation Service

The following were the primary documents reviewed for this section:

Title	Source	Date
Emergency Operations Plan	Deschutes County Sheriff's Office	November 2003
Deschutes County Code	Deschutes County	2001
Bend City Code	Bend City Code	2006
Preliminary Risk Assessment for Creosote	Environmental Protection Agency	
Critical Areas Ordinance; Best Available Science Volume 1; Chapter 4: Channel Migration Zones	King County Washington	

Digital data layers were combined to create maps depicting the existing environmental information available. The following are the map titles along with the data layers shown and the source of the data focusing on environmental hazards. See Appendix I for details on the metadata.

Map #	Map Name	Data Title	Data Source
11	<b>Natural Hazards</b>	Earthquake Fault Lines	Deschutes County
		FEMA 100 Year Flood	Deschutes County
		Historic Fires	Deschutes County
		Steep slopes >25%	Deschutes County
		Surface Mine Impact Area	Deschutes County
		Surface Mines	Deschutes County Deschutes County
		Topography 100 Foot Contours	Deschutes County
		Topography 50-100 Foot Contours	Deschutes County
12	<b>Soil Conductivity</b>	Soil conductivity (permeability)	USDA

See also these maps: Stormwater, Environmental Health and Water Quality, discussed in the Water Resources section of this report.

### Findings

The Environmental Protection Agency website was reviewed but no active sites were located in the BMPO on the Toxic Release Inventory or the superfund site (see also Air Quality.)

Wildfire evacuation routes are important to public safety. Transportation projects could conflict with public safety if evacuation routes are not considered. The Natural Hazard Map (no. 11), shows fires that have occurred in the past. More than 20 homes were destroyed in the Awbrey Hall fire in 1990.

Flooding of the Deschutes River occurs very rarely because the river is highly regulated by dams. Flooding occurs when ice dams build up in the winter then break, releasing

water. The last flood was in the early 1980's. An ice boom is installed in the river in the winter to prevent the formation of ice dams. Tumalo Creek floods in the spring. The reach of the creek that floods is in Shevlin Park where it is allowed to spill over its banks and it has changed course over the years. Flooding and channel migration may be an issue for transportation projects near the creek. Impacts to the creek and to property can be avoided if they are assessed early on and the project is designed to minimize conflict. The Federal Emergency Management Administration floodplains are shown on Map 11.

Several proposed transportation projects cross earthquake fault lines (Map 11). They are also crossing areas of low soil conductivity (Map 12). This could contribute to stormwater problems (see Water Resources.) Landslides are not common in the BMPO.

Surface Mine Impact Areas are also identified (Map 11) and regulations restrict noise and dust-sensitive uses in the area of a surface mine (Deschutes County Code 18.56.) The purpose of the zone is to protect the surface mining resources of Deschutes County from new development which conflicts with the removal and processing of a mineral and aggregate resource while allowing owners of property near a surface mining site reasonable use of their property. The zone applies to all property located within one-half mile of the boundary of a surface mining zone. This is not anticipated to have any conflicts with proposed transportation projects.

The Burlington Northern Railroad bisects the BMPO in a north-south direction. Conflicts with transportation projects include increased cost of crossing a railroad or avoiding it and potential environmental concerns from toxics transported on the railroad. In addition the Environmental Protection Agency (EPA) is currently reassessing creosote (commonly used in railroad ties) as part of its ongoing re-registration program for older pesticides. The EPA website has a fact sheet with recommended safety precautions advised for the use, removal and disposal of railroad ties.

### **Recommendations**

- Consideration of wildfire and other emergency evacuation routes should be taken into account in the design of transportation projects.
- Further investigation of the issues involved with railroad transport should be conducted, specifically the potential for toxic releases and railroad maintenance.
- Transportation projects near Tumalo Creek should analyze potential flooding impacts and channel migration potential and develop mitigation if impacts are identified.

## Climate Change

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### Summary

The Climate Change section of this chapter focuses on issues relating to predicted changes in the climate in the BMPO area from global warming. Data was gathered from the Oregon Climate Service, Climate Impacts Group, the Governor's Advisory Group on Global Warming and the Oregon Department of Environmental Quality. There are no maps that relate to this section. This section should be reviewed along with the section on Air Quality as they are closely linked. Impacts from transportation include greenhouse gas emissions. Greenhouse gases result primarily from the burning of fossil fuels in vehicles. Mitigations have been identified to reduce greenhouse gasses through the design of transportation projects and the adoption of greenhouse gas reducing tactics. Recommendations include adopting the some key actions identified in the *Oregon Strategy for Greenhouse Gas Reduction*.

### Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Oregon Department of Environmental Quality
- Climate Impacts Group
- Governor's Advisory Group on Global Warming
- Oregon Climate Service

The following were the primary documents reviewed for this section:

Title	Source	Date
2005 Air Quality Data Summaries	DEQ	June 2006
Oregon Strategy for Greenhouse Gas Reduction	Governor's Advisory Group on Global Warming	Dec. 2004 revised
Oregon Climate Service website	Oregon Climate Service	
Climate Impact Group website	Climate Impact Group	

No maps were made for this section.

### Findings

The Oregon Climate Service includes the BMPO in the South Central Oregon climatic division, which extends from Sisters in the west, Fossil in the north, Malheur in the east and Klamath Falls to the south. The area is described a "vast area of high desert prairie punctuated by a number of mountain ranges and isolated peaks." Most of this region receives relatively low amounts of precipitation with areas near the Cascades including the BMPO area tending to have annual distributions very similar to those in western Oregon: winter precipitation followed by a steady decrease, with lowest monthly averages in midsummer. The months of July through September are generally the driest of the year throughout the region and often have isolated local thunderstorms. Some months are very wet and others almost completely dry" (Oregon Climate Service website).

Oregon's environment is already being impacted by global climate change. All of our glaciers are receding, some by as much as 60%. Snow pack is down, making it increasingly difficult to find enough water to irrigate farms and maintain adequate flows for fish. An oxygen depleted dead zone has developed off the Oregon coast, decimating crab and fish populations. Scientists suggest it may be due to rising ocean temperatures and shifting current patterns (Hayes, 2007).

According to the Climate Impact Group's website the climate of the Pacific Northwest has changed during the past 100 years in a number of ways including:

- Region-wide warming of about 1.5°F (0.8°C) in 100 years.
- Increase in precipitation in most of the region.
- Decline in snowpack – especially at lower elevations – since 1950.
- Spring is arriving earlier in the western U.S.

The website further states, "In a future, warmer world, warmer temperatures will result in more winter precipitation falling as rain rather than snow throughout much of the Pacific Northwest, particularly in mid-elevation basins where average winter temperatures are near freezing. This change will result in:

- less winter snow accumulation,
- higher winter streamflows,
- earlier spring snowmelt,
- earlier peak spring streamflow, and
- lower summer streamflows"

Global climate models scaled to the Pacific Northwest project an increase in average regional temperatures of 0.5° per decade throughout the 21st century. Temperature increases are expected to occur across all seasons with the largest increases in summer. Changes in annual precipitation are less certain. Most of the models analyzed by the Climate Impact Group show decreases in summer precipitation and increases in winter precipitation with little change in the annual mean.

A declining snowpack could have a significant impact on water resource availability. Substantial reductions in summer streamflow are anticipated in the coming decades and will adversely affect many water users, including farmers who rely on irrigation, resident and anadromous fish, and summertime hydropower production.

If Central Oregon experiences a reduced snowpack or earlier snow melts, there would be a change in run-off patterns for the Little Deschutes River, a tributary of the Deschutes River upstream of the BMPO. Currently, its average peak run off month is May and June. This could be a month earlier in the future. It may also result in higher flows during the winter because of rain rather than snowfall. There may not be a significant change in the flows of the Deschutes River because most of the run-off occurs through the absorption of snowmelt into the ground and emanating as spring flow later in the summer. For the most part, due to the porous nature of the soils in the

Deschutes basin, precipitation in any form at any time of the year is mostly absorbed into the ground. Predicting changes in weather patterns, however, is very uncertain (Gorman, 2007).

Other climate change related impacts in the areas could include:

- Warmer water temperatures in rivers and stream affecting fisheries
- Increase in wild fires
- Change in the composition of forest species
- Increase in noxious non-native species of insect, plants and mammals
- Drought resulting in less water instream for irrigation and fish
- Extinction of local populations
- Loss of biological diversity

According to the Department of Energy “The impacts of such changes on Oregon citizens, businesses and environmental values are likely to be extensive and destructive. Coastal and river flooding, snowpack declines, lower summer riverflows, impacts to farm and forest productivity, energy cost increases, public health effects, and increased pressures on many fish and wildlife species are some of the effects anticipated by scientists at Oregon and Washington universities.”

The Oregon Strategy for Greenhouse Gas Reduction states that in 2000, 84% of greenhouse gas emissions in Oregon were Carbon dioxide (CO<sub>2</sub>). The primary source of CO<sub>2</sub> emissions came from burning fossil fuels, such as coal (power plants), gasoline, diesel, and natural gas. There were also emissions from various industrial processes and emissions from municipal and industrial wastes incineration of fossil-fuel derived products.

One-third of Oregon’s greenhouse gas emissions are from transportation. Cars, light trucks, sport utility vehicles, buses, large trucks, airplanes, trains and marine vessels all contribute to these emission levels. There are over 3.1 million motor vehicles registered for roadway use in Oregon. Oregonians spend more than \$3 billion for transportation fuels each year.

### **Recommendations**

Adopt the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction that are appropriate for the BMPO.

Mitigations measures from the Oregon Strategy for Greenhouse Gas Reduction are designed to reduce greenhouse gas emissions from consumption of fossil fuels by displacing conventional combustion engines with hybrid, electric and other technological/fuel options, and to guide land use choices, especially in Oregon’s urban areas, toward more efficient choices including higher densities, transit options, mixed-use neighborhoods, and common wall dwelling designs. Mitigations should be updated as new information becomes available. Among the recommended actions outlined in the report that may be appropriate for the BMPO are:

- Adopt Low Emission Vehicle Emission Vehicle Standards.
- Adopt greenhouse gas Tailpipe Emission Standards (refer to State of Oregon’s rules OAR Chapter 340 Division 257, Oregon Low Emission Vehicle Program).
- Integrate land use and transportation decisions with greenhouse gas consequences.
- Promote biofuel use and production.
- Incorporate Clean Diesel actions.
- Incorporate greenhouse gas emission impacts into transportation planning decisions.
- Adopt state standards for high efficiency/low rolling resistance tires.
- Reduce GHG emissions from government fleet purchase and vehicle use.
- Set and meet goals for reduced truck idling at truck and safety stops.
- Set up traffic flow engineering “Best Practices.”
- Set and meet goals for freight (truck/rail) transportation efficiency; achieve this through equipment, coordination and land use.
- Improve mass transit and inter-city transit links.

Other recommendations:

- Recommend the City of Bend sign the US Mayors Climate Protection Agreement.
- Work with the City of Bend to conduct a carbon inventory and consider crafting a comprehensive carbon emissions reduction plan.

## **Air Quality**

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### **Summary**

This section focuses on air quality in the BMPO. Data was collected primarily from the Oregon Department of Environmental Quality and the US Environmental Protection Agency. Documents reviewed include air emission reports, comprehensive plans and air quality data. This section should be reviewed with the section on Climate Change and Hazards as they are closely related. Potential conflicts resulting from transportation projects to air quality include increases in carbon monoxide from vehicle emissions and dust from cinders (used for icy road conditions). Recommendations include supporting the Clean Air Committee and further analysis of transportation projects impacts on air quality.

### **Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- US Environmental Protection Agency
- Oregon Department of Environmental Quality

The following were the primary documents reviewed for this section:

Title	Source	Date
Air Emissions Inventory (PM 10 Emission Estimates)	Oregon Department of Environmental Quality	
PM 10 Emissions Estimates, Fugitive Dust Report	Oregon Department of Environmental Quality	June 2005
Deschutes County Comprehensive Plan	Deschutes County	2005
City of Bend General Plan	City of Bend	1998
Environmental Protection Agency TriExplorer website	Environmental Protection Agency	
2005 Air Quality Data Summaries	Oregon Department of Environmental Quality	June 2006

There are no maps for this section.

### Findings

According to the 2005 Air Quality Data Summary from the Oregon Department of Environmental Quality the air pollutants of greatest concern in Oregon are:

- ground-level ozone, commonly known as smog
- fine particulate matter (mostly from wood smoke, other combustion sources, cars and dust) known as:
  - PM10 (10 micrometers and smaller diameter) and
  - PM2.5 (2.5 micrometers and smaller diameter)
- hazardous air pollutants (also called Air Toxics)
- Carbon monoxide (mostly from motor vehicles)

Motor vehicles are the primary source of air pollution in Oregon. Although each individual car or truck contributes relatively small amounts of pollution, the sheer number of vehicles makes their total contribution larger than any other single source. Emissions from cars contribute to ground level ozone pollution (smog) especially on hot summer days (DEQ, 2005).

Fine particulate air pollution consists of solid particles or liquid droplets that are less than 10 microns in diameter (PM10) or less than 2.5 microns in diameter (PM2.5). Particles in these size ranges are of great concern because they can be inhaled deeply into the lungs where they can remain for years. The health effects of particulate matter vary with the size, concentration, and chemical composition of the particles (Oregon Department of Environmental Quality Website).

The Bend General Plan adopted in 1998 notes that in Bend, there are two air pollutants of concern that are monitored on a regular basis. They are carbon monoxide (CO) and very small particulate matter (PM10). Automobile exhaust and other incomplete combustion are typical sources of CO production. A variety of materials such as windblown dust, field and slash burning, wood stove smoke, and road cinders used for winter sanding can produce fine particles that fall into both the PM10 and PM2.5 air pollution category.

The plan further states that, “Although the few occurrences of exceeding these two air quality standards have *not* been of sufficient frequency to have Bend designated as an air quality “non-attainment area,” the forecast of significant population and economic growth for Bend and Deschutes County increases concerns about Bend’s ability to maintain compliance with the air quality standards” (Bend General Plan, 1998).

Other occurrences or activities affecting air quality in the BMPO include wood burning stoves, winter inversions, cinder particulates (spread on roads to reduce icy conditions) and outdoor burning. Field burning (primarily north of the BMPO) and wildfires also contribute to poor air quality.

The Air Quality Index (AQI) is based on data collected from the Oregon Department of Environmental Quality’s air monitors. These raw measurements are converted into AQI values. An AQI value is calculated for each individual pollutant using standard formulas. The highest of the AQI values for the individual pollutants becomes the AQI value for that day. For example, if AQI values were 90 for ozone and 88 for carbon monoxide, the AQI reported would be 90 for the pollutant ozone on that day (DEQ website). Bend has a monitor in Pioneer Park that monitors daily air quality. Table 18-4 shows the AQI for 2005 for the BMPO area.

**Table 18-4: 2005 Bend Air Quality Index**

<b>AQI Days</b>	<b>All</b>	<b>PM2.5</b>	<b>CO</b>
Good	346	346	171
Moderate	19	19	0
UFSG	0	0	0
Unhealthy	0	0	0
No AQI	0	0	11
Total	365	365	182

*Source: DEQ website*

Since the year 2000 there has been a general downward trend of PM10, PM 2.5 and carbon monoxide in the Bend area. PM10 standards were exceeded once each in 1996 and 2000.

The fugitive dust portion of the Emission Inventory (EI) was not included in the statewide Emission Inventory for 2002. This is an important piece of the emissions picture. Deschutes County ranked sixth highest in the state for total fugitive dust, with most dust coming from unpaved roads (Calkins, 2007).

Outdoor burning is still allowed during limited times during the year for residents to burn yard debris. A new program will be instituted this summer in Bend to do curbside pick up of yard waste which, if successful, could lead to a phase-out of outdoor burning.

A citizen’s clean air committee has been active in the BMPO area for many years. It was instrumental in increasing the speed and frequency of street cleaning after cinders

were used to avoid having the cinders blow into the air. Recently, however, the group has been much less active.

The US Environmental Protection Agency website shows trends for releases from 1988 – 2005 for Deschutes County. Only two areas reported releases. They are fugitive air emissions and point source emissions. Fugitive air emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Stack or point source air emissions occur through confined air streams such as stack, vents, ducts, or pipes. The trend since 1988 has been generally trending sharply downward.

### **Recommendations**

To analyze the impact of proposed transportation projects to air quality:

- Use the transportation demand model, the complimentary air quality models, and the emissions inventory to assess the air quality impacts of transportation system improvements.
- Participate in the Clean Air Committee to identify and implement air quality improvement strategies that will help maintain the regions clean air and avoid a federal nonattainment listing.
- Participate in the Clean Air Committee to provide education and awareness of air quality issues.

See also the recommendations in the Climate Change section of this report for other actions that will mitigate air quality conflicts.

## **Scenic Resources**

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### **Summary**

The Scenic Resources section of this chapter focuses on a variety of protected scenic resources in the BMPO. Data was gathered from Deschutes County and Deschutes National Forest and others. Documents reviewed include management plans for the scenic byway and the wild and scenic river segments, county zoning regulations and Oregon statutes and policies. Of the approximately 14 miles of river running through the BMPO, nearly 11 miles are designated scenic. There is one map for this section: Map 13 Scenic Resources. Potential conflicts resulting from transportation projects include degrading scenic resources by building new projects in view corridors and air pollution obscuring views. Potential conflicts have been identified for the Cooley Road Project. Avoiding conflicts with scenic resources is the preferred mitigation.

### **Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend

- Deschutes County
- Deschutes National Forest

The following were the primary documents reviewed for this section:

<b>Title</b>	<b>Source</b>	<b>Date</b>
Cascade Lakes Scenic Byway, Corridor Management Plan	US Forest Service	July 1996
Cascade Lakes Scenic Byway, Interpretive Plan	US Forest Service	June 1996
Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan	US Forest Service	July 1996
Oregon Administrative Rules 736-040-0073; 736-040-0030; 736-040-0035	State of Oregon	
Oregon Revised Statute Chapter 390.805-995	State of Oregon	

Digital data layers were combined to create maps depicting the existing scenic resources. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix I.

<b>Map #</b>	<b>Map Title</b>	<b>Data Layer</b>	<b>Data Source</b>
13	<b>Scenic Resources</b>	Cascade Lakes National Scenic Byway	City of Bend (created)
		County Landscape Management Combining Zone	Deschutes County
		County Landscape Management Combining Zone - Water	Deschutes County
		Federal Wild and Scenic Rivers	Deschutes County
		State Scenic Waterways	Deschutes County

All known data necessary for this section was collected. The Federal Wild and Scenic River boundaries may be slightly inaccurate.

### **Findings**

There are significant scenic resources within the BMPO. Views of Three Sisters, Mt. Bachelor, Tumalo Mountain and Broken Top along with the Deschutes River are all visible and prominent from the BMPO. Numerous protections exist for scenic resources including:

- County Landscape Management zones
- Cascade Lakes National Scenic Byway
- State Scenic Waterway designation
- Federal Wild and Scenic River designation

These are all protected resources with varying levels of requirements that must be taken into account in all transportation projects. All of the areas are identified on Map 13 and described below.

#### County Landscape Management Zones

The purposes of Deschutes County's Land Management Combining Zone are to maintain scenic and natural resources of the designated areas and to maintain and enhance scenic vistas and natural landscapes as seen from designated roads, rivers or streams. To implement the zone, the County regulates new structures and landscaping to avoid impacts to scenic views from roads, on rimrock and near rivers. The zone applies to all areas within ¼ mile of the roads in the zone and in State Scenic Waterway and the Federal Wild and Scenic River corridor and all areas within 660 feet of rivers and streams otherwise identified as landscape management corridors in the comprehensive plan and the County Zoning Map.

#### National Scenic Byway

The route on Forest Highway 46 between Bend and Highway 58 is designated as the Cascade Lakes National Scenic Byway. It begins with the Tour Route in Drake Park and follows Galveston to 14<sup>th</sup> Street. The Byway begins at edge of the Urban Growth Boundary on the way to Mt. Bachelor at the Deschutes National Forest boundary, travels through the Cascade Lakes recreation area adjacent to the Three Sisters Wilderness, and ends at the junction of Road 61 and Highway 58 close to Crescent Lake. It received its designation for its outstanding scenic, natural, and recreational qualities. There are numerous goals for the Byway including the reduction of impacts from billboards and protection of scenic views, wildlife and recreation opportunities. While there are no specific regulations associated with the Byway, it is a nationally and regionally recognized resource as well as a part of Oregon's state scenic byways program. The US Forest Service administers the program. The Federal Highway Administration administers a program that awards funds competitively each year in the form of merit –based grants covering 80 percent of the project cost and with the requirement that the remaining 20 percent be matched by local, state, other federal or in-kind means. Funds have been secured in the past for projects along the Cascade Lakes National Scenic Highway.

#### Scenic Waterways and Wild and Scenic River designation

Of the approximately 14 miles of river within the BMPO, about 10.8 miles are designated scenic. There are two sections of State Scenic Waterway in the BMPO – one in the north and the other at the south end of the BMPO, encompassing a total of 8.4 miles (Map 13). The south section enters the BMPO' southern boundary and ends at the Central Oregon Irrigation District diversion. The north section starts just below the North Unit Dam (near Mt. Washington Drive) and continues through the BMPO to the north. Oregon State rules govern the Scenic Waterway program and The Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan contains specific rules that address setbacks, building color, vegetation retention, river crossings, screening and timber harvest for the southern

section within a ¼ mile of the designated river sections. Oregon Park and Recreation Department administers the program.

There is one stretch of Federal Wild and Scenic River within the BMPO that begins just outside the City of Bend city limits and is about 2.4 miles long within the BMPO. Protection for federal scenic rivers is focused on the “outstandingly remarkable values” that have been identified for the river including geologic, hydrologic, fishery, vegetative, wildlife, cultural, recreational and scenic values. The Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan identifies goals, standards and guidelines for each of the values. This program has similar goals to the state program but differs in the type of protection offered. The US Forest Service administers this program.

### Potential Conflicts

Potential conflicts from transportation to the scenic resource could come from the building or rebuilding bridges over the river near the designated scenic sections or building roads within a quarter to a half-mile of designated resources. There are potential conflicts identified for the Cooley Road extension project for the State Scenic Waterway and the County Landscape Management Zone.

### **Recommendations**

- For all transportation projects, review the Scenic Resources map and identify and potential conflicts.
- For the Cooley Road extension project: Design the project to avoid impacts to the State Scenic Waterway and the County Landscape Zone.

## **Historic and Cultural Preservation**

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### **Summary**

The Historic and Cultural Preservation section of this chapter focuses on designated historic and cultural resources in the BMPO. Data was gathered from the several sources including the Deschutes County Historical Landmarks Commission, the Oregon State Historic Preservation Office, the Bureau of Land Management and the Deschutes National Forest. Three tribes were contacted with no response to date. Documents reviewed include websites, regulations, reference materials and maps on historic and cultural resources. Resources identified include two historic districts and other individual resources listed on the National Register of Historic Places. All properties listed on the National Register, properties located in the two historic districts, and other properties that may be eligible for listing on the National Register of Historic Places are subject to Federal Section 4(f) regulations. Map 14: Cultural Resource Protection shows these resources and also some archeological high sensitivity areas. The Oregon State Archaeologist and the Landmarks Commission report that there are many archaeological reports filed about sites in the study area, but they are not available to show on a map. No potential conflicts to the resources resulting from transportation projects were identified, but a request for further review by the Oregon State Historic Preservation Office will be necessary on a case-by-case basis when specific

transportation projects are funded. Avoiding conflicts with historic and cultural resources is required, if other alternatives exist, by federal law and is the preferred course of action.

**Methodology**

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Deschutes County Historical Landmarks Commission
- Deschutes County
- Oregon State Historic Preservation Office (SHPO)
- Deschutes National Forest
- Bureau of Land Management

Several conversations were held with the Confederated Tribes of Warm Springs, but no data was collected from them at this time.

Also contacted by letter and phone with no response to date:

- Burns-Paiute Tribe
- Klamath Tribe

The following were the primary documents reviewed for this section:

<b>Title</b>	<b>Source</b>	<b>Date</b>
A Cultural Resource Survey of the Deschutes River from Bend to the Deschutes Jefferson County Line, Deschutes County Oregon	Scott, Sara A.	Jan 1986
National Register of Historic Places	National Park Service web site and the Oregon State Historic Preservation Office	2007
City of Bend General Plan, Chapter 3	City of Bend	1998
City of Bend website; Community Development Department Historic Preservation	<a href="http://www.ci.bend.or.us/depts/community_development/planning_division/historic_preservation.html">http://www.ci.bend.or.us/depts/community_development/planning_division/historic_preservation.html</a>	n/a
Section 4(f) of the Department of Transportation Act ( <u>49 USC303 and 23 USC 138</u> )	Department of Transportation	1966

Digital data layers were combined to create maps depicting the existing environmental information available. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix I.

Map #	Map Title	Data Layer	Data Source
14	Cultural Resource Protection	Archeological Sites	Bureau of Land Management
		National Register Historic Districts	City of Bend Community Development Department
		Historic Resources	Deschutes County
		Craftsman Bungalows	Des Chutes Historical Center

The State Historic Preservation Office was contacted and they requested that the BMPO contact them on a case-by-case basis for each transportation project rather than attempting to document the entire BMPO area.

## Findings

### Historic Resources

There are two National Register of Historic Places Historic Districts in the BMPO, totaling 421 properties and 26 individually listed properties. There are also numerous individually designated historic and cultural buildings and sites (Map 14 and Appendix I). The City of Bend General Plan designates the Deschutes County Historical Landmarks Commission as the review body for projects that may affect a designated cultural or historical site. The Commission maintains the inventories and files on over 3,000 buildings and sites in the County, including the City of Bend. The City will ask for assistance from the Commission and its staff, a City Planner, in identifying resources.

In addition to the listings on the National Register, Bend City Council adopted a list of historic and cultural resources that has been approved by Oregon Land Conservation and Development Commission (Appendix I). Any land use action or building modification to the historic structures on the approved list must be reviewed and approved by the Deschutes County Historical Landmarks Commission (a Certified Local Government) (City of Bend, 1998). These lands may also be considered Section 4(f) lands. Additionally, the Craftsman bungalows identified as potentially eligible for the National Register may also be 4(f) lands (Map 14).

### Cultural Resources

There are three tribal nations, which may consider the area where the BMPO is today their usual and accustomed summer camps, hunting and gathering areas. They are the Confederated Tribes of Warm Springs, the Burns Paiute Tribe and the Klamath Tribe. All of the tribes were contacted several times for comment. Each should be contacted again on a case-by-case basis as transportation projects move forward. Areas of “high sensitivity” for archaeological sites identified by the Bureau of Land Management’s Prineville Office were also included on Map 14. These mapped resources do not represent all of the archeological resources and case-by-case research and/or surveys will be required. There are over 1,800 significant sites in Deschutes County that have been identified by archaeological reports filed with the State Historic Preservation Office.

### Section 4(f)

Section 4(f) of the US Department of Transportation Act provides protection to historic resources from transportation projects. Historic sites listed on or eligible for listing on the National Register of Historic Places are considered “significant” and therefore considered Section 4(f) lands by the Federal Highway Department (FHWA). FHWA projects are prohibited from using land from any significant historic site (publicly or privately owned) unless there is no alternative to the use of land. The proposed action must also include planning to minimize harm to the property that would result from such use. Section 4(f) applies to all archaeological sites on or eligible for inclusion on the National Register, including those discovered during construction. Numerous 4(f) lands are identified within the BMPO. *De minimis* impacts related to historic sites are defined as the determination of either "no adverse effect" or "no historic properties affected" in compliance with Section 106 of the National Historic Preservation Act. ([www.state.in.us/dot/div/envassess/manuals/studies/30\\_section\\_4f.pdf](http://www.state.in.us/dot/div/envassess/manuals/studies/30_section_4f.pdf))

### Conflicts

No impacts from transportation projects to any of the historical resources on Map 14 were identified but it will be necessary for each project to consult with the State Historic Preservation Office on a case-by-case basis.

### **Recommendations**

- Consult with the Deschutes County Historical Landmarks Commission, the State Historic Preservation Office and the tribes on a case-by-case basis for each proposed transportation project to determine if there is the presence of any historical or archeological resources or Section 4 (f) lands.
- For any Section 4(f) lands identified, property boundaries shall be defined and jurisdictional responsibilities identified. The BMPO shall work with the responsible jurisdiction to avoid impacts to the 4f lands according to federal requirements.

## **Recreation Resources**

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### **Summary**

The Recreation Resources section of this chapter identifies the recreational facilities, parks and trails within the BMPO. Data was gathered from agencies including the Bend Metro Park and Recreation District, Oregon Parks and Recreation Department, Deschutes County, and the City of Bend. Documents reviewed include comprehensive plans and zoning regulations. This section is related to the sections on Historic and Cultural Resources and Fish and Wildlife Resources because all are provided some protection under Section 4(f) of the US Department of Transportation Act. There are significant recreation resources within the BMPO and they are shown on Map 15: Public Lands and Trails. Conflicts that could potentially result from transportation project include crossing recreational trails and other impacts to recreational lands and facilities. There are minor potential conflicts with parks, primarily in trail crossings. Avoiding impacts to parks and trails consistent with federal and state law is required.

## Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Bend Metro Park and Recreation District
- City of Bend
- Deschutes County
- Oregon Parks and Recreation Department
- Deschutes National Forest
- Bureau of Land Management

The following were the primary documents reviewed for this section:

Title	Source	Date
Bend Metro Park and Recreation Comprehensive Plan	Bend Metro Park and Recreation District	2005
Deschutes County Zoning regulations	Deschutes County	2001
City of Bend General Plan	City of Bend	1998
Section 4(f) of the Department of Transportation Act (49 USC303 and 23 USC 138)	Department of Transportation	1966
Section 6(f)(3) of the Land Water Conservation Fund	National Park Service	1964

Digital data layers were combined to create a map depicting the existing recreation resource information available. The following is the map title along with the data layers shown and the main source of the data. For details on the metadata see Appendix I.

Map #	Map Title	Data Layer	Data Source
15	Public Lands & Trails	Bend Metro Park and Recreation District Parks and Trails	Bend Metro Park and Recreation District
		Bureau of Land Management lands	Deschutes County
		City Lands	City of Bend
		County Lands	Deschutes County
		Other – Federal lands	Deschutes County
		Other Parks	Deschutes County, Bend Metro Park and Recreation District
		State land	Deschutes County
		Trails	City of Bend
		US Forest Service lands	Deschutes County

There are many acres of lands managed by the Bureau of Land Management (BLM) and the Deschutes National Forest surrounding the BMPO. These agencies provided maps and documents regarding these lands, but no recreational lands were identified within the BMPO boundary.

A list of projects that have been supported by the federal Land Water Conservation Fund program was available and there are numerous facilities in the BMPO that have

received these funds. Further research is needed to determine if the entire park property upon which improvements have been made is affected as many of the LWCF improvements were made in parks that are composed of multiple parcels. Also, some of the parks have changed names or management over the years. There are also 4(f) lands – “significant publicly owned” parks. A list of these properties will require further research.

## **Findings**

The BMPO benefits from an abundance of parks and trails. Numerous agencies provide park land and facilities in the area including Oregon Parks and Recreation Department, Deschutes County and the City of Bend, but the primary provider of parks and trails is the Bend Metro Park and Recreation District which is a separate jurisdiction from the city. The District currently manages 71 parks and natural areas and 58 miles of trail within the BMPO. In addition to all of the recreation land and facilities within the BMPO, the area is surrounded by thousands of acres of lands managed by the Bureau of Land Management (BLM) and the Deschutes National Forest. The Forest/Urban interface lands on Bend’s west side are receiving increasing recreation use and pressure as the Bend population has grown and residents demand close to home opportunities. Providing for and managing interface trail connections are of particular concern to the responsible agencies (Ronning, 2007.)

There are two federal acts that provide protection to recreational lands under certain conditions. The provisions for protection are in Section 6(f)(3) of the Land Water Conservation Fund (LWCF) and in Section 4(f) of the US Department of Transportation Act 1966.

Section 6(f)(3) of the LWCF Act states “No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing Statewide Comprehensive Outdoor Recreation Plan (SCORP) and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.” This "anti-conversion" requirement applies to all parks and other sites that have been the subject of Land and Water grants of any type, whether for acquisition of parkland, development or rehabilitation of facilities. In many cases, even a relatively small LWCF grant (e.g., for development of a picnic shelter) in a park of hundreds or even thousands of acres provides anti-conversion protection to the entire park site (Haupt, 2007).

There are numerous recreation facilities within the BMPO that have been supported by LWCF monies over the years including the Juniper Swim and Fitness Center, Skyline Sport Park, and Hollinshead Historical Park as well as numerous smaller community and neighborhood park projects. The LWCF program provides matching grants to States and local governments for the acquisition and development of public outdoor recreation areas and facilities. The LWCF website lists 34 projects in Deschutes County (Appendix I) totaling more than \$1,750,000 since 1966, many of which are within the

BMPO. Further research will be required to determine the boundaries of each property parcel and if it meets the requirements for protection from transportation projects.

Section 4(f) of the US Department of Transportation Act also provides protection to recreation lands from transportation projects. Federal Highway Administration projects are prohibited from using land from a publicly owned park or recreation area unless there is no feasible and prudent alternative to the use of land. *De minimis* impacts on publicly owned parks, recreation areas, and wildlife and waterfowl refuges are defined as those that do not "adversely affect the activities, features and attributes" of the Section 4 (f) resource. The use of land from a publicly owned school playground may require Section 4 (f) documentation. If the playground is open to the public and serves either organized or recreational purposes (walk-in activity), it may be subject to section 4(f) if the playground is determined to be significant for recreational purposes. There are lands in the BMPO that qualify as 4 (f) however; transportation projects proposed avoid nearly all lands identified on Map 15. The Pine Nursery, a large parcel located in the northeast quadrant of the BMPO is a newly acquired park currently under construction. This land was formerly managed by the federal government and required two separate acts of congress to transfer it to local jurisdiction. A road improvement is planned through the southwest corner of the property; however the right-of-way agreement with Deschutes County was in place at the time the park and recreation district acquired the property and the park has been designed around the future road improvement.

### **Recommendations**

In the early stages of planning for transportation projects in the BMPO, a survey should be conducted to identify all 4(f) and 6 f (3) lands. Property boundaries defined and jurisdictional responsibilities should be identified. The BMPO should work with the responsible jurisdiction to avoid, reduce or minimize impacts to the 4(f) or 6 f (3) lands consistent with requirements outlined in the respective regulations.

## **Environmental Justice**

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### **Summary**

The Environmental Justice section of this chapter identifies low-income and minority households within the BMPO as required by Executive Order 12898. Data was collected from agencies including the Federal Highway Administration and the Census Bureau. Documents reviewed include Census information, general information on environmental justice issues and the Executive Order requiring this analysis. Two maps were developed for this section: Map 16, percent of minority households by census block group and Map 17, percent of low-income households by census block group. The maps show that there are low-income and minority households within the BMPO, especially along Highway 97. Conflicts that could potentially result from transportation projects include disproportionately high and adverse effects on human and environmental health, including social and economic effects. Recommendations include avoiding, minimizing, or mitigating disproportionately high or adverse human health and environmental effects, including social and economic effects, on minority populations and low-income.

## Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Federal Highway Administration
- Oregon Department of Transportation

The following were the primary documents reviewed for this section:

Title	Source	Date
Memo: FM Larry D. Anderson RE: Environmental Justice	Larry D. Anderson	May 10, 2006
GIS Mapping Report of Environmental Justice Census Characteristics	Randy Johnson, OSU; Alan Kirk, ODOT	October 1, 2004
An Overview of Environmental Justice and Transportation	Federal Highway Administration	May 2000
US Department of Transportation, Environmental Justice website	Federal Highway Administration	

Digital data layers were combined to create maps depicting the existing information on environmental justice. The following are the map titles along with the data layers shown and the source of the data. For information on the metadata see Appendix I.

Map #	Map Title	Data Layer	Data Source
16	Percent of Minority Households	Minorities	ODOT
17	Low of Income Households	Low income households	ODOT

## Findings

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994) requires that every transportation project nationwide consider the human environment. The Order states, "Each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In addition, Title VI of the Civil Rights Act of 1964 states, "No person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."

There are three fundamental environmental justice principles:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

To certify compliance with Title VI and address environmental justice, MPOs need to:

- Enhance their analytical capabilities to ensure that the long-range transportation plan and the transportation improvement program (TIP) comply with Title VI.
- Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.
- Evaluate and - where necessary - improve their public involvement processes to eliminate participation barriers and engage minority and low-income populations in transportation decision-making.

Low-income and minority maps were developed to conduct environmental justice analysis. The data used is from the 2000 Census. The BMPO population has grown significantly since then and the demographics have anecdotally changed as well. This work will need to be updated when new census data is available.

#### Low income

According to the 2000 census numbers, the highest percentage (50% or greater of the households) of the low-income households are located north and south along Highway 97. There is also a concentration of low income households around the railroad tracks east of Highway 97.

#### Minorities

There is a small core of a high percentage of minority households (23-37% of the households) in the central part of the city of Bend. There are three separate areas of minority households (ranging from 12-23%.) In the majority of the Census Block groups in the BMPO, minority households comprise less than 7 percent of total households.

#### **Recommendations**

Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

Ensure that the long-range transportation plan and the transportation improvement program comply with Title VI.

#### *Future work to be Completed*

Conduct further analysis as new census data becomes available.

Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.

Develop a public outreach plan that encourages participation and engages minority and low-income populations in transportation decision-making including providing Spanish translations of printed materials and at meetings if needed.

# Chapter 19: Revenue Analysis

## Introduction

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This chapter presents a financial analysis of funding resources that the BMPO can reasonably expect (financial constraint) to fund the projects in the plan and to support operations and maintenance of the transportation system. This report summarizes research on reasonably available funding resources, estimated project costs, and the probable funding gap.

This chapter focuses is on estimating revenues that will be available over the next 25 years for transportation improvements in the region. Other parts of the plan discuss potential projects, their benefits, and their costs. A subsequent and critical step in the planning process is the comparison of the revenue estimates in this report to project performance measures and costs in other reports to decide on the best package of transportation improvements that can be assembled within the agreed upon revenue (fiscal) constraints.

The MPO is responsible for preparing a long-range regional transportation plan for the Bend metropolitan area. That plan is called the Metropolitan Transportation Plan (MTP). The MTP takes a “big-picture” look at future demand for all modes of transportation in the Bend region and how that demand might be accommodated by investments in infrastructure. The MTP is an initial step in developing the region's network of transportation facilities and services, and serves as a framework for more detailed project planning.

The rules of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) require the MTP to be “fiscally constrained,” meaning that the cost of projects included in the MTP cannot exceed the capacity of the region to fund the projects. This chapter estimates the level of transportation-related funding that jurisdictions in the Bend MPO can reasonably expect to have available over the planning period. This report provides a basis for making decisions about the amount of revenue available over the next 20 years to fund regional transportation improvements.

This MTP addresses only the *regional* transportation system. Regional facilities include all state transportation facilities, major arterials and minor arterials, and some major collectors. Local facilities (the remainder of the collector system and local roads) are not addressed in the plan.

ODOT, Deschutes County, and the City of Bend each prepare short-term capital improvement plans that identify projects that will be funded in the near future, generally the next three to five years. Projects built and operated by jurisdictions in the Bend MPO area must be consistent with the MTP in order to be eligible for federal funding.

## Methods

To complete this chapter, the following steps were followed:

- **Reviewed existing data and previous studies.** Primary documents reviewed included ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030* report and the Bend Transportation System Plan. Also reviewed were the City's *Urban Area Street SDC Inventory* and ODOT guidelines relating to SAFETEA-LU planning requirements.
- **Reviewed project costs data.** Project cost data compiled by the city, county, ODOT, and the transportation engineering/planning consultants working on the project.
- **Conferred with Federal Transit Administration staff.** Discussions with regional FTA staff to gain insight on agency's funding of new transit systems.

## **Context for the Analysis of Revenues**

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### **Transportation Finance Principles**

Building and maintaining the transportation system is a joint responsibility of federal, state, and local governments. Projects to improve the transportation system are funded through a mix of federal, state, and local revenues distributed through a variety of funding programs that dictate how this revenue can be spent. In addition to revenue generation and spending by multiple jurisdictions, revenue sharing among jurisdictions and cooperation among multiple jurisdictions on individual projects makes describing transportation finance complicated.

To organize this review of available transportation funding in the Bend metropolitan area, the chapter focuses on the sources of public funding for transportation and how those funds are spent.

There is a distinction between the terms “funding” and “financing,” which often get used interchangeably. Providing transportation facilities and services costs money, and somebody has to pay for these costs. The ultimate source of revenue for these costs is funding. When the funds for transportation costs are borrowed and paid back over time, then these costs have been financed. Public agencies finance costs for the same reasons as households and businesses—to reduce the current out-of-pocket costs by spreading out payments over time.

### **Legislative framework**

The bulk of people and freight using the transportation system are traveling on roads in cars, trucks, and buses. In addition, many walkways and bicycle facilities are part of the roadway system. The roadway system in the United States is primarily owned and operated by the public sector. While the system of freeways, highways, and streets function as a single system, it is the joint responsibility of federal, state, and local governments to build and maintain this system.

Road systems in urban areas are extensive and cross many jurisdictions. Efficiently building and maintaining such a complex system requires planning to coordinate the investments of multiple jurisdictions. Large urban areas are required by federal and

Oregon law to coordinate plans for transportation improvements at a regional level.<sup>1</sup> The regional (or metropolitan) transportation plan serves this function by considering long-run transportation needs at a regional level and identifying policies, programs, and projects to meet these needs. The plans of local jurisdictions responsible for the transportation system in the Bend metropolitan area must be consistent with the policies, programs, and projects identified in the MTP.

While measures in an MTP can include policies, strategies, and programs, the focus of an MTP is usually on *capital investments* to improve existing roadways, construct new roadways, and improve transit service. A key requirement for regional transportation plans is that they be *fiscally constrained*—the cost of actions identified in the MTP cannot exceed the level of funding considered reasonably available in the region. In addition, projects must be in the MTP to be eligible for most federal and state funding programs.

The cost of all projects in a region that could contribute to system improvements almost always exceeds the financial resources considered *reasonably available* to pay for the projects. For these reasons, the biggest and defining task of a regional (or metropolitan) transportation plan is to select and prioritize projects within the constraint of available funding. A regional (or metropolitan) transportation plan also describes projects beyond those that fall within whatever definition of fiscal constraint that a region ultimately chooses. These projects are considered *illustrative*: they could be included in the fiscally constrained set of projects if new funding sources are found. Moreover, even if they are not part of the fiscally-constrained set of projects, they are potentially part of a longer-run transportation plan, and give local governments some ability to conduct certain planning studies that might be necessary given the long time it takes for project development.

To address the requirement for fiscal constraint, regional transportation plans have a chapter or technical appendix that estimates the level of funding for capital projects that are reasonably available in the region. This document focuses on available funding for projects.

The purpose of this chapter is to provide a financial context for the discussion and evaluation of projects.

## **Overview of Current Transportation Funding in the Bend MPO**

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The purpose of this chapter is to provide a financial context for the discussion and evaluation of projects. It does so by estimating the level of revenue that will be “reasonably available” (consistent with how that term is defined by federal requirements) to fund improvements to the transportation system in the Bend MPO. As shown in this

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<sup>1</sup> Planning, in addition to being a good idea, is the law. Much of the funding for metropolitan transportation systems comes from the federal government. As a condition of that funding, the federal government (through the US Department of Transportation and the Federal Highway Administration) requires metropolitan areas with more than 50,000 people to form a Metropolitan Planning Organization (MPO) and to have that MPO create a long-range Regional Transportation Plan.

Chapter, reasonably available revenue in a jurisdiction is primarily from existing revenue sources. Reasonably available revenue can include increased revenue from growth in underlying factors that determine that revenue (such as increases in population that increase gasoline consumption and thus fuel taxes) and from future increases in the tax rate or fees that continue a historic trend of such increases.

This section describes recent trends in transportation funding in the Bend MPO in order to identify the existing funding sources that will be used as the basis of establishing reasonably available revenues later in this report.

## **Roads**

Funding for building and operating roadways is typically the largest component of transportation-related expenditures by the public sector. The transportation system in the Bend MPO was built and is operated by the State of Oregon (through ODOT), Deschutes County, and the City of Bend. Revenue from each of these jurisdictions will be used to make future improvements to the regional transportation system.

This section describes current expenditures by the State of Oregon, Deschutes County, and the City of Bend to maintain and construct roadways that are part of the regional transportation system in the Bend MPO area. Though the focus of the description in this section is roadways, expenditures for road maintenance and construction frequently include elements for transit, bicycles, and pedestrians, such as bus stops, bike lanes and sidewalks.

## **State of Oregon**

The State of Oregon is responsible for maintenance of federal and state highways in the Bend MPO area. ODOT does not report its expenditures for highways in a way that allows a summary of expenditures in the Bend MPO area. For the analysis in this report it is assumed that ODOT will continue to be responsible for operation and maintenance of federal and state highways in the Bend MPO area. Included is a discussion about the impact of increasing operation and maintenance (O&M) costs on capital funding available at the statewide level, and the implication of statewide conditions for capital funding available in the Bend MPO area.

Table 19-1 shows planned roadway projects in the Bend MPO area as listed in the current Statewide Transportation Improvement Program (STIP) prepared by ODOT. The STIP lists improvement projects on federal and state highways maintained by ODOT. The STIP also lists projects on local streets that have regional significance, even if these projects will be built entirely with local funds. The STIP is a four-year capital-improvements program, not a long-range plan. In general, funding for projects listed in the STIP has been identified and the projects have a high likelihood of actually being funded. Funding for projects in the STIP, however, may be a mix of federal, state, and local funds.

**Table 19-1: Bend MPO roadway projects in the 2006-2009 STIP**

Route	Description	Project Expenditures by Year				Total
		FY2006	FY2007	FY2008	FY2009	
US97	Interchange at Cooley Rd			\$20,000,000		\$20,000,000
US97	Traffic Signal at Reed Market Rd				\$328,000	\$328,000
US97	Access management/pavement		\$4,433,000			\$4,433,000
Empire Avenue	Extend from Purcell to 27th St		\$3,600,000			\$3,600,000
Reed Market Road	Corridor improvements		\$8,300,000			\$8,300,000
Murphy Road	Corridor improvements			\$4,500,000		\$4,500,000
Neff Road	Corridor improvements		\$1,250,000			\$1,250,000
Various	MPO STP Funds	\$605,000	\$605,000	\$605,000	\$605,000	\$2,420,000
<b>Total</b>		<b>\$605,000</b>	<b>\$18,188,000</b>	<b>\$25,105,000</b>	<b>\$933,000</b>	<b>\$44,831,000</b>

Source: ODOT Statewide Transportation Improvement Plan 2006-2009. Summarized by ECONorthwest.

Table 19-1 shows that annual expenditures on projects in the Bend MPO area will range from \$605,000 to \$25.1 million between FY2006 and FY2009. Annual funding for capital projects can vary widely from year to year due to the inclusion of one or a few large projects in any given year. The total spending shown in Table 19-1 averages \$11.2 million per year.

Table 19-2 shows funding sources identified in the STIP for the projects shown in Table 19-1.

**Table 19-2: 2006-2009 STIP Funding Sources**

Route	Description	STIP Funding by Source					Total
		STP	OTIA III	NHS	HEP	Other	
US97	Interchange at Cooley Rd		\$14,984,000			\$5,016,000	\$20,000,000
US97	Traffic Signal at Reed Market Rd	\$328,000					\$328,000
US97	Access management/pavement	\$798,012		\$2,854,060	\$329,040		\$3,981,112
Empire Avenue	Extend from Purcell to 27th St					\$3,600,000	\$3,600,000
Reed Market Road	Corridor improvements					\$8,300,000	\$8,300,000
Murphy Road	Corridor improvements					\$4,500,000	\$4,500,000
Neff Road	Corridor improvements					\$1,250,000	\$1,250,000
Various	MPO STP Funds	\$2,171,468					\$2,171,468
<b>Total</b>		<b>\$3,297,480</b>	<b>\$14,984,000</b>	<b>\$2,854,060</b>	<b>\$329,040</b>	<b>\$22,666,000</b>	<b>\$44,130,580</b>

Source: ODOT Statewide Transportation Improvement Plan 2006-2009. Summarized by ECONorthwest.

STIP funding source acronyms defined: Surface Transportation Program (STP), Oregon Transportation Investment Act III (OTIA III), National Highway System program (NHS), and the Hazard Elimination Program (HEP).

According to the STIP, funding classified as “Other” represents local funding, not federal or state funding.<sup>2</sup> Table 19-2 shows that local sources are expected to contribute a total of \$22.7 million or about 50% of the cost of STIP projects in the MPO area. The projects listed for Empire Avenue, Reed Market Road, Murphy Road, and Neff Road will all be built primarily with local funds. Traffic signals on US 97 at Reed Market Road will be funded by ODOT through the Surface Transportation Program (STP). In addition, the STIP does not include any required local matching funds as a funding source.<sup>3</sup> The funding shown in Table 19-2 is roughly \$700,000 less than total project costs shown in Table 19-1, suggesting that this amount shortfall would be met by local matching funds. This level of local funding averages \$175,000 per year over the four years of the STIP.

<sup>2</sup> Oregon Department of Transportation. 2005. *Final Statewide Transportation Improvement Program 2006–2009*. Appendix 1 Fund Code Descriptions, page 389.

<sup>3</sup> *Ibid.*, Key to Project Listing, page 4.

Of the \$21.5 million of federal and state funding shown in Table 19-2, the primary sources are the Oregon Transportation Investment Act III (OTIA III), Surface Transportation Program (STP), National Highway System program (NHS), and the Hazard Elimination Program (HEP). The \$15 million of funding from OTIA III in Table 19-2 is derived from bonds issued by the State of Oregon, so this funding is not from a continuing or reoccurring source. Federal and state funding from ongoing transportation programs in Table 19-2 totals almost \$6.5 million, with an average of \$1.6 million per year over the four years of the STIP.

### **Deschutes County**

Most expenditures by Deschutes County for road maintenance and construction are for roads in unincorporated areas of the County. Most of the area within the Bend MPO, however, is in the City of Bend. Thus, (1) most of the lane-miles of road that the County maintains are outside the MPO, and (2) inside the MPO any County expenditures for road maintenance or construction occur primarily in the unincorporated areas of the MPO.

Most County roads in the MPO are located east and south of the City of Bend. Of the 55.5 miles of County roads in the MPO, 34.5 miles (62%) of these roads are local roads and 13.9 miles or 25% are collector roads, and 1 mile (2%) is a forest highway. Only 6.1 miles (11%) of County roads in the MPO are arterial roads that serve regional traffic.

Deschutes County spends \$10.5 million/year for road maintenance and improvements. In addition, the county has averaged \$425,000 per year in LID improvements.<sup>4</sup> The bulk of expenditures by Deschutes County are in areas outside of the MPO. The City and County have long cooperated on maintenance of roads at Bend's urban fringe by pooling resources and coordinating efforts for efficiency. The Deschutes County Road Department estimates that it annually spends \$10,000 to \$15,000 per mile to maintain roads in the County, and that its expenditure on roads in the Bend MPO area currently averages about \$700,000 per year. While this is only 5% of the County total expenditures for roads, officials with the City of Bend have identified these expenditures as an important contribution for maintaining road conditions in Bend's urban fringe for regional mobility.

It is assumed that Deschutes County will continue to maintain roads in unincorporated areas of the Bend MPO. As the City of Bend expands into unincorporated areas of the MPO, it is likely that the MPO boundaries will also expand. As that happens, there will continue to be unincorporated areas of the MPO in which the County is responsible for road maintenance and improvement.

Analysis of road-related expenditures by Deschutes County shows that annual spending for Capital Projects ranged from \$1.6 million to \$3.0 million between fiscal years 2002/03 and 2004/05, averaging \$2.5 million per year over these three years.<sup>5</sup> These

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<sup>4</sup> Figures provided by County staff on 11/9/06 via comments on preliminary draft document.

<sup>5</sup> County staff comment on 11/6/06: These numbers include overlay/preservation projects which have averaged \$1.6 million per year. True capital expenditures have been fairly minimal.

expenditures were for all of Deschutes County, which includes expenditures outside of the Bend MPO area.

Table 19-3 shows roadway-related projects in the County's current Capital Improvement Program.

**Table 19-3: Deschutes County Capital Improvement Program, 2005/06–2009/10**

Location	Description	Expenditures by Year					Total	Funding Source	
		2005-06	2006-07	2007-08	2008-09	2009-10		FHWA	ODOT
Various	Asphalt Overlay Projects	\$2,000,000	\$2,200,000	\$2,000,000	\$2,000,000	\$2,000,000	<b>\$10,200,000</b>		
Huntington Rd / 1st St	Intersection improvements	\$570,000					<b>\$570,000</b>		
Various	Flashing intersection lights		\$40,000	\$40,000	\$40,000	\$40,000	<b>\$160,000</b>		
Millican Rd		\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	<b>\$250,000</b>		
Deschutes Junction	Hwy 97 Phase 2	\$2,360,760					<b>\$2,360,760</b>		
FS Road 40 / 45	Sunriver to Mount Bachelor	\$6,400,000					<b>\$6,400,000</b>	\$5,400,000	
Hwy 97 / South Century Dr	Interchange	\$6,000,000					<b>\$6,000,000</b>	\$2,100,000	\$2,900,000
South Century Dr	Patch Bridge to Burgess Rd				\$4,000,000		<b>\$4,000,000</b>	\$4,000,000	
Wickiup Junction	Planning	\$76,500					<b>\$76,500</b>		\$76,500
Various	Right-of-way acquisitions	\$200,000	\$30,000	\$30,000	\$30,000	\$30,000	<b>\$320,000</b>		
Various	LID Projects	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	<b>\$3,750,000</b>		
Empire / 27th St	Extension	\$250,000					<b>\$250,000</b>		
Various	Bike / Ped improvements	\$75,000	\$75,000	\$76,000	\$77,000	\$77,000	<b>\$380,000</b>		
<b>Total</b>		<b>\$18,732,260</b>	<b>\$3,145,000</b>	<b>\$2,946,000</b>	<b>\$6,947,000</b>	<b>\$2,947,000</b>	<b>\$34,717,260</b>	<b>\$11,500,000</b>	<b>\$2,976,500</b>

Source: Deschutes County. <http://ww2.deschutes.org/index.cfm?objectId=410D3576-BDBD-57C1-9C5E611547AFF5E7>

Deschutes County plans to spend a total of \$34.7 million on roadway-related projects over the five years shown in Table 19-3. Roughly \$14.5 million of those expenditures are expected to come from the Federal Highway Administration (FHWA) and ODOT. In addition, projects funded by Local Improvement Districts (LIDs) are expected to total \$3.75 million over the period shown in Table 19-3. Other funding sources are not reported by the County's CIP document—remaining project costs of about \$16.5 million will presumably be paid from County funds, but some additional federal, state, or local funding may be included in the costs shown in Table 19-3. The level of remaining project costs results in average capital expenditures of \$3.3 million per year by Deschutes County over the five years. These expenditures will occur throughout Deschutes County, primarily in areas outside of the Bend MPO area. The only County project in the Bend MPO boundaries in Table 19-3 is the extension of Empire to 27<sup>th</sup> Street. The city of Bend is building the extension. Deschutes County is providing \$250,000 of funding towards the project.

### City of Bend

Table 19-4 shows that the City of Bend spent \$20 million for road-related expenses in fiscal year 2002/03, falling to roughly \$12 to \$11 million per year in the following two fiscal years. Over half of the road-related expenditures in Bend were for Capital Projects in the three years shown in Table 19-4, primarily for construction of new roads. The City's expenditures for Operation & Maintenance were more stable than those for Capital Projects, averaging just under \$5 million per year.

The City of Bend generates over 70% of annual road-related revenues from local sources, primarily System Development Charges (SDCs) and Franchise Fees. Proceeds from the sale of bonds generated a one-time revenue of \$12.3 million for the City in FY 2002/03. Revenue from the State Highway Fund Apportionment provided roughly 23% of the City's annual revenue in FY 2003/04 and 2004/05. Compared to SDCs, Franchise Fees, and the State Highway Fund, no other single source produces a substantial share of road-related revenue for the City of Bend.

**Table 19-4: Road-related revenues and expenditures, City of Bend, FY 2002/03– 2004/05**

	FY 2002/03	FY 2003/04	FY 2004/05
<b>Beginning Balance(s)</b>	<b>\$4,275,500</b>	<b>\$8,911,100</b>	<b>\$8,289,800</b>
<b>Receipts from Local Sources</b>	<b>\$21,563,100</b>	<b>\$8,558,200</b>	<b>\$9,579,700</b>
Special Area Assessments (LID, EID, etc)	\$1,942,200	\$12,800	\$12,400
System Development Charges	\$4,150,000	\$5,377,200	\$6,474,400
Transfers from Non-road Funds	\$129,000	\$209,100	\$215,100
Interest Income	\$230,600	\$151,500	\$383,200
Land Sales & Rentals	\$202,800	\$7,700	\$8,800
Permits	\$1,300	\$0	\$0
Proceeds from Sale of Bonds and Notes	\$12,303,600	\$0	\$0
Hotel/Motel Taxes	\$493,000	\$582,000	\$653,000
Franchise Fees	\$1,619,400	\$1,679,600	\$1,716,800
Private Contributions	\$455,700	\$509,900	\$17,100
Unspecified Other	\$35,500	\$28,400	\$98,900
<b>Receipts from State Government</b>	<b>\$2,384,900</b>	<b>\$3,107,900</b>	<b>\$3,899,300</b>
State Highway Fund Apportionment	\$2,294,900	\$2,730,800	\$3,099,000
State General Fund	\$90,000	\$0	\$0
Fund Exchange Program	\$0	\$309,100	\$473,100
Unspecified Other	\$0	\$68,000	\$327,200
<b>Receipts from Federal Government</b>	<b>\$273,300</b>	<b>\$0</b>	<b>\$0</b>
Unspecified Other	\$273,300	\$0	\$0
<b>Other Receipts</b>	<b>\$532,000</b>	<b>\$0</b>	<b>\$0</b>
Receipts from other Governments	\$500,000	\$0	\$0
Work for other Jurisdictions	\$32,000	\$0	\$0
<b>TOTAL REVENUE</b>	<b>\$24,753,300</b>	<b>\$11,666,100</b>	<b>\$13,479,000</b>
<b>Capital Projects</b>	<b>\$14,657,400</b>	<b>\$6,788,800</b>	<b>\$6,412,500</b>
Right-of-Way	\$3,674,100	\$831,400	\$1,011,400
Construction Engineering	\$899,400	\$337,300	\$1,068,400
Construction & Expansion	\$8,927,400	\$4,022,400	\$2,748,300
Bike/Pedestrian Facilities	\$206,100	\$3,000	\$0
Debt Service	\$950,400	\$1,594,700	\$1,584,400
<b>Administration and General Engineering</b>	<b>\$734,000</b>	<b>\$476,900</b>	<b>\$362,300</b>
<b>Operation &amp; Maintenance Projects</b>	<b>\$4,726,300</b>	<b>\$5,021,700</b>	<b>\$4,472,800</b>
Repair & Preservation	\$558,100	\$713,200	\$946,900
General Maintenance	\$3,470,800	\$3,016,800	\$2,891,200
Safety & Traffic	\$539,600	\$607,900	\$282,100
Snow/Ice Removal	\$157,800	\$683,800	\$352,600
<b>TOTAL EXPENDITURES</b>	<b>\$20,117,700</b>	<b>\$12,287,400</b>	<b>\$11,247,600</b>
<b>Ending Balance</b>	<b>\$8,911,100</b>	<b>\$8,289,800</b>	<b>\$10,521,200</b>

Source: ODOT Local Road and Street Finance Questionnaire. Summarized by ECONorthwest.

Note: Ending balances are total revenue minus total expenditures plus carry over from previous year.

Table 19-5 shows that roadway-related projects in the City's current capital improvement schedule have a total cost of \$40.8 million over the next five years. The majority of these projects will expand the capacity of existing streets, bring streets up to standards, improve intersections, and add signals. These improvements are all related to increasing the capacity of existing streets to maintain an acceptable level of service to the traveling public.

**Table 19-5: Transportation Capital Improvement Program, City of Bend, 2005/06-2009/10**

Location	Description	2005/06	2006/07	2007/08	2008/09	2009/10	Total
<b>Continuing Projects</b>							
Citywide	Transportation SDC Analysis	\$75,000		\$50,000		\$50,000	<b>\$175,000</b>
Arterial / Collector streets	Streetlights improvements	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	<b>\$1,250,000</b>
Newport Bridge	Replacement**	\$2,765,000	\$1,700,000				<b>\$4,465,000</b>
Hwy 97	Mt. Washington bridge**	\$2,865,000					<b>\$2,865,000</b>
27th St (Neff to Forum)	Widening**	\$1,630,000					<b>\$1,630,000</b>
Empire Ave at Boyd Acres	Traffic signal**	\$1,495,000					<b>\$1,495,000</b>
Cooley Rd	Interchange and corridor**	\$500,000	\$2,250,000	\$2,250,000			<b>\$5,000,000</b>
15th Ave (Hwy 20 to Bear Cr)	Extension**	\$856,000					<b>\$856,000</b>
Reed Market Rd	Corridor improvements**	\$500,000	\$1,300,000	\$1,400,000	\$2,000,000	\$3,000,000	<b>\$8,200,000</b>
Empire Ave	Modernization	\$620,000					<b>\$620,000</b>
<b>New Projects</b>							
8th at Greenwood, 8th at Olney	Capacity improvements	\$500,000					<b>\$500,000</b>
Downtown Signals	Capacity improvements			\$500,000	\$500,000		<b>\$1,000,000</b>
Revere at Division St	Capacity improvements					\$500,000	<b>\$500,000</b>
Neff Rd (8th to 27th St)	Corridor improvements	\$250,000	\$1,000,000				<b>\$1,250,000</b>
Empire Ave	Empire Ave extension (Ph 1)	\$350,000	\$2,000,000	\$1,250,000			<b>\$3,600,000</b>
Murphy Rd	Brookwood to 15th St	\$500,000	\$500,000		\$2,250,000	\$1,250,000	<b>\$4,500,000</b>
Butler Market at Brinson	Intersection improvements	\$100,000	\$700,000				<b>\$800,000</b>
Brookwood at Powers	Roundabout		\$500,000	\$800,000			<b>\$1,300,000</b>
Purcell at Bear Creek	Intersection improvements			\$800,000			<b>\$800,000</b>
<b>Total</b>		<b>\$13,256,000</b>	<b>\$10,200,000</b>	<b>\$7,300,000</b>	<b>\$5,000,000</b>	<b>\$5,050,000</b>	<b>\$40,806,000</b>

Source: City of Bend. Transportation Improvements Five-Year Capital Improvement Program

Note: Projects marked \*\* are those for which ODOT is contributing funds.

To obtain a clearer picture of local costs, projects listed in the City of Bend transportation improvements capital program are compared with those in the Statewide Transportation Improvement Program (STIP) within the Bend MPO area. Several projects in the City of Bend, listed in Table 19-5, appear identical to some projects in the Bend MPO that are listed in the current STIP. The STIP projects are summarized in Tables 19-1 and 19-2. Comparing the project cost in Table 19-5 to the level of "Other" funding shown in Table 19-2 appears to confirm the supposition that "Other" funding in the STIP is from local sources. Taking into account and netting out federal and state funding for STIP projects listed in Table 19-2 (approximately \$6.5 million) leaves the remaining project costs of \$34.3 million presumably must be funded by local sources. This level of local funding would average \$6.9 million per year over the five years shown in Table 19-6.

The City's capital improvement schedule does not identify specific funding sources for listed projects. The City of Bend reports the project costs that are expected to be funded by ODOT and City sources other than SDCs; the remaining amount are the costs that will be funded by current SDC revenue. This analysis is shown in Table 19-6. Non-SDC funds are expected to contribute almost \$10.5 million for project costs, leaving costs of \$30.3 million to be funded by expected SDC revenue. This level of costs over five years implies that SDC revenue is expected to average just over \$6 million per year over the five years shown in Table 19-5.

The only funding source other than SDCs identified in Table 19-6 is ODOT funding for the Newport Bridge project and other funding sources for the Empire Avenue extension and the Cooley Road interchange. In addition, Table 19-2 shows that federal and state sources are expected to contribute funding of \$6.5 million (STP, NHS, HEP funds) for projects in listed in Table 19-5. The cost of projects other than those funded by SDCs or ODOT in Table 19-6 totals \$6 million (other funding for Empire Avenue extension and Cooley Road interchange), or \$1.2 million per year. City staff report that funding sources for these remaining costs have not been identified, and that these projects may or may not occur depending on the availability of funding.

**Table 19-6: Capital Projects Funding Sources, City of Bend, 2005/06-2009/10**

<b>Cost / Funding Component</b>	<b>Amount</b>
<b>Total capital costs</b>	<b>\$40,806,000</b>
<b>Less Non-SDC funds</b>	<b>\$10,465,000</b>
ODOT funding of Newport Bridge project	\$4,465,000
Other funding of Empire Ave extension	\$1,000,000
Other funding of Cooley Rd interchange	\$5,000,000
<b>= Net City share using current SDCs</b>	<b>\$30,341,000</b>

Source: City of Bend. Transportation Improvements Five-Year Capital Program

Private funding is an important supplement to government sources. Bend's development code requires developers to build local streets serving their development. These streets must be built to City standards and donated to the City, which is responsible for ongoing maintenance. These local streets are not part of the regional system, and not relevant to the MTP. But developers and other private entities may also contribute funds or build improvements to collector and arterial streets, often to provide access to their property or to mitigate the impacts of their development. Depending on the nature and reason for privately-funded improvements, their cost may or may not be credited toward SDCs that may apply. The West Side Traffic Consortium, for example, used developer-provided improvements, in conjunction with LID assessments, to finance some transportation improvements in west Bend.

The City of Bend provided information on private contributions to road projects between June 1990 and June 2006. Contributions tracked by the City were those beyond the level of SDC and other fee reimbursements—that is, these private contributions were a net increase in the level of funding available for capital improvements. Analysis of these data show that private contributions for street projects totaled over \$4.2 million between 1990 and 2006, resulting in an average of \$600,000 per year (in constant 2006 dollars).

### **Summary of current road-related expenditures**

Table 19-7 summarizes the annual average road-related expenditures in the Bend MPO by ODOT, Deschutes County, and the City of Bend. The annual averages in Table 19-7 are based on the analysis of current expenditures in this section for various years.

**Table 19-7: Average Annual Road-Related Expenditures for Various Years**

<b>Agency/Jurisdiction</b>	<b>O&amp;M</b>	<b>Capital</b>
ODOT	unknown	\$1,600,000
Deschutes County	\$700,000	\$50,000
City of Bend	\$5,000,000	\$6,900,000
<b>Total</b>	<b>\$5,700,000</b>	<b>\$8,550,000</b>

Source: ECONorthwest.

Note, these figures were derived from data from various years and compiled into this summary from the analysis conducted in this section. To recap, ODOT will expend an average of \$1.6 million per year over 2006 through 2009. The County of Deschutes expends within the Bend MPO about \$50,000 per year (a conservative estimate) on capital projects per year and \$700,000 on O&M per year based on data from 2005/6 to 2009/10. The City of Bend, in 2003/04 showed O&M expenditures averaging just under \$5 million per year and 2004/05. Data from 2003/04 and 2004/05 showed that expenditures on the order of \$7 million per year.

### **Transit**

The City of Bend has offered Dial-a-Ride service to provide transportation to the general public on a demand-response basis for many years. Beginning in September 2006, the City initiated a new fixed-route bus service, Bend Area Transit (BAT). The City continues to offer Dial-a-Ride service, but it is now focused on providing mobility services for low income seniors and people with disabilities.

Table 19-8 shows the City's Public Transit Fund budget for the current year, and actual or projected revenues and expenditures for the previous three years. The City's Public Transit Fund tracked revenues and expenditures for the Dial-a-Ride program only in the years shown in Table 19-8. Expenditures from the Public Transit Fund increased from \$1.7 million in FY 02/03 to \$2.3 million in FY 05/06. The bulk of these expenditures are for driver contracts, vehicle maintenance, and fuel.

**Table 19-8: Public Transit Fund, City of Bend, FY02/03–FY05/06**

	<b>FY 02/03 Actual</b>	<b>FY 03/04 Actual</b>	<b>FY 04/05 Projected</b>	<b>FY 05/06 Budget</b>
<b>Working Capital Carryover</b>	<b>\$326,000</b>	<b>\$296,000</b>	<b>\$523,000</b>	<b>\$579,000</b>
<b>Receipts</b>	<b>\$1,686,000</b>	<b>\$2,170,000</b>	<b>\$1,995,000</b>	<b>\$1,731,000</b>
Transient Room Tax	\$125,000	\$146,000	\$165,000	\$0
Intergovernmental Revenue	\$1,290,000	\$1,945,000	\$1,581,000	\$955,000
Charges for Service	\$64,000	\$76,000	\$245,000	\$248,000
Interest	-\$3,000	-\$1,000	\$4,000	\$8,000
Miscellaneous	\$10,000	\$4,000	\$0	\$0
Transfers from Other Funds	\$0	\$0	\$0	\$520,000
Borrowing Proceeds	\$200,000	\$0	\$0	\$0
<b>Expenses</b>	<b>\$1,716,000</b>	<b>\$1,943,000</b>	<b>\$1,939,000</b>	<b>\$2,311,000</b>
Personal Services	\$75,000	\$83,000	\$87,000	\$93,000
Materials and Services	\$754,000	\$1,033,000	\$1,413,000	\$1,481,000
Capital Outlay - Equipment	\$0	\$22,000	\$0	\$0
Capital Outlay - Vehicles	\$367,000	\$202,000	\$0	\$142,000
Debt Service	\$277,000	\$200,000	\$0	\$0
Transfers	\$243,000	\$403,000	\$439,000	\$518,000
Contingency	\$0	\$0	\$0	\$77,000
<b>Ending Balance</b>	<b>\$296,000</b>	<b>\$523,000</b>	<b>\$579,000</b>	<b>-\$1,000</b>

Source: City of Bend, Adopted Budget Fiscal Year 2005/06.

Table 19-8 shows that Intergovernmental Revenue is the largest revenue source for the Public Transit Fund. Table 19-9 shows the source of these transfers for FY 04/05 and FY 05/06, the only two years for which detailed information is available in the City's budget document. Table 19-9 shows that the largest Intergovernmental Revenue source in both years is a federal operating grant. Table 19-9 also shows that the City expects no revenue in FY 05/06 from two sources that provided substantial revenue in the previous year: Liquor Tax and State Revenue Sharing. Table 19-8 shows that this lost revenue will be partially replaced by increased Transfers from Other Funds. This may represent a change in accounting practices rather than an actual shift in funding by routing Liquor Tax and State Revenue Sharing revenues through the City's General Fund.

**Table 19-9: Intergovernmental Transfers to the Public Transit Fund, City of Bend, FY 04/05–FY 05/06**

<b>Revenue Source</b>	<b>FY 04/05 Projected</b>	<b>FY 05/06 Budget</b>
Federal Operating Grant	\$548,300	\$575,800
Miscellaneous Grant	\$20,700	\$0
Misc. Grants - Federal Passthru	\$16,800	\$250,100
State Revenue Sharing	\$218,000	\$0
Liquor Tax	\$640,200	\$0
STF Grant - State Passthru	\$136,000	\$129,500
Dial-a-Ride Program	\$600	\$0
<b>Total</b>	<b>\$1,580,600</b>	<b>\$955,400</b>

Source: City of Bend, Adopted Budget Fiscal Year 2005/06.

In addition, ODOT has provided funds to Bend's Dial-a-Ride program from its share of the federal Surface Transportation Program (State Revenue Sharing). Funds from the state's Special Transportation Fund (STF) are derived from state cigarette tax revenues and are distributed to programs that serve the transportation needs of the low income seniors and people with disabilities.

Table 19-10 shows Federal Transit Administration (FTA) grants included in the Bend MPO Metropolitan Transportation Improvement Program (MTIP) for 2004–2009. Table 19-10 shows that Bend's public transit system (BAT and Dial-a-Ride) is expected to receive grants from three FTA programs:

- **FTA Section 5307** provides formula-based grants for operation and capital support of local transit systems. This program is expected to provide an annual grant of roughly \$575,000 to \$667,000 between 2004 and 2007. This program requires a 50% local match for operating funds, and 20% for capital funds.
- **FTA Section 5309** provides discretionary grants for capital improvements by local transit systems. This program is expected to provide an annual grant of roughly \$190,000 to \$280,000 between 2006 and 2009. This program requires a 20% local match.
- **FTA Section 5310** provides discretionary grants to local transit systems for operations and capital improvements tied to services for seniors and people with disabilities. This program is expected to provide an operational grant of \$195,000 and a capital grant of roughly \$198,000 in 2006. This program requires a 20% local match for operations and a 10% match for capital.

**Table 19-10: FTA grants included in the Bend MPO MTIP, 2004–2009**

FTA Program	2004	2005	2006	2007	2008	2009	Total
<b>Operations &amp; Maintenance</b>							
<b>FTA 5307</b>	<b>\$1,149,218</b>	<b>\$1,164,008</b>	<b>\$1,269,590</b>	<b>\$1,333,068</b>			<b>\$4,915,884</b>
Federal	\$574,609	\$582,004	\$634,795	\$666,534			\$2,457,942
Local	\$574,609	\$582,004	\$634,795	\$666,534			\$2,457,942
<b>FTA 5310</b>			<b>\$243,750</b>				<b>\$243,750</b>
Federal			\$195,000				\$195,000
Local			\$48,750				\$48,750
<b>Total</b>	<b>\$1,149,218</b>	<b>\$1,164,008</b>	<b>\$1,513,340</b>	<b>\$1,333,068</b>			<b>\$5,159,634</b>
<b>Capital Improvements</b>							
<b>FTA 5309</b>			<b>\$237,946</b>	<b>\$248,293</b>	<b>\$336,229</b>	<b>\$349,161</b>	<b>\$1,171,629</b>
Federal			\$190,357	\$198,634	\$268,983	\$279,329	\$937,303
Local			\$47,589	\$49,659	\$67,246	\$69,832	\$234,326
<b>FTA 5310</b>			<b>\$221,000</b>				<b>\$221,000</b>
Federal			\$198,303				\$198,303
Local			\$22,697				\$22,697
<b>Total</b>			<b>\$458,946</b>	<b>\$248,293</b>	<b>\$336,229</b>	<b>\$349,161</b>	<b>\$1,392,629</b>

Source: Bend Metropolitan Transportation Improvement Program 2004–2009.

Note: The city expects to receive an additional \$100,000 in 2007 and 2008 from FTA 5310 funds.

Table 19-11 shows the amount of state and federal funding included in the 2006–2009 Statewide Transportation Improvement Program (STIP). Table 19-11 shows that FTA Section 5307 grants are expected to continue at their current level, growing at an average rate of 5% between 2006 and 2009 (slightly faster than the rate of inflation

anticipated by ODOT, 3.1%). Table 19-11 also shows that transit services in the Bend MPO will receive one-time grants from the Job Access Reverse Commute program, FTA Section 5310 program, and the state STF.

**Table 19-11: Federal and State Transit Funding in the 2006-2009 STIP**

<b>Funding Source</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>Local Match Requirement</b>
Job Access Reverse Commute	\$175,000				50%
FTA 5307 Transit Operations	\$596,500	\$626,500	\$658,000	\$690,500	50%
FTA 5310 Transit Operations	\$195,200				20%
STF Capital Grant	\$198,303				10%

Source: Oregon Department of Transportation. Statewide Transportation Improvement Plan 2006-2009. Summarized by ECONorthwest.

Note: The City of Bend expects to receive about \$80,000 per year of JARC funding in future years from the small urban area allocation.

The City of Bend initiated fixed-route bus transit service in September 2006. Bend Area Transit (BAT) operates buses on seven routes Monday–Friday and six routes on Saturday. Fares are \$1 per trip or \$2 for an unlimited day pass. Discounted fares are available for seniors, the disabled, and purchases of multi-day or monthly passes.

The City is currently funding BAT within its existing budget but hopes to develop a dedicated funding source for this service. Newspapers report that the City estimates that BAT will cost about \$1.5 million annually to operate at its current level of service.<sup>6</sup> A recent supplemental budget approved by Bend’s City Council, however, added \$457,000 in revenue and expenses to the Public Transit Fund to reflect operation of BAT service. Table 19-12 shows that supplemental budget.

**Table 19-12: Supplemental Budget for Bend Area Transit, FY 2006/07**

<b>Line Item</b>	<b>FY 06/07</b>
<b>Receipts</b>	<b>\$457,000</b>
Federal Grant	\$226,000
Fare Box	\$151,000
Transfers from General Fund	\$80,000
<b>Expenses</b>	<b>\$457,000</b>
Paratransit Contract	\$175,300
Professional Services	\$22,800
Operating Supplies	\$84,000
Temporary Employees	\$35,800
Capital Purchases	\$27,000
Transfer Station / ROW Improvements	\$112,100

Source: City of Bend. Bend City Council Issue Summary. September 20, 2006 Council Meeting.

Table 19-12 shows that a federal grant will provide \$226,000 or almost 50% of supplemental operating revenue for BAT in fiscal year 2006/07. City documents do not identify the specific federal program that is providing this grant funding. Fare box revenues are expected to generate just over \$150,000. An \$80,000 transfer from the

<sup>6</sup> Matthew Preusch. “Bend swoops into transit with BAT.” The Oregonian. September 27, 2006.

City's General Fund provides the rest of the funding needed to operate BAT at its initial level of service.

The City of Bend had a *Service Plan*<sup>7</sup> developed for new fixed-route service in Bend. Since a new fixed-route service would affect the need for Dial-a-Ride services, the *Service Plan* considered the need and cost for both types of public transit services. This Plan estimated that fare revenue would be \$225,000 from fixed-route service available 12 hours per day, 6 days per week. This Plan also identified other funding sources for fixed-route service, including:

- **FTA Section 5307.** This program is expected to provide Bend with \$585,000 in FY06, increasing to \$705,000 in FY09.
- **FTA Section 5309.** This program is expected to provide Bend with about \$200,000 per year through FY09 for bus purchases.
- **Oregon Special Transportation Fund.** This program provides funds on a formula basis and as discretionary grants based on need and merit. These funds can be used for operating or capital expenses. Bend is expected to receive \$147,000 annually for transit operations.

Other funding sources identified in the Service Plan are primarily for services to senior and disabled residents that would be used for the City's Dial-a-Ride services. Table 19-13 shows the expected revenue sources and expenditure categories for public transit service in Bend, for both fixed-route and Dial-a-Ride service. Table 19-13 shows that the fixed-route and Dial-a-Ride service, together, are expected to cost \$2.6 million per year to operate excluding capital purchases in 2006. Just over half of annual revenues are expected to come from federal and state sources, with just under half from local sources. The primary funding sources are expected to be the City's General Fund, FTA funding programs, fares, and the Special Transportation Fund.

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<sup>7</sup> Nelson|Nygaard Consulting Associates. *Draft Service Plan*. Prepared for the City of Bend. May 2006.

**Table 19-13: Annual Revenues & Expenditures for Public Transit Service in Bend, 2006**

<b>Line Item</b>	<b>Annual</b>
<b>City Working Capital</b>	<b>\$142,900</b>
<b>Federal &amp; State Funding</b>	<b>\$1,592,064</b>
FTA 5307 Operating	\$634,800
FTA 5310 Operating	\$195,000
FTA 5309 Capital (FR buses)	\$192,280
FTA 5310 Capital (DAR vehicles)	\$122,984
Job Access / Reverse Commute Grant	\$300,000
Special Transportation Fund	\$147,000
<b>Local Funding</b>	<b>\$1,395,000</b>
City General Fund	\$1,138,000
Fares	\$250,000
Interest	\$7,000
<b>Total Revenue</b>	<b>\$2,987,064</b>
Personnel	\$96,438
Contracted Services	\$1,249,700
Materials & Other Services	\$171,300
Capital Purchases	\$375,100
Debt Service	\$0
Transfers to City (Overhead & Support)	\$669,800
<b>Total Expenses</b>	<b>\$2,562,338</b>
<b>Contingency &amp; Carryover</b>	<b>\$577,626</b>

Source: Nelson|Nygaard Consulting Associates. *Draft Service Plan*. Prepared for the City of Bend. May 2006. Page 31.

## **Reasonably Available Funding for Capital Improvements**

This section estimates the funding that will be available for transportation capital projects and public transportation operations in the Bend MPO area over the planning period for the MTP. Most of the funding sources considered in this section already exist. For many, the revenues they generate are likely to increase even without changes in rates because of growth: in population, registered vehicles, gasoline consumption, and other rate-base factors. In some cases additional revenue from increased taxes or fees is considered to be “reasonably available” based on historical trends or other clear and reasonable assumptions.

To estimate the amount of funding that is likely to be available for capital (construction) projects, future costs for operation and maintenance (O&M) of the transportation system must also be projected. The starting point for this analysis is an assumption that available funding will be used first to operate the existing transportation system and maintain it at an optimal level. This implies that flexible funding (that is, funds that can be used for either capital costs or O&M) will only be used for capital projects after O&M needs are met. Capital funding will therefore be the remainder of any flexible funds after O&M needs are met, plus any revenue that is restricted to capital projects only.

## Roads

This section forecasts various major road-related funding sources at the federal, state, and local level from 2007 to 2030. These major funding sources, with the jurisdiction they supply funding for, include the following:

- ODOT capital spending through the STIP from federal and state revenue sources and programs
- Federal Surface Transportation Program (STP) allocation (Bend MPO and Deschutes County)
- Federal High Priority Projects Program (HPPP) (ODOT)
- State Highway Fund (SHF) (ODOT, Deschutes County, and City of Bend)
- National Forest Reserve Revenue (Deschutes County) [Note: The long-term status of this funding program is uncertain]
- System Development Charges (SDC) (City of Bend)
- Transfers from Other Funds (City of Bend)
- Special Area Assessments, including Local Improvement Districts (LIDs) (Deschutes County and City of Bend)
- Other Miscellaneous Revenue (Deschutes County and City of Bend)

The assessment of future funding from these federal and state sources for capital improvements in the Bend MPO is based primarily on ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030* (which is referred to as ODOT's *Financial Assumptions*).<sup>8</sup> This document provides information on trends in major federal and state funding sources, provides forecasts of statewide revenue from these sources and, in some cases, forecasts of potential distributions to specific MPOs in Oregon. While this document was developed before passage of the most recent federal legislation authorizing funding programs for transportation (SAFETEA-LU), the forecast tables that accompany this document were updated by ODOT in March 2006 to reflect the changes in the federal SAFETEA-LU legislation.

### ODOT funding for capital improvements

For funding at the local level, this report forecasts total revenue and nets out costs for operation and maintenance of the existing system to determine funds available for capital improvements. At the state level, this analysis has already been completed. ODOT's *Financial Assumptions* includes a forecast of future revenue available to ODOT from the full range of major federal and state sources, and future costs for distributions to other jurisdictions, mandated set-asides, and priority needs such as preservation, safety, operations, and debt service. This forecast allows an estimate of ODOT's funding for modernization once distributions to other jurisdictions and priority needs for maintenance and other costs are taken out of total revenue. In theory, any revenue retained by ODOT that is not required for O&M or debt service is available for modernization. Modernization funds are used for improvements to the state highway system.

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<sup>8</sup> ODOT Financial Services, Policy and Economic Analysis Unit. December 2004 (tables updated March 2006).

For the next several years, however, the ODOT forecast shows that its O&M needs will be greater than available revenue, even with a gradual gas tax increase described below in the discussion of the State Highway Fund. While this would lead to no ODOT funding for modernization if all O&M needs were met, Oregon Revised Statute (ORS) 366.507 requires a minimum amount of spending by ODOT on modernization, and the revenue bonds of the Oregon Transportation Investment Act (OTIA) will provide additional modernization funds through 2012.

Table 19-14 shows the level of ODOT funding for modernization projects statewide under two scenarios: *Current Law* (assuming the equivalent of an increase of the fuel tax by \$0.01 per gallon every year to fund O&M) and *Above Current Law* (with the equivalent of a \$15 increase in the vehicle registration fee every eight years).

Under *Current Law*, ODOT's forecast is for its modernization funding to decline from its 2007 level of nearly \$127 million, to nearly \$92 million in 2012, and then drop to \$49.9 million in 2013 as the OTIA funding program concludes. From 2013 to 2030, ODOT expects its annual modernization funds to increase about 19% in constant 2006 dollars to \$59.4 million in 2030.

Under *Above Current Law*, statewide funding for modernization follows a similar pattern as that under *Current Law*, but the additional revenue from increased vehicle registration fees (or the equivalent) increases available funding by roughly \$5 million annually between 2010 and 2017, \$8 million annually between 2018 and 2025, and \$10 million annually between 2026 and 2030.

Table 19-14 shows potential allocations of modernization funds to Region 4 and Deschutes County based on their average percentage of Oregon's population, vehicle miles of travel, freight ton miles of travel, vehicle registrations, and their allocation of modernization funds between FY99 and FY01 (10.1% in Region 4, and 3.5% in Deschutes County).<sup>9</sup>

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<sup>9</sup> ODOT. *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030: Appendix*. Regional Distribution of Modernization Funds. Page 15.

**Table 19-14: Funds available to ODOT for modernization statewide, and allocation of funding to Region 4 and Deschutes County based on historical distribution, 2007–2030 (millions of 2006 dollars)**

Year	Statewide		Region 4: 10.1%		Deschutes Co: 3.5%	
	Current Law	Above Current Law	Current Law	Above Current Law	Current Law	Above Current Law
2007	\$126.9	\$126.9	\$12.8	\$12.8	\$4.4	\$4.4
2008	\$107.3	\$107.3	\$10.8	\$10.8	\$3.8	\$3.8
2009	\$104.6	\$104.6	\$10.6	\$10.6	\$3.7	\$3.7
2010	\$91.7	\$97.3	\$9.3	\$9.8	\$3.2	\$3.4
2011	\$90.3	\$95.8	\$9.1	\$9.7	\$3.2	\$3.4
2012	\$91.7	\$97.0	\$9.3	\$9.8	\$3.2	\$3.4
2013	\$49.9	\$55.2	\$5.0	\$5.6	\$1.7	\$1.9
2014	\$49.8	\$54.9	\$5.0	\$5.5	\$1.7	\$1.9
2015	\$49.7	\$54.6	\$5.0	\$5.5	\$1.7	\$1.9
2016	\$49.5	\$54.4	\$5.0	\$5.5	\$1.7	\$1.9
2017	\$49.4	\$54.1	\$5.0	\$5.5	\$1.7	\$1.9
2018	\$49.3	\$58.4	\$5.0	\$5.9	\$1.7	\$2.0
2019	\$49.1	\$58.0	\$5.0	\$5.9	\$1.7	\$2.0
2020	\$49.0	\$57.6	\$4.9	\$5.8	\$1.7	\$2.0
2021	\$48.8	\$57.2	\$4.9	\$5.8	\$1.7	\$2.0
2022	\$48.7	\$56.9	\$4.9	\$5.7	\$1.7	\$2.0
2023	\$48.5	\$56.5	\$4.9	\$5.7	\$1.7	\$2.0
2024	\$48.3	\$56.1	\$4.9	\$5.7	\$1.7	\$2.0
2025	\$48.2	\$55.7	\$4.9	\$5.6	\$1.7	\$2.0
2026	\$48.0	\$59.0	\$4.8	\$6.0	\$1.7	\$2.1
2027	\$54.5	\$65.2	\$5.5	\$6.6	\$1.9	\$2.3
2028	\$54.1	\$64.6	\$5.5	\$6.5	\$1.9	\$2.3
2029	\$53.7	\$63.9	\$5.4	\$6.5	\$1.9	\$2.2
2030	\$59.4	\$69.3	\$6.0	\$7.0	\$2.1	\$2.4
<b>Total</b>	<b>\$1,520.4</b>	<b>\$1,680.5</b>	<b>\$153.5</b>	<b>\$169.8</b>	<b>\$53.1</b>	<b>\$58.9</b>

Source: ODOT. *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030: Appendix*. Updated March 2006. Allocation to Region 4 and Deschutes County, and conversion to 2006 dollars, by ECONorthwest.

The 2006–2009 STIP shows that ODOT expenditures for modernization using federal and state funds in the Bend MPO area totals \$21.5 million over those four years. This level of funding, however, includes \$15 million from the Oregon Transportation Investment Act III (OTIA III), which is a one-time funding that will not reoccur. Excluding OTIA III funding, ODOT expenditures on modernization in the Bend MPO totals almost \$6.5 million or \$1.6 million per year between 2006 and 2009. This level of funding is roughly 1/3 of the 2007 allocation of modernization funds to Deschutes County shown in Table 19-14 for either scenario.

It is important to note that if the state gas tax is not increased, as assumed in both the Current Law and Above Current Laws scenarios in Table 19-14, some of the funds otherwise used by ODOT for modernization would probably have to be diverted to O&M. Without these additional funds, ODOT’s revenue would be below the level of its O&M

needs, so that any modernization at all would require deferred maintenance on the state highway system.<sup>10</sup>

### **Federal discretionary funds**

ODOT receives federal funds that are distributed at the discretion of the Oregon Transportation Commission (OTC). Among these funds is the federal High-Priority Project Program (HPPP) for capital projects that is included in the revenue forecasts in ODOT's *Financial Assumptions*. ODOT's forecast uses two approaches to bound the range of future HPPP funding potentially available to the Bend MPO.<sup>11</sup> The low end of this range is based on the Bend MPO having received no HPPP or other federal discretionary funds in the past 18 years.<sup>12</sup> Based on this trend, the Bend MPO might expect to similarly receive no HPPP or other federal discretionary funds between 2005 and 2030. For the high end of the range, ODOT assumed that HPPP and other discretionary funds will be distributed on the basis of population. Under this assumption, the Bend MPO would receive an annual allocation averaging \$856,000 in constant 2006 dollars. The lack of growth in federal discretionary funding in constant dollars results from ODOT's assumption that this funding will increase only at the rate of inflation after 2010. Table 19-15 summarizes federal Surface Transportation Program (STP) and discretionary funds allocated to Deschutes County and the Bend MPO based on ODOT's *Financial Assumptions*.

The assumptions behind each of the forecasts for federal discretionary funding shown in Table 19-15 are too unlikely for this revenue to be considered as reasonably available funding for the Bend MPO. That is, it is unlikely that the Bend MPO will receive no discretionary funding, and it is unlikely that the Bend MPO will receive discretionary funding proportionate to its share of Oregon's population.

Discretionary funds are distributed by the Oregon Transportation Commission to critical projects in Oregon. Given the concentration of population and aging transportation infrastructure in urban areas of the Willamette Valley, and the relatively newer infrastructure in the Bend area, most of the critical projects receiving HPPP funds have been in regions other than Bend. But there is evidence that other areas of Central Oregon will receive federal discretionary funds for projects. SAFETEA-LU includes earmarked funds requested by the Oregon Transportation Commission for projects in Redmond (re-route of Highway 97, \$14 million) and Klamath County (improvements to Highway 97, \$5.1 million).<sup>13</sup>

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<sup>10</sup> ODOT is required by statute to spend a specific (at least some) of its flexible funds on modernization.

<sup>11</sup> *Ibid.*, p. 5. "...these approaches [to distribution of HPPP funds] will be used to establish reasonable bounds of funds distribution."

<sup>12</sup> It is not clear if this historical trend is because the Bend MPO did not exist before recently, and therefore could not have received funds as an MPO, or if the Bend area has really not received any federal discretionary funds for transportation projects in the last eighteen years.

<sup>13</sup> Oregon Department of Transportation. *SAFETEA-LU: A Reference Guide*. January 2006. Table 5. <http://www.oregon.gov/ODOT/docs/SAFETEA-LUReferenceGuide.pdf>

**Table 19-15: Federal STP and Discretionary funds allocated to Deschutes County and the Bend MPO, FY2007–FY2030 (2006 dollars)**

Fiscal Year	Deschutes Co	Bend MPO		
	STP	STP	HPPP (historic)	HPPP (share of population)
2007	\$367,471	\$524,552	\$0	\$893,235
2008	\$368,041	\$525,366	\$0	\$866,377
2009	\$368,612	\$526,182	\$0	\$840,327
2010	\$369,184	\$526,998	\$0	\$841,631
2011	\$369,757	\$527,816	\$0	\$842,937
2012	\$370,331	\$528,635	\$0	\$844,245
2013	\$370,906	\$529,456	\$0	\$845,556
2014	\$371,481	\$530,277	\$0	\$846,868
2015	\$372,058	\$531,100	\$0	\$848,182
2016	\$372,635	\$531,924	\$0	\$849,498
2017	\$373,213	\$532,750	\$0	\$850,817
2018	\$373,793	\$533,577	\$0	\$852,137
2019	\$374,373	\$534,405	\$0	\$853,459
2020	\$374,954	\$535,234	\$0	\$854,784
2021	\$375,535	\$536,065	\$0	\$856,110
2022	\$376,118	\$536,897	\$0	\$857,439
2023	\$376,702	\$537,730	\$0	\$858,770
2024	\$377,287	\$538,564	\$0	\$860,102
2025	\$377,872	\$539,400	\$0	\$861,437
2026	\$378,458	\$540,237	\$0	\$862,774
2027	\$379,046	\$541,076	\$0	\$864,113
2028	\$379,634	\$541,915	\$0	\$865,454
2029	\$380,223	\$542,756	\$0	\$866,797
2030	\$380,813	\$543,599	\$0	\$868,142

Source: ODOT, *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030*.  
 Note: Converted to constant dollars by ECONorthwest.

Earmarked funding in SAFETEA-LU suggests that the Bend area has a chance to receive some HPPP funding in the future. In addition, growth in the Bend MPO will create strong demand for improvement projects, its infrastructure will age, and its growing population makes Bend an area of increasing economic and political power that is more likely to get its “fair share” of discretionary funds.

For the purposes of forecasting “reasonably available” funding for this MTP, it is assumed that the Bend MPO will receive no discretionary funding, based on historical data.

ODOT’s *Financial Assumptions* state that MPOs may choose to address HPPP funding by including high-priority projects that cannot be built without substantial federal funding in the “illustrative” set of projects that will be included in the MTP if discretionary funding becomes available.

## **Federal Surface Transportation Program (STP)**

ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030*<sup>14</sup> includes an estimate of the STP apportionment to the Bend MPO and to Deschutes County. The STP is a flexible multi-modal formula grant, providing funds for a broad range transportation uses. ODOT's forecasts assume that the STP funds allocated to both the Bend MPO and Deschutes County increase at approximately the rate of inflation (3.1% annually).

Since STP funds are expected to increase at approximately the same rate as inflation, the allocation to the Bend MPO and Deschutes County remains fairly constant in 2006 dollars, roughly \$534,000 per year to the Bend MPO and \$374,000 per year to Deschutes County through the forecast period.

It is notable that the same annual increase in STP funding was assumed for all MPOs and counties, regardless of expected population growth. It is possible that the Bend MPO's and Deschutes County's STP funding might increase more than these ODOT assumptions suggest if Bend and Deschutes County continue growing faster than the rest of the state and therefore increase their population-based share of STP funding. STP funding for the Bend MPO formerly went to the City of Bend; it was shifted to the MPO after the MPO was formed. The MPO board has transferred this funding to the City for road maintenance but MPO staff report that in the future this funding may be reserved for funding capital projects at the Board's discretion.

## **State Highway Fund**

State Highway Fund revenue is generated primarily by statewide fuel taxes and vehicle registration fees. State Highway Fund revenue is allocated to counties based on their share of statewide vehicle registrations, and to cities based on their share of statewide population. These funds must be used for roadway-related expenses, but they can be used for capital or O&M costs. The forecasts of State Highway Fund revenues for Deschutes County and the City of Bend are based on four scenarios for statewide revenue developed by ODOT:

- Continuation of existing trends (no change to the state gas tax or vehicle registration fee).
- A \$0.01 per gallon increase in the state gas tax every year from 2006 through 2030.
- A \$15 increase in the biennial vehicle registration fee every eight years.
- The combined effect of both the state gas tax increase and the vehicle registration fee increase.

The result of each of these scenarios for the amount of State Highway Fund revenue allocated to Deschutes County and Bend is shown in Table 19-16. The assumptions behind estimates for each of these scenarios are described in the following sections.

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<sup>14</sup> ODOT Financial Services, Policy and Economic Analysis Unit. December 2004.

**Table 19-16: Annual allocation of State Highway Fund revenue to Deschutes County and Bend under various scenarios (millions of 2006 dollars)**

Fiscal Year	Deschutes County				City of Bend			
	Baseline	Increased Gas Tax	Increased Reg Fee	Combined Increases	Baseline	Increased Gas Tax	Increased Reg Fee	Combined Increases
2007	\$7.9	\$8.2	\$7.9	\$8.2	\$3.3	\$3.4	\$3.3	\$3.4
2008	\$7.8	\$8.4	\$7.8	\$8.4	\$3.3	\$3.5	\$3.3	\$3.5
2009	\$7.8	\$8.7	\$7.8	\$8.7	\$3.3	\$3.7	\$3.3	\$3.7
2010	\$7.7	\$9.0	\$8.1	\$9.4	\$3.3	\$3.8	\$3.4	\$3.9
2011	\$7.6	\$9.2	\$8.0	\$9.6	\$3.2	\$3.9	\$3.4	\$4.1
2012	\$7.5	\$9.4	\$7.9	\$9.8	\$3.2	\$4.0	\$3.4	\$4.2
2013	\$7.5	\$9.6	\$7.9	\$10.0	\$3.2	\$4.1	\$3.4	\$4.3
2014	\$7.4	\$9.9	\$7.8	\$10.3	\$3.2	\$4.2	\$3.3	\$4.3
2015	\$7.3	\$10.1	\$7.7	\$10.5	\$3.1	\$4.3	\$3.3	\$4.5
2016	\$7.2	\$10.3	\$7.6	\$10.7	\$3.1	\$4.4	\$3.3	\$4.6
2017	\$7.1	\$10.5	\$7.5	\$10.9	\$3.1	\$4.5	\$3.2	\$4.6
2018	\$7.0	\$10.7	\$7.8	\$11.5	\$3.0	\$4.5	\$3.3	\$4.8
2019	\$6.9	\$10.9	\$7.7	\$11.7	\$3.0	\$4.6	\$3.3	\$4.9
2020	\$6.9	\$11.0	\$7.6	\$11.7	\$3.0	\$4.7	\$3.3	\$5.0
2021	\$6.7	\$11.2	\$7.4	\$11.9	\$2.9	\$4.8	\$3.2	\$5.1
2022	\$6.6	\$11.4	\$7.3	\$12.1	\$2.9	\$4.9	\$3.2	\$5.2
2023	\$6.5	\$11.5	\$7.2	\$12.2	\$2.8	\$4.9	\$3.1	\$5.2
2024	\$6.4	\$11.6	\$7.1	\$12.3	\$2.8	\$5.0	\$3.1	\$5.3
2025	\$6.3	\$11.8	\$7.0	\$12.5	\$2.8	\$5.0	\$3.0	\$5.2
2026	\$6.2	\$11.9	\$7.2	\$12.9	\$2.7	\$5.1	\$3.1	\$5.5
2027	\$6.1	\$12.0	\$7.0	\$12.9	\$2.7	\$5.1	\$3.0	\$5.4
2028	\$6.0	\$12.1	\$6.9	\$13.0	\$2.6	\$5.2	\$3.0	\$5.6
2029	\$5.9	\$12.2	\$6.8	\$13.1	\$2.6	\$5.2	\$2.9	\$5.5
2030	\$5.8	\$12.3	\$6.6	\$13.1	\$2.5	\$5.3	\$2.9	\$5.7
<b>Totals</b>	<b>\$166.1</b>	<b>\$253.9</b>	<b>\$179.6</b>	<b>\$267.4</b>	<b>\$71.6</b>	<b>\$108.1</b>	<b>\$77.0</b>	<b>\$113.5</b>

Source: Based on source data in ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030*. Calculations and conversion of figures to constant 2006 dollars by ECONorthwest.

**Scenario One: no change to gas tax or vehicle registration fees**

ODOT's *Financial Assumptions* show that assuming no change in the gas tax or vehicle registration fees would result in only modest revenue increases well below the expected level inflation. As a result, the constant dollar value of the State Highway Fund would decline over time. ODOT finds that this would result in a sharp decline in the condition of pavement and bridges in the state system, and therefore rejects this scenario in its *Financial Assumptions*.

Despite being rejected in ODOT's *Financial Assumptions*, this scenario is modeled in ODOT's *Summary of Transportation Economic and Revenue Forecasts*<sup>15</sup>. This scenario results in total State Highway Fund apportionments to cities and counties increasing at about 1% per year FY05 to FY11. With expected increases in overall inflation at 3.1% per year, a 1% annual increase in State Highway Fund apportionments would result in declining annual revenue for most cities and counties in constant dollars.

<sup>15</sup> ODOT Financial Services. *Summary of Transportation Economic and Revenue Forecasts*. December 2005.

Allocations of the State Highway Fund to counties are based on vehicle registrations, and allocations to cities are based on population. While total State Highway Fund apportionments to counties and cities would decline in constant dollars under this scenario, the apportionment for Deschutes County and Bend will also be affected by their share of Oregon's population. Both Deschutes County and Bend are growing much faster than other counties and cities in Oregon, and official forecasts predict this to continue. According to the Oregon Office of Economic Analysis (April 2004), Deschutes County is expected to grow faster than the state average for the next 30 years, though by a gradually decreasing margin. Deschutes County's population growth slows from around 3% per year in 2006 to a more modest 1% per year by 2030. The same trend is predicted for both Deschutes County and the City of Bend in the Deschutes County Coordinated Population Forecast (November 2004).

Because the City of Bend's allocation of SHF revenue is based on population, and Deschutes County's allocation is based on vehicle registrations (which is correlated with population change), these population trends mean that both Bend and Deschutes County can expect an increased share of SHF revenue over time. Initially this increasing share and the expected 1% annual increase in total State Highway Fund revenue will approximately compensate for cost inflation, maintaining a constant purchasing power. As population growth rates in Bend and Deschutes County approach the state's growth rate, however, their share of SHF revenues will increase at a rate below highway maintenance costs and overall inflation. The effect will be a gradual decline in annual SHF revenue to Deschutes County and Bend in constant dollars.

Deschutes County's annual SHF revenue in constant 2006 dollars is expected to decrease from \$7.9 million in FY07 to \$5.8 million in FY30. The City of Bend's SHF revenue is expected to decline from \$3.3 million in FY07 to \$2.5 million by FY30 in constant 2006 dollars.

#### **Scenario Two: \$0.01 per gallon annual increase in state gas tax**

Based on ODOT's estimates of the statewide revenues expected from this gas tax increase, and the expected increase in Bend's and Deschutes County's share of State Highway Fund revenue, this scenario would result in increasing annual revenue to both the County and City in constant dollars. In this scenario, Deschutes County's annual SHF revenue would increase from \$8.2 million in FY07 to \$12.3 million in FY30 in constant 2006 dollars. Bend's annual SHF revenue would increase from \$3.4 million in FY07 to \$5.3 million in FY30 in constant 2006 dollars.

#### **Scenario Three: \$15 increase in biennial vehicle registration fee every 8 years**

Based on ODOT's estimates of the statewide revenues expected from an \$15 increase in vehicle registration fees (an increase would only occur 2 or 3 times during the course of the planning horizon), and the expected increase in Bend's and Deschutes County's share of State Highway Fund revenue, this scenario would result in relatively stable annual revenue to both the County and City over the next ten years (in constant 2006 dollars). After 2018, however, this scenario results in a declining stream of annual revenue to the County and City in constant dollars. This scenario also results in less

annual revenue to the County and City compared to revenue under Scenario Two (increased gas tax).

In this scenario, Deschutes County's annual SHF revenue would roughly remain at the current level of \$7.9 million through FY18, and then decline slowly to \$6.6 million in FY30 in constant 2006 dollars. Bend's annual SHF revenue would follow a similar pattern, remaining at about \$3.3 million through FY18, and then declining slowly to \$2.9 million in FY30 in constant 2006 dollars.

#### **Scenario Four: combined effect based on ODOT assumptions**

Based on ODOT's estimates of the statewide revenues expected from both a gas tax increase and an increase in vehicle registration fees, plus an increasing share of State Highway Fund revenue for both Deschutes County and the City of Bend due to high population growth, this scenario results in an increasing stream of annual revenue to both the County and City in constant 2006 dollars.

In this scenario, Deschutes County's annual SHF revenue would increase from \$8.2 million in FY07 to \$13.2 million in FY30 in constant 2006 dollars. (Note, the numbers are not additive across the table; the combined total, column D, extracts out the baseline figure included in the gas tax and fee increase scenarios.) Bend's annual SHF revenue would increase from \$3.4 million in FY07 to \$5.6 million in FY30 in constant 2006 dollars.

#### **National Forest Reserve revenue**

Deschutes County receives National Forest Reserve revenue from the federal government.<sup>16</sup> Receipts from this source increased at an average annual rate of 1.3% between FY03 and FY05. Applying this growth rate to current receipts would cause Deschutes County's allocation of this revenue to decrease from \$3 million in 2007 to just under \$2 million in 2030 in constant 2006 dollars. While this revenue is presumably used by Deschutes County to maintain rural roads outside the MPO area, this revenue affects total revenue available to the County for road maintenance and improvement projects throughout the County. [Note: the long-term status of this funding program is not known. The revenue will be updated as additional information becomes available.]

#### **System Development Charges**

The City of Bend charges System Development Charges (SDCs) to new development to pay for infrastructure needed to serve demand generated by that new development. Revenues from the City's transportation SDC are used for capital costs of transportation infrastructure including sidewalks, landscaping, engineering, staff expenses, paving, and certain right-of-way acquisitions. SDC funds are frequently combined with funds from other sources to pay for transportation improvements.

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<sup>16</sup> National forest reserve revenue – the current bill under which the counties receive forest payments expired in September of 2006. The bill has not been reauthorized. Deschutes County is facing the potential loss of \$3 million per year if the federal government does not reauthorize the forest payments bill (long-term reauthorization of this program is uncertain).

Bend received \$6.5 million from transportation SDCs in FY05, up from \$5.4 million in FY04 and \$4.2 million in FY03. According to the City of Bend's adopted FY06 budget, SDC rates were at 80% of their maximum potential in FY05, at \$3,145 for a single-family home.

For FY07, the City of Bend has set SDC rates at 100% of the maximum allowable level. The fee for a single-family home is now \$4,217, up 34% from the FY05 level. This increase reflects the increased percentage charged by the City as well as increasing construction costs for transportation projects on which the SDC is based.<sup>17</sup> Assuming that transportation SDC rates for other land uses have also increased by this amount, and that the level of development in Bend is similar to that in FY05, the FY07 SDC revenues can be estimated at 34% more than FY05 revenues or \$8.7 million. Future revenue generated by the City's transportation SDC will depend on any increases in SDC rates to reflect inflation as well as the level of development activity in Bend.

SDC rates are based on the cost of improvements needed to serve demand created by new development. Only the portion of a project that is needed to serve new development is used to set SDC rates—SDCs cannot fund improvements that are needed to address deficiencies that are not related to growth and development. Given this relationship between project costs and SDC rates, in theory SDCs should produce revenue sufficient to fully cover the costs of needed improvements if a jurisdiction experiences the level of growth that the improvements are intended to serve. In Bend, projects that form the basis for SDC rates had growth-related costs of \$202.4 million in 2006 (excluding property acquisition). Thus, in theory, SDCs in Bend should generate revenue sufficient to build projects that would cost \$202.4 million to construct in 2006.

SDC revenue in Bend grew at an average rate of 25% per year between 2003 and 2005. Population in Bend grew at an average rate of 5.7% per year between 2003 and 2005, a rate that is more than twice the rate forecast for Bend in the County's 2000–2025 Coordinated Population Forecast.<sup>18</sup> Thus, the growth in SDC revenue resulted from a rate of population growth that is not expected to be sustained over the MTP planning period. To forecast SDC revenues in Bend, the following adjustments and assumptions were made:

- To establish a baseline level of SDC revenue to forecast, the FY05 SDC revenue was adjusted to reflect the fact that a) the revenue is based on rates set at 80% of cost rather than 100%, and b) the revenue resulted from growth more than twice as high as the expected long-run average. These adjustments resulted in lowering actual FY05 SDC revenue of \$6.5 million to a baseline of \$3.2 million for the purposes of this forecast.
- It is assumed that future SDC revenue would grow at the same rate as expected population growth, 2.3% per year, with adjustments for annual increases in road construction costs at the current rate of 4.3% per year.

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<sup>17</sup> Construction costs are currently growing at a rate of 4.3% annually.

<sup>18</sup> Deschutes County Comprehensive Plan, Chapter 23.16.

The results of the forecast based on these assumptions is shown in Table 19-17. This table shows that annual SDC revenue to the City would increase from the baseline of \$3.2 million in 2005 to \$16.2 million in 2030, in constant 2006 dollars. The revenues shown in Table 19-17 are annual averages; actual revenue in any one year may be more or less depending on the level of development and SDC rates. Over the twenty-five years shown in Table 19-17, SDC revenue would total \$209.7 million, close to the \$202.4 million of growth-related project costs used as the basis for SDC rates. This result is reasonable considering that SDC rates can be adjusted for increases in construction costs, which are currently increasing at rates higher than overall inflation.

**Table 19-17: Forecast of SDC revenue based on assumptions and adjustments to baseline, City of Bend, 2005–2030 (millions of 2006 dollars)**

<u>Year</u>	<u>SDC Revenue</u>
2005	\$3.2
2006	\$3.4
2007	\$3.6
2008	\$3.9
2009	\$4.1
2010	\$4.4
2011	\$4.7
2012	\$5.0
2013	\$5.4
2014	\$5.7
2015	\$6.1
2016	\$6.5
2017	\$7.0
2018	\$7.4
2019	\$7.9
2020	\$8.5
2021	\$9.0
2022	\$9.6
2023	\$10.3
2024	\$11.0
2025	\$11.7
2026	\$12.5
2027	\$13.3
2028	\$14.2
2029	\$15.2
2030	\$16.2

Source: ECONorthwest, using assumptions described in report.

### **Transfers from the General Fund**

The City of Bend receives revenue from Franchise Fees charged to utilities and the Transient Room Tax on overnight rooms. Revenue, or a portion of revenue, from these sources was formally dedicated to funding road maintenance and improvements in Bend. For FY06 City of Bend decided to deposit Franchise Fee and Transient Room Tax into the General Fund and then transfer revenue from the General Fund to the Transportation Operations Fund and other funds for public expenditures.

Examination of the City's Adopted Budget for 2005/06 shows that Franchise Fees, Transient Room Taxes, and Transfers from Other Funds together contributed \$2.3 million to the Transportation Operations Fund in FY 2002/03. Revenue from these sources increased to \$2.5 million in FY 2003/04 and \$2.6 million in 2004/05. Revenue from these sources (now primarily Transfers from Other Funds) is budgeted at \$2.3 million in FY 2005/06.

This brief history shows that revenue from these sources was relatively stable but declined slightly in FY 2005/06. The General Fund receives revenue from a variety of funding sources, including property taxes in addition to franchise fees and transient room tax revenue. Thus, the future level of the General Fund is not tied to any specific funding sources. For purposes of forecasting reasonably available funding for road-related needs from Transfers from the General Fund, it is assumed that these transfers will keep pace with inflation over the forecast period for this MTP, averaging \$2.4 million per year over the forecast period.

### **Special area assessments**

Special area assessments can be used for capital projects (in the case of Local Improvement Districts (LIDs)) or maintenance (in the case of road maintenance districts). The City of Bend received \$12,400 from LIDs in FY05 and \$12,800 the year before that.

The City of Bend has a special levy for urban renewal of the downtown area. This levy was used to fund some transportation-related improvements to sidewalks and streets in the downtown area, and revenue from this source is currently being used to pay for improvements that are already completed.

Deschutes County received \$629,407 from LIDs in FY05 and \$715,535 the year before that. It is believed that only one of these County Road Districts is within the MPO Area. However, the County receives no funds from the Special Road District tax assessment. These dollars go directly back to the taxing districts for maintenance of the non-county roads within the district.

The County currently has a policy of not accepting any new roads into the county-maintained system. This includes a moratorium on LID's and a moratorium on the acceptance of any new roads constructed within developments. Residents are still allowed to form Special Road Districts for the maintenance of non-county roads.

For the purposes of this evaluation, it is assumed that special area assessments will continue to make important but relatively small contributions for construction and maintenance of regional road projects over the planning period for this MTP.

### **Other miscellaneous sources**

Table 19-4 shows other sources of road-related revenue in Bend, including:

- Interest Income (\$383,200 in FY05)

- Land Sales & Rentals (\$8,800 in FY05)
- Private Contributions (\$17,100 in FY05 but more in years before)
- “Unspecified Other” (\$98,900 in FY05)
- State “Unspecified Other” (\$327,200 in FY05)

Together these funds contribute about 5% to 10% of the City’s road-related revenue. While this funding is important, *new* future funding from these sources was not explicitly estimated because these sources contribute a small share of total road-related revenue. An estimate is provided that assumes private contributions remain at current levels and other local sources conservatively grow over the planning horizon.

**Summary: reasonably available funding for roads**

This section described the amount of revenue at the state, county, and local level that can be reasonably expected by 2030 to be available for road-related expenses in the Bend MPO area. For the purposes of this financial analysis, it is assumed that ODOT will continue to fund operation and maintenance of state highways in the MPO area.

Deschutes County also funds roadway operation, maintenance, and capital improvements. The bulk of County expenditures, however, are outside of the Bend MPO area. The County primarily maintains and improves roadways in unincorporated areas, which has included some areas outside of the City of Bend but inside the MPO boundary. Funding for County improvement projects inside the MPO has primarily come from special assessments. It is assumed that Deschutes County will continue to contribute funding for improvements to roads in unincorporated areas near Bend that are in the MPO boundary, and that this funding will remain at roughly the current level of \$50,000 per year. While this funding will be important for maintaining transportation services in the region, it will be a small share of the total cost for improvements identified in the MPO.

Table 19-18 summarizes the road-related revenue *available to the City of Bend* from major funding sources addressed in this section. This table shows a Low and High estimate to reflect the impact of the various scenarios for State Highway Fund revenue. Table 19-18 shows that Bend’s total road-related revenue is expected to be between \$10.3 and \$10.4 million in fiscal year 2007, and to increase to between \$23.2 to \$26.3 million in fiscal year 2030. Total revenue in Table 19-18 increases at an average rate of 3.1% to 3.3% per year in constant, 2006 dollars. This level of growth is unlikely to keep up with increases in the cost of road maintenance and construction, which are currently growing at a rate of 1% to 2% per year over inflation.<sup>19</sup>

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<sup>19</sup> While the cost for some components of construction, such as steel and concrete, have increased rapidly in the last few years, overall highway construction costs are growing at about 4% to 6% per year.

**Table 19-18: City of Bend Road-Related Revenue, 2007–2030 (millions of 2006 dollars)**

Fiscal Year	State Highway Fund Scenarios				Local Sources				Total Revenue	
	A	B	C	D	E	F	G	H	I	J
	Baseline	Increased Gas Tax (Including Baseline)	Increased Reg Fee (Including Baseline)	Baseline + Combined Increases*	SDCs	General Fund	Private Funds	Other	Low	High
2007	\$3.3	\$3.4	\$3.3	\$3.4	\$3.6	\$2.4	\$0.3	\$0.8	\$10.3	\$10.4
2008	\$3.3	\$3.5	\$3.3	\$3.5	\$3.9	\$2.4	\$0.3	\$0.8	\$10.6	\$10.8
2009	\$3.3	\$3.7	\$3.3	\$3.7	\$4.1	\$2.4	\$0.3	\$0.8	\$10.9	\$11.3
2010	\$3.3	\$3.8	\$3.4	\$4.0	\$4.4	\$2.4	\$0.3	\$0.8	\$11.2	\$11.9
2011	\$3.2	\$3.9	\$3.4	\$4.1	\$4.7	\$2.4	\$0.3	\$0.9	\$11.5	\$12.3
2012	\$3.2	\$4.0	\$3.4	\$4.2	\$5.0	\$2.4	\$0.3	\$0.9	\$11.8	\$12.7
2013	\$3.2	\$4.1	\$3.4	\$4.2	\$5.4	\$2.4	\$0.3	\$0.9	\$12.2	\$13.3
2014	\$3.2	\$4.2	\$3.3	\$4.3	\$5.7	\$2.4	\$0.3	\$1.0	\$12.5	\$13.7
2015	\$3.1	\$4.3	\$3.3	\$4.4	\$6.1	\$2.4	\$0.3	\$1.0	\$12.9	\$14.2
2016	\$3.1	\$4.4	\$3.3	\$4.5	\$6.5	\$2.4	\$0.3	\$1.1	\$13.3	\$14.7
2017	\$3.1	\$4.5	\$3.2	\$4.6	\$7.0	\$2.4	\$0.3	\$1.1	\$13.8	\$15.4
2018	\$3.0	\$4.5	\$3.3	\$4.8	\$7.4	\$2.4	\$0.3	\$1.1	\$14.2	\$16.1
2019	\$3.0	\$4.6	\$3.3	\$4.9	\$7.9	\$2.4	\$0.3	\$1.2	\$14.7	\$16.7
2020	\$3.0	\$4.7	\$3.3	\$5.0	\$8.5	\$2.4	\$0.3	\$1.2	\$15.4	\$17.4
2021	\$2.9	\$4.8	\$3.2	\$5.1	\$9.0	\$2.4	\$0.3	\$1.3	\$15.9	\$18.0
2022	\$2.9	\$4.9	\$3.2	\$5.1	\$9.6	\$2.4	\$0.3	\$1.3	\$16.5	\$18.7
2023	\$2.8	\$4.9	\$3.1	\$5.2	\$10.3	\$2.4	\$0.3	\$1.4	\$17.2	\$19.5
2024	\$2.8	\$5.0	\$3.1	\$5.2	\$11.0	\$2.4	\$0.3	\$1.4	\$17.9	\$20.4
2025	\$2.8	\$5.0	\$3.0	\$5.3	\$11.7	\$2.4	\$0.3	\$1.5	\$18.6	\$21.2
2026	\$2.7	\$5.1	\$3.1	\$5.5	\$12.5	\$2.4	\$0.3	\$1.6	\$19.4	\$22.2
2027	\$2.7	\$5.1	\$3.0	\$5.5	\$13.3	\$2.4	\$0.3	\$1.6	\$20.3	\$23.1
2028	\$2.6	\$5.2	\$3.0	\$5.5	\$14.2	\$2.4	\$0.3	\$1.7	\$21.2	\$24.1
2029	\$2.6	\$5.2	\$2.9	\$5.6	\$15.2	\$2.4	\$0.3	\$1.8	\$22.2	\$25.2
2030	\$2.5	\$5.3	\$2.9	\$5.6	\$16.2	\$2.4	\$0.3	\$1.9	\$23.2	\$26.3
<b>Totals</b>	<b>\$71.5</b>	<b>\$107.9</b>	<b>\$76.9</b>	<b>\$113.4</b>	<b>\$203.1</b>	<b>\$57.6</b>	<b>\$6.4</b>	<b>\$29.0</b>	<b>\$367.6</b>	<b>\$409.5</b>

Source: State Highway fund scenarios based on source data from ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005–2030*. Local sources based on available data from City of Bend and ECONorthwest assumptions described in this report. Final calculations and conversion of figures to constant 2006 dollars by ECONorthwest.

\* The combined total in column D of Table 19-18 is the total of the baseline figure plus the incremental change of gas tax and registration fee increases. Note, columns B and C each separately include the baseline figure. They reflect the change *plus* the baseline figure. For example, in 2007, the incremental change generated by increased gas tax is \$0.1 million and no change under the registration fee.

Some of the revenue in Table 19-18 is restricted for certain uses. Specifically, funds from SDC revenue must be used for capital projects. Table 19-19 shows the level of future revenue available to Bend split by funds that are restricted to capital projects only and unrestricted funds. The unrestricted funds have a high and low range to reflect different scenarios for State Highway Fund revenue.

The level of available revenue is compared against future costs for operation and maintenance (O&M) of the built transportation system. To estimate future O&M costs, the average level of O&M expenditures by the City of Bend during the last three years is used (as reported in Table 19-4 [\$4.7 million]). It is also assumed that these expenditures would grow to keep pace with the increased costs of operation and maintenance and with population growth. Costs for operation and maintenance are currently growing rapidly, about 4% per year, in current dollars. To calculate the growth of these costs in constant dollars, the assumption for future inflation (3.1%) is subtracted from this growth factor. In addition to growth in costs, the extent of the built transportation system maintained by the City will grow over time. It is assumed that this

growth would equal population growth in the City, which is currently forecasted at 2.2% per year between 2005 and 2030. Note, too, a backlog of road maintenance exists that would require funding above and beyond current funding.

To estimate the level of funding available for O&M and capital costs, the estimate of future revenue is compared by type to future O&M costs. It is assumed that O&M costs would be fully funded to the extent possible with unrestricted revenue. If excess funds are available from unrestricted revenue (that is, unrestricted revenue exceeds O&M costs), it is assumed that the excess would be used for capital expenses. Funds restricted to use for capital projects—SDC and private funds—must be used for capital expenditures. Table 19-19 shows the result of this analysis.

**Table 19-19: City of Bend Road-Related Revenue by Restriction, O&M Costs, and Funding available for O&M and Capital Expenditures, 2007–2030 (millions of 2006 dollars)**

Fiscal Year	Revenue by Restriction			Local O&M Costs	Funds Available for Expenses			
	Capital SDC + Priv	Unrestricted Low	Unrestricted High		O&M Low	O&M High	Capital Low	Capital High
2007	\$3.9	\$6.4	\$6.6	\$4.9	\$4.9	\$4.9	\$5.5	\$5.6
2008	\$4.2	\$6.4	\$6.6	\$5.0	\$5.0	\$5.0	\$5.6	\$5.8
2009	\$4.4	\$6.5	\$6.9	\$5.2	\$5.2	\$5.2	\$5.7	\$6.1
2010	\$4.7	\$6.5	\$7.2	\$5.4	\$5.4	\$5.4	\$5.8	\$6.5
2011	\$5.0	\$6.5	\$7.3	\$5.6	\$5.6	\$5.6	\$5.9	\$6.7
2012	\$5.3	\$6.5	\$7.4	\$5.7	\$5.7	\$5.7	\$6.0	\$6.9
2013	\$5.6	\$6.5	\$7.5	\$5.9	\$5.9	\$5.9	\$6.1	\$7.2
2014	\$5.9	\$6.5	\$7.7	\$6.1	\$6.1	\$6.1	\$6.3	\$7.5
2015	\$6.3	\$6.5	\$7.8	\$6.4	\$6.4	\$6.4	\$6.5	\$7.8
2016	\$6.7	\$6.5	\$7.9	\$6.6	\$6.5	\$6.6	\$6.7	\$8.1
2017	\$7.1	\$6.5	\$8.1	\$6.8	\$6.5	\$6.8	\$7.1	\$8.4
2018	\$7.6	\$6.5	\$8.3	\$7.0	\$6.5	\$7.0	\$7.6	\$8.9
2019	\$8.0	\$6.6	\$8.5	\$7.3	\$6.6	\$7.3	\$8.0	\$9.3
2020	\$8.5	\$6.6	\$8.6	\$7.5	\$6.6	\$7.5	\$8.5	\$9.6
2021	\$9.1	\$6.5	\$8.7	\$7.8	\$6.5	\$7.8	\$9.1	\$10.0
2022	\$9.6	\$6.6	\$8.9	\$8.0	\$6.6	\$8.0	\$9.6	\$10.5
2023	\$10.3	\$6.5	\$8.9	\$8.3	\$6.5	\$8.3	\$10.3	\$10.9
2024	\$10.9	\$6.6	\$9.1	\$8.6	\$6.6	\$8.6	\$10.9	\$11.4
2025	\$11.6	\$6.6	\$9.2	\$8.9	\$6.6	\$8.9	\$11.6	\$11.9
2026	\$12.3	\$6.7	\$9.4	\$9.2	\$6.7	\$9.2	\$12.3	\$12.6
2027	\$13.1	\$6.7	\$9.5	\$9.5	\$6.7	\$9.5	\$13.1	\$13.1
2028	\$14.0	\$6.6	\$9.6	\$9.8	\$6.6	\$9.6	\$14.0	\$14.0
2029	\$14.9	\$6.7	\$9.7	\$10.1	\$6.7	\$9.7	\$14.9	\$14.9
2030	\$15.8	\$6.7	\$9.8	\$10.5	\$6.7	\$9.8	\$15.8	\$15.8
<b>Totals</b>	<b>\$204.8</b>	<b>\$157.3</b>	<b>\$199.2</b>	<b>\$175.9</b>	<b>\$149.2</b>	<b>\$174.6</b>	<b>\$212.8</b>	<b>\$229.4</b>

Source: ECONorthwest.

Under the Low scenario for State Highway Fund revenue (no increase in gas tax or vehicle registration fees), Table 19-19 shows that the level of O&M costs exceed the level of unrestricted revenue beginning in fiscal year 2016. Before 2016, unrestricted funds would add to the funding available for capital projects. Beginning in 2016, the City would have to use all of its unrestricted funding for O&M expenses, and this revenue would not fully cover O&M costs. The only funding available for capital projects after

2016 would be those funds restricted to use for capital improvements (SDC revenue). The total amount of funding available for capital improvements in the low scenario is \$212.8 million between 2007 and 2030 (in 2006 dollars).

Under the High scenario for State Highway Fund revenue (in increase in both the gas tax and vehicle registration fees), Table 19-19 shows that the level of future O&M costs can be fully funded by unrestricted revenue available to the City, with a portion left over to contribute to revenue available for capital projects. The total amount of funding available for capital improvements in this scenario is \$229.4 million between 2007 and 2030 (in 2006 dollars).

The implication of this analysis is that the City of Bend will have funding available for capital roadway projects because it has implemented SDCs designed to fund the growth-related costs of transportation improvements needed to serve that growth. The City's unrestricted funding, however, may not keep pace with increasing costs, leading to a shortfall in funding for operation and maintenance of its roadway system. In addition, this shortfall in funding will restrict the City's ability to fund the non-growth related portions of project costs to address existing or future deficiencies. Table 19-20 shows the level of this shortfall under the Low and High scenarios for State Highway Fund revenue.

**Table 19-20: Unfunded O&M costs by State Highway Fund scenario in the City of Bend, 2007–2030 (millions of 2006 dollars)**

Fiscal Year	SHF Scenario	
	Low	High
2007	\$0.0	\$0.0
2008	\$0.0	\$0.0
2009	\$0.0	\$0.0
2010	\$0.0	\$0.0
2011	\$0.0	\$0.0
2012	\$0.0	\$0.0
2013	\$0.0	\$0.0
2014	\$0.0	\$0.0
2015	\$0.0	\$0.0
2016	-\$0.1	\$0.0
2017	-\$0.3	\$0.0
2018	-\$0.5	\$0.0
2019	-\$0.7	\$0.0
2020	-\$0.9	\$0.0
2021	-\$1.2	\$0.0
2022	-\$1.4	\$0.0
2023	-\$1.8	\$0.0
2024	-\$2.0	\$0.0
2025	-\$2.2	\$0.0
2026	-\$2.5	\$0.0
2027	-\$2.8	\$0.0
2028	-\$3.2	-\$0.2
2029	-\$3.5	-\$0.4
2030	-\$3.7	-\$0.7
<b>Total</b>	<b>-\$26.7</b>	<b>-\$1.3</b>

Source: ECONorthwest.

Table 19-21 summarizes the road-related capital funding that is estimated to be reasonably available in the Bend MPO from 2007 to 2030, including estimated ODOT expenditures in the Bend MPO.<sup>20</sup> Table 19-21 also shows the result of this of county and city expenditures in the MPO. Note, “unrestricted funds” also include general and other fund categories.

<sup>20</sup> Table 19-14 shows ODOT’s forecast of statewide funds available for modernization, and the potential distribution to Region 4 and Deschutes County. Comparison of the potential allocation to Deschutes County to current ODOT expenditures of federal and state funds on modernization projects in the Bend MPO shows that roughly 1/3 of modernization funds in the County are spent in the MPO. We assume that this ratio of expenditures will continue over the forecast period for this MTP, and apply this ratio to the funding shown in Table 19-14 to estimate future ODOT expenditures in the MPO.

**Table 19-21: Road-related capital funding reasonably available in the Bend MPO, 2007–2030 (millions of 2006 dollars)**

<b>Jurisdiction</b>	<b>Low</b>	<b>High</b>
<b>ODOT</b>	<b>\$40.4</b>	<b>\$42.2</b>
STIP	\$17.6	\$19.4
STP	\$12.8	\$12.8
Discretionary	\$10.0	\$10.0
<b>Deschutes Co.</b>	<b>\$1.0</b>	<b>\$1.0</b>
<b>City of Bend</b>	<b>\$212.0</b>	<b>\$228.5</b>
SDC	\$197.6	\$197.6
Private	\$6.4	\$6.4
Unrestricted	\$8.0	\$24.6
<b>Total</b>	<b>\$253.3</b>	<b>\$271.7</b>

Source: ECONorthwest

## Transit

The City of Bend initiated fixed-route bus transit service in September 2006. Bend Area Transit (BAT) operates buses on seven routes Monday–Friday and six routes on Saturday. Fares are \$1 per trip or \$2 for an unlimited day pass. Discounted fares are available for seniors, the disabled, and purchases of multi-day or monthly passes.

This fixed-route system supplemented existing Dial-A-Ride service in Bend. That service was formerly available to the general public, but is now limited to residents with limited mobility. The City currently operates both the BAT and Dial-a-Ride service through its Public Transit Fund. While the City may seek formation of a transit district to operate BAT in the future, the assessment of reasonably available revenue in this section assumes that the City continues to operate BAT and Dial-a-Ride service using existing and current funding sources.

The assessment of future transit funding available in the Bend MPO in this section is drawn primarily from ODOT’s *Financial Assumptions*. That report was prepared before the City of Bend initiated fixed-route bus service, and it does not state whether it considered this for its forecasts of transit funding available to the Bend MPO. The ODOT forecasts used for this report, however, were updated in March 2006. Comparison of actual and expected funding for BAT to these updated forecasts suggests that ODOT’s forecasts do include consideration of fixed-route service in Bend.

## Federal Transit Administration funds

ODOT’s *Financial Assumptions* provides forecasts of funding allocated to the Bend MPO from the two main Federal Transit Administration (FTA) programs, Section 5307 and Section 5309. FTA Section 5307 funds are distributed on a formula basis and can be used for capital, maintenance, and operating costs. ODOT assumes that Bend’s allocation will increase only at the rate of inflation, at around 3.1% annually. This assumption means that Bend’s Section 5307 revenue stays roughly constant at an average of roughly \$650,000 per year over the forecast period, in constant 2006 dollars. FTA Section 5309 funding is distributed on a discretionary basis and can be used for capital projects only. ODOT’s forecast of Section 5309 allocations to the Bend MPO shows spikes in funding in 2007-08, 2018-2020, and 2030. These spikes probably reflect funding for expected equipment replacement. ODOT’s forecast is for Bend to

receive a total of \$15.6 million from Section 5307 and \$13.8 million from Section 5309 between 2007 and 2030, in constant 2006 dollars. Annual funding from these programs is shown in Table 19-22 at the end of this section.

### **State transit funding**

ODOT's *Financial Assumptions* document also forecasts transit support from the state's Special Transportation Fund (STF), which is used primarily for operation of transit systems for the elderly and disabled (including Americans with Disabilities Act compliance on general services). The STF is funded roughly half by a 2-cent per pack cigarette tax and roughly half by miscellaneous unrestricted state revenues. From 2007 to 2011, the cigarette tax fluctuates year by year, from a low of \$4.3 million to a high of \$4.5 million. ODOT assumes that cigarette tax revenue will remain constant after 2011, at about \$4.6 million, and that the rest of the STF revenue will continue to increase with inflation throughout the forecast period. This results in an average increase in STF revenue of around 1.7% annually, less than assumed inflation. In constant 2006 dollars, Bend's share of STF revenues are expected to decline from roughly \$230,000 in 2007 to \$173,000 in 2030, for a total of \$4.8 million over the 2007-2030 period.

ODOT's *Financial Assumptions* also include a forecast of state support of transit programs from revenue that is now being devoted to repayment of lottery-backed bonds that paid for the Portland area's light rail system in the 1990s. This funding is available for capital expenses only. In constant 2006 dollars, ODOT forecasts that Bend will receive over \$270,000 in 2011. This annual amount declines to \$152,000 in 2030, with total funding of \$4.3 million over the 2007-2030 period. Annual funding from these sources is shown in Table 19-22 at the end of this section.

### **Transfers from the General Fund**

Table 19-8 shows that the City of Bend has budgeted for a transfer of \$520,000 from its General Fund in FY 2005/06. Table 19-12 shows an additional transfer of \$80,000 from the Transportation Fund to operate BAT. The *Draft Service Plan* developed for the fixed-route service estimated a much higher level of City support would be needed, with an annual General Fund transfer of \$1.1 million to operate transit services in Bend (both BAT and Dial-a-Ride).

The City's General Fund is expected to have current revenue of \$30.5 million in FY 2006/07, with total resources of \$37.1 million including funding carried over from previous years.<sup>21</sup> Thus, transfers from the General Fund for transit service are currently about 2% of General Fund revenues, and would be almost 4% of General Fund revenues at the level anticipated in the *Draft Service Plan*. The City's General Fund revenues are primarily derived from property taxes, transient room taxes, and franchise fees. Rapid growth of population and property values in Bend should cause General Fund revenues to increase at a rate above general inflation. Given expected growth in the City's General Fund, and the small share transferred for transit service, the City should be able to maintain its current and anticipated level of support of transit services through transfers from the General Fund.

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<sup>21</sup> City of Bend. *Adopted Budget Fiscal Year 2006/07*. Page 69.

## Summary

Table 19-22 summarizes the level of funding available for transit services in Bend over the 2007–2030 period, in constant 2006 dollars. Table 19-22 shows that transit capital and operations funding is expected to remain relatively stable at roughly \$2.5 million per year though the forecast period, with spikes in funding that correspond to expected federal and state grants for purchases and maintenance of capital equipment.

The City's Public Transit Fund currently has expenses of about \$2.2 million excluding capital purchases. The City's Supplemental Budget for fixed-route service adds about \$400,000 to this expense, for a total of \$2.6 million per year, again excluding capital expenses. Table 19-22 shows that total unrestricted revenue from federal and state sources, and transfers from the City's General Fund, is expected to be about \$1.7 million per year in constant 2006 dollars. While this level of revenue is below current operating costs, revenue in Table 19-22 does not include revenue from fares (which should generate \$150,000 to \$250,000 per year at current level of service) and other miscellaneous funding sources. In addition, some of the operating costs reported by the City are for maintenance of vehicles, other capital equipment, and transit stops, all of which can be funded with revenue restricted to capital expenses.

With future revenues roughly similar to current operating costs, and uncertainty about future transit operating costs in Bend, it appears that current revenue sources are sufficient to fund public transit operation in Bend at its current level of service. This is particularly true if the City can increase transfers from its General Fund to cover operating shortfalls from federal and state sources or fares.

**Table 19-22: Summary of transit funding available in the Bend MPO, 2007–2030  
(in 2006 dollars)**

Year	Unrestricted			Capital Only		Total		
	FTA Section 5307	State STF	City General Fund	FTA Section 5309	State Capital Support	Unrestricted	Capital Only	Total
2007	\$592,000	\$229,590	\$850,000	\$1,287,000	\$0	\$1,671,590	\$1,287,000	\$2,958,590
2008	\$623,000	\$227,420	\$850,000	\$5,231,000	\$0	\$1,700,420	\$5,231,000	\$6,931,420
2009	\$643,000	\$225,330	\$850,000	\$88,000	\$0	\$1,718,330	\$88,000	\$1,806,330
2010	\$644,000	\$223,330	\$850,000	\$80,000	\$198,100	\$1,717,330	\$278,100	\$1,995,430
2011	\$645,000	\$221,360	\$850,000	\$88,000	\$270,630	\$1,716,360	\$358,630	\$2,074,990
2012	\$646,000	\$218,480	\$850,000	\$87,000	\$262,490	\$1,714,480	\$349,490	\$2,063,970
2013	\$647,000	\$215,640	\$850,000	\$175,000	\$254,600	\$1,712,640	\$429,600	\$2,142,240
2014	\$648,000	\$212,840	\$850,000	\$88,000	\$246,940	\$1,710,840	\$334,940	\$2,045,780
2015	\$649,000	\$210,070	\$850,000	\$77,000	\$239,520	\$1,709,070	\$316,520	\$2,025,590
2016	\$650,000	\$207,340	\$850,000	\$88,000	\$232,320	\$1,707,340	\$320,320	\$2,027,660
2017	\$651,000	\$204,640	\$850,000	\$87,000	\$225,330	\$1,705,640	\$312,330	\$2,017,970
2018	\$652,000	\$201,980	\$850,000	\$1,841,000	\$218,560	\$1,703,980	\$2,059,560	\$3,763,540
2019	\$653,000	\$199,360	\$850,000	\$1,234,000	\$211,990	\$1,702,360	\$1,445,990	\$3,148,350
2020	\$654,000	\$196,770	\$850,000	\$1,219,000	\$205,610	\$1,700,770	\$1,424,610	\$3,125,380
2021	\$655,000	\$194,210	\$850,000	\$87,000	\$199,430	\$1,699,210	\$286,430	\$1,985,640
2022	\$656,000	\$191,680	\$850,000	\$87,000	\$193,430	\$1,697,680	\$280,430	\$1,978,110
2023	\$657,000	\$189,190	\$850,000	\$174,000	\$187,620	\$1,696,190	\$361,620	\$2,057,810
2024	\$658,000	\$186,730	\$850,000	\$87,000	\$181,980	\$1,694,730	\$268,980	\$1,963,710
2025	\$659,000	\$184,300	\$850,000	\$87,000	\$176,500	\$1,693,300	\$263,500	\$1,956,800
2026	\$660,000	\$181,910	\$850,000	\$87,000	\$171,200	\$1,691,910	\$258,200	\$1,950,110
2027	\$661,000	\$179,540	\$850,000	\$87,000	\$166,050	\$1,690,540	\$253,050	\$1,943,590
2028	\$662,000	\$177,210	\$850,000	\$87,000	\$161,060	\$1,689,210	\$248,060	\$1,937,270
2029	\$663,000	\$174,910	\$850,000	\$87,000	\$156,210	\$1,687,910	\$243,210	\$1,931,120
2030	\$664,000	\$172,630	\$850,000	\$1,232,000	\$151,520	\$1,686,630	\$1,383,520	\$3,070,150
<b>Total</b>	<b>\$15,592,000</b>	<b>\$4,826,460</b>	<b>\$20,400,000</b>	<b>\$13,772,000</b>	<b>\$4,311,090</b>	<b>\$40,818,460</b>	<b>\$18,083,090</b>	<b>\$58,901,550</b>

Source: Base data from ODOT's Financial Assumptions document. Calculations and summary by ECONorthwest. Note, the State Special Transportation Fund (STF) includes General Funds, Transportation Operating Funds, ID card revenue, or other sources. It also includes a 2-cent cigarette gas tax.

Assuming that unrestricted revenue in Bend is used completely for transit O&M costs, Table 19-22 shows that revenue restricted to transit capital expenses totals \$18.1 million over the forecast period for the MTP.

## Conclusions

### Revenues, estimated costs, and funding gap

Transportation finance is complex. It is complex because funds for projects come from a number of sources. Often times these sources can only be spent on certain types of projects, some may even decline in the years ahead. In this analysis, there was an examination of the various funding sources, the projects they might pay for, and the gap between funds and costs of transportation costs. To that end, three main questions were asked:

- How much funding is available for planned future regional road and transit projects?
- What are the costs of the planned future regional transportation projects—including operations and maintenance?
- What is the funding gap between reasonably available revenues and estimated project costs?

In trying to answer these questions, the analysis was separated between road-related and transit-related projects.

### Roads

For roads, “low” and “high” revenue scenarios were considered. It was assumed that unrestricted local funds would be spent first to fully fund operations and maintenance of roadways. The “low” funding scenario assumes no increase in gas tax or vehicle registration fees. The “high” funding scenario assumes an increase in gas tax and vehicle registration fees. In the early years (2007-2016), surplus unrestricted funds for O&M are transferred to revenue for capital expenditures. In the later years (2016-2030), there are shortfalls in O&M funding (see Tables 19-19 and 19-20).

After O&M expenditures and transfers of surplus unrestricted funds, the total available for capital expenditures, in 2006 constant dollars, ranges from about \$253 million (“low” scenario) to \$272 million (“high” scenario).

Table 19-23 summarizes the range of total available revenue after O&M expenditures and the total range of estimated costs.

**Table 19-23. Range of Estimated Total Available Funding for Capital Expenditures and Total Estimated Capital Costs for Road-related Projects the Bend MPO, 2007–2030 (millions of 2006 dollars)**

Categories of funds and costs	Range
Total available funds for capital expenditures	\$253-272
Total estimated project costs	\$258

Source: ECONorthwest.

Note: “Total available for capital expenditures” is the sum of transferred unrestricted funds and base capital funds. Base capital funds consist of estimated ODOT and local revenues earmarked for capital projects.

The difference between the range of available funding and projected costs is summarized in Table 19-24. Over the planning period 2007 to 2030 (24 years), assuming a “low” funding scenario, a funding gap of \$0.2 million per year is probable. Assuming a “high” funding scenario, a surplus of about \$0.6 million per year is probable.

**Table 19-24. Estimated Annualized Funding Gap or Surplus of Road-related Capital Projects in the Bend MPO, 2007–2030 (millions of 2006 dollars)**

Capital Costs	Funding Scenario	
	Low: \$253	High: \$272
\$258	-\$0.2	\$0.6

Source: ECONorthwest. Gap and surplus figures are calculated taking the difference between available funds and projected costs and spreading the difference per year over the planning period (24 years).

This gross comparison, however, misses the following key issues that may create a funding shortfall for roads in the Bend MPO:

- While the City of Bend will have Transportation SDC revenue that is restricted to capital expenses, the level of unrestricted funding will likely fall short of needed O&M expenses. Thus, even with sufficient capital funding the City will need additional sources of unrestricted revenue to fund adequately O&M costs.
- The bulk of the City's capital revenue is from its Transportation SDC, which can only be used for growth-related improvements. The City, however, is likely to face substantial costs to address existing or future road deficiencies, and these costs cannot be funded by SDC revenue. Thus, even if SDC revenue is sufficient to fund growth-related costs, the City will face non-growth related project costs for which it may not have funding.
- Additionally, other than an improvement to the US97/Cooley Road intersection, the plan does not include any projects to address existing and future congestion on US97 from the north study limits to approximately Reed Market Road. Congestion is forecast to increase significantly on this corridor. No projects or funding are currently identified to address those issues.

### **Transit**

The Bend region's transit system is still in its infancy. A fixed route bus system was implemented in September 2006. To fund the operations and maintenance and growth of the evolving transit system, an estimated \$59 million in revenue (in constant 2006 dollars) would come from a mix of federal, state, and local sources.

The Bend region is expected to receive a steady flow of federal transit funds from 2007–2030. In constant 2006 dollars, unrestricted revenue (Section 5307 funds for capital and operations and maintenance) stays roughly constant at an average of \$650,000 annually, or \$15.6 million over the 24-year forecast period. Funds restricted to capital projects (Section 5309 funding) are forecast to be \$13.8 million over the planning period.

From the state's Special Transportation Fund, the Bend region is forecast to receive \$4.8 million (in constant 2006 dollars) in transit support over the planning period. An additional \$4.3 million is assumed for the region with revenue generated from repayment of lottery-backed bonds that paid for the Portland area's light rail system in the 1990s.

Local sources include transfers from the City's General Fund, currently \$600,000 per year, but an estimate of transit operating costs with Dial-a-Ride and BAT shows transfers of \$1.1 million per year. If City transfers continue through the planning period at about \$850,000 per year (between \$600,000 and \$1.1 million), it will generate about \$20 million in revenue for transit services in Bend.

# Chapter 20: Performance & Mobility Measures

**Performance & Mobility Measures**  
**Chapter to be completed at a Later Date**

# Chapter 21: Outstanding Issues

## Introduction

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The improvements, funded and unfunded, called for in this Plan do not solve all of the identified transportation issues. In fact, some of the more obvious issues are not fully addressed by the improvements identified in this Plan. The reasons for this are:

- 1) The nature of these issues is very complex and further analysis is required to adequately understand the underlying travel demand contributing to the issues;
- 2) Several potential approaches might be useful, either alone or in combination, to address these issues;
- 3) The lack of funding available to implement the solutions, or restrictions on the funds available that preclude their use in being applied toward a particular issue;
- 4) No consensus solutions are currently identified to address these issues, and additional public deliberation and input is required before a preferred alternative can be selected and included in the Plan; and
- 5) Several of these issues are the subjects of current ongoing planning studies and as such do not have any recommended solutions at this time.

This chapter summarizes the outstanding issues that were identified in the preceding chapters, along with some broader issues facing the region. In addition to those outstanding issues discussed below, other problem areas will likely be the subject of further study as part of the development of local Transportation System Plans by jurisdictions in the region, or as part of specific study processes associated with updating local comprehensive land use plans.

Although interrelated packages of improvements for each of these outstanding issues will likely be identified as a result of the ongoing planning studies, there may be instances where specific projects or actions to preserve right(s)-of-way for eventual improvements are warranted prior to the completion of the entire study. If such actions can successfully demonstrate consensus support and operational separability (i.e., the action or improvement is warranted on its own merits and will not preclude elements of a comprehensive solution), then they may be advanced individually and remain consistent with this Plan without being specifically identified in it.

## Bend Urban Growth Boundary

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The City of Bend is assessing its needs for economic and residential lands for the next 20 years. The goal is to ensure Bend satisfies Oregon state planning laws with a 20 year supply of buildable land inside its Urban Growth Boundary (UGB) for needed housing and employment. In June 2007, the City submitted its proposed Urban Growth Boundary expansion map and supporting materials to the Oregon Department of Land Conservation and Development for review. An adopted UGB expansion map is not expected until late 2007. The outcome of the UGB expansion could have profound

impacts on the transportation system. Upon completion of the UGB expansion process, the MTP will need to be reviewed and revised.

## **Funding Issues**

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As can be seen in the preceding chapters, the region is facing a shortfall in revenues when compared with the projects that have been identified as being needed and in regards to operating and maintaining the existing system. This shortfall impacts all aspects of the transportation system, from the roads and highways, to the operation of bus service. With no solution to the dilemma of decreasing resources, the area will need to make do with reduced levels of maintenance of roads and bridges, increasing congestion, and constrained transit services.

As shown in the financial chapter of this Plan, there is a considerable difference between the amount of revenues that will be available to the region during the horizon of this Plan and the costs of the improvements necessary to address all the issues that face the transportation system. The financially constrained selection of projects presented in the previous chapters addresses the federal planning requirements related to financial constraint.

## **Pedestrian**

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Providing safe and convenient pedestrian links along and across the regional road system is one of the policies of this Plan. Currently, there are several areas where this is not being met.

Ensuring connectivity for all modes is a continuing aim for this plan. Development of the regional trail system and in-fill of missing sidewalk segments along the arterial roadway system would greatly improve the pedestrian system. Additionally, development of the city of Bend's accessway plan would provide extensive pedestrian connectivity throughout the study area. The Bicycle and Pedestrian Advisory Committee developed a process for prioritizing sidewalk projects. That project list and prioritization process should be updated. Additionally, annual dedicated funding should be identified to insure the projects are constructed.

## **Bicycle**

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Several portions of the designated regional bicycle system cannot accommodate the addition of dedicated bike lanes or even widened outside travel lanes. Two examples are Greenwood Avenue from Wall Street to 3<sup>rd</sup> Street and much of 3<sup>rd</sup> Street.. Impediments to the addition of bicycle facilities on these segments range from safety concerns to the financial cost of acquiring the necessary right-of-way. Finding a satisfactory solution to these problem areas will require additional time and effort and remain an outstanding issue in the regional transportation planning process.

## **Goods Movement**

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The movement of goods is typically regarded as confidential business information, such that the businesses involved do not share the data with each other or public agencies. The need for additional information regarding the quantity and type of goods being moved in and around the Bend area, as well as a more thorough identification of particular freight-critical routes and associated problem areas, is an issue that needs to be addressed in the future to better design solutions to ensure future mobility.

The MTP establishes a local freight route system. It will be critical to further evaluate this freight system to determine appropriate signage systems and design standards.

ODOT is beginning work on a statewide freight study. The potential outcomes of that plan are not known at this time. As much as possible, the BMPO will be involved in development of that plan and will work to include the findings in the MTP.

## **Rail**

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Rail issues include the safety of railroad crossings, traffic congestion associated with rail crossing closures, and at-grade rail crossing impacts on emergency services. Forecast future increases in the number of trains will only exacerbate these issues. Efforts should be focused on providing alternate routes, construct overcrossings, and enhancing the safety of at-grade crossings.

Other outstanding issues that cannot be fully addressed by this document include: 1) the preservation of land that is currently capable of being served by rail and noise associated with the trains, and 2) the study/evaluation of moving the rail line to the east of the current urban growth boundary.

## **Transportation System Efficiency Management**

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Transit ITS applications (e.g., electronic fare payment systems, signal preemption) may have some promise in terms of increasing the efficiency of transit operations and customer confidence in the transit system. Improving mobility in regional transportation corridors where the physical and political impediments to adding right-of-way are high is identified as an "outstanding issue" in this Plan. ITS applications should be examined as part of an overall recommended strategy to improve mobility in the regions congested corridors (e.g. Hwy 20/3<sup>rd</sup> Street, Reed Market Road). It is expected that ITS applications will also be used in other appropriate locations.

## **Public Transportation**

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The major difficulty involved in expanding the Public Transportation System is a lack of ongoing, stable funding for significant increases in the level and type of transit services provided in the region. The mass transit system and the ADA/Elderly and Handicapped systems all require additional levels of funding to be maximally effective.

### ***Mass Transit System Funding Shortfall***

The transit system can be expected to be able to afford necessary capital improvements (new replacement buses and equipment) over the next 20-25 years but cannot afford to provide significant expansions of transit levels of service beyond those called for in this Plan without renewed or additional sources of funding (see Finance chapter). Securing stable and continuing sources of adequate operations funding for the mass transit system is critical to the ability of the overall regional transportation system to function effectively, and is a high priority. In the near term, in cooperation with the City of Bend, the BMPO and the other jurisdictions in the region will cooperatively seek to identify, evaluate, and recommend appropriate new funding sources for transit operations to the region's citizenry and businesses.

### ***Intercity Bus Service***

The feasibility of, and an operating and financial plan for, an ongoing intercity bus service connecting the Bend area with the other cities in Deschutes County should be evaluated. The BMPO will work with area staff to develop and conduct such a feasibility study as funds are available.

### ***ADA/Elderly and Handicapped-Related Services Funding Shortfall***

The Bend Dial-a-Ride system is meeting the demand currently. But in the foreseeable future, the demand for service will grow faster than available funding. As a result of this fact, the system will have to pursue additional funding.

## **Roads**

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### ***North Corridor Project (US97-US20 NEPA)***

The US97/US20 Refinement Plan (2006) identified two possible new alignments for US97 in north Bend. The next step is to conduct environmental, design and public involvement activities necessary to prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS) to determine a preferred corridor. The EA or EIS will also seek to identify a viable consensus combination of funding sources to construct the preferred alternative. Work on this process began in 2007 and will likely extend through 2008.

### ***US97/Murphy Road***

An Interchange Area Management Plan (IAMP) is currently being developed for the proposed interchange connecting US97 and Murphy Road (2007). Upon completion of the IAMP, the next step will be to conduct environmental, design and public involvement activities necessary to prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS) on the preferred design. Results from the IAMP are expected in late 2007. Funding is not yet identified for the EA or EIS.

### ***US97 Mobility***

Travel demand model analysis has shown that much of US97 will not meet ODOT mobility standards in the future. The corridor was not examined in detail as part of the MTP. It is recommended that a refinement plan be prepared to evaluate the long-term

operational needs of the US97 corridor. The refinement plan should evaluate several options including: closure of the at-grade intersections, construction of auxiliary lanes, widening, and employment of alternate mobility standards. At this time, there is neither the funding nor consensus regarding future improvements to US97. For these reasons, there are no specific projects in this plan.

### ***US97 Interchanges***

Several of the interchanges on US97 are congested and recent developments and proposed developments are expected to place additional demands on the interchanges. The interchanges could be evaluated as part of a larger US97 Refinement Plan or IAMPs could be prepared to identify the severity of the expected problems and to evaluate and recommend preferred solutions.

### ***US20 Mobility***

Travel demand model analysis and more refined corridor analysis have shown that much of US20 through Bend does not now or will not meet ODOT mobility standards in the future. The northwest section of the corridor was examined in detail as part of the US97/US20 Refinement Plan. A refinement plan is scheduled for the eastern section of the corridor from Purcell Boulevard to Powell Butte Highway. Additionally, detailed operational analysis has been completed through the Central Area Plan and Bend Urban Growth Boundary Expansion for much of the corridor between Butler Market Road and 27<sup>th</sup> Street. It is recommended that additional analysis be completed to determine a long-term strategy for the corridor including ITS solutions, minor widening, and employment of alternate mobility standards.

### ***NE Bend Refinement Plan***

Discussions are just beginning (2007) about development of a NE Bend Refinement Plan. The plan would tentatively examine the entire roadway network in NE Bend to determine appropriate improvements, phasing of those improvements, and funding options.

### ***Eastside Bypass***

The discussion regarding the need for an “eastside bypass” can be traced as far back as the 1950s. This idea was also incorporated into the first draft of the Bend General Plan in the mid 1970s. In that early draft of the Plan, an expressway facility was described that would skirt the southern and eastern edge of the urban area as a possibility for meeting the future transportation needs of the community. While the document acknowledged that the need for the facility might not be achieved within the time frame of the plan, it did urge that the corridor be preserved for some type of future facility. In subsequent drafts of the Bend General Plan, and in the adopted Plan approved by the state, the eastside bypass was eliminated from the circulation element of the plan and hence no right-of-way was preserved for this expressway.

In the study of the Bend Parkway, one of several alternatives considered was another version of the eastside bypass. This one deviated from the original plan by connecting to Highway 97 on the north, near Cooley Road. One key issue that led to the rejection of

the Eastside Bypass alternative was the traffic data forecasts. The bypass was projected to pull away only 10,200 of the 75,000+ vehicles expected to travel Bend's central corridor by the year 2015. In addition, other traffic impact and land use issues were related to a bypass. Many of the landowners on the eastern side objected to the intrusion of a major roadway into a rural area. This applied not only to the bypass itself, but also to the east-west arterials that would have to be upgraded to connect to the bypass. Another concern was the potential of the bypass to foster development pressures outside of the Urban Growth Boundary. This would have been inconsistent with the road planning requirements recently defined by the State Transportation Planning Rule.

Some public sentiment for the idea of an east-side bypass has remained even though the decision was made to build the Parkway. In light of this interest, the City of Bend has pledged to continue to evaluate the need for the bypass as the community grows.

### ***North River Crossing***

The draft Transportation System Plan map submitted as part of the Bend Urban Growth Boundary expansion package identifies a possible future bridge over the Deschutes River interchange connecting Cooley Road to Skyline Ranch Road. No traffic modeling or detailed traffic analysis has been conducted to evaluate the potential impacts of this crossing. It is recommended that a sketch-level analysis be conducted to evaluate the impacts of such a river crossing and to determine whether to proceed with a more refined analysis.

## **Increasing Reliance on Non-Automobile Modes**

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The Oregon Transportation Planning Rule (TPR) requires that the MPO and the local jurisdictions in the urban area develop measures and benchmarks that will demonstrate that the Bend area is increasing its reliance on non-automobile modes. It is believed that land use changes will be required in order to facilitate this change from the status quo. Upon completion of the Bend UGB expansion, analysis will likely be initiated to examine the use of mixed land use centers, corridors, and high transit service levels as methods for reducing automobile reliance. These studies will be designed as the basis for meeting the TPR requirement for the area jurisdictions to develop an "integrated land use/transportation plan." The types of measures that may be considered to demonstrate increased non-auto reliance include: the number of people who live within a ¼-mile walk to a transit stop; non-auto mode share; number of dwellings close to retail services and employment. In terms of the development of the MTP, recent guidance has reinforced the federal mandate that the MPO plan be based upon *currently adopted Local Comprehensive Land Use Plans*, including only those land uses and developments that can be considered likely to occur over the planning horizon.

The BMPO *can*, however, provide modeling outputs useful in the evaluation of alternative future land use scenarios, *if such outputs are requested and defined by a member jurisdiction, and those local comprehensive land use plan changes are in the pipeline for adoption by the affected local jurisdiction.*

# APPENDIX A

## Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Compliance Matrix

**Achieving SAFETEA-LU Compliance  
Bend Metropolitan Planning Organization  
Final – August 2, 2007**

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance <i>Name of MPO: BMPO</i>
1.	Metropolitan Transportation Plan Cycle	Maximum Plan Cycles: 4 Yr Plan Air Quality Areas 5 Yr Plan Otherwise	<i>Current status: SAFETEA-LU compliant plan (2007-2030 MTP) adopted on June 27, 2007.</i>  <b>Recommendation: Next major plan update would be scheduled for completion in June 2012. Several local projects (including but not limited to the City of Bend UGB expansion, US97 North Corridor EIS, S Parkway IAMP, and the Juniper Ridge Master Plan) could necessitate a major update in the next 1-2 years.</b>
2.	MTIP Cycle and Scope	Max MTIP Cycle = 4yrs Min MTIP Scope = 4yrs	<i>Current status: 2006-2009 MTIP adopted June 16, 2005. MTIP has 2 year cycle and 4 year scope.</i>  <b>Recommendation: Next MTIP (2008-11) will have 4 year scope and 2 year cycle (consistent with ODOT). Scheduled for adoption in September/October 2007 (will be SAFETEA- LU compliant)</b>
3.	Air Quality Conformity	Designated air quality non-attainment areas must prepare conformity determinations for the plan and MTIP.	<i>Current Status: Not applicable to the BMPO (not a designated air quality non-attainment area)</i>  <b>Recommendation: Not applicable</b>
4.	Environmental Mitigation	Plans must identify environmental resources; discuss mitigation issues and activities; and document supporting consultation with	<i>Current status: The 2007-2030 MTP includes an Environmental Considerations chapter. The chapter identifies natural, historic, and cultural resources, mitigation issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps. The draft chapter was presented to the ODOT Collaborative Environmental Transportation Agreement for Streamlining (CETAS) group at their May 2007 meeting. Additionally, several meetings were held with local resource agencies (ODFW, USFS, ODEQ, County Historic Resources Planner, etc).</i>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<b>Name of MPO: BMPO</b>
		relevant Federal, State, wildlife, land management, and regulatory agencies.	<p><i>The Technical Advisory Committee currently includes representatives from the Department of Land Conservation and Development and the Oregon Department of Environmental Quality.</i></p> <p><b>Recommendation: As possible, the BMPO will expand consultation to include applicable federal and state agencies and others. Other agencies within the region are currently evaluating storm water issues, including green streets. As that work is completed, the BMPO will consider inclusion of applicable elements in the MTP.</b></p>
5.	Expanded Consultation	Expand existing consultation of the Plan to include State and local agencies responsible for land use mgmt, natural resources, environmental protection, conservation and historic preservation.	<p><i>Current status: BMPO currently coordinates with the City of Bend, Deschutes County, DLCDC, ODEQ, Bend-La Pine Schools, Central Oregon Community College, and the Central Oregon Intergovernmental Council.</i></p> <p><i>Consultation with regards to land use occurs in a variety of ways. MPO staff has been involved in the City of Bend Urban Growth Boundary (UGB) expansion planning process and Urban Reserves (UR) planning process. This has included the identification of potential future mixed-use sites and multi-modal transportation system improvements. After the UGB and UR expansions are completed, MPO staff will be involved in further evaluating the impacts of potential mixed-use sites and multi-modal corridors.</i></p> <p><i>There is policy language on environmental resources and associated activities in the MTP. There are policies and related strategies dealing specifically with consulting with state and federal agencies, including natural resource agencies.</i></p> <p><i>Consultation during MTP development included a presentation to and discussion with the ODOT Collaborative Environmental and Transportation Agreement for Streamlining (CETAS) group and meetings with the ODFW, USFS, and ODEQ. Additionally, letters and e-mail messages were sent and phone calls were made to the USDA Forest Service, Bureau of Land Management, U.S. Environmental Protection Agency, US Fish and Wildlife, US Army Corps of Engineers and many other local, state, and national agencies. The letters explained the role of the MTP, SAFETEA-LU's guidance for consultation in the area of environmental mitigation, and ways in which the MTP could meet consultation expectations with natural resource agencies.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: <b>BMPO</b>
			<b>Recommendation: BMPO will expand existing consultation to include applicable federal, state, and local agencies, commissions, and special districts.</b>
6.	Planning Factor: Promote consistency with State and local planned growth and economic development patterns.	Planning process and plan must consider projects and strategies that will promote consistency with growth and development patterns.	<p><i>Current status: This is standard practice for the BMPO. BMPO staff has been involved in the City of Bend UGB and UR planning processes. BMPO staff will be involved in future evaluations of potential mixed-use centers and multi-modal corridors in the UGB and UR area. The MTP also identifies the importance of transportation to the economic vitality of the region.</i></p> <p><b>Recommendation: Continue with current practice</b></p>
7.	Planning Factor: Increase the security of the transportation system for motorized and non-motorized users.	Planning process and plan must consider projects and strategies that will increase the security of the system for its users.	<p><i>Current status: The adopted 2007-2030 MTP includes a Security chapter. The chapter identifies potential issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps.</i></p> <p><i>The MTP and its associated policies recognize the importance of planning, building, operating and maintaining the transportation system so that it is secure for all modes and all system users. The MTP recognizes that it is especially important to be consistent with the leadership of federal, state and local homeland security entities and recognizes the need to deter, detect, defend and design in order to protect transportation facilities and users.</i></p> <p><b>Recommendation: As additional information and guidance becomes available, updates will be made to the Security chapter. Additionally, BMPO staff will evaluate opportunities for better involvement in local, regional, and statewide security planning efforts.</b></p>
8.	Planning Factor: Increase the safety of the transportation system for motorized and non-motorized users.	Planning process and plan must consider projects and strategies that will increase the safety of the system for its users.	<p><i>Current status: The adopted 2007-2030 MTP includes a Safety chapter and Existing Conditions chapter. The Safety chapter identifies potential issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps. The Existing Conditions chapter includes a detailed assessment of crash data from throughout the study area and identifies high crash locations.</i></p> <p><i>Safety is a primary goal for the BMPO and its member agencies. ODOT places safety</i></p>

SAFETEA-LU Requirement		General Expectation	<b>Recommendations for SAFETEA-LU Compliance</b> <b>Name of MPO: BMPO</b>
			<p>for users of the transportation system at the highest level of its plan priorities. The City of Bend has an active Traffic Safety Advisory Committee and Safe Routes to Schools advisory committee.</p> <p>Additionally, the City of Bend has a policy to implement roundabouts instead of signals unless it can be shown that a roundabout is not feasible. The City now has an almost equal number of roundabouts and signals. Crash data indicate that crash rates and crash severities are far lower at roundabouts.</p> <p>The MTP recognizes safety as a critical challenge. While the overall safety numbers are improving in Oregon, attention to safety must always be a priority.</p> <p>BMPO staff is also tracking development of the ODOT Strategic Highway Safety Plan (SHSP). When completed, BMPO staff will evaluate opportunities for incorporating applicable components of the SHSP into the MTP.</p> <p><b>Recommendation: The City of Bend is considering funding a series of corridor safety audits. As that discussion progresses, BMPO staff will participate and help identify corridors for study, funding opportunities, and ultimately implementation strategies. Additionally, BMPO staff will evaluate opportunities for better involvement in local, regional, and statewide safety planning efforts.</b></p>
9.	Operational and Management Strategies	The plan should specifically address the identification and implementation of TSM/TDM strategies.	<p>Current status: The adopted 2007-2030 MTP includes a Transportation Systems Management chapter and a Transportation Demand Management chapter.</p> <p>Systems management seeks to improve the efficiency of the transportation system by optimizing the existing transportation infrastructure capacity with improved operations and management. The chapter identifies potential issues, policies, and recommended actions. It also identifies data gaps and recommended next steps. There is also an ITS Plan for central Deschutes County. Much of the content of the ITS Plan was incorporated in the TSM chapter.</p> <p>The TSM chapter promotes removing barriers and bringing innovative solutions together so that the transportation system functions as smoothly as possible. Effective management of the transportation system between jurisdictions and system providers</p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<p><b>Name of MPO: BMPO</b></p> <p><i>is also critical to achieving the goal of efficient system management and operations. System optimization is also identified in the chapter.</i></p> <p><i>The TDM chapter discusses new approaches to implementing demand management techniques. It also includes a lengthy list of policies encouraging demand management at many different levels.</i></p> <p><i>The MTP recognizes the growing challenges of increased system demands and growing congestion coupled with limited funding for transportation system improvements. These challenges make it vital to effectively manage and operate existing infrastructure as a way to optimize the system.</i></p> <p><b>Recommendation: The regional ITS working group will be reconvening in FY07-08 to review the ITS Plan and identify needed updates and implementation options. If that plan undergoes significant revisions, the MTP will be amended as needed. Additionally, rapidly escalating project costs will greatly limit capacity improvements in the coming years. Opportunities for maximizing operational and management strategies will be critical. BMPO staff will work with member agencies/jurisdictions to identify operational and management strategies.</b></p> <p><b>Additionally, funding has been programmed for the first phase of the highest priority project identified in the ITS Plan. That project (Central Signal System) could provide significant operational improvements throughout the study area. BMPO staff will track that project and work with the project team to identify funding opportunities to fully implement the project.</b></p>
10.	Public Participation Plan	<p>MPOs are to develop, adopt and utilize “participation plans”. These plans are to:</p> <ol style="list-style-type: none"> <li>1. Provide reasonable opportunities for</li> </ol>	<p><i>Current status: The BMPO developed a draft Public Participation Program (PPP) in FY06-07. That draft plan was reviewed by the Citizen Advisory Committee and the Policy Board. It was also posted on the BMPO website. The Policy Board opened the public comment period on the draft plan. At the same time, other MPOs in Oregon developed and adopted PPPs during FY06-07. Those plans contain a series of best practices for public participation. The draft PPP was not adopted. Staff determined it was best to update the draft PPP to include these best practices from other MPOs. The BMPO PPP should be completed and adopted during the first quarter of FY07-08.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<b>Name of MPO: BMPO</b>
		<p>interested parties (including users of transportation services and recipients of transportation assistance) to comment on the plan and TIP;</p> <p>2. Be developed in consultation with all interested parties; and</p> <p>3. Afford participants an opportunity to comment on the plan and MTIP prior to approval.</p>	<p><i>The MTP development process provided frequent and accessible opportunities for all interested parties to participate and provide comments on the draft MTP chapters. Many opportunities were presented through the BMPO committee process – Policy Board, Technical Advisory Committee, and Citizen Advisory Committee. Representatives of various stakeholder groups including public agencies such as the Department of Land Conservation and Development, members of the freight community, transportation demand management representatives, and many other interested parties serve on these committees. A complete list of committee members is available in the MTP.</i></p> <p><i>The OTP underwent a public outreach and review process. Staff made presentations during initial MTP development to a few interested groups. Staff provided public notification announcing completion of draft chapters, the public hearing process, and adoption. These notifications were provided to local and regional media, public agency staff, interested private sector parties, and interested citizens.</i></p> <p><i>Draft components of the MTP were posted on the BMPO website during the planning process. The website contained the draft chapters, maps, committee meeting information, and contact information.</i></p> <p><i>In addition to feedback at the meetings, staff received written comment (letters and emails) from public agencies and a few interested parties. BMPO staff updated the MTP in response to the comments received.</i></p> <p><i>Public notice of the public hearing was distributed to interested parties. The BMPO Policy Board received additional comments at public hearings held on June 21 and June 27, 2007. The BMPO Policy Board adopted the MTP on June 27, 2007.</i></p> <p><b>Recommendation: Update the draft PPP to include the best practices included in other PPPs. Hold a public review and comment period and adopt the PPP in the first quarter of FY2007-08.</b></p>
11.	Public Meetings	In carrying out the public participation	<i>Current status: This is standard practice for the BMPO. Much of the MTP outreach process occurred at regularly scheduled meetings for the various BMPO committees.</i>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<b>Name of MPO: BMPO</b>
		plan, public meetings are to be conducted at convenient and accessible locations at convenient times.	<p><i>Meetings of the Policy Board and Citizen Advisory Committee are held in the late afternoon and early evening, respectively. These meetings are held in accessible locations.</i></p> <p><i>Additionally, "Accessible Meeting Information" is included on the meeting agendas for all BMPO meetings. The information indicates that the meeting location is physically accessible, that communication or other accommodations for people with disabilities will be made upon advance request. The information also identifies a process and contact information to request accommodations.</i></p> <p><b>Recommendation: Continue with current practice</b></p>
12.	Process to provide reasonable comment opportunities to expanded list of interested parties.	MPO to provide representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled with reasonable opportunity to comment on transportation plan.	<p><i>Current status: The BMPO developed a draft Public Participation Program (PPP) in FY06-07. That draft plan was reviewed by the Citizen Advisory Committee and the Policy Board. It was also posted on the BMPO website. The Policy Board opened the public comment period on the draft plan. At the same time, other MPOs in Oregon developed and adopted PPPs during FY06-07. Those plans contain a series of best practices for public participation. The draft PPP was not adopted. Staff determined it was best to update the draft PPP to include these best practices from other MPOs. The BMPO PPP should be completed and adopted during the first quarter of FY07-08.</i></p> <p><i>The MTP development process provided frequent and accessible opportunities for all interested parties to participate and provide comments on the draft MTP chapters. Many opportunities were presented through the BMPO committee process – Policy Board, Technical Advisory Committee, and Citizen Advisory Committee.</i></p> <p><i>Key staff and members of the regional Bicycle and Pedestrian Advisory Committee (BPAC) are also members of the Technical Advisory Committee. Development of the Bicycle and Pedestrian chapter was closely coordinated with and linked to the city, county, and parks and recreation district bicycle and pedestrian planning efforts.</i></p> <p><i>The MTP underwent a public outreach and review process. Staff made presentations during initial MTP development to a few interested groups. Staff provided public notification announcing completion of draft chapters, the public hearing process, and adoption. These notifications were provided to local and regional media, public agency</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<p><b>Name of MPO: BMPO</b></p> <p>staff, interested private sector parties, and interested citizens.</p> <p>Draft components of the MTP were posted on the BMPO website during the planning process. The website contained the draft chapters, maps, committee meeting information, and contact information.</p> <p>In addition to feedback at the meetings, staff received written comment (letters and emails) from public agencies and a few interested parties. BMPO staff updated the MTP in response to the comments received.</p> <p>Public notice of the public hearing was distributed to interested parties. The BMPO Policy Board received additional comments at public hearings at meetings held on June 21 and June 27, 2007. The BMPO Policy Board adopted the MTP on June 27, 2007.</p> <p><b>Recommendation: Update the draft PPP to include the best practices included in other PPPs. Hold a public review and comment period and adopt the PPP in the first quarter of FY2007-08.</b></p>
13.	Visualization Techniques	Development of the transportation plan and MTIP shall, to the maximum extent practicable, employ visualization techniques.	<p><i>Current status: The BMPO currently employs a variety of visualization techniques such as: GIS, PowerPoint, newspaper display ads, etc. A variety of visualization techniques were used to develop and present the MTP transportation needs information, financial analysis and policy implications. This included maps, tables, diagrams, charts and figures to illustrate a result or concept.</i></p> <p><i>The regional transportation model was used to identify future needs and possible future improvement options. Model plots were used to show the outputs of the model and helped convey future issues to the Policy Board, other committees, and the public.</i></p> <p><i>System maps were developed for the existing conditions report and the environmental considerations chapter. The maps show locations of various transportation facilities including airports, highways, bike lanes, sidewalks, and railroads. The maps also show many aspects of the natural and cultural environments.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<b>Name of MPO: BMPO</b>
			<p>The current practice of using visualization techniques for planning activities is increasing. In the future, additional maps and other visualization tools should be readily available to policy makers and the public.</p> <p><b>Recommendation: The BMPO will continue with the current practice and evaluate other options (e.g. before/after images and simulations).</b></p>
14.	Electronic access to plans	MPOs should publish and make available on the internet its plans and MTIP. MPOs shall also make public information available in electronically accessible format and means, such as the World Wide Web, as appropriate.	<p><i>Current status</i> The BMPO has a website where the public can access Policy Board and committee materials, the MTIP and the completed MTP:  <a href="http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html">http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html</a></p> <p>The site provided convenient opportunities for contacting staff and providing comments on the MTP. The adopted MTP is located on the website, along with some support materials developed for the MTP which may be of interest or useful for other applications.</p> <p><b>Recommendation: The BMPO will continue to keep the website up-to-date. The BMPO will also be updating the layout and format of the website to insure compliance with the requirements of the ADA.</b></p>
15.	Electronic publication of plan	MPOs shall publish or otherwise made readily available for public review transportation plans including (to the maximum extent practicable) in electronically accessible formats such as the World Wide Web.	<p><i>Current status</i> The BMPO has a website where the public can access Policy Board and committee materials, the MTIP and the completed components of the MTP,  <a href="http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html">http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html</a></p> <p><b>Recommendation: The BMPO will continue to keep the website up-to-date. The BMPO will also be updating the layout and format of the website to insure compliance with the requirements of the ADA.</b></p>
16.	Congestion Management Process	Transportation Management Areas are to develop and utilize Congestion	<p><i>Current status:</i> Not applicable to the BMPO (not a TMA)</p> <p><b>Recommendation: Not applicable</b></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			<b>Name of MPO: BMPO</b>
		Management Processes (formerly Congestion Management Systems) in the development of their plans and MTIP	
17.	TMA Certification Cycle	Transportation Management Areas are to have certification reviews at least every four years.	<p><i>Current Status: Not applicable to the BMPO (not a TMA)</i></p> <p><b>Recommendation: Not applicable</b></p>
18.	Coordinated Public Transit/ Human Services Transportation Plan	<p>As a prerequisite to receiving FTA funds for:</p> <ol style="list-style-type: none"> <li>1. Special Needs and Elderly.</li> <li>2. Job Access and Reverse Commute.</li> <li>3. New Freedom Proposed projects must come from a public transit/human services transportation plan.</li> </ol>	<p><i>Current status: In Oregon, the Department of Transportation required each county to develop the Coordinated Public Transit/ Human Services Transportation Plan (“the plan”). Through the Oregon Solutions Program, the State of Oregon funded a public transportation coordination project in Deschutes County. The work completed through this project provided the information needed for the plan. The Central Oregon Intergovernmental Council developed the plan with assistance from Deschutes County, City of Bend, City of Redmond, ODOT, and many providers of special transportation services. The BMPO was actively involved in development of the plan. The plan was completed and adopted by the Deschutes County Board of Commissioners in late June 2007.</i></p> <p><b>Recommendation: Because the plan was not completed until late June, the findings of the plan were not incorporated in the Metropolitan Transportation Plan (MTP). During FY07-08, the BMPO will amend the MTP to include applicable components and findings from the plan.</b></p>
19.	Addition of transit operator in the development of funding estimates for the financial component of the plan.	Development of estimates of funds that will be available to support plan implementation must be a cooperative	<p><i>Current status: This is standard practice for the BMPO. The transit operator (the City of Bend) was included throughout development of the Metropolitan Transportation Plan, including development of the long-range financial forecasts and system costs.</i></p> <p><b>Recommendation: Continue with current practice</b></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: <b>BMPO</b>
		effort among the MPO, State and transit operators.	
20.	Congestion Management Process	Transportation Management Areas are to develop and utilize a Congestion Management Processes (formerly Congestion Management Systems) in the development of their plans and MTIP.	<p><i>Current Status: Not applicable to the BMPO (not a TMA)</i></p> <p><b>Recommendation: Not applicable</b></p>
21.	Intermodal connectors added as transportation facility.	Plan is to include identification of transportation facilities (including roadways, transit, multimodal and intermodal connectors)	<p><i>Current status: The adopted MTP identifies transportation facilities (including roadways, transit, bicycle facilities, pedestrian facilities, air facilities, rail lines, and pipelines). Currently, there are very few multimodal and intermodal connectors in the study area. As the region grows, it is expected that the number of multimodal and intermodal connectors will grow both in number and importance to the larger transportation system.</i></p> <p><b>Recommendation: The MTP considers all modes of transportation. Future updates to the MTP will evaluate the presence of new intermodal and multimodal connectors and the need for new intermodal and multimodal connectors. The need for and location of multimodal connectors will be particularly important as the region begins to evaluate and plan for long-term public transportation system improvements.</b></p>
22.	Plan to include accessible pedestrian walkways and bicycle facilities.	The plan is to provide for the development and integrated management and operation of transportation	<p><i>Current status: The MTP considers all modes of the regional transportation system, including bicycle and pedestrian facilities, as a single, integrated system. Several goals and policies speak to the development, management and operation of an integrated system. The MTP also recognizes that the regional transportation system is part of a broader regional and national. Maintaining good access to those systems and supporting state and federal efforts to improve them is important to the Bend MPO.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: <b>BMPO</b>
		systems and facilities (including accessible pedestrian walkways and bicycle transportation facilities)	<b>Recommendation: The MTP considers all modes of transportation. Future updates to the MTP will evaluate the strategies to insure development and integrated management and operation of the region's transportation systems and facilities.</b>
23.	Plan to distinguish between operations and capital investments by including separate operational and management strategies.	Plan must identify operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods and capital investment and other strategies to preserve the existing and projected future metropolitan transportation infrastructure	<p><i>Current status: The adopted 2007-2030 Metropolitan Transportation Plan (MTP) includes operational and management strategies to improve the performance of existing transportation facilities. These strategies are primarily located in the TSM chapter. The MTP also includes several capital projects that will help preserve the existing infrastructure by providing improving connectivity and providing new travel routes.</i></p> <p><i>Additionally, the long-range financial forecast explicitly considered long-term operations and maintenance costs of the existing system. These costs were deducted from the revenue forecast and assumed to be committed to long-term operations and maintenance costs.</i></p> <p><b>Recommendation: The adopted MTP includes strategies to preserve and improve the existing system. Future updates to the MTP will evaluate the strategies and financial assumptions to insure adequate provisions are in place to preserve the system.</b></p>
24.	Due consideration of other planning activities required.	Metropolitan transportation plans and the MTIP are required to be developed with due consideration of other related	<i>Current status: Development of the MTP complied with this requirement. As the BMPO developed the MTP, consideration was given to the many studies currently underway including local and state corridor studies, local land use refinement studies, and updates to the state's plans and planning requirements. The outcomes of the many local and regional studies currently underway in the region could significantly impact the MTP and require amendments.</i>

SAFETEA-LU Requirement	General Expectation	<i>Recommendations for SAFETEA-LU Compliance</i>
	<p>planning activities within the metropolitan area.</p> <p>In addition, SAFETEA authorizes a new categorical program for highway safety, the Highway Safety Improvement Program (HSIP). This program, to be administered by the State DOT, requires the development of a State strategic highway safety plan.</p>	<p><i>Name of MPO: BMPO</i></p> <p>Safety is one of the 8 planning factors in SAFETEA-LU. The MTP includes a safety chapter.</p> <p><b><i>Recommendation: Continue with current practice. The BMPO will coordinate as appropriate with all member agencies and jurisdictions. In the short-term, the BMPO will coordinate as follows:</i></b></p> <p><b><i>1) ODOT</i></b></p> <ul style="list-style-type: none"> <li><b><i>-Development of the strategic highway safety plan</i></b></li> <li><b><i>-Development of the South Parkway Interchange Area Management Plan</i></b></li> <li><b><i>-Development of the US97 North Corridor EIS</i></b></li> <li><b><i>-Development of the US20 Refinement Plan (for east Bend area)</i></b></li> <li><b><i>-Possible development of a US20 Bend-Sisters Refinement Plan</i></b></li> </ul> <p><b><i>2) Deschutes County</i></b></p> <ul style="list-style-type: none"> <li><b><i>-Update of the County Transportation System Plan, including development of a county-wide travel demand model</i></b></li> <li><b><i>-Designation of Urban Reserves around Bend</i></b></li> </ul> <p><b><i>3) City of Bend</i></b></p> <ul style="list-style-type: none"> <li><b><i>-Designation of an expanded Urban Growth Boundary</i></b></li> <li><b><i>-Designation of Urban Reserves</i></b></li> <li><b><i>-Possible development of a NE Bend Transportation Refinement Plan</i></b></li> <li><b><i>-Development of the Juniper Ridge Master Plan</i></b></li> <li><b><i>-Development of various corridor studies/plans</i></b></li> </ul>

# APPENDIX B

## Oregon Transportation Planning Rule (TPR) Compliance Matrix

**TPR Matrix to be completed at a Later Date**

# APPENDIX C

## Existing Conditions Documents

## **Bend Dial-a-Ride Classification**

**General Public:** Anyone that is registered over the phone without an application, over 18, not senior, disabled or low income.

**Youth:** Anyone that has an approved application on file and is 10-17.

**Disabled:** Anyone that has an approved application on file, and is certified by either a case manager or physician. (No longer use this category except for clients that were registered before 2002).

**Honored Citizen:** Anyone that has an approved application on file and is over 60.

**Senior:** Anyone that has an approved application on file and is over 60 (We no longer use this category except for clients that were registered before 2002).

**Other:** Escorts, Children under the age of 10 and Personal Care Attendants riding with a paying client.

**Low Income:** Anyone that has an approved application on file, and is receiving food stamps.

**Medicaid:** Trips must be assigned from COIC (Broker) for authorized trips.

## Roadway Functional Classification

<i>Roadway</i>	<i>From</i>	<i>To</i>	<i>Classification</i>
<b>City of Bend Classification</b>			
Business 97 (3Road St.)	Greenwood Avenue	Highway 20/Highway 97 south junction	Principal Arterial
Reed Market Road	Brookwood Blvd.	SE 27th St.	Major Arterial
27th St.	Reed Market Road	Butler Market Road	Major Arterial
Empire Ave.	Highway 20	Purcell Blvd.	Major Arterial
Reed Market Road	Century Drive	Brookwood Blvd.	Minor Arterial
Cooley Road	Highway 20	NE 18th St.	Minor Arterial
Robal Road.	Highway 20	Highway 97	Minor Arterial
Empire Ave.	O.B. Riley Road	Highway 20	Minor Arterial
NE 18th St.	Cooley Road	Empire Ave.	Minor Arterial
Boyd Acres Road	Empire Ave.	Butler Market Road	Minor Arterial
Mt. Washington Drive	Century Drive	Highway 20	Minor Arterial
Butler Market Road	Highway 20	East MPO boundary	Minor Arterial
NE 8th St.	Butler Market Road	NE 9th St.	Minor Arterial
NE 9th St.	NE 8th St.	Reed Market Road	Minor Arterial
NE 15th St.	Highway 20	Knott Road	Minor Arterial
Knott Road	Highway 97	SE 27th St.	Minor Arterial
SE 27th St.	Knott Road	Reed Market Road	Minor Arterial
Neff Road	NE 8th St.	East MPO Boundary	Minor Arterial
Olney Ave.	NE 8th St.	Wall St.	Minor Arterial
Revere Ave.	Hill St.	NE 8th St.	Minor Arterial
Division St.	Highway 20	Revere Ave.	Minor Arterial
Bear Creek Road	NE 10th St.	East City Limits	Minor Arterial
Franklin Ave.	NE 10th St	Wall St.	Minor Arterial
Galveston Ave.	Riverside Drive	NW 17th St.	Minor Arterial
Riverside Drive	Wall St.	Galveston Ave.	Minor Arterial
Skyliners Road	NW 17th St.	West MPO Boundary	Minor Arterial
Greenwood Ave.	Wall St.	NE 3Road St.	Minor Arterial
Shelvin Park Road	Newport Ave.	West MPO Boundary	Minor Arterial
Newport Ave.	Shelvin Park Road	Wall St.	Minor Arterial
Brookwood Blvd.	Baker Road	Reed Market Road	Minor Arterial
Baker Road	Highway 97	Brookwood Blvd.	Minor Arterial
Simpson Ave.	Simpson Ave.	Colorado Ave.	Minor Arterial
NE 14th St.	Newport Ave.	Simpson Ave.	Minor Arterial
Colorado	Mt. Washington Drive	Scott St.	Minor Arterial
Arizona Ave.	Colorado Ave.	Colorado Ave.	Minor Arterial

<b>Roadway</b>	<b>From</b>	<b>To</b>	<b>Classification</b>
Wall St.	Franklin Ave.	Hill St.	Minor Arterial
Hill St.	Wall St.	Revere St.	Minor Arterial
Bond St.	Franklin Ave.	Wall St.	Minor Arterial
NE 4th St.	Franklin Ave.	Butler Market Road	Minor Arterial
Wilson Ave.	SE 3Road St.	Bond St.	Minor Arterial
Bond St.	Reed Market Road	Wilson Ave.	Minor Arterial
Century Drive	Reed Market Road	West MPO Boundary	Minor Arterial
Wells Acres Road	Butler Market Road	NE 27th St.	Major Collector
Pettigrew Road	Reed Market Road	Bear Creek Road	Major Collector
Purcell Blvd.	Bear Creek Road	Yeoman Road	Major Collector
Yeoman Road	East City Limits	Deschutes Market Road	Major Collector
Brinson Blvd.	Boyd Acres Road	Butler Market Road	Major Collector
NE 18th St.	Empire Ave.	Brinson Blvd.	Major Collector
Stevens Road	SE 27th St.	East MPO Boundary	Major Collector
Ward Road	Stevens Road	Hamby Road	Major Collector
Hamby Road	Ward Road	Butler Market Road	Major Collector
Ferguson Road	SE 27th St.	SE 15th St.	Major Collector
NE 4th St.	Franklin Ave.	Glenwood Drive	Major Collector
Glenwood Drive	NE 4th St.	SE 9th St.	Major Collector
Wilson Ave.	SE 3Road St.	SE 15th St.	Major Collector
American Lane	Reed Market Road	Brosterhous Road	Major Collector
Brosterhous Road	SE 3Road St.	Knott Road	Major Collector
Murphy Road	Brosterhous Road	NW 3Road St.	Major Collector
Country Club Road	Knott Road	Murphy Road	Major Collector
Parrell Road	China Hat Road	Brosterhous Road	Major Collector
China Hat Road	Knott Road	Highway 97	Major Collector
Ponderosa Drive	Highway 97	Lodgepole Drive	Major Collector
Lodgepole Drive	Ponderosa Drive	Brookwood Blvd.	Major Collector
Archie Briggs Road	Mt. Washington Drive	O.B. Riley Road	Major Collector
O.B. Riley Road	Highway 20	North MPO Boundary	Major Collector
Summit Drive	Mt. Washington Drive	Mt. Washington Drive	Major Collector
NW 12th St.	Summit Drive	NW 9th St.	Major Collector
NW 9th St.	NW 12th St.	Newport Ave.	Major Collector
Putnam Road	Mt. Washington Drive	North MPO Boundary	Major Collector
Awbrey Road	Mt. Washington Drive	Newport Ave.	Major Collector
Portland Ave.	Wall St.	College Way	Major Collector
College Way	Newport Ave.	Saginaw Ave.	Major Collector
Powers Road	Brookwood Blvd.	Parrell Road	Major Collector
Chase Road	Parrell Road	Brosterhous Road	Major Collector

<b>Roadway</b>	<b>From</b>	<b>To</b>	<b>Classification</b>
Bond St.	Wilson Ave.	Franklin Ave.	Major Collector
Wall St.	Industrial Way	Franklin Ave.	Major Collector
Hawthorne Ave.	NE 4th St.	Oregon Ave.	Major Collector
Hawthorne Ave.	Wall St.	Highway 97	Major Collector
Oregon Ave.	Hawthorne Ave.	Wall St.	Major Collector
Studio Road	NE 4th St.	Butler Market Road	Major Collector
Northwest Crossing Drive	West MPO Boundary	Shelvin Park Road	Major Collector
Lemhi Pass Road	Skyliners Road	Northwest Crossing Drive	Major Collector
Deschutes Market Road	Butler Market Road	North MPO Boundary	Major Collector
Brentwood Road	Brosterhous Road	American Lane	Major Collector
Metolious Drive	Mt. Washington Drive	West MPO Boundary	Major Collector
Skyline Ranch Road	West MPO Boundary	North MPO Boundary	Major Collector
SE 2 <sup>nd</sup> Ave	Scott St.	Wilson Ave.	Major Collector
Beall Road	NE 27th St.	Hamby Road	Major Collector

**Deschutes County Classification**

Baker Road	Zuni Road	Brookwood Blvd	Rural Collector
Baker Road	Highway 97	Brookwood Blvd	Rural Arterial
Brookwood Blvd.	Baker Road	South City UGB	Rural Arterial
China Hat Road	Knott Road	South MPO boundary	Forest Highway
Knott Road	Highway 97	China Hat Road	Rural Arterial
Skyliners Road	West City UGB	West MPO boundary	Rural Collector
Yeoman Road	18th St	Deschutes Market Road	Rural Collector
Deschutes Market Road	Butler Market Road	Hamehook Road	Rural Collector
Butler Market Road	East City UGB	East MPO Boundary	Rural Arterial
Neff Road	East City UGB	East MPO boundary	Rural Arterial
Bear Creek Road	East City UGB	East MPO boundary	Rural Collector
Stevens Road	East City UGB	East MPO boundary	Rural Collector
Ward Road	Stevens Road	Highway 20	Rural Collector
Ward Road	Stevens Road	East MPO boundary	Rural Collector
Bear Creek Road	Ward Road	East MPO boundary	Rural Collector
Hamby Road	Highway 20	Butler Market Road	Rural Collector
Cinder Butte Road	Baker Road	Minnetonka Lane	Rural Collector
Minnetonka Lane	Cinder Butte Road	Kiowa Road	Rural Collector
Kiowa Road	Minnetonka Lane	Riverwoods Drive	Rural Collector
Riverwoods Drive	Kiowa Road	Choctaw Road	Rural Collector
Choctaw Road	Riverwoods Drive	Pima Road	Rural Collector
Pima Road	Choctaw Road	Zuni Road	Rural Collector

<b>Roadway</b>	<b>From</b>	<b>To</b>	<b>Classification</b>
Zuni Road	Pima Road	Baker Road	Rural Collector
<b>ODOT Classification</b>			
Highway 97	North MPO Boundary	South MPO Boundary	Statewide Expressway
Highway 20	North MPO Boundary	Highway 20/Highway 97 north junction	Statewide Expressway
Highway 20	Highway 20/Highway 97 north junction	NE 12th St.	Statewide Highway
Highway 20	NE 12th St.	East MPO Boundary	Statewide Expressway

## Intersection Level of Service and Volume/Capacity Ratios

<i>Intersection</i>	<i>Level of Service</i>	<i>Delay (sec./veh)</i>	<i>Volume / Capacity</i>
<b>Unsignalized Intersections</b>			
<b>ODOT Jurisdiction</b>			
Highway 20/Cooley Road	E/A	47.5	0.19
Highway 20/Hamby Road	C/A	22.4	0.26
Highway 97 southbound Ramp/Empire Avenue	E/B	41.6	0.40
Highway 97 southbound Ramp/Butler Market Road	*	*	*
Highway 97 northbound Ramp/Butler Market Road	*	*	*
Highway 97 northbound Ramp/Colorado Avenue	*	*	*
Highway 97 northbound Ramp/Reed Market Road	F/A	53.7	0.39
Highway 97/Badger Road	*	*	*
Highway 97/Ponderosa Road – China Hat Road	<b>F/B</b>	<b>&gt;100</b>	<b>0.88</b>
Highway 97 northbound Ramp/Baker Road	*	*	*
Highway 97 southbound Ramp/Baker Road	*	*	*
<b>Bend Jurisdiction</b>			
Empire Avenue/Boyd Acres Road (all-way stop)	<b>F</b>	<b>&gt;100</b>	<b>&gt;1.00</b>
Empire Avenue/18th Street	<b>F/B</b>	<b>&gt;100</b>	<b>&gt;1.00</b>
Ferguson Road/27th Street	B/A	13.1	0.08
Rickard Road/27th Street	B/A	12.7	0.12
Reed Market Road/9th Street	E/A	40.1	0.46
Reed Market Road/American Lane	<b>F/B</b>	<b>&gt;100</b>	<b>&gt;1.00</b>
Knott Road/15th Street	*	*	*
Knott Road/China Hat Road	C/A	17.9	0.44
Brookwood Boulevard/Baker Road	B/A	12.7	0.11
Neff Road/Hamby Road	B/A	14.5	0.27
Butler Market Road/Hamby Road	*	*	*
Butler Market Road/Hamehook Road	A/A	5.4	0.44
Brookwood Boulevard/Powers Road	C/A	18.0	0.29
Deschutes Market Road/Hamehook Road	B/A	10.1	0.15
<b>Roundabout</b>			
<b>Bend Jurisdiction</b>			
Reed Market Road/Mount Washington Drive	A	4.8	0.38
Reed Market Road/Brookwood Boulevard	C	19.2	0.94
Mount Washington Drive/Shelvin Park Road	A	4.9	0.31
Colorado Avenue – Century Drive/14th Street	A	4.8	0.38
Newport Avenue/14th Street	A	7.1	0.58
Galveston Avenue/14th Street	A	7.2	0.57
Colorado Avenue/Simpson Avenue	A	5.2	0.44

<b>Intersection</b>	<b>Level of Service</b>	<b>Delay (sec./veh)</b>	<b>Volume / Capacity</b>
Simpson Avenue/14th Street	A	5.8	0.43
Mount Washington Drive/Skyliners	A	3.9	0.25
Butler Market Road/8th Street	A	7.8	0.62
<b>Signalized Intersections</b>			
<b>ODOT Jurisdiction</b>			
Highway 20/Robal Road	B	11.2	0.51
Highway 20/Empire Avenue	C	28.7	0.73
Highway 20/Butler Market Road – Mount Washington Drive	C	28.4	0.58
Highway 20/Greenwood Avenue	<b>D</b>	<b>51.8</b>	<b>0.93</b>
Highway 20/8th Street	C	33.8	0.63
Highway 20/15th Street	*	*	*
Highway 20/27th Street	<b>D</b>	<b>43.9</b>	<b>0.85</b>
Highway 20/Revere Avenue	*	*	*
Highway 20/Olney Avenue	C	28.6	0.72
Highway 97/Cooley Road	<b>C</b>	<b>25.1</b>	<b>0.86</b>
Highway 97/Robal Road	C	22.6	0.73
Highway 97 northbound Ramp/Empire Avenue	C	24.4	0.71
Highway 97 southbound Ramp/Revere Avenue	*	*	*
Highway 97 northbound Ramp - Division/Revere Avenue	B	16.0	0.41
Highway 97 southbound Ramp/Colorado Avenue	*	*	*
Highway 97 southbound Ramp/Reed Market Road	C	21.1	0.67
Highway 97/Powers Road	B	19.3	0.67
Highway 97/Pinebrook Boulevard	*	*	*
Highway 97/3Road Street	*	*	*
<b>Bend Jurisdiction</b>			
3Road Street/Reed Market Road	D	47.4	0.90
3Road Street/Wilson Avenue	C	33.7	0.72
3Road Street/Franklin Avenue	C	34.4	0.70
3Road Street/Powers Road	B	19.6	0.56
3Road Street/Murphy Road	C	25.2	0.32
Butler Market Road/27 <sup>th</sup> Street	C	25.7	0.62
27th Street/Neff Road	<b>E</b>	<b>69.5</b>	<b>&gt;1.00</b>
Reed Market Road/27th Street	B	18.8	0.42
Reed Market Road/15th Street	D	45.0	0.89
Portland Avenue – Olney Avenue/Wall Street	D	37.5	0.85
Olney Avenue – Neff Road/8th Street	D	43.3	0.88

<i><b>Intersection</b></i>	<i><b>Level of Service</b></i>	<i><b>Delay (sec./veh)</b></i>	<i><b>Volume / Capacity</b></i>
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Notes:

Unsignalized Intersections:

A/A = Minor Street turn LOS/Major street turn LOS

V/C = Individual lane groups

Delay = Individual lane groups

Roundabouts:

V/C = Individual approach

Delay = Individual approach

Signalized and All-Way Stop Intersections:

Delay = Average vehicle delay in the peak hour for entire intersection in seconds.

\* = Turn movement counts to be available in the near future

# APPENDIX D

## Land Use Data

**Land Use Appendix to be completed at a later date**

# APPENDIX E

## Motor Vehicle Chapter Supporting Documents

## Traffic Operations for Study Area Intersections (PM Peak Hour)

Intersection	2030 Committed Scenario			2030 Capacity Enhancing Scenario		
	Delay	LOS	V/C	Delay	LOS	V/C
<b>Unsignalized Intersections</b>						
<b>ODOT Jurisdiction</b>						
Highway 20/Cooley Road		B/F	>1.0		B/F	>1.0
Highway 20/Hamby Road		A/F	0.72		A/E	0.53
Highway 97 southbound Ramp/Empire Avenue		C/F	0.95		F/F	>1.0
Highway 97 southbound Ramp/Butler Market Road		NA/F	>1.0		NA/F	0.87
Highway 97 northbound Ramp/Butler Market Road		B/F	0.80		B/D	0.22
Highway 97 northbound Ramp/Colorado Avenue		E/F	>1.0		NA	NA
Highway 97 northbound Ramp/Reed Market Road						
Highway 97/Badger Road		A/E	0.23		N/A	N/A
Highway 97/Ponderosa Road – China Hat Road		A/C	0.19		A/C	0.16
Highway 97 northbound Ramp/Baker Road		A/B	0.21		A/B	0.21
Highway 97 southbound Ramp/Baker Road		A/B	0.48		A/B	0.48
<b>Bend Jurisdiction</b>						
Empire Avenue/Boyd Acres Road (all-way stop)						
Empire Avenue/18th Street		D/F	>1.0		-	-
Ferguson Road/27th Street		A/C	0.20		A/C	0.30
Rickard Road/27th Street		A/C	0.23		A/C	0.17
Reed Market Road/9th Street		A/E	0.71		B/F	>1.0
Reed Market Road/American Lane		C/F	>1.0		E/F	>1.0
Knott Road/15th Street		A/F	>1.0		B/F	>1.0
Knott Road/China Hat Road		A/C	0.11		A/C	0.11
Brookwood Boulevard/Baker Road		A/B	0.12		A/B	0.12
Neff Road/Hamby Road		A/C	0.40		A/C	0.39
Butler Market Road/Hamby Road		A/A	0.47		A/A	0.31
Butler Market Road/Hamehook Road		A/A	0.59		A/A	0.49
Brookwood Boulevard/Powers Road						
Deschutes Market Road/Hamehook Road		A/B	0.29		A/C	0.61
<b>Roundabouts</b>						
<b>Bend Jurisdiction</b>						
Mount Washington Drive/Shelvin Park Road				2.4	A	0.55
Colorado Avenue – Century Drive/14th Street				1.7	A	0.57
Newport Avenue/14th Street				2.0	A	0.73
Galveston Avenue/14th Street				7.0	A	0.92
Colorado Avenue/Simpson Avenue				1.0	A	0.43
Simpson Avenue/14th Street				1.9	A	0.48
Mount Washington Drive/Skyliners				1.0	A	0.45

Intersection	2030 Committed Scenario			2030 Capacity Enhancing Scenario		
	Delay	LOS	V/C	Delay	LOS	V/C
Butler Market Road/8th Street				4.7	A	0.69
<b>Signalized Intersections</b>						
<b>ODOT Jurisdiction</b>						
Highway 20/Robal Road		B	0.51		C	0.88
Highway 20/Empire Avenue		D	0.93		F	>1.0
Highway 20/Butler Market Road – Mount Washington Drive		E	>1.0		D	0.97
Highway 20/Greenwood Avenue						
Highway 20/8th Street						
Highway 20/15th Street		B	0.86		B	0.83
Highway 20/27th Street		F	>1.0		F	>1.0
Highway 20/Revere Avenue		E	>1.0		E	>1.0
Highway 20/Olney Avenue		D	>1.0		D	0.94
Highway 97/Cooley Road		C	0.96		C	0.93
Highway 97/Robal Road		E	>1.0		E	>1.0
Highway 97 northbound Ramp/Empire Avenue		E	>1.0		D	0.95
Highway 97 southbound Ramp/Revere Avenue		F	>1.0		F	>1.0
Highway 97 northbound Ramp - Division/Revere Avenue		B	0.56		B	0.50
Highway 97 southbound Ramp/Colorado Ave		D	>1.0		D	>1.0
Highway 97 southbound Ramp/Reed Market Road		E	>1.0		C	0.94
Highway 97/Powers Road		F	>1.0		N/A	N/A
Highway 97/Pinebrook Boulevard		C	0.89		A/B	0.31
Highway 97/3rd Street		C	0.76		N/A	N/A
<b>Bend Jurisdiction</b>						
3rd Street/Reed Market Road	>80.0	F	>1.0	>80.0	F	>1.0
3rd Street/Wilson Avenue	63.1	E	>1.0	52.7	D	0.98
3rd Street/Franklin Avenue	61.9	E	>1.0	51.5	D	0.98
3rd Street/Powers Road	42.2	D	0.91	>80.0	F	>1.0
3rd Street/Murphy Road	42.0	D	0.91	47.7	D	0.90
Butler Market Road/27 <sup>th</sup> Street	52.2	D	0.94	-	-	-
27th Street/Neff Road	>80.0	F	>1.0	>80.0	F	>1.0
Reed Market Road/27th Street	27.8	C	0.82	62.9	E	>1.0
Portland Avenue – Olney Avenue/Wall Street	80	E	>1.0	75.8	E	>1.0
Olney Avenue – Neff Road/8th Street	>80.0	F	>1.0	69.5	E	>1.0

Notes: Unsignalized Intersections:

A/A = Minor Street turn LOS/Major street turn LOS

V/C = Individual lane groups

Delay = Individual lane groups

Roundabouts:

V/C = Individual approach

Delay = Individual approach

Signalized and All-Way Stop Intersections:

Delay = Average vehicle delay in the peak hour for entire intersection in seconds

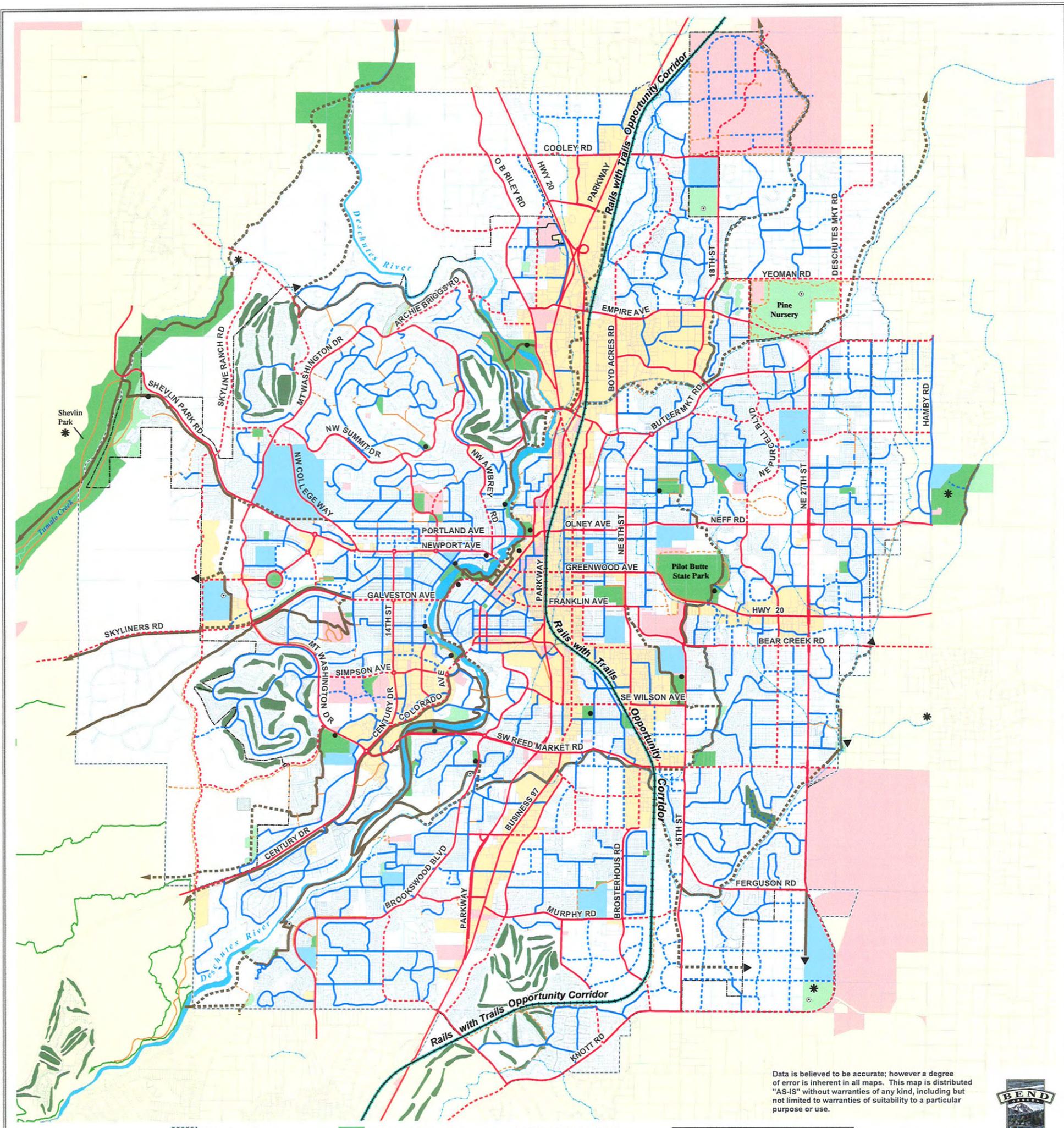
# **APPENDIX F**

**Bicycle and Pedestrian System Map**

**Primary Trail System Map**

**Primary Trail System Index Map**

**Primary Trail System Matrix**



Data is believed to be accurate; however a degree of error is inherent in all maps. This map is distributed "AS-IS" without warranties of any kind, including but not limited to warranties of suitability to a particular purpose or use.



- |                                |                            |                                    |
|--------------------------------|----------------------------|------------------------------------|
| Urban Area Reserve             | Developed Parks            | Existing shared roadway            |
| City Boundary                  | Undeveloped Parks          | Future shared roadway              |
| River                          | Potential / Future Parks   | Existing multi-use path, Primary   |
| Canals                         | Existing trailhead         | Future multi-use path, Primary     |
| Railroad                       | Proposed trailhead         | Existing multi-use path, Connector |
| Golf course                    | Proposed Rails with Trails | Future multi-use path, Connector   |
| Schools                        | Existing bicycle lane      | Forest Service Trails              |
| Commercial / Industrial Zoning | Future bicycle lane        |                                    |
| Public Ownership               |                            |                                    |

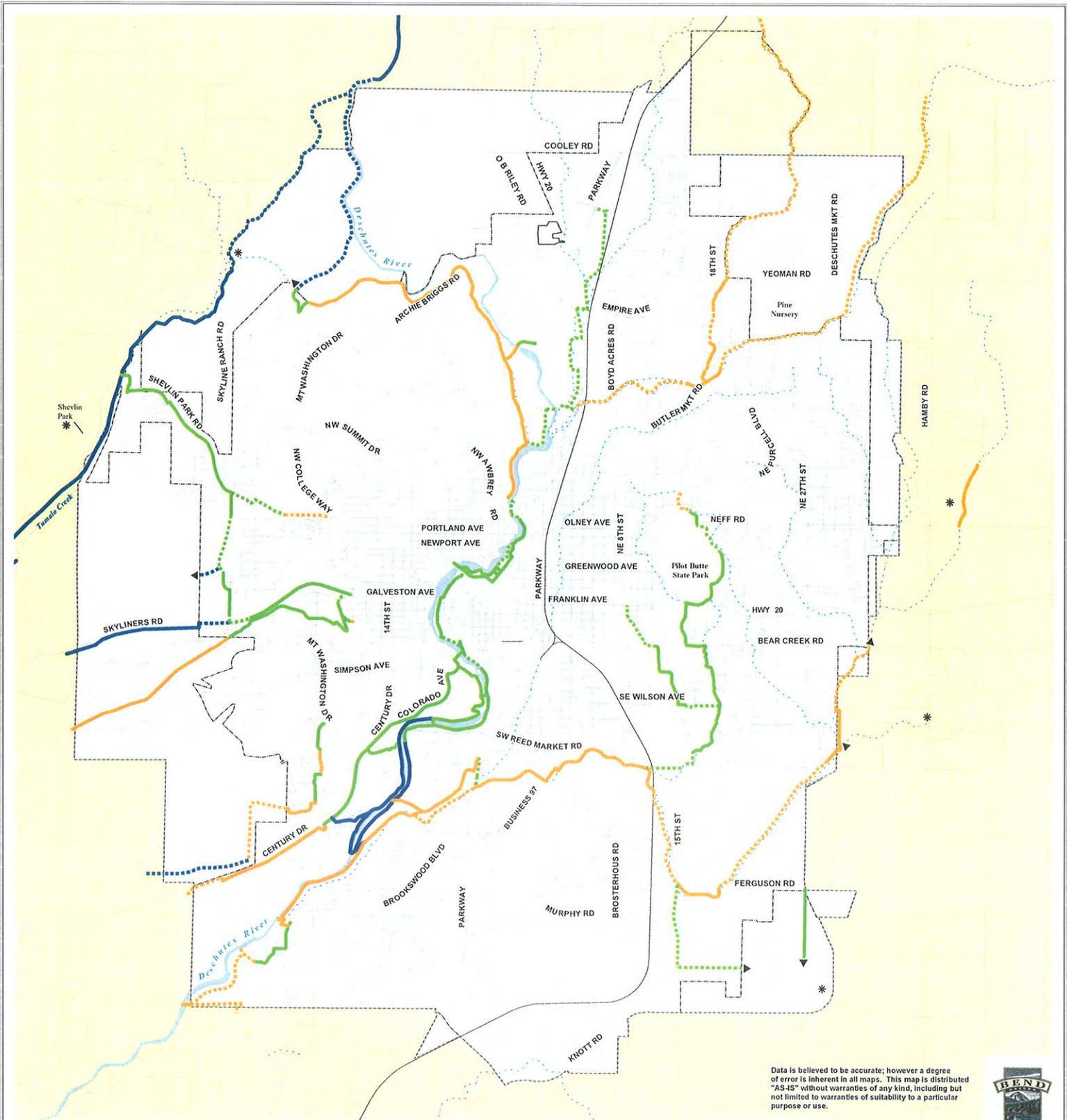
**Bend System Plan Legend**  
 \* Destination    ▶ Connection Point

DESCHUTES  
**GEOgraphics**  
 J. T. ATKINS COMPANY PC

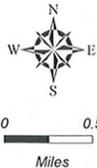
**Bend Urban Area Bicycle and Pedestrian System Plan**

October 20, 2006

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- Urban Area Reserve
- City Boundary
- River
- Canals
- Street
- Railroad

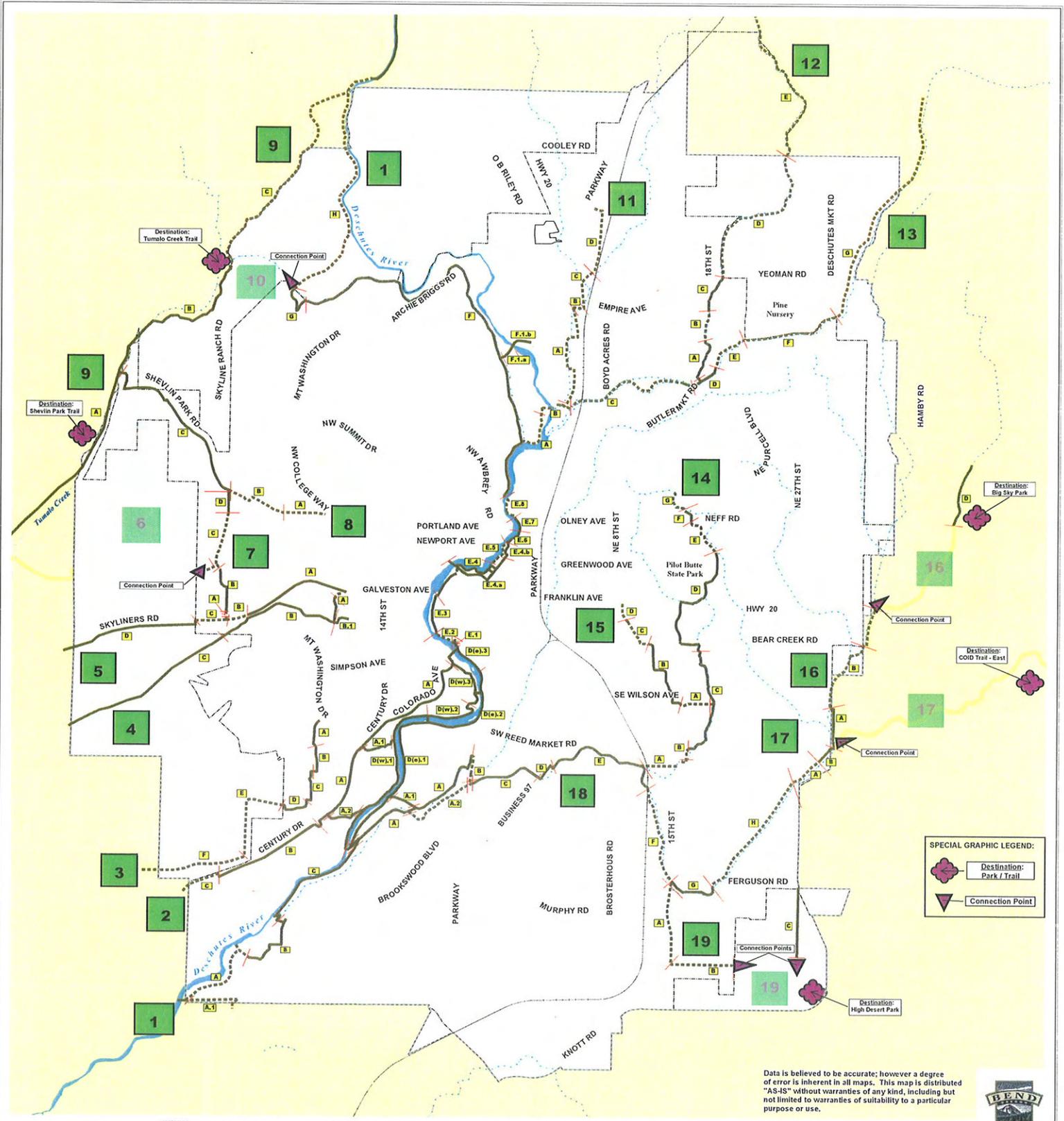
- Primary Trail System Legend**
- Destination
  - Connection Point

**Primary Trail System**

DESCHUTES  
**geo**graphics

J.T. ATKINS COMPANY PC

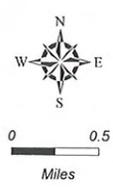
**Bend Urban Area Bicycle and Pedestrian System Plan**



**SPECIAL GRAPHIC LEGEND:**

- Destination: Park / Trail
- Connection Point

Data is believed to be accurate; however a degree of error is inherent in all maps. This map is distributed "AS-IS" without warranties of any kind, including but not limited to warranties of suitability to a particular purpose or use.



- |                                |                            |                                  |
|--------------------------------|----------------------------|----------------------------------|
| Urban Area Reserve             | Developed Parks            | Existing shared roadway          |
| City Boundary                  | Undeveloped Parks          | Future shared roadway            |
| River                          | Potential / Future Parks   | Existing multi-use path, Primary |
| Canals                         | Existing trailhead         | Future multi-use path, Primary   |
| Railroad                       | Proposed Rails with Trails | Forest Service Trails            |
| Golf course                    | Existing bicycle lane      |                                  |
| Schools                        | Future bicycle lane        |                                  |
| Commercial / Industrial Zoning |                            |                                  |
| Public Ownership               |                            |                                  |

**PRIMARY TRAIL SYSTEM INDEX**

TRAIL INDEX NUMBER

TRAIL SEGMENT I.D.

DESCHUTES GEOgraphics  
 J.T. ATKINS COMPANY PC

**Bend Urban Area Bicycle and Pedestrian System Plan**

Revised: October 12, 2006



Primary Trails

PrimaryTrails

P

	Primary Trail:	Segment	Proposed	Length: (Feet)	Type:	Roadway	Trail	R.O.W.: (Existing)	Public	Private	Easement	Improvement Need:	Public	Private	Improvement Cost:	Segment Type	Unit Cost per LF	Public Cost	Private Cost	Location:	Other Comments:
1	Deschutes River Trail	A	X	4,450			X			X			X	X		8	\$16	\$7,244	\$65,192	South Reach of River Trail	10%:Public, 90%:Private
1	Deschutes River Trail	A	B X	300			X		X				X			13	\$1,414	\$424,278		River Xing @ South UGB	New Bridge across river
1	Deschutes River Trail	A	1	2,100			X			X				X		8	\$16		\$34,183	South Reach of River Trail	Cinder Cone Spur & S. UGB
1	Deschutes River Trail	B		3,500			X			X	X						\$0			Subdivision Street System	
1	Deschutes River Trail	C	X	5,400			X			X	X		X			7.1	\$14	\$73,875		COID Canal Ditch Rider Road	
1	Deschutes River Trail	D	E 1	5,550			X		X	X	X						\$0			South Canyon Trail	
1	Deschutes River Trail	D	E 1 B	100			X			X	X						\$0			River Xing @ South Canyon	Existing Bridge across river
1	Deschutes River Trail	D	E 2	6,100			X		X	X	X						\$0			Farewell Bend Pk/Old Mill	
1	Deschutes River Trail	D	E 2 B	200			X		X	X	X						\$0			River Xing @ Old Mill #1	Existing Bridge across river
1	Deschutes River Trail	D	E 2 B	200			X		X	X	X						\$0			River Xing @ Old Mill #2	Existing Bridge across river
1	Deschutes River Trail	D	E 2 B X	200			X		X	X	X		X			15	\$2,121	\$424,240		River Xing @ Old Mill #3	New Bridge across river
1	Deschutes River Trail	D	E 3	1,000			X		X	X	X		X			10	\$55	\$55,421		Old Mill District	
1	Deschutes River Trail	D	W 1	7,650			X			X	X						\$0			South Canyon Trail	
1	Deschutes River Trail	D	W 2	2,500			X		X	X	X		X			10	\$55	\$138,553		Old Mill District	
1	Deschutes River Trail	D	W 3	3,500			X		X	X	X						\$0			Old Mill District	
1	Deschutes River Trail	D	W 3 B	200			X		X								\$0			River Xing @ Colorado	Existing Bridge across river
1	Deschutes River Trail	E	1	500			X			X	X						\$0			N. of Colorado	Existing Connection to Carlon
1	Deschutes River Trail	E	2	850			X			X				X		10	\$55	\$47,108		N. of Colorado - Riverfront	
1	Deschutes River Trail	E	3	1,800			X		X								\$0			Riverfront - Drake Park	
1	Deschutes River Trail	E	3 B	100			X		X								\$0			River Xing @ Gilchrist	Existing Bridge across river
1	Deschutes River Trail	E	4	3,300			X		X								\$0			Newport Br. - Pacific Park	
1	Deschutes River Trail	E	4 a	3,000			X		X								\$0			Harmon - Brooks Alley	via Park/Riverside/Brooks Alley
1	Deschutes River Trail	E	4 B	200			X		X								\$0			River Xing @ Nashville	Existing Bridge across river
1	Deschutes River Trail	E	4 b	1,000			X		X				X			10	\$55	\$55,421		Newport Br to Pacific Park	via Alley Route
1	Deschutes River Trail	E	5	1,100			X		X	X			X			10	\$55	\$60,963		Newport Br to Pacific Park	via River Trail Route
1	Deschutes River Trail	E	6	850			X		X								\$0			Pacific Park	
1	Deschutes River Trail	E	7	650			X		X				X			10	\$55	\$36,024		Pioneer Park	
1	Deschutes River Trail	E	8	1,000			X		X	X			X			10	\$55	\$55,421		Pioneer Pk - 1st St. Rapids	
1	Deschutes River Trail	E	8 B	200			X		X	X			X			15	\$2,121	\$424,240		River Xing @ 1st St. Rapids	New Bridge across river
1	Deschutes River Trail	F		18,550			X			X	X		X			7.1	\$14	\$253,773		River Run Trail	Along Tumalo Irrigation Line
1	Deschutes River Trail	F	1 a	700			X		X				X			7.1	\$14	\$9,576		Sawyer Park Spur	"West" of River
1	Deschutes River Trail	F	1 a B	100			X		X								\$0			River Xing @ Sawyer Park	Existing Bridge across river
1	Deschutes River Trail	F	1 b	800			X		X								\$0			Sawyer Park Spur	"East" of River
1	Deschutes River Trail	G		1,900			X		X								\$0			Kirkaldy Ct - Awbrey Mdws	Along street system
1	Deschutes River Trail	H	X	7,300			X			X			X			6	\$6	\$44,895		N. of Awbrey Meadows	To North URB
				1	:	86,850 ft.	16.4 mi.														
2	Century Drive Trail	A		9,750			X		X								\$0			Simpson, Colorado & Century	Shevlin Hixon - Mamouth Dr
2	Century Drive Trail	A	1	1,400			X			X	X						\$0			Reed Mkt. Road	Century Dr. - River Trail
2	Century Drive Trail	A	2	1,800			X			X	X						\$0			Mt. Bachelor Village	Century Dr. - River Trail
2	Century Drive Trail	B	X	5,100			X		X				X			7.1	\$14	\$69,771		Century Drive	Mamouth Dr. - Bachelor View
2	Century Drive Trail	C	X	1,600			X		X	X	X		X			8	\$16	\$26,044		Century Drive	Bachelor View to UGB
				2	:	19,650 ft.	3.72 mi.														

Primary Trails

	<u>Primary Trail:</u>	<u>Segment</u>	<u>Proposed</u>	<u>Length: (Feet)</u>	<u>Type:</u>	<u>Roadway</u>	<u>Trail</u>	<u>R.O.W.: (Existing)</u>	<u>Public</u>	<u>Private</u>	<u>Easement</u>	<u>Improvement Need</u>	<u>Public</u>	<u>Private</u>	<u>Improvement Cost:</u>	<u>Segment Type</u>	<u>Unit Cost per LF</u>	<u>Public Cost</u>	<u>Private Cost</u>	<u>Location:</u>	<u>Other Comments:</u>
3	Broken Top - South	A		1,400			X			X	X						\$0			Metolius Drive	Mt. Washington Dr - Skyline Pk
3	Broken Top - South	B	X	1,400			X		X				X			8	\$16	\$22,789		Trail	West side of Cascade M.S.
3	Broken Top - South	C		1,400			X			X	X						\$0			Subdivision Streets	
3	Broken Top - South	D	X	1,350			X			X	X		X			7	\$7	\$9,319		Trail	
3	Broken Top - South	E	X	3,750			X			X				X		8	\$16		\$61,042	Trail	Access to Alpine Pk/USFS Trail
3	Broken Top - South	F	X	3,750			X			X				X		9	\$24		\$89,167	Trail	Access to Alpine Pk/USFS Trail
				<b>3</b>	:	<b>13,050</b>	<b>ft.</b>	<b>2.47</b>	<b>mi.</b>												
4	Broken Top - North	A	X	500			X		X	X			X			---	---		Easement*	Overturf Reservoir Road	
4	Broken Top - North	B		6,800			X		X								\$0			Overturf Butte Trail	to west of Mt. Washington Dr.
4	Broken Top - North	B	1	700			X		X	X	X						\$0			East side of Butte	Trail Access from 17th St.
4	Broken Top - North	C		7,500			X		X	X							\$0			Trail	from City limits to UAR
				<b>4</b>	:	<b>15,500</b>	<b>ft.</b>	<b>2.94</b>	<b>mi.</b>												
5	Skyliners Road Trail	A		4,850			X		X								\$0			N. side of Skyliners Rd.	Existing paved trail
5	Skyliners Road Trail	B	X	900			X		X				X			10	\$55	\$49,879	\$49,879	N. side of Skyliners Rd.	West of Mt. Wash. Drive
5	Skyliners Road Trail	C	X	1,400			X		X				X			8	\$16	\$22,789	\$22,789	S. side of Skyliners Rd.	West of Mt. Wash. Drive
5	Skyliners Road Trail	D		5,550			X		X	X							\$0			S. side of Skyliners Rd.	West of Mt. Wash. Drive
				<b>5</b>	:	<b>12,700</b>	<b>ft.</b>	<b>2.41</b>	<b>mi.</b>												
6	West Bend Trail	A	X	1,000			X		X				X			8	\$16		\$16,278	West Bend	Trail: Summit HS Trail to W. UGB
6	<b>West Bend Trail</b>		X	<b>9,000</b>			X		X				X			8	\$16		<b>\$146,500</b>	<b>West Trail location TBD</b>	<b>Trail: West UGB to Shevlin Pk</b>
				<b>6</b>	:	<b>10,000</b>	<b>ft.</b>	<b>1.89</b>	<b>mi.</b>												
7	Summit H.S. Trail	A	X	300			X		X				X			10	\$55		\$16,626	Trail	Skyliners to H.S.
7	Summit H.S. Trail	B		2,100			X		X								\$0			Trail	East side of H.S.
7	Summit H.S. Trail	C	X	2,250			X		X				X			10	\$55		\$124,698	Trail	NW Crossing Drive to north
7	Summit H.S. Trail	D		1,100			X		X	X							\$0			Trail connect. to Shev. Pk. Rd.	West Side of COCC property
				<b>7</b>	:	<b>5,750</b>	<b>ft.</b>	<b>1.09</b>	<b>mi.</b>												
8	COCC - Shevlin Park	A	X	1,800			X		X	X			X	X		9	\$24	\$38,520	\$4,280	S. side of COCC	N side of Shev.Pk Rd/Trail (E)
8	COCC - Shevlin Park	B	X	2,800			X		X				X			3	\$83	\$233,230		Trail	College Way - Trail #7
8	COCC - Shevlin Park	C		7,900			X		X	X	X						\$0			S. side of Shev.Pk Road	From #7 - Shevlin Park
8	COCC - Shevlin Park	C	<b>B</b>	50			X		X								\$0			Creek Xing @ Shevlin Park	Existing <b>Bridge</b> over creek
				<b>8</b>	:	<b>12,550</b>	<b>ft.</b>	<b>2.38</b>	<b>mi.</b>												
9	Tumalo Creek Trail	A		4,650			X		X								\$0.00			Shevlin Park Trail	In park
9	Tumalo Creek Trail	B	X	7,700			X		X				X	X		4	\$0.13	\$963	\$963	Shevlin Park Trail	In and out of park
9	Tumalo Creek Trail	C	X	6,350			X		X				X			6	\$6.15	\$39,053		Tumalo Ck. To URB	
				<b>9</b>	:	<b>18,700</b>	<b>ft.</b>	<b>3.54</b>	<b>mi.</b>												
10	<b>Buck Drive Trail</b>		X	<b>4,000</b>			X		X				X			10	\$55		<b>\$221,685</b>	<b>Buck Dr. Trail Location TBD</b>	<b>Putnam Rd to Buck Drive</b>
10	Buck Drive Trail	<b>B</b>	X	200			X		X				X			13	\$1,414	\$282,852		Creek Xing @ Buck Drive	<b>New Bridge across Tumalo Creek</b>
				<b>10</b>	:	<b>4,200</b>	<b>ft.</b>	<b>0.8</b>	<b>mi.</b>												
11	North Parkway Trail	A	X	5,000			X		X	X			X	X		10	\$55	\$277,106	\$277,106	West side of Parkway	Butler Mkt to Empire
11	North Parkway Trail	B	X	500			X		X				X			3	\$83	\$41,648		Parkway Crossing	Empire Avenue St. frontage
11	North Parkway Trail	C	X	1,900			X		X				X			10	\$55	\$105,300		East side of Parkway	Empire to Nels Anderson Rd.
11	North Parkway Trail	D		2,900		X			X								\$0			Nels Anderson Rd.	From end of trail to H97
				<b>11</b>	:	<b>10,300</b>	<b>ft.</b>	<b>2.0</b>	<b>mi.</b>												

Primary Trails

	• <u>Primary Trail:</u>	• <u>Segment</u>	• <u>Proposed</u>	• <u>Length (Feet)</u>	• <u>Type:</u>	Roadway	Trail	• <u>R.O.W.: (Existing)</u>	Public	Private	Easement	• <u>Improvement Need</u>	Public	Private	• <u>Improvement Cost:</u>	Segment Type	Unit Cost per LF	Public Cost	Private Cost	• <u>Location:</u>	• <u>Other Comments:</u>
12	Old Pilot Butte Canal	A	X	1,900			X		X	X			X			7.1	\$14	\$25,993		Canal ditch rider road	Tr #13 - N. edge of Basalt Bus Pk
12	Old Pilot Butte Canal	B	X	1,200			X		X				X			7.1	\$14	\$16,417		Canal ditch rider road	Basalt Bus. Pk. - Empire
12	Old Pilot Butte Canal	C	X	1,800			X		X	X			X			7.1	\$14	\$24,625		Canal ditch rider road	Empire - Yeoman
12	Old Pilot Butte Canal	D	X	6,950			X		X				X			7.1	\$14	\$95,079		Canal ditch rider road	Yeoman - Juniper Ridge
12	Old Pilot Butte Canal	E	X	6,000			X	X					X			7.1	\$14	\$82,083		Canal ditch rider road	Through Juniper Ridge Phase I.
		12	:	17,850 ft.			3.38 mi.														
13	North Unit Canal	A	X	1,200			X		X				X			10	\$55		\$66,506	River's Edge - River Frontage	Section Along G.C. & Conv Cntr
13	North Unit Canal	A	B	X	1,000		X		X				X			12	\$1,271		\$1,271,259	River's Edge - River Frontage	Boardwalk Section Along G.C.
13	North Unit Canal	B	X	1,800			X	X	X	X			X	X		11	\$68	\$122,258	\$122,258	Mt Wash./Butler Mkt to RR	10' - S/W along roadway
13	North Unit Canal	C	X	5,150			X		X	X			X			7.1	\$14	\$70,455		Canal ditch rider road	RR to West of Brinson
13	North Unit Canal	D	X	1,900			X		X	X			X			7.1	\$14	\$25,993		Canal ditch rider road	W. of Brinson - E. of Brinson
13	North Unit Canal	E	X	1,600			X		X				X			7.1	\$14	\$21,889		Canal ditch rider road	E. of Brinson - W. of Purcell
13	North Unit Canal	F	X	3,200			X	X					X			7.1	\$14	\$43,778		Canal ditch rider road	Pine Nursery Frontage
13	North Unit Canal	G	X	7,150			X		X				X			7.1	\$14	\$97,816		Canal ditch rider road	Desch. Mkt Rd. to North East
		13	:	23,000 ft.			4.36 mi.														
14	Larkspur Trail	A	X	1,800			X		X				X			3	\$83	\$149,933		Reed Mkt. Road	S/W. fr W. of RR to Larkspur Pk
14	Larkspur Trail	B	X	500			X		X				X			10	\$55	\$27,711		Larkspur Park	W. side of Senior Center
14	Larkspur Trail	C	X	4,950			X		X	X			X			10	\$55	\$274,335		Larkspur Trail	Larkspur Park to Bear Crk Rd.
14	Larkspur Trail	D		5,800			X		X								\$0			Br Ck Rd & 15th Street	Trail S. of Br. Ck - Pilot Butte Pk
14	Larkspur Trail	E	X	1,800			X		X				X			10	\$55	\$99,758		Pilot Butte M. S.	Pilot Butte Pk - Neff Road
14	Larkspur Trail	F		500		X			X								\$0			Eastwood Drive	Neff Road - Shepard Road
14	Larkspur Trail	G	X	1,300			X		X				X			8	\$16	\$21,161		Trail along Lateral Corridor	Shepard Road - Hollinghead Pk
		14	:	16,650 ft.			3.15 mi.														
15	Coyner Trail	A	X	1,400			X		X				X			10	\$55		\$77,590	East of 15th Street	Pinewood Park - 15th Street
15	Coyner Trail	B	X	3,500			X		X				X			10	\$55	\$193,974		W. of 15th St/N. of Wilson	Ponderosa Pk/Bear Crk School
15	Coyner Trail	C	X	1,600			X		X	X			X			10	\$55	\$88,674		East of 9th	Franklin Ave - Bear Crk School
15	Coyner Trail	D		700			X		X								\$0			East of 9th	Franklin Ave - Bear Crk School
		15	:	7,200 ft.			1.36 mi.														
16	Big Sky Park Trail	A	X	1,800			X		X	X			X			7.1	\$14	\$24,625		Canal ditch rider road	East Canal Trail to Big Sky Park
16	Big Sky Park Trail	B	X	4,450			X		X				X			7.1	\$14		\$60,878	Canal ditch rider road	East Canal Trail to Big Sky Park
16	Big Sky Park Trail		X	5,000			X		X				X			7.1	\$14		\$68,403	Trail location TBD	East side trail to Big Sky Park
16	Big Sky Park Trail	D		2,800			X		X								\$0			Canal ditch rider road	East Canal Trail to Big Sky Park
		16	:	14,050 ft.			2.7 mi.														
17	East Bend Canal Trail	A	X	1,400			X		X				X			7.1	\$14		\$19,153	Canal ditch rider road	Trail East of 27th Street
17	East Bend Canal Trail	B		850			X		X	X							\$0			Canal ditch rider road	Trail East of 27th Street
17	East Bend Canal Trail		X	(undefined)			X		X	X			? ?			7.1	\$14			Trail location TBD	Trail heading east of Bend
		17	:	2,250 ft.			0.43 mi.														
18	COID Canal - South	A	X	7,650			X		X	X			X			7.1	\$13.68	\$104,656		Canal ditch rider road	Deschutes River - Brookwood
18	COID Canal - South	A	1	X	1,250		X		X	X			X			7.1	\$13.68	\$17,101		Canal ditch rider road	Deschutes R. Spur to Power Hse
18	COID Canal - South	A	2	X	3,400		X		X	X			X			7.1	\$13.68	\$46,514		Canal ditch rider road	Trail #18.a - Brookwood
18	COID Canal - South	B	X	1,250			X	X					X			3	\$83	\$104,120		Blakely Road	10' S/W along old Blakely Road

# Primary Trails

Primary Trail:	Segment	Proposed	Length: (Feet)	Type:	Roadway	Trail	R.O.W.: (Existing)	Public	Private	Easement	Improvement Need	Public	Private	Improvement Cost:	Segment Type	Unit Cost per LF	Public Cost	Private Cost	Location:	Other Comments:
18 COID Canal - South	C	X	3,200			X			X	X		X			7.1	\$13.68	\$43,778		Canal ditch rider road	Blakely Rd. - 3rd Street
18 COID Canal - South	D	X	1,050			X		X				X			2	\$41.71	\$43,796		Third Street/Brosterhaus	COID Canal - COID Canal
18 COID Canal - South	E	X	5,800			X			X	X		X			7.1	\$13.68	\$79,347		Canal ditch rider road	Brosterhaus - RR
18 COID Canal - South	F	X	4,050			X			X			X			7.1	\$13.68	\$55,406		Canal ditch rider road	RR - 15th Street
18 COID Canal - South	G	X	2,100			X		X				X			7.1	\$13.68	\$28,729		Canal ditch rider road	15th Street - Ferguson
18 COID Canal - South	H	X	5,800			X			X			X			7.1	\$13.68	\$79,347		COID Canal: Ferguson-27th	
<b>18</b>			<b>35,550</b>	<b>ft.</b>		<b>6.73</b>	<b>mi.</b>													
19 High Desert Pk Trail	A	X	3,600			X			X			X			10	\$55		\$199,517	Trail	To High Desert Park
19 High Desert Pk Trail	B	X	2,650			X		X				X			10	\$55		\$146,866	Trail	To High Desert Park
19 High Desert Pk Trail	C		3,000			X		X								\$0			Trail	To High Desert Park
19 <i>High Desert Pk Trail</i>	<i>(E-W)</i>	<i>X</i>	<i>2,650</i>			<i>X</i>		<i>X</i>				<i>X</i>			10	<i>\$55</i>		<i>\$146,866</i>	<i>Trail location TBD</i>	<i>To High Desert Park</i>
19 <i>High Desert Pk Trail</i>	<i>(N-S)</i>	<i>X</i>	<i>2,200</i>			<i>X</i>		<i>X</i>				<i>X</i>			10	<i>\$55</i>	<i>\$121,927</i>		<i>Trail location TBD</i>	<i>To High Desert Park</i>
<b>19</b>			<b>14,100</b>	<b>ft.</b>		<b>2.67</b>	<b>mi.</b>													

NOTES: 1. *Italic* distances used for rough estimating purposes only. Actual approved alignment distances may differ.

2. *TBD* = To Be Determined

Total All Regional Trails = 64 mi.

\* Cost of Securing a Public Use Easement Not Included

E = River East  
 W = River West  
 B = Bridge  
 B = Boardwalk

Total Length of Regional Trail System (miles) =	64	miles
Regional Total Public Cost Estimate =	\$4,778,685	54%
Regional Total Private Cost Estimate =	\$4,019,900	46%
Regional Total All =	\$8,798,586	100%

*Brown Text* = Trail Alignments to be determined by subsequent 'Master Planning' for the affected areas when they are annexed into the Urban Growth Boundary area.

Surface Type	
	: Native (blue)
	: Alternative (orange)
	: Hard (pink)

Improvement Type Code:

Lookup Table

Type #	Cost per LF
0	\$0.00
1	\$0.13
2	\$42
3	\$83
4	\$0.13
5	\$1.15
6	\$6
7	\$7
7.1	\$14
8	\$16
9	\$24
10	\$55
11	\$68
12	\$1,271
13	\$1,414
14	\$1,907
15	\$2,121
16	\$3,808
17	\$52
17.1	\$8

# **APPENDIX G**

## **Future Public Transit System**

A preliminary cost estimate was prepared to assess the possible costs of expanding the public transportation system. A general summary of the system expansion components is provided below.

#### Enhancements to Existing Routes

- Add 2 hours of additional service in the evenings for all routes (1-6 and 11)
- Add 3.5 hours of additional service in the evenings on Saturday for routes 1-6

#### New Routes

- Add 6 new routes in Bend providing the same level of service provided on routes 1-6 (the tentative alignments for the new routes are shown on Figure G-1)

#### New Intercity Routes

- Provide A.M. and P.M. peak period service to Redmond, Sisters, and Prineville. (Note: Service to La Pine was not included because a non-profit is currently providing transit service to/from the La Pine area. It is assumed that service will continue into the future.)

#### Capital Expenses

- New heavy duty diesel-electric buses to serve the new routes in Bend
- New diesel buses to serve the inter-city routes
- Improvements to existing park-and-ride facilities
- New park-and-ride facilities
- New central transit/transfer station
- Installation of benches and signage at some transit stops
- Installation of covered shelters at high-use transit stops

A summary of the costs to provide these additional services is provided in Table G-1.

**Table G-1: Expanded Public Transportation Cost Estimate**

Year	Enhanced City Operations	New City Operations	New Intercity Operations	Rolling Stock New City Service	Rolling Stock Intercity Service	Other Capital	Total
2008	\$235,400	\$1,366,800	\$373,200	\$3,360,000	\$600,000	\$348,500	\$6,283,900
2009	\$244,800	\$1,421,500	\$388,100			\$359,000	\$2,413,400
2010	\$254,600	\$1,478,400	\$403,600			\$369,800	\$2,506,400
2011	\$264,800	\$1,537,500	\$419,700			\$380,900	\$2,602,900
2012	\$275,400	\$1,599,000	\$436,500			\$392,300	\$2,703,200
2013	\$286,400	\$1,663,000	\$454,000			\$404,100	\$2,807,500
2014	\$297,900	\$1,729,500	\$472,200			\$416,200	\$2,915,800
2015	\$309,800	\$1,798,700	\$491,100		\$744,000	\$428,700	\$3,772,300
2016	\$322,200	\$1,870,600	\$510,700			\$441,600	\$3,145,100
2017	\$335,100	\$1,945,400	\$531,100			\$454,800	\$3,266,400
2018	\$348,500	\$2,023,200	\$552,300				\$2,924,000
2019	\$362,400	\$2,104,100	\$574,400				\$3,040,900
2020	\$376,900	\$2,188,300	\$597,400	\$4,972,800			\$8,135,400
2021	\$392,000	\$2,275,800	\$621,300				\$3,289,100
2022	\$407,700	\$2,366,800	\$646,200		\$922,600		\$4,343,300
2023	\$424,000	\$2,461,500	\$672,000				\$3,557,500
2024	\$441,000	\$2,560,000	\$698,900				\$3,699,900
2025	\$458,600	\$2,662,400	\$726,900				\$3,847,900
2026	\$476,900	\$2,768,900	\$756,000				\$4,001,800
2027	\$496,000	\$2,879,700	\$786,200				\$4,161,900
2028	\$515,800	\$2,994,900	\$817,600				\$4,328,300
2029	\$536,400	\$3,114,700	\$850,300		\$1,144,000		\$5,645,400
2030	\$557,900	\$3,239,300	\$884,300				\$4,681,500
Totals	\$8,620,500	\$50,050,000	\$13,664,000	\$8,332,800	\$3,410,600	\$3,995,900	\$88,073,800

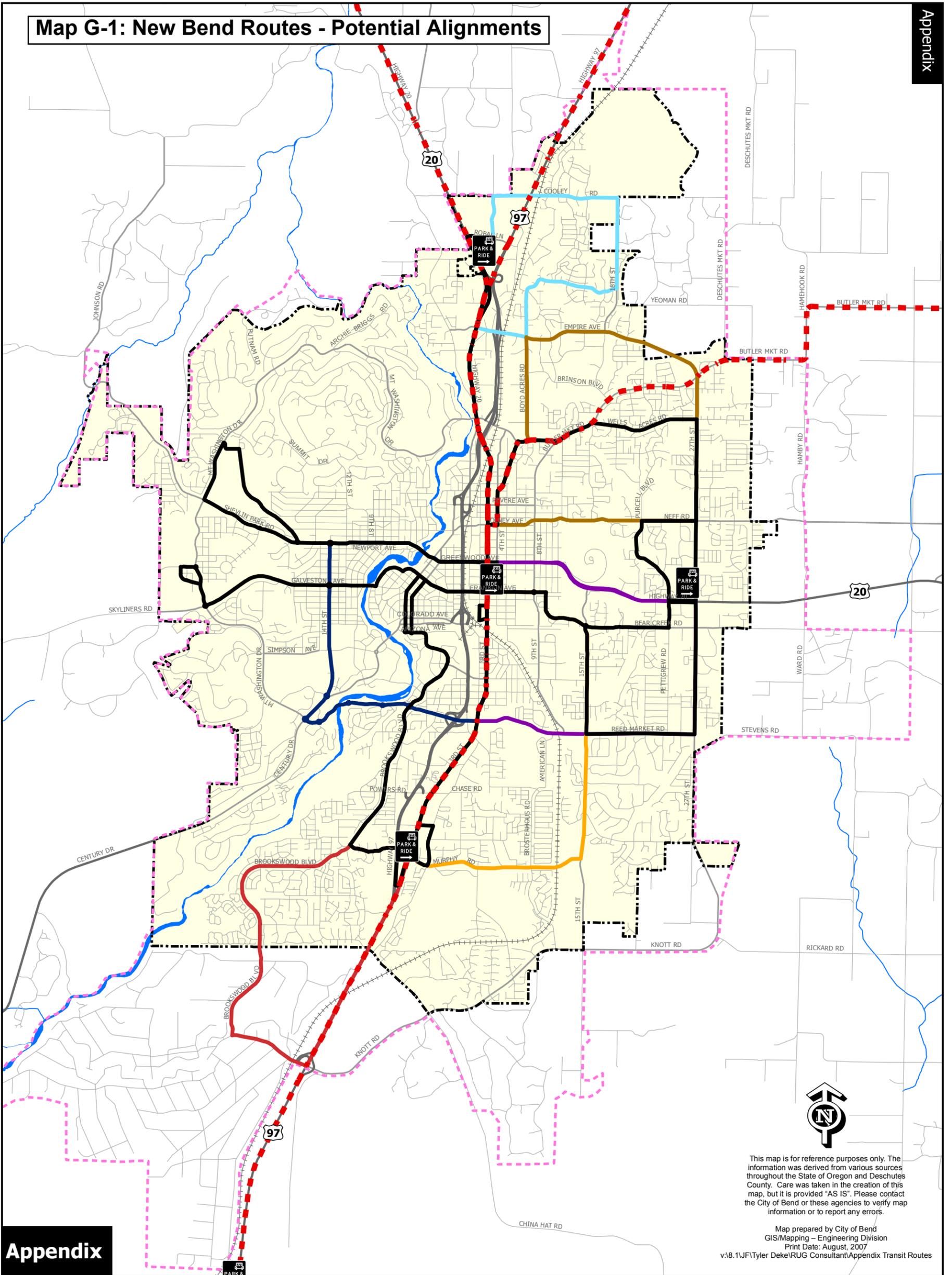
**Notes**

Cost calculations do not include the costs to maintain the existing service levels

Assumes 4% annual inflation rate

"Other" capital costs (park-and-ride lots, transit center, stop improvements) are spread over 10-year period

# Map G-1: New Bend Routes - Potential Alignments



Appendix

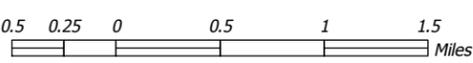
This map is for reference purposes only. The information was derived from various sources throughout the State of Oregon and Deschutes County. Care was taken in the creation of this map, but it is provided "AS IS". Please contact the City of Bend or these agencies to verify map information or to report any errors.

Map prepared by City of Bend  
 GIS/Mapping - Engineering Division  
 Print Date: August, 2007  
 v\18.1\JFT\tyler Deke\RUG Consultant\Appendix Transit Routes

## Bend MPO Potential Future Transit Routes

August 2007

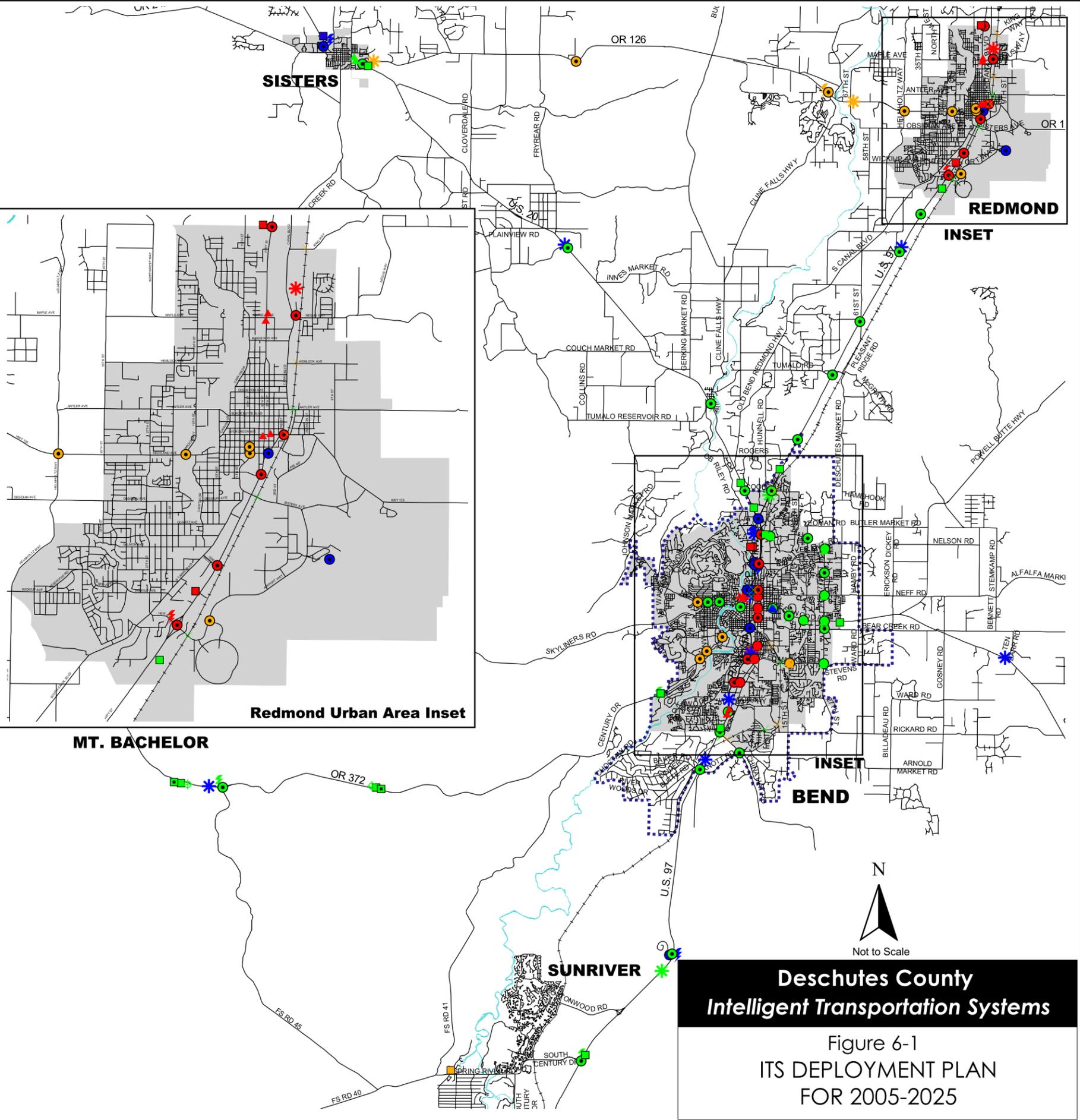
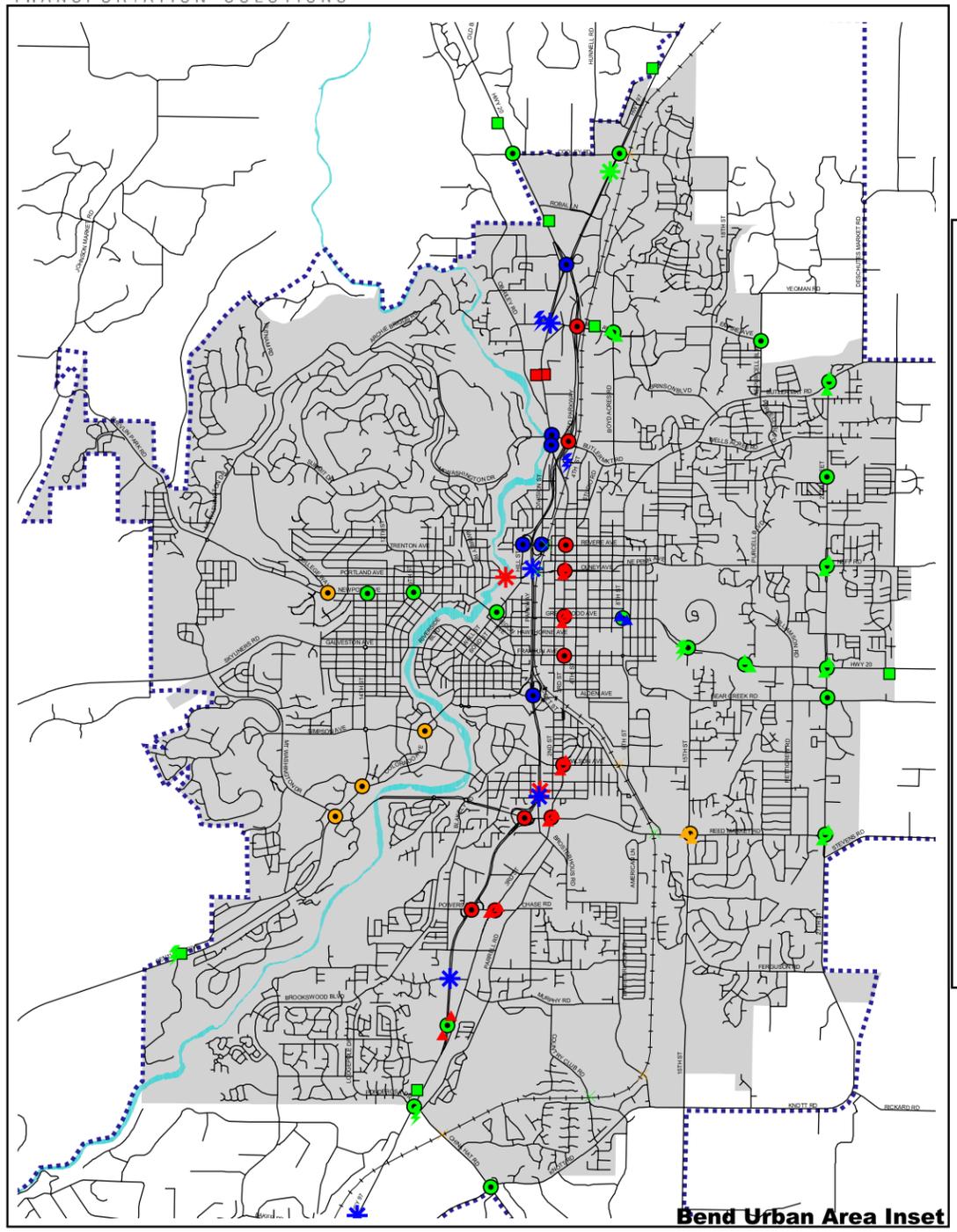
Data sources include:  
 City of Bend  
 Deschutes County GIS  
 ODOT  
 DKS Associates



- Legend**
- - - Out of Area Routes
  - Existing Routes
  - Proposed 14th St Route
  - Proposed Neff Route
  - Proposed Pinebrook-Brookwood Route
  - Proposed Murphy-Brosterhouse Route
  - Proposed Reed Market Route
  - Proposed Boyd Acres Route
  - Proposed Park "n Ride Sites
  - Highway/Expressway
  - Arterial/Collector/Local
  - - - - - Railroad
  - - - - - MPO Boundary
  - Bend Urban Growth Boundary
  - City Limits
  - Streams
  - ~ River

# **APPENDIX H**

## **Deschutes County ITS Plan Project Map**



**LEGEND**

	Railroads		ITS Equipment
	Bend MPO Boundary		Variable Message Sign
<b>Device Phasing</b>			Weather Station
	Existing		Automated Traffic Recorder
	Proposed 0-5 Years		Count Stations
	Proposed 6-10 Years		Advanced Rail Warning System
	Proposed 11-20 Years		Dynamic Speed Limit Sign
			Speed Photo Enforcement

**Deschutes County  
Intelligent Transportation Systems**

Figure 6-1  
ITS DEPLOYMENT PLAN  
FOR 2005-2025

# APPENDIX I

## Environmental Considerations

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Tim Berg, GIS, Deschutes County  
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Steve Marx, Oregon Department of Fish and Wildlife  
Chris Carey, Oregon Department of Fish and Wildlife  
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Letha Sanderson, Oregon Parks and Recreation Department  
Kyle Gorman, Oregon Water Resources Department  
Nancy Gilbert, US Fish and Wildlife Service  
Molly Chaudet, US Forest Service  
Robin Gyorgyfalvy, US Forest Service

# Appendix I-1: SAFETEA-LU

**Federal Register Friday, June 9, 2006 Part II**  
**Department of Transportation, Federal Highway Administration**  
**23 CFR Parts 450 and 500**  
**Federal Transit Administration**  
**49 CFR Part 613**  
**Statewide Transportation Planning; Metropolitan Transportation Planning;**  
**Proposed Rule**

**PUBLIC LAW 109–59—AUG. 10, 2005**  
**SAFE, ACCOUNTABLE, FLEXIBLE, EFFICIENT TRANSPORTATION EQUITY ACT:**  
**A LEGACY FOR USERS**

## **§ 5303. Metropolitan transportation planning**

(i) DEVELOPMENT OF TRANSPORTATION PLAN.—

(2) TRANSPORTATION PLAN. — A transportation plan under this section shall be in a form that the Secretary determines to be appropriate and shall contain, at a minimum, the following:

(B) MITIGATION ACTIVITIES.—

(i) IN GENERAL. — A long-range transportation plan shall include a discussion of types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the plan.

(ii) CONSULTATION. — The discussion shall be developed in consultation with Federal, State, and tribal wildlife, land management, and regulatory agencies.

(4) CONSULTATION.—

(A) IN GENERAL.—In each metropolitan area, the metropolitan planning organization shall consult, as appropriate, with State and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation concerning the development of a long-range transportation plan.

(B) ISSUES. — The consultation shall involve, as appropriate—

(i) comparison of transportation plans with State conservation plans or maps, if available; or

(ii) comparison of transportation plans to inventories of natural or historic resources, if available.

#### **§ 450.104 Definitions.**

*Environmental mitigation activities means* strategies, policies, programs, actions, and activities that, over time, will serve to avoid, minimize, rectify, reduce, or compensate for (by replacing or providing substitute resources) the impacts to or disruption of elements of the human and natural environment associated with the implementation of a long-range statewide transportation plan or metropolitan transportation plan. The human and natural environment includes, for example, neighborhoods and communities, homes and businesses, cultural resources, parks and recreation areas, wetlands and water sources, forested and other natural areas, agricultural areas, endangered and threatened species, and the ambient air. The environmental mitigation strategies and activities are intended to be regional in scope, even though the mitigation may address potential project-level impacts. The environmental mitigation strategies and activities must be developed in consultation with Federal, State, and Tribal wildlife, land management, and regulatory agencies during the statewide and metropolitan transportation planning processes and be reflected in all adopted transportation plans.

#### **§ 450.322 Development and content of the metropolitan transportation plan.**

(f) The metropolitan transportation plan shall, at a minimum, include:

(7) A discussion of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the metropolitan transportation plan. The discussion shall be developed in consultation with Federal, State, and Tribal land management, wildlife, and regulatory agencies. The MPO may establish reasonable timeframes for performing this consultation;

(g) The MPO shall consult, as appropriate, with State and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation concerning the development of the transportation plan. The consultation shall involve, as appropriate:

(1) Comparison of transportation plans with State conservation plans or maps, if available; or

(2) Comparison of transportation plans to inventories of natural or historic resources, if available.

Environmental mitigation activities means strategies, policies, programs, actions, and activities that, over time, will serve to avoid, minimize, rectify, reduce, or compensate for (by replacing or providing substitute resources) the impacts to or disruption of elements of the human and natural environment associated with the implementation of a long-range statewide transportation plan or metropolitan transportation plan. The human and natural environment includes, for example, neighborhoods and communities, homes and businesses, cultural resources, parks and recreation areas, wetlands and water sources, forested and other natural areas, agricultural areas, endangered and threatened species, and the ambient air. The environmental mitigation strategies and activities are intended to be regional in scope, even though the mitigation may address

potential project-level impacts. The environmental mitigation strategies and activities must be developed in consultation with Federal, State, and Tribal wildlife, land management, and regulatory agencies during the statewide and metropolitan transportation planning processes and be reflected in all adopted transportation plans.

## Appendix I-2: CETAS Meeting Minutes

### CETAS Draft Technical Meeting Notes

May 15, 2007

Flanders Building – Room 228  
123 NW Flanders, Portland

#### Members (in attendance):

Hal Gard, ODOT	Susan Haupt, ODOT	Michelle Eraut, FHWA
Yvonne Vallette, EPA	Charlotte Kucera, NMFS	David Leal, USFWS
Joyce Cohen, ODOT	Eric Metz, DSL	Michael Turaski, USACE
Corey Saxon, DEQ	Mollie Manion, SHPO	Art Marin, ODFW

#### Guests:

Rod Thompson, ODOT	Dan Ferke, ODOT	Tim Burkhardt, CH2MHILL
Susan Whitney, ODOT	John Raasch, ODOT	Mike Baker, ODOT
John Wiebke, DEA	Jerry Marmon, ODOT	Barbara Fraser, ODOT
Greg Holthoff, ODOT	Patti Caswell, ODOT	Claire Carder, ODOT
Tyler Deke, Bend MPO	Darcy McNamara, Consultant	Emily Moshofsky, ODOT
Ron Weinman, Clackamas County	Larry Conrad, Clackamas County	Linda Wannamaker, Wannamaker Consulting
Kay Van Sickle, Otak	Isaac Sanders, ODFW	

**Meeting Facilitator:** Susan Haupt, ODOT

**Note Taker:** Donette Miranda, HDR

*Excerpt from minutes:*

**Agenda Item:** Bend MPO Long-Range Plan Consultation

**Lead:** Tyler Deke, Bend MPO

#### Handouts:

General Data, PowerPoint Presentation, Draft Environmental Considerations Chapter Report Structure, and Maps

#### Notes:

Tyler Deke (Bend MPO) gave an overview of the Bend area.

#### Historic

- Native American encampments along Deschutes River
- High desert vegetation
- US Forest Service and National Monument land

- City of Bend incorporated in 1904

#### Current

- Low density urban
- Small farms and ranches

#### Bend MPO

- Second smallest in the state
- Member Agencies
  - City of Bend
  - Deschutes County
  - ODOT

David asked if the City of Redmond will be added at some point. Tyler stated that Redmond would not meet the population density criteria, but could under the Deschutes County designation. Bend is currently undergoing a major UGB expansion. The MPO boundary will need to expand to accommodate.

A TSP is not adopted. The area is not within an air quality nonattainment area, plan updates are required every five years. The plan will be adopted then revised to reflect the Bend UGB expansion. The expansion will impact which projects have funding.

There has been a lot of data collection and map development. Now analysis and impact discussion is occurring.

The product is map based. Each section will have a summary, methodology, findings, and mitigation options.

#### Bend:

- High desert
- Deschutes River
- Cascades
- Rain/snow precipitation

The community visioning process has been completed. There are site specific documents and plans. Used bend UGB study area as the study area boundary.

Utilities will be added to the zoning map if possible.

An NPDES permit was obtained in January. Stormwater was discharged directly into the Deschutes and underground with little or no treatment. Drainage is becoming a big issue. Impervious surface areas are being calculated. TMDLS are due in 2008, so they will not be included in this planning project. Any retrofits will have to comply with the new standards. The potential for hazardous material issues is significant. Could have major groundwater contamination. Data points are from an original set that has not been ground truthed and is not very accurate. The second is from a set that is being ground truthed and is accurate.

The drill holes do not contribute too much to the Deschutes baseflow. Stormwater may have an impact, but how much is unknown. Stormwater is going to a shallow aquifer on top of the drinking water.

Portions of the Deschutes is 303(d) listed for temperature, pH, DO, and chlorophyll A. The main reason is due to flow regime. The Deschutes has five irrigation diversions. Flow is low from April to October, which is when the issues occur, particularly temperature issues. Tumalo Creek is to the northwest . About 30 to 40 percent of the households are on septic (approximately 8,000 to 12,000 households. There are plans to get households on sewer.

Irrigation service areas do not service all areas. Canals are dry from October to April. There are four dams and five diversions in the area. Diversions started construction in 1901. The city was incorporated in 1904. In 1906 fish were plentiful. In 1912 hatcheries were being built to replenish the fisheries. Dams were in place by 1920. Fish passage is spotty. One dam is 35 feet tall with no fish ladder and there is not great fish ladder potential. One diversion has a good fish screen. All have some element to prevent fish from getting into the canals, but with varying degrees of success.

Bull trout were historically present, but not currently. Native redband trout are present and brook trout and brown trout have been introduced. Art stated that Steelhead Falls precludes anadromous fish migration. He suggested the team use Streamnet data. David stated that there is bull trout critical habitat. Data can be obtained from the USFWS website. Art stated that there is no EFH there.

There are no upland wetlands. All wetlands are associated with the river and riparian areas. NWI data was used for the county as LWI data was not available. Areas of special interest include rock outcroppings under Goal 5 and rivers of special interest. Buffers vary from 30 to 100 feet. The deer and elk range is from the county. They tend to not enter the city. The Open Space Conservation zone has air and water regulations and unique qualities. Bull trout and eagle are the two species with recovery plans. Spotted frog is in the county, as are bats and sage grouse. There may be lamprey and mussels.

There are no known listed plant species in the MPO. There are a lot of invasive species. David suggested they double check the eagle databases. Nesting sites are pretty well mapped out.

Approximately half the drinking water is from wells that are 300 feet or more deep. There are well protection areas. Water reallocation is being discussed in terms of drinking water capacity for anticipated future population. The bigger issue is outside of Bend. There is an issue in Prineville. Canals are now being lined to prevent leakage. There are three water providers in the city.

Fire evacuation routes are a serious issue. Access routes cannot be limited too much for fire evacuation. There are aggregate mines in the MPO area.

There have been attempts at filtration systems to filter stormwater. Soils in the area are very porous and water shoots through. Mazama ash is in the soil. Filtration ponds have been built on some impervious soils and ended up filling with stagnant waters and not draining. 75 percent of the deep aquifer is from snowmelt. There is interest in mapping the change in snow pack.

Air quality issues are from wood burning stoves and agricultural fires. The DEQ website showed that the area exceeded PM10 on one day last year, which did not trigger a designation. There is interest in additional monitoring throughout the region. Car testing is not required. There are wood burning stove regulations in Bend and standards have to be met. Wood burning stoves are rarely put in new construction. The area has minor inversion layers.

Scenic resources include the byway, state and federal waterways, and upland and water landscape management areas, which regulate scenic views.

There are two historic sensitivity areas, two historic districts downtown. SHPO will be contacted on a case by case basis. The Klamath, Burns Paiute, and Warm Springs tribes have been contacted.

There are parks, trails, parks 4(f), historic 6(f), refuges 4(f), and boat ramps 4(f) in the area. Susan stated that she can help the MPO determine which resources are 4(f) and 6(f).

The MPO has EJ layers, but not here. There are low-income populations, but they are not sure about minority populations yet.

A detailed analysis of how projects overlay on resources has not yet been done. A draft project map has been completed. The project list is fairly in alignment with the Bend and Deschutes TSPs. The only new projects are the connection between 27<sup>th</sup> and Empire, Murphy Road extension, and an access road into the Gopher Gulch area. There is interest in extending the road from Century Road up to Highway 20. Land use changes at the north end of the MPO will impact transportation systems. There will also be changes at the south end of the MPO, which will segment projects. The city is following the state's UGB process for expansion. Issues are coming down to transportation access and sanitary sewer. Sanitary sewer will dominate.

Initial findings include potential impact areas. Wildlife crossings will be a bigger issue if the MPO expands. Stormwater costs are not being estimated right now. There is a lot of discussion around cost estimates. A consultant has been hired. There are huge discrepancies in cost estimates.

The MPO is moving forward to collect additional data. Not all data is readily available or may be difficult to get it. Applying recovery plans on a localized basis can be challenging. The MPO does not have good data about where species on lists are

located or if they exist in or adjacent to the study area. Environmental resources have not been addressed at this level in the past, but more on a project or regional level.

**Questions/Comments:**

Charlotte stated that it appears no NMFS species are in this area due to upstream dams, which is unique among MPOs. She suggested that the MPO state that in the documentation. Eric said that there is local interest in reestablishing steelhead. Art said that steelhead will not be able to access this area. Yvonne asked if there was an LWI for Bend. Darcy McNamara (Consultant) said Bend does, but there are not any wetlands [*note: actual statement should be that there are no wetlands other than the identified wetlands in the riparian zone of the Deschutes River. There are identified NWI wetlands in the County (outside the city limits, but it is doubtful they are actually wetlands and are most likely mapping artifacts - dm.*] Michelle said that it would be helpful to include transportation projects, by phase, on some of the maps. Tyler said that they plan to by the final submission. Michelle mentioned that the public comment period will be open if resource agencies are interested. Tyler said that the MPO efforts are on the city website. The intention is to have a draft done by the first week of June and the comment period in June. Adoption will occur in late June, which will only meet federal requirements, not state requirements. Michelle stated that it was insightful to consider the UGB expansion and buffer. Tyler said it came to light when considering large mammal range issues. A lot of the UGB expansion area will be designated as urban reserve. Michelle said that an illustrative list might be beneficial to include on some of the maps. Barbara asked what the timeline was for the other part of the planning process. Tyler stated that the goal is to have the state compliance plan done by the end of the fiscal year. They have compiled a lot of data. It is a matter of how to package it and what it implies. May not do anything with the state compliance plan until the UGB expansion is finalized.

# Appendix I-3: Federally Listed Species in Deschutes County

## Federally Listed Threatened, Endangered, Proposed Candidate Species and Species of Concern Which May Occur Within Deschutes County, Oregon

### LISTED SPECIES<sup>1/</sup>

#### Mammals

Canada lynx<sup>2/</sup> *Felis lynx canadensis*  
T

#### Birds

Bald eagle<sup>3/</sup> *Haliaeetus leucocephalus*  
T

Northern spotted owl<sup>4/</sup> *Strix occidentalis caurina*  
CH T

#### Fish

Bull trout (Columbia River Basin)<sup>5/</sup> *Salvelinus confluentus*  
CH T

### PROPOSED SPECIES

None

### CANDIDATE SPECIES<sup>6/</sup>

#### Mammals

Pacific fisher<sup>7/</sup> *Martes pennanti pacifica*

#### Birds

Yellow-billed cuckoo *Coccyzus americanus*

#### Amphibians and Reptiles

Oregon spotted frog *Rana pretiosa*

### SPECIES OF CONCERN

#### Mammals

Pygmy rabbit *Brachylagus idahoensis*  
Pale western big-eared bat *Corynorhinus townsendii pallescens*  
California wolverine *Gulo gulo luteus*  
Silver-haired bat *Lasionycteris noctivagans*  
Small-footed myotis (bat) *Myotis ciliolabrum*  
Long-eared myotis (bat) *Myotis evotis*  
Long-legged myotis (bat) *Myotis volans*  
Yuma myotis (bat) *Myotis yumanensis*  
California bighorn *Ovis canadensis californiana*  
Prebles shrew *Sorex preblei*

#### Birds

Northern goshawk *Accipiter gentilis*  
Western burrowing owl *Athene cunicularia hypugea*  
Ferruginous hawk *Buteo regalis*  
Greater sage-grouse *Centrocercus urophasianus*

Black tern  
Olive-sided flycatcher  
Willow flycatcher  
Harlequin duck  
Yellow-breasted chat  
Lewis' woodpecker  
Mountain quail  
White-headed woodpecker

*Chlidonias niger*  
*Contopus cooperi*  
*Empidonax trailli adastus*  
*Histrionicus histrionicus*  
*Icteria virens*  
*Melanerpes lewis*  
*Oreortyx pictus*  
*Picoides albolarvatus*

#### Amphibians and Reptiles

Tailed frog  
Oregon slender salamander  
Cascades frog  
Northern sagebrush lizard

*Ascaphus truei*  
*Batrachoseps wrighti*  
*Rana cascadae*  
*Sceloporus graciosus graciosus*

#### Fishes

Pacific lamprey  
Interior redband trout

*Lampetra tridentata*  
*Oncorhynchus mykiss gibbsi*

#### Plants

Estes' artemisia  
Cliff paintbrush  
Cusick's erigonum  
Disappearing monkeyflower  
Little mousetail  
Peck's penstemon  
Howell's theylody

*Artemisia ludoviciana* ssp. *estesii*  
*Castilleja rupicola*  
*Eriogonum cusickii*  
*Mimulus evanescens*  
*Myosurus minimus* ssp. *apus* (= var. *sessiliflorus*)  
*Penstemon peckii*  
*Thelypodium howellii* ssp. *howellii*

(E) - Listed Endangered (T) - Listed Threatened (CH) - Critical Habitat has been designated for this species  
(PE) - Proposed Endangered (PT) - Proposed Threatened (PCH) - Critical Habitat has been proposed for this species  
Species of Concern - Taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.

\* Consultation with NOAA's National Marine Fisheries Service may be required.

<sup>1</sup> U.S. Department of Interior, Fish and Wildlife Service, October 31, 2000, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12

<sup>2</sup> Federal Register Vol. 65, No. 58, Mar 24, 2000, Final Rule - Canada lynx

<sup>3</sup> Federal Register Vol. 60, No. 133, July 12, 1995, - Final Rule - Bald Eagle

<sup>4</sup> Federal Register Vol. 57, No. 10, January 15, 1992, Final Rule - Critical Habitat for the Northern Spotted Owl

<sup>5</sup> Federal Register Vol. 63, No. 111, June 10, 1998, Final Rule - Columbia River and Klamath River Bull Trout

<sup>6</sup> Federal Register Vol. 69, No. 86, May 4, 2004, Notice of Review - Candidate or Proposed Animals and Plants

<sup>7</sup> Federal Register Vol. 69, No. 68, April 8, 2004, 12-Month Finding for a Petition to List the West Coast Distinct Population Segment of the Fisher

## Appendix I-4: Fish Listed in Deschutes County

### Fish Listed in Deschutes County

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Adjacent States
Oncorhynchus mykiss	Inland Columbia Basin redband trout	G5T4	S3	SOC	4	Bake, Croo, Desc, Gill, Gran, Harn, Jeff, Klam, Malh, Morr, Sher, Umat, Unio, Wall, Wasc	BM, BR, CB, EC, SP	ID, WA +
Salvelinus confluentus	Bull trout (Columbia River population)	G3T2Q	S2	LT	1	Bake, Desc, Doug, Gran, Harn, Hood, Jeff, Klam, Lane, Linn, Malh, Umat, Unio, Wall, Wasc	BM, CB, EC, WC, WV	ID, MT, WA

## Appendix I-5: Invertebrates Listed in Deschutes County

### Invertebrates Listed in Deschutes County

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
Anodonta californiensis	California floater (mussel)	G3	S1	SOC			2 Clatsop, Columbia, Coos?, Deschutes, Grant, Harney, Klamath, Linn, Malheur, Multnomah, Sherman, Wasco, Washington	BM, BR, CB, CR, EC, WC, WV	CA, ID, NV, WA +
Gonidea angulata	Western ridgemussel	G3	S2				2 Clackamas, Columbia, Deschutes, Harney, Klamath, Linn, Malheur, Marion, Multnomah, Wasco, Washington	BM, BR, CB, EC, WC, WV	CA, ID, NV, WA, BC
Margaritifera falcata	Western pearlshell	G4	S3				4 Benton, Clackamas, Clatsop, Coos, Crook, Deschutes, Douglas, Harney, Klamath, Lane, Lincoln, Linn, Marion, Polk, Sherman, Wasco, Washington, Wheeler	BM, BR, CB, CR, EC, WC, WV	CA, ID, NV, WA +
Juga hemphilli ssp. nov.	Indian Ford juga (snail)	G2T1	S1				1 Deschutes	EC	
Pristiloma arcticum crateris	Crater Lake tightcoil (snail)	G4T1	S1				1 Deschutes, Douglas, Jefferson, Klamath	EC, WC	

## Appendix I-6: Non-Vascular Plants in Deschutes County

### Non-Vascular Plants and Fungi Listed in Deschutes County

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Nardia japonica</i>	Liverwort	G5	S2			3	Desc, Hood	WC	WA +
<i>Tritomaria exsectiformis</i>	Liverwort	G5	S2			2	Desc, Doug, Jeff, Klam	WC	ID, WA +
<i>Bruchia bolanderi</i>	Moss	G2	S2			3	Clac, Desc, Klam, Lane	WC	CA, BC
<i>Buxbaumia aphylla</i>	Moss	G4G5	S2			3	Desc, Doug, Gran, Klam, Lane	BM, EC, WC	CA, WA, ID +
<i>Helodium blandowii</i>	Moss	G5	S2			2	Desc, Gran, Jack, Klam, Umat	BM, WC	CA, ID, WA +
<i>Tomentypnum nitens</i>	Moss	G5	S2			2	Desc, Jack, Klam, Lane	EC, WC	WA, MT +, N.E. North America, Europe, U.K., Scandinavia
<i>Chaenotheca furfuracea</i>	Lichen	G4G5	S3			3	Bent, Coos, Desc, Doug, Lane, Till	CR, KM, WC	WA, CA +
<i>Lecanora pringlei</i>	Lichen	G3	S2			3	Desc, Hood, Klam	WC	CA, WA
<i>Usnea sphacelata</i>	Lichen	G4	S1			3	Desc, Hood, Klam	WC	WA +, Mexico +, E North America, Iceland
<i>Brauniellula albipes</i>	Fungus	G3	S1			3	Clac, Desc, Hood, Jose	KM, WC	CA, ID, CO
<i>Cortinarius wiebeae</i>	Fungus	G2	S2			3	Desc, Wasc	WC	
<i>Elaphomyces subviscidus</i>	Fungus	G2G3	S1S2			3	Desc, Jack	WC	ID, AZ, Mexico
<i>Fevansia aurantiaca</i>	Fungus	G1	S1			3	Desc, Linn	WC	

Cont.

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Gastroboletus ruber</i>	Fungus	G3	S3			3	Bent, Clac, Desc, Hood, Jeff, Lane	CR, WC	CA, WA
<i>Gautieria magnicellaris</i>	Fungus	G3G5	SU			3	Desc	WC	CA, eastern N.A., Europe, Mexico
<i>Gyromitra californica</i>	Fungus	G4	S2			2	Clac, Desc, Doug, Hood, Jack, Klam, Linn	WC	CA, ID, WA, BC +
<i>Helvella crassitunicata</i>	Fungus	G3	S2			2	Desc, Hood, Lane	WC	WA
<i>Hydnotrya inordinata</i>	Fungus	G2	S2			3	Clac, Desc, Mari	WC	CA
<i>Polyzellus multiplex</i>	Fungus	G4	S3			4	Clac, Desc, Lane, Linn, Mari, Wasc	WC	CA, ID, WA +, north central & northeast N.A., Japan
<i>Rhizopogon atroviolaceus</i>	Fungus	G2G3	S2S3			3	Clac, Desc, Doug, Klam, Lane, Linn	WC	ID
<i>Rhizopogon flavofibrillosus</i>	Fungus	G2G3	S2			3	Curr, Desc, Doug, Jose, Lane	EC, KM, WC	CA, ID, MT
<i>Rhizopogon semireticulatus</i>	Fungus	G2?	S1			3	Desc	EC	WA
<i>Rhizopogon subpurpureus</i>	Fungus	G2?	S1			3	Desc, Hood, Jeff	EC, WC	ID

## Appendix I-7: Plants Listed in Deschutes County

### Plants Listed in Deschutes County

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Agoseris elata</i>	Tall agoseris	G4	S1			2	Clackamas, Deschutes, Hood River, Jefferson, Wasco	EC, WC	CA, WA
<i>Allium bisceptrum</i>	Two-stemmed onion	G4G5	S4			4	Crook, Deschutes, Grant, Harney, Klamath, Lake, Malheur	BM, BR	CA, ID+
<i>Arnica viscosa</i>	Shasta arnica	G4	S2			2	Deschutes, Douglas, Klamath	WC	CA
<i>Artemisia ludoviciana</i> ssp. <i>estesii</i>	Estes' artemisia	G5T2	S2	SOC		1	Crook, Deschutes, Jefferson	BM, EC	
<i>Astragalus peckii</i>	Peck's milk-vetch	G3	S3		LT	1	Deschutes, Klamath	BM, EC, WC	
<i>Botrychium pumicola</i>	Pumice grape-fern	G3	S3		LT	1	Deschutes, Klamath, Lake	EC, WC	CA
<i>Carex capitata</i>	Capitate sedge	G5	S2			2	Deschutes, Harney, Jackson, Klamath, Lake	BR, EC, WC	ID, NV, WA +
<i>Carex hystericina</i>	Porcupine sedge	G5	S2			2	Baker, Crook, Deschutes, Gilliam, Grant, Jefferson, Malheur, Wallowa, Wasco, Wheeler	BM, BR, CB, SP	CA, ID, WA +
<i>Carex integra</i>	Smooth beaked sedge	G5	S3			4	Deschutes, Jackson, Klamath, Lake, Lane, Linn	EC, WC	CA, NV
<i>Carex lasiocarpa</i> var. <i>americana</i>	Slender sedge	G5T5	S2			2	Deschutes, Klamath, Wallowa, Wasco	BM, WC	ID, WA +

Cont.

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
Castilleja chlorotica	Green-tinged paintbrush	G3	S3			1	Crook, Deschutes, Klamath, Lake	BM, EC	
Castilleja rupicola	Cliff paintbrush	G3	S2	SOC		2	Clackamas?, Deschutes, Hood River?, Lane, Linn, Marion?, Multnomah	WC	WA, BC
Collomia larsenii	Talus collomia	G5T4	S4			4	Clackamas, Deschutes, Hood River, Jefferson, Lane	WC	CA, WA
Cypripedium montanum	Mountain lady's-slipper	G4G5	S3S4			4	Baker, Benton, Clackamas, Crook, Deschutes?, Douglas, Grant, Hood River, Jackson, Jefferson, Josephine, Klamath, Lake, Lane, Marion, Morrow?, Multnomah, Umatilla, Union, Wallowa, Wasco, Wheeler	BM, EC, KM, WC, WV	CA, ID, WA +
Douglasia laevigata	Smooth-leaved douglasia	G3	SNR			3	Clackamas, Clatsop, Deschutes, Hood River, Linn, Marion, Multnomah, Tillamook	CR, WC	WA +
Draba aureola	Golden alpine draba	G4	S4			4	Clackamas, Deschutes, Klamath, Lane	WC	CA, WA
Elatine brachysperma	Short-seeded waterwort	G5	S1			2	Crook?, Deschutes, Lake, Malheur	BM, BR	CA, NV, WA +
Elmera racemosa var. racemosa	Elmera	G4G5T4	S4			4	Deschutes, Douglas, Jefferson, Klamath, Lane	WC	WA +

Cont.

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Elodea nuttallii</i>	Nuttall's waterweed	G5	SNR			3	Columbia, Deschutes, Harney, Lake, Lane, Multnomah	BR, EC, WC, WV	CA, WA, ID +
<i>Epilobium latifolium</i>	Broad-leaved willow-herb	G5	S3			4	Deschutes, Grant, Linn, Wallowa	BM, WC	CA, ID, WA +
<i>Epilobium luteum</i>	Yellow willow-herb	G5	SNR			3	Clackamas, Deschutes, Douglas, Jackson, Lane, Linn	BM, WC	CA, WA +
<i>Erigeron cascadenis</i>	Cascade daisy	G4	S4			4	Clackamas?, Deschutes?, Douglas, Klamath, Lane, Linn, Marion	WC	
<i>Eriogonum cusickii</i>	Cusick's eriogonum	G2	S2	SOC	C	1	Crook, Deschutes, Harney, Lake	BM, BR	
<i>Gentiana newberryi</i>	Newberry's gentian	G4	S2			2	Deschutes, Klamath, Lane	EC, WC	CA
<i>Heuchera merriamii</i>	Merriam alumroot	G2?	SNR			3	Deschutes, Josephine, Lane	KM, WC	CA
<i>Hieracium horridum</i>	Shaggy hawkweed	G4	SNR			3	Curry, Deschutes, Jackson, Klamath	KM, WC	CA
<i>Hierochloa odorata</i>	Holy grass	G4G5	SNR			3	Benton, Clackamas, Columbia?, Coos, Crook, Deschutes, Douglas, Grant, Harney, Josephine, Klamath, Lane, Multnomah, Umatilla	BM, CR, EC, KM, WC, WV	CA +
<i>Lilaea scilloides</i>	Flowering quillwort	G5?	S3?			4	Clatsop, Deschutes, Douglas, Harney, Klamath, Lake, Lane, Malheur, Sherman?	BR, CB?, CR, EC	CA, ID, NV, WA +

Cont.

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Lycopodium annotinum</i>	Stiff clubmoss	G5	S3			4	Baker, Clackamas, Deschutes, Douglas, Grant, Hood River, Jefferson, Lane, Marion, Multnomah, Union, Wallowa, Wasco	BM, WC	ID, WA
<i>Mimulus jepsonii</i>	Jepson's monkeyflower	G4	S3			4	Deschutes, Douglas, Jackson, Josephine, Klamath, Lake	EC, KM, WC	CA
<i>Myriophyllum sibiricum</i>	Common water-milfoil	G5	S3			4	Crook, Curry, Deschutes, Harney, Jefferson, Klamath, Malheur, Tillamook, Wallowa, Wheeler	BM, BR, CR, EC	CA, WA +
<i>Nama densum</i> var. <i>parviflorum</i>	Compact fiddlelef	G5T5	SNR			3	Deschutes, Harney, Lake, Malheur	BM, BR	CA, ID, NV, WA +
<i>Navarretia leucocephala</i>	White-flowered navarretia	G4G5	SNR			3	Crook, Deschutes, Douglas, Harney, Jackson, Josephine, Klamath, Lake, Lane, Malheur, Sherman, Wasco	BM, BR, CB, EC, KM, WV	CA
<i>Penstemon peckii</i>	Peck's penstemon	G3	S3	SOC		1	Deschutes, Jefferson	EC	
<i>Pilularia americana</i>	American pillwort	G5	S2			2	Crook, Deschutes, Jackson, Klamath, Lake	BM, BR, EC, KM	CA+
<i>Poa suksdorfii</i>	Western bluegrass	G4	SNR			3	Deschutes, Hood River, Jackson, Lane, Union, Wallowa	BM, KM, WC	CA, WA+

Cont.

Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	Heritage List	Oregon County Distribution	Oregon Ecoregion Distribution	Other States
<i>Polystichum kruckebergii</i>	Kruckeberg's sword-fern	G4	S4			4	Baker, Deschutes, Grant, Harney, Klamath, Lane, Umatilla, Wallowa, Wasco	BM, BR, EC	CA, ID, WA+
<i>Potamogeton filiformis</i>	Slender-leaved pondweed	G5	S3			4	Deschutes, Harney, Malheur, Wallowa	BM, BR, EC	CA, ID, NV, WA +
<i>Scheuchzeria palustris</i> ssp. <i>americana</i>	Scheuchzeria	G5T5	S2			2	Clackamas, Deschutes, Klamath, Lane, Linn, Multnomah	EC, WC	CA, ID, WA+
<i>Silene suksdorfii</i>	Suksdorf campion	G4	S4			4	Deschutes, Douglas, Hood River, Jefferson, Klamath, Lane, Marion	WC	CA, WA
<i>Smelowskia ovalis</i> var. <i>ovalis</i>	Shortfruited smelowskia	G5T4	S4			4	Deschutes, Hood River, Lane	WC	WA+
<i>Thelypodium howellii</i> ssp. <i>howellii</i>	Howell's thelypody	G2T2	SH	SOC		2-ex	Crook, Deschutes, Grant, Harney, Klamath, Lake	BM, BR, EC	CA

## Appendix I-8: Descriptions of Listed Plant Species

Information from Nancy Gilbert, US Fish and Wildlife Service

### **Estes' artemesia, *Artemesia ludoviciana* ssp. *Estesii***

[http://plants.usda.gov/java/county?state\\_name=Oregon&statefips=41&symbol=ARLUE](http://plants.usda.gov/java/county?state_name=Oregon&statefips=41&symbol=ARLUE)  
Shown at this website to be present in Deschutes, Jefferson and Crook County  
<http://home.teleport.com/~howieb/treats/estes.html>

This website which is an article from 1996 issue of the *Kalmiopsis*, the Journal of the Native Plant Society of Oregon, states that the plant is only found adjacent to the Deschutes River. Please read the article for a full description.

### **Cliff paintbrush (*Castilleja rupicola*)**

Status: Oregon Heritage- List 2; Federal Species of Concern; R-6 Sensitive

#### **A. Range and Habitat**

Cliff paintbrush grows on perpendicular cliffs and rocky slopes at 4000-7000 feet elevation along the range of the Cascade Mountains from central Oregon to southern British Columbia It flowers from June to August.

Taken from: <http://www.fs.fed.us/r6/willamette/manage/nepa/current/hartz/hartz-app-d.pdf>

For further description visit: [http://www.nargs.org/potm/potm\\_feb01.html](http://www.nargs.org/potm/potm_feb01.html)

### **Cusick's Erigonum, *Erigonum cusickii***

Range map from following website:

[http://plants.usda.gov/java/county?state\\_name=Oregon&statefips=41&symbol=ERCU3](http://plants.usda.gov/java/county?state_name=Oregon&statefips=41&symbol=ERCU3)  
Only shows plant present in Harney and Lake County

### **Disappearing Monkey Flower, *Mimulus evanescens***

Distribution: *Mimulus evanescens* is distributed widely along the northwestern edge of The Great Basin at elevations between 1200-1700 meters (Meinke, 1995). It ranges from

Southwest Idaho west through eastern Oregon and south into northeastern California (Meinke, 1995). See the complete 1995 Great Basin Naturalist Article for more information on sites. (pg. 252 list Oregon sites, none listed in Deschutes County, full article is attached)

### **Little mousetail, *Myosurus minimus* ssp. *apus***

According to the Oregon Natural Heritage Program the only extant populations of this plant are found near Arlington, Oregon. Here is my e-mail information from Sue Vrillakas with ONHP: We track the species as *Myosurus sessilis* and we know of two extant (we think) populations, T2n R21e Sec 31 and another at Sec 27. There is an historical collection from Madras.

**Peck's Penstemon, *Penstemon peckii***

The plant has been confirmed in the Sisters Ranger District and is suspected to exist within the Bend Fort Rock and Crescent Ranger Districts. Peck's penstemon occurs on the Sisters Ranger District in ponderosa pine openings, open ponderosa pine forests, pine/mixed conifer openings, recovering fluvial surfaces (streambanks, overflow channels, inactive floodplains), seeps, rills, springs, vernal pools; draws, ditches, skid roads; dry or intermittent stream channels; moist-wet meadows.

See the following links for more information:

[http://www.fs.fed.us/r6/centraloregon/projects/units/bendrock/opine/documents/opine\\_b\\_e\\_nov21\\_06.pdf](http://www.fs.fed.us/r6/centraloregon/projects/units/bendrock/opine/documents/opine_b_e_nov21_06.pdf)

[http://www.uoregon.edu/~ecolrest/2006\\_Pecks\\_Elliot.pdf](http://www.uoregon.edu/~ecolrest/2006_Pecks_Elliot.pdf)

**Howell's Thelypody, *Thelypodium howellii ssp. howellii***

According to the Oregon Natural Heritage link:

[http://oregonstate.edu/ornhic/2007\\_t&e\\_book.pdf](http://oregonstate.edu/ornhic/2007_t&e_book.pdf)

The plant is present in Crook, Deschutes, Grant, Harney, Klamath & Lake Counties in Oregon

The plant is suspected to exist within the Sisters Ranger District, Bend Fort Rock and Crescent Ranger Districts. Considered by Oregon Natural Heritage ranking to be extirpated from Oregon. No recent collections; closest Nature Conservancy sites are Paulina Marsh, Tumalo State Park (approx.), Camp Polk, and Big Summit Prairie.

Information taken from:

[http://www.fs.fed.us/r6/centraloregon/projects/units/bendrock/opine/documents/opine\\_b\\_e\\_nov21\\_06.pdf](http://www.fs.fed.us/r6/centraloregon/projects/units/bendrock/opine/documents/opine_b_e_nov21_06.pdf)

# Appendix I-9: Deschutes County Weed List

## Deschutes County Weed Policy and Classification System

“NOXIOUS WEED” means any weed designated by the Deschutes County Board of Commissioners that is injurious to public health, agriculture, range, recreation, wildlife, or any public or private property; any weed that impacts and displaces desirable vegetation, such as Threatened and Endangered Plant Species, wildlife habitat, and livestock.

It is acknowledged that certain noxious weeds have become so thoroughly established and are spreading so rapidly on state, county, and federally owned lands, as well as on private land, that they may have been declared by Oregon Revised Statue 570.505 to be a menace to public welfare. Steps leading to eradication where possible, are necessary. It is further recognized that the responsibility for such eradication and/or intensive control rests not only on the private landowner and operator, but also the county, state and federal government.

## Noxious Weed Control Rating System

Noxious Weeds, for the purpose of this system, shall be designated “A”, “B” or “C”

1. An “A” designated weed is: a priority noxious weed designated by the Deschutes Weed Board as a target weed species on which the Weed Control District will comply with a state wide management plan and/or implement a county wide plan for intensive control and monitoring. An “A” rated weed may also be a weed of known economic or ecological importance which occurs in small enough infestations to make eradication/containment possible; or one that is not known to occur here, but its presence in neighboring counties make future occurrence here seem imminent.

Recommended Action: Infestations are subject to intensive control when and where found.

2. A “B” designated weed is: a weed of economic importance, which is both locally abundant and abundant in neighboring counties.

Recommended Action: Moderate control and or monitoring at the county level.

3. A “C” designated weed is: a weed that has the potential to cause harm to agriculture production and transportation systems.

Recommended Action: Control and monitoring at the county level.

### **“A” Rated Weeds**

African rue

Peganum harmala

Buffalobur +

Solanum rostratum

common houndstongue

Cynoglossum officinale

dyer’s woad -

Isatis tinctoria

false brome \*  
hydrilla  
leafy spurge +  
meadow knapweed -  
Mediterranean sage +  
medusahead rye +  
musk thistle -  
orange hawkweed +  
perennial pepperweed +  
purple loosestrife +  
rush skeletonweed  
Russian knapweed +  
Scotch thistle +  
squarrose knapweed  
sulfur cinquefoil  
saltcedar tamarix +  
tansy ragwort +  
whiteweed; hoary cress +  
wild carrot +  
yellow starthistle -

#### **“B” Rated Weeds**

Canada Thistle +  
dalmatian toadflax +  
diffuse knapweed +  
kochia (annual) +  
myrtle spurge +  
poison hemlock +  
puncturevine +  
Russian thistle +  
Scotch broom +  
spotted knapweed +  
yellow toadflax or “butter and eggs” +  
yellow flag iris +

#### **“C” Rated Weeds**

bur buttercup +  
bull thistle +  
cheat grass ( Downy brome) +  
common mullein +  
dodder +  
field bindweed +  
filaree redstem +  
horseweed +  
poverty sumpweed +  
quackgrass +

Brachypodium sylvaticum  
Hydrilla verticillata  
Euphorbia esula  
Centaurea pratensis  
Salvia aethiopis  
Taeniatherum caputmedusae  
Carduus nutans  
Hieracium aurantiacum  
Lepidium latifolium  
Lythrum salicaria  
Chondrilla juncea  
Acroptilon repens  
Onopordum acanthium  
Centaurea virgata  
Potentilla recta  
Tamarix ramosissima  
Senecio jacobaea  
Lepidium draba  
Daucus carota  
Centaurea solstitialis

Cirsium arvense  
Linaria dalmatica  
Centaurea diffusa  
Kochia scoparia  
Euphorbia myrsinites  
Conium maculatum  
Tribulus terrestris  
Salsola spp.  
Cytisus scoparius  
Centaurea biedersteinii  
Linaria vulgaris  
Iris pseudacorus

Ranunculus testiculatus  
Cirsium vulgare  
Bromus tectorum  
Verbascum thapsus  
Cuscuta spp.  
Convolvulus arvensis  
Erodium cicutarium  
Conyza Canadensis  
Iva axillaries  
Agropyron repens

South American waterweed +  
spiny cocklebur +  
St Johnswort +  
sweet clover(s) -Only on Right of Ways +  
Western Water-hemlock / +

Elodea densa  
Xanthium spinosum  
Hypericum perforatum  
Melilotus officinalis  
Cicuta douglasii+

**+ Currently in the County**

- **All known populations have been treated**

\* **Weeds Added this Year**

/ **Natives but Poisonous to Animals or Humans**

## Appendix I-10: National Register Nominations for Bend Properties

Name of Property	Date of Construction	Address
Bend Amateur Athletic Club/ Old Bend High School Gymnasium March 1983, August 1992, August 1992 (version 2)	1918	520 NW Wall Street at corner of Idaho Avenue
Bend High School	1924-1925	520 NW Wall Street at corner of Kansas Avenue
Charles and Anna Boyd Ranch House, Bunk House and Ice House	1905-1909	20410 Rivermall Avenue
Brooks-Scanlon Sawmill "A" and Crane Shed (not listed) *	1915 1937	805 SW Industrial Way and 721 Industrial Way
Congress Apartments	1924	221, 223, 225, 227, 229 NW Congress Street
Craftsman Bungalows in Deschutes County	1910-1935	Various
Peter Byberg House	1916	153 NW Jefferson Place
Deschutes County Library	1939	507 NW Wall Street
William P. Downing's Cafe and Rooms	1920	1033-1035 NW Bond Street
Benjamin Hamilton (and Elsa M. Acton Hamilton) House	1923	552 NW State Street
Historic Development of the Bend Company in Bend, Oregon	1911-1939	various
Ralph A. (and Frances O) Hope-William L.(and Dorothy Houk) Van Allen House	1927	352 NW Drake Road
Simpson E.(and Rosemarie) Jones House	1924	1535 NW Awbrey Road
Liberty Theater	1917	849 NW Wall Street
Thomas McCann House	1915	440 NW Congress Street
Robert Dennis Moore (and Eva Roche Moore) House	1921	545 NW Congress Street
Hugh (and Hele) O'Kane Building	1916	115 NW Oregon Avenue
New Taggart Hotel/ Wright Hotel/ Pioneer Hotel	1911	215 NW Greenwood Avenue
Pilot Butte Inn III	1917	1121 Wall Street
George Palmer Putnam and Dorothy Binney House	1911	606 NW Congress Street
Reid School	1914	129 NW Idaho Avenue
Evan Andreas Sather House	1911	7 NW Tumalo Avenue

N. P. (Nicholas Paul). Smith Pioneer Hardware	1909	935-937 Wall Street
B. A. (Byron A."Dutch" and Ruth) Stover House	1927	1 NW Rocklyn Road
Trinity Episcopal Church	1929	469 NW Wall Street

Source: Deschutes Landmark Commission website:  
[www.ci.bend.or.us/depts/community\\_development/planning\\_division/](http://www.ci.bend.or.us/depts/community_development/planning_division/)

## Appendix I-11: Historic Designations

### City of Bend Historic and Cultural Resources Designated by the City Council

<u>File Number</u>	<u>Historic Site / Name</u>	<u>Address</u>	<u>Tax Map Number</u>
1848 TL/08700	<b>1813 Rock</b> <i>in museum</i>	129 NW Idaho Ave.	17-12-32CA
	1813		
126 TL/05100	<b>Drake, A.M. Lodge</b> <i>demolished</i>	Drake Park	17-12-32BD
	1901		
44 TL/08600	<b>Bend Athletic Club Gym*</b>	520 NW Wall St.	17-12-32CA
	1918		
10 TL/00132	<b>Oregon Trunk Railroad Passenger Depot</b>	313 Shevlin-Hixon Drive	18-12-0500
	1911 <i>moved</i>		
22 TL/07100	<b>Bend School Landmark</b>	Drake Park	17-12-32BD
	1877 <i>demolished</i>		
18 TL/01500	<b>Bend Water &amp; Light Co.</b>	Foot of Vermont St.	17-12-32AC
	<b>Powerhouse and Dam</b>		
	1909		
25 TL/03200	<b>Bend Woolen Mill</b>	1854 NE Division St.	17-12-29DD
	1923		
24 TL/05100	<b>Central Oregon Pioneers Landmark</b>	Pioneer Park	17-12-32AB
	1923		
118 TL/07300	<b>Downing Hotel and Café*</b>	1033 NW Bond St.	17-12-32AC
	1920 <i>listed on the National Register of Historic Places in November 2004</i>		
20	<b>First Presbyterian Church*</b> 157 NW Franklin Ave.		17-12-32DB TL/11001
	1912		
39 TL/01800	<b>Foley Landmark</b>	Pilot Butte State Park	17-12-34
	<i>Land donated in 1928 to public in his honor</i>		
113 TL/00200	<b>French, A. L. House*</b>	429 NW Georgia	17-12-32CD
	1912		
267 TL/04400	<b>Hoovers Universal Garage</b>	124-128 NW Greenwood	17-12-32AC
	1915		

23	<b>Johns Landmark</b>	Drake Park	17-12-32BD
TL/07100	1928 <i>drowning</i>		
109	<b>Kenwood School</b>	701 NW Newport Ave.	17-12-32BC
TL/04900	1920		
119	<b>Liberty Theater*</b>	849 NW Wall St.	17-12-32BD
TL/06200	1917		
115	<b>Lucas, A. C. House</b>	42 NW Hawthorne Ave.	17-12-32DA
TL/01800	1910 ( <i>first brick house in Bend</i> )		
125	<b>Steidl and Tweet Dam</b>	Division St. near Yale Ave.	17-12-29AD
TL/04300	(DCMID Irrigation Dam)		
	1912		
272	<b>McCann, Thomas House*</b>	440 NW Congress St.	17-12-32CB
TL/03200	1915		
120	<b>Trinity Episcopal Church*</b>	469 NW Wall St.	17-12-32CA
TL/04000	1929		
281	<b>Niswonger, C. P. House</b>	44 NW Irving	17-12-32AD
TL/04800	1910		
19	<b>O’Kane Building*</b>	115 NW Oregon Ave.	17-12-32AC
TL/06200	1916		
11	<b>Oregon Trunk Freight</b>	Division St.	17-12-32AD
TL/05000	Warehouse Site		
	1912 <i>demolished</i>		
121	<b>Putnam, George Palmer House*</b>	606 NW Congress St.	17-12-32CA
TL/02900	1911		
288	<b>Pilot Butte Inn Site*</b>	1133 NW Wall St.	17-12-32AC
TL/01400	1902, 1903, 1916 <i>demolished June 15, 1973</i>		
13	<b>Tucker, A. J. Blacksmith Shop</b>	200-202 NW Greenwood	17-12-32AC
TL/02700	1919		
102	<b>Reed, James E. House</b>	45 NW Greeley Ave.	17-12-32DA
TL/05300	1904		
21	<b>Reid School*</b>	129 NW Idaho Ave.	17-12-32CA
TL/08700	1914		
135	<b>St. Francis Catholic Church*</b>	494 NW Lava Rd.	17-12-32DB
TL/11900	1920 ( <i>2001 NRHP</i> )		

16	<b>Shevlin Hixon Mill Site*</b>	Shevlin Center	18-12-
	05BB TL/00300		
	1915 <i>demolished</i>		
123	<b>Smith, N. P. Hardware Store *</b>	935-937 NW Wall St.	17-12-32BD
	TL/06800		
	1910		
93	<b>U.S. Post Office*</b>	777 NW Wall St.	17-12-32CA
	TL/08300		
	1932		
90	<b>Weist Home Site Landmark</b>	1315 NE 3rd St.	17-12-33BB
	TL/06400		
	1914, <i>demolished</i>		
12	<b>West, John I. Building</b>	130 NW Greenwood Ave.	17-12-32AC
	TL/04300		
	1911		
14	<b>Wright Hotel*</b>	215 NW Greenwood Ave.	17-12-32AC
	TL/07700		
	1911, <i>partially demolished in 1989</i>		
	Adopted August 17, 1988		
	Resolution 1857		
110	<b>Sawyer, Robert House</b>	434 Drake Rd.	17-12-32BC
	TL/01000		
	1913		
103	<b>Sather, Evan A. House*</b>	7 NW Tumalo	17-12-32CB
	TL/12900		
	1911		
116	<b>Allen, Herbert E. House*</b>	875 Brooks St.	17-12-32BD
	TL/04900		
	1904 ( <i>Oldest house in Bend. Officially named the Goodwillie, Allen-Rademacher house</i> )		
	Adopted April 17, 1991		
	Resolution 1963		
280	<b>Nelson, August Building</b>	838 NW Bond St.	17-12-32DB
	TL/03700		
	1916		
133	<b>Cozy Hotel</b>	327 NW Greenwood	17-12-32AC
	TL/07500		
	1917		
15	<b>Brooks-Scanlon Office</b>	15 SW Colorado Ave	18-12-05BB
	TL/00200	<b>Building Site</b> (Lumberman's Hospital)	
	1919 <i>demolished in 1987 to make way for new office building</i>		
17	<b>Brooks-Scanlon Crane Shed</b>	721 SW Industrial Way	18-12-05BA
	TL/00600		
	1937 <i>demolished illegally on August 19, 2004</i>		
249	<b>Brooks-Scanlon Mill "A" Sawmill</b>	805 SW Industrial Way	18-12-05BA
	TL/00400		
	1915 (Removed from resource list by City Council in 2006.)		
124	<b>Boyd, Charles Homestead*</b>	20410 Bend River Mall	17-12-21C
	TL/00902		

1905-1909 moved to make way for Bend River Mall

Revised March 3, 1993  
Bend Area General Plan

247	<b>Old Bend High School*</b>	520 NW Wall St.	17-12-32CA
TL/08600			
	1914		
269	<b>Keyes, John P. House*</b>	912 NW Riverside Blvd	17-12-32CA
TL/02600			
	1912		
276	<b>Mountain View (Mayne) Hospital*</b>	515 NW Kansas Ave.	17-12-32CB
TL/01900			
	1919		
291	<b>Moore, Robert D. House*</b>	545 NW Congress St.	17-12-32CB
TL/02700			
	(Shevlin-Hixon Exec. House)		
	1921		
294	<b>Stover, Ruth and Dutch A. House*</b>	1 NW Rocklyn Road	17-12-32BD
TL/03200			
	1927		
260	<b>Deschutes County Library*</b>	507 NW Wall St.	17-12-32CA
TL/08500			
	1938		
	Adopted March 3, 1993		
	Resolution 2057		
101	<b>Delaware Grocery*</b>	845 NW Delaware	17-12-32CD
TL/13000			
	1923		
98	<b>Bend Clinic</b>	731 NW Franklin Ave.	17-12-32CA
TL/01300			
	1924		
107	<b>O'Donnell Building</b>	933 NW Wall St.	17-12-32BD
TL/06700			
	1912		
111	<b>Pierson, Pete Blacksmith Shop</b>	211 NW Greenwood	17-12-32AC
TL/08700			
	1923	(at the corner of Harriman)	
122	<b>Spheer, D. H. Building</b>	901 NW Bond St	17-12-32AC TL/05700
	1917	(at the corner of Minnesota)	
	Adopted January 15, 1992		
	Resolution 2001		

\* Property is also listed on the National Register of Historic Places

# Appendix I-12: Potential 4(f) Lands

Source: <http://waso-lwcf.ncrc.nps.gov/public/index.cfm>

**United States Department of the Interior**  
**National Park Service**  
**Land & Water Conservation Fund**  
 ---  
**Detailed Listing of Grants Grouped by County**  
 ---

**Oregon - 41**

Grant ID & Element Type Grant Sponsor	Date Approved Exp. Date Status	Amount
Grant Element Title  Today's Date: 5/26/2007 Page: 18 <b><u>DESCHUTES</u></b>		
	Cong. District	
	11/3/1966 11/1/1967	
D CITY OF BEND		\$5,792.50
	C 2	
COLUMBIA PARK 19 - XXX		
	1/20/1967 7/1/1969	
D CITY OF BEND		\$5,525.00
	C 2	
COLUMBIA PARK 107 - XXX		
	3/12/1968 12/31/1969	
D CITY OF BEND		\$4,800.00
	C 2	
COLUMBIA PARK-DEV PHASE III 239 - XXX		
	6/25/1970 6/30/1970	
A CITY OF BEND		\$3,750.00
	C 2	
DUTCH STOVER PARK 251 - XXX		
	10/27/1970 12/31/1971	
D CITY OF BEND		\$4,925.00

	C 2		
DUTCH STOVER PARK 285 - XXX		7/9/1971 12/31/1974	
D CITY OF BEND			\$7,970.00
	C 2		
DUTCH STOVER PARK DEV 369 - XXX		5/5/1972 12/31/1974	
D CITY OF BEND			\$39,128.00
	C 2		
JUNIPER ACQUATIC & FITNESS CENTER 403 - XXX		7/13/1972 12/31/1974	
D CITY OF BEND			\$18,695.67
	C 2		
VINCE GENNA STADIUM LIGHTS 511 - XXX		8/17/1973 11/6/1973	
D CITY OF BEND			\$36,000.00
	C 2		
JUNIPER PK TENNIS COURTS & LANDSCAPI 548 - XXX		5/23/1974 12/31/1976	
A CITY OF BEND			\$59,854.00
	C 2		
DRAKE PARK 597 - XXX		6/26/1974 12/31/1977	
D CITY OF BEND			\$7,404.84
	C 2		
SHEVLIN PARK WATER SYSTEM 607 - XXX		3/24/1975 6/30/1977	
D BEND METRO PARK & REC. DIST.			\$17,104.72
	C 2		
PONDEROSA PARK PICNIC AREA 905 - XXX		1/17/1978 12/31/1981	
JUNIPER PARK COVERED POOL D BEND METRO PARK & REC. DIST.			\$737,338.82
		3/28/1978 6/30/1980	

Type  
Grant Sponsor

Amount

Date  
Approved  
Exp. Date  
Status

Grant Element Title

Cong.  
District

Today's Date: 5/26/2007

Page: 19

**DESCHUTES**

D  
BEND METRO PARK & REC. DIST.

\$93,710.84

C  
2

SKYLINE PARK, DEV., PHASE I  
1028 - XXX

2/8/1982  
12/31/1986

C  
BEND METRO PARK & REC. DIST.

\$90,365.00

C  
2

HOLLINSHEAD ACQUISITION/DEVELOPMENT  
1272 - XXX

12/4/1984  
12/31/1990

D  
BEND METRO PARK & REC. DIST.

\$47,666.83

C  
2

KIWANIS PARK DEVELOPMENT  
1320 - XXX

1/4/1985  
12/31/1990

D  
BEND METRO PARK & REC. DIST.

\$15,967.25

C  
2

HILLSIDE PARK PH. 2  
1410 - XXX

3/23/1992  
6/30/1996

R  
BEND METRO PARK & REC. DIST.

\$102,500.00

A  
2

SAWYER PARK BRIDGE ACCESS & SAFETY  
IMPROVEMENTS  
1510 - XXX

## Appendix I-13: Metadata for Maps

Compiled by: Jude Fulghum, City of Bend, Engineering/GIS Department

### **Layers Included on All Maps:**

The following layers are included on all maps. These layers were created locally, either by the City of Bend or Deschutes County GIS departments under the direction of planning staff.

- Bend City Limits
- Study Area Boundary
- Arterial/Collector Roads- Bend has many roundabouts located on arterial and collector streets which are shown as circles
- State Highways
- Deschutes River

The layer, MPO Boundary, found on all maps was given to the City by the Oregon Department of Transportation (ODOT).

The Deschutes County GIS department also created several other layers present on many of the maps:

- Streams
- Railroad
- Canals

Metadata applicable to specific map layers includes:

Map 1: Relief Map: Hillshade relief layer supplied by Deschutes County GIS department. This file was created in 1998.

Map 2: Zoning: Zoning layer created and updated by Deschutes County GIS department. City of Bend information derived from City Zoning Ordinance.

### Map 3: Utilities:

- Pressure and gravity sewer line data was obtained from the City of Bend and represents those lines 10" in diameter or larger.
- Water line information was obtained from the City of Bend and shows those lines 8" in diameter or larger.
- Gravity interceptor information was provided to the City of Bend by an outside consultant working on the development of the City's Sewer Master Plan.
- Avion water lines were obtained from Avion Water in May 2006, and include lines with 8" diameter or greater.

#### Map 4: Stormwater:

- River drainage layer drawn by City of Bend GIS staff based on catch basin system with flow to the Deschutes River. See notes below regarding the accuracy of catch basin data.
- City of Bend stormwater data only provided for locations for which the City is responsible for maintaining (i.e., structures found on private property are not included). Accuracy of drill hole, drywell, and catchbasin layers based on the following:
  - All locations prior to May 2003 were entered by hand, based on flat maps updated by City of Bend street department,
  - All locations between May 2003 and April 2005 were determined by GPS position, with accuracy of approximately 1 meter, and typically only reflects new construction,
  - All locations after April 2005 were determined by GPS position, with accuracy of approximately 1 inch, and typically only reflects new construction (or occasional update of existing data).
- Deschutes County stormwater data was obtained from the Deschutes County GIS department and shows locations on County owned properties within the study boundary. Classifications of feature types are slightly different from the City's. The City obtains a GPS feature for each type; the County has one feature that may include more than one type. Please see the legend of this map for symbology.

#### Map 5: Water Quality:

- The top five (5) drainage problem areas were identified as part of the City of Bend Master Plan workshop in January, 2007.
- The DEQ 2002 303(d) streams GIS coverage was obtained from the Department of Environmental Quality (DEQ) and reflects 2002 data. According to DEQ, the list includes data submitted by individuals, organizations and government agencies as well as DEQ's own monitoring information.
- Subbasin information was generated for the City of Bend by MWH, a private consulting firm, contracted to develop the City's Sewer Master Plan. Subbasin information is reflected as of September 14, 2005.

#### Map 6: Environmental Health:

- Information regarding the location of the wells was obtained from the Deschutes County GIS department and represents the Public Water System groundwater well, infiltration gallery, and spring locations used for drinking water. The layer includes Department of Environmental Quality (DEQ) and Oregon Department of Human Services' (DHS) Drinking Water Program Source Water Assessment results for systems active in June 1999.
- Location of service stations was obtained using Deschutes County GIS department layers, and was based on a query through the County's factor book (property class and stat class codes) which describes improvements on

Deschutes County properties. The query singled out all properties identified as commercial automotive Service Stations, but may be incomplete.

- Well protection area information was obtained from the Department of Environmental Quality (DEQ) in 2005 and may have inaccuracies based on lack of groundtruthing of well locations.
- Avion Water District boundary obtained from GIS department at Avion Water. Roats boundary drawn based on flat map information provided by Roats Water. City of Bend boundary based on remainder of area within City's city limits.

Map 7: Irrigation Service Areas: Sources for GIS layers for boundary lines for the four irrigation districts affected by the study are listed below. Note that irrigation boundaries may overlap each other as some districts serve customers of other districts.

- Central Oregon Irrigation District (COID): obtained directly from the District's GIS department,
- Arnold Irrigation District: obtained from Geo-Spatial Solutions, a GIS consulting firm located in Bend, Oregon specializing in water resource issues,
- Swalley and Tumalo Irrigation Districts: obtained from the Deschutes County GIS department and verified as current by Geo-Spatial Solutions.

Map 8: Fish Passage:

- Source for the information on bridges in the study area was derived from the National Bridge Inventory System which was supplied to the Deschutes County GIS department by the Oregon Department of Transportation (ODOT).
- Dam and diversion locations verified by the City of Bend.

Map 9: Natural Resource Protection Areas:

- Approved Waterway Overlay Zone (WOZ) and Upland and River Areas of Special Interest (ASI) layers for the City of Bend were originally created by the Deschutes County GIS department based on formal ordinances approved by the City of Bend's City Council.
- County ASI data was obtained from the Deschutes County GIS department.
- City Significant Goal 5 Wetlands were created in late 2000 as the result of a Riverway project grant. The GIS layers were created from maps drawn as the result of a wetland inventory conducted by an outside consultant as part of that grant.
- The NWI Wetlands layer was obtained from the Deschutes County GIS department, and reflects wetlands area location and classification as defined by the U.S. Fish & Wildlife Service.
- The Open Space Conservation and Wildlife Area layers were obtained from the Deschutes County GIS department and are compiled from their zoning ordinance.
- Eagle nest vicinity information supplied by the Oregon Department of Fish and Wildlife (ODFW) from the Isaacs and Anthony databases.

Map 10: Vegetation: The vegetation information was obtained from the Deschutes County GIS department and presents the current distribution of ecological systems (as defined by NatureServe, [www.natureserve.org](http://www.natureserve.org)) in Deschutes County.

Map 11: Natural Hazards:

- The earthquake fault line was obtained from Deschutes County's GIS department.
- 100 foot contour line data was obtained from Deschutes County's GIS department (for areas outside of the City of Bend). 50 foot contour lines within the City of Bend were supplied by 3Di, a consulting firm hired by the City to fly an aerial view of the city limits and provide topographic information resulting from that flight (flown in April, 2005).
- Slope data was obtained from the Deschutes County GIS department and depict slopes with a 25% grade or greater.
- Surface mine and surface mining impact area information was obtained from the Deschutes County GIS department. The surface mine information is part of the zoning ordinance, and the impact area represents a half mile buffer around the surface mining zones.
- Fire history information was obtained from the Deschutes County GIS department and depicts historical wildfire locations in the study area from 1908 through 2006.
- FEMA 100 foot floodplain information was obtained from the Deschutes County GIS department and is based on Flood Insurance Rate Maps published by the Federal Emergency Management Agency (FEMA).

Map 12: Soil Conductivity: Hydrologic soil group information was obtained from the U.S. Department of Agriculture and, according to USDA, "represent estimates of runoff potential with soils being assigned to one of four groups according to the rate of water filtration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-term storms".

Map 13: Scenic Resources:

- The Federal Wild and Scenic Waterway and the Oregon Scenic Waterway layers were obtained from Deschutes County's GIS department and represent waterways designated as scenic by either the United States Congress or the Oregon legislature.
- The two County Landscape Management layers were also obtained from Deschutes County's GIS department and represent corridors identified in the Comprehensive Plan and Zoning maps as important to the maintenance of natural and scenic resources.
- The Cascade Lakes National Scenic Byway information was obtained from the Deschutes National Forest based on the road's selection in 1989 as a National Scenic Byway by Scenic America.

#### Map 14: Cultural Resource Protection:

- Historical designations identify properties with significant historical and cultural heritage values. Properties are identified as historic resources by the Deschutes County Landmark Commission and Bend City Council. Some historic resources shown are granted status through the National Register of Historic Places while others do not have the same level of protection granted through the National Register.
- The Central Oregon Heritage Group High Sensitivity Area information was obtained from the Bureau of Land Management.
- Craftsman style bungalow information was obtained through the Des Chutes Historical Center, and was prepared in November, 1999.

#### Map 15: Public Lands and Trails:

- The trail system layer was obtained from Deschutes GeoGraphics, an outside consultant hired by the City of Bend in 2006 to create an updated bike and trail system map. This layer was originally sent to the consultant on 8/3/05 by the Bend Park and Recreation District, but was modified in the process of creating the City's bike and ped plan. Some alignments were changed, but the majority of trail additions were included. This layer is displayed along with an additional layer updated and given to the City by the Bend Park and Recreation District in April, 2007.
- Park Area information consists of two GIS layers. "Other Parks" was obtained from the Deschutes County GIS department and includes parcel outlines of parks, state parks, city parks, rural parks, as well as campgrounds, trailheads, boat launches, and other features. Laid over this layer is "Bend Metro Parks" which is a GIS layer received from Bend Park and Recreation District in April, 2007.
- The remaining layers (County Land, Federal Land, State Land, Public Lands) associated with government owned land were obtained from the Deschutes County GIS department and are based on parcel ownership.

Map 16: Percent of Minority Households: Information regarding the percent of minority households was obtained from the Oregon Department of Transportation (ODOT), although ODOT did not create and does not maintain this GIS data. The original data was created by the Oregon Geospatial Enterprise Office (GEO) from Year 2000 census blockgroup boundaries, using US Census Bureau information. "Minority households" refers to non-White and White Hispanic persons.

Map 17: Percent of Low Income Households: Information regarding the percent of minority households was obtained from the Oregon Department of Transportation (ODOT), although ODOT did not create and does not maintain this GIS data. The original data was created by the Oregon Geospatial Enterprise Office (GEO) from Year 2000 census blockgroup boundaries, using US Census Bureau information. Data refers to the percent of persons in households with incomes below the poverty threshold, as defined by the US Environmental Protection Agency in the "National Guidance for Conducting Environmental Justice Analyses" document (1998).

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## Appendix I: Maps

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# APPENDIX J

## Revenue Analysis – Potential Sources of Additional Road Funds

This section looks at potential additional sources road funding. It considers both expansion of existing sources and the creation of new revenue sources. The focus is on local (city or county) sources, but state and federal sources are also considered.

## **Expansion of existing sources**

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Existing sources that could be expanded include:

- State highway trust fund revenue (through an increase to the state gas tax and/or the state vehicle registration fee)
- Federal discretionary (non-formula) grants
- City of Bend's system development charges (SDCs)
- Property taxes (including bond levies, road maintenance districts, and LIDs)

### **State gas tax increase**

State highway trust fund revenue allocated to cities and counties is flexible and can be used for capital or O&M costs. The last increase to the state gas tax was 1991, and the most recent attempt in 2000 failed at the ballot box by an 88% to 12% margin. Nevertheless, the State Highway Fund forecast in ODOT's *Financial Assumptions* document assumes a 1-cent per gallon increase in the fuel tax every year from 2006 through 2030. That assumption has been used in the forecast of reasonably available revenue in Chapter 19.

While it is unlikely that the state gas tax will increase any more than 1-cent per gallon annually, it is easy to illustrate the likely effect of any further increase. Given the estimates for a 1-cent per gallon annual increase, if the gas tax were instead increased by 2-cents per gallon annually, the additional revenue to the City of Bend and Deschutes County would correspondingly double. The amount of additional revenue generated by an extra 1-cent increase in the gas tax (in addition to the 1-cent increase included in the ODOT forecast) is shown in Table J-1.

### **State VRF increase**

State vehicle registration fees were last increased in 2003, with the biennial fee for passenger vehicles rising from \$30 to \$55. ODOT's *Financial Assumptions* assume a \$15 increase in the biennial vehicle registration fee every eight years, to fund modernization (capital) projects. That assumed increase was included in the forecasts of reasonable available revenue in Chapter 19.

While it is unlikely that the state's biennial VRF will increase any more than \$15 every 8 years, the likely effect of any additional increase can be modeled in the same manner as with the state gas tax increase. If the biennial VRF increase were doubled so that the VRF increased \$30 every 8 years, the additional revenue to the City of Bend and Deschutes County would correspondingly double.

Table J-1 shows the projected *additional* revenue for Deschutes County and the City of Bend generated by a 1-cent per gallon annual increase in the gas tax and an extra \$15 VRF every eight years (in addition to the \$15 VRF increase included in the ODOT forecast).

**Table J-1. ADDITIONAL State Highway Fund revenue apportionment projected for Deschutes County and the City of Bend generated by statewide increases in the gas tax and vehicle registration fee (millions of 2006 dollars)**

Fiscal Year	Deschutes County					City of Bend				
	A	B	C	D	E	F	G	H	I	J
	Baseline	Additional Revenue from Increased Gas Tax	Additional Revenue from Reg Fee	Potential combined additional revenue (B+C)	Combined total revenue allocation (A+B+C)	Baseline	Additional Revenue from Increased Gas Tax	Additional Revenue from Reg Fee	Potential combined additional revenue (G+H)	Combined total revenue allocation (F+G+H)
2007	\$7.9	\$0.3	\$0.0	\$0.3	\$8.2	\$3.3	\$0.1	\$0.0	\$0.1	\$3.4
2008	\$7.8	\$0.6	\$0.0	\$0.6	\$8.4	\$3.3	\$0.3	\$0.0	\$0.3	\$3.5
2009	\$7.8	\$0.9	\$0.0	\$0.9	\$8.7	\$3.3	\$0.4	\$0.0	\$0.4	\$3.7
2010	\$7.7	\$1.3	\$0.4	\$1.7	\$9.4	\$3.3	\$0.5	\$0.2	\$0.7	\$4.0
2011	\$7.6	\$1.6	\$0.4	\$2.0	\$9.6	\$3.2	\$0.6	\$0.2	\$0.8	\$4.1
2012	\$7.5	\$1.9	\$0.4	\$2.3	\$9.8	\$3.2	\$0.8	\$0.2	\$0.9	\$4.2
2013	\$7.5	\$2.2	\$0.4	\$2.6	\$10.0	\$3.2	\$0.9	\$0.2	\$1.1	\$4.2
2014	\$7.4	\$2.5	\$0.4	\$2.9	\$10.3	\$3.2	\$1.0	\$0.2	\$1.2	\$4.3
2015	\$7.3	\$2.8	\$0.4	\$3.2	\$10.5	\$3.1	\$1.1	\$0.2	\$1.3	\$4.4
2016	\$7.2	\$3.1	\$0.4	\$3.5	\$10.7	\$3.1	\$1.3	\$0.2	\$1.4	\$4.5
2017	\$7.1	\$3.4	\$0.4	\$3.7	\$10.9	\$3.1	\$1.4	\$0.2	\$1.5	\$4.6
2018	\$7.0	\$3.6	\$0.7	\$4.4	\$11.4	\$3.0	\$1.5	\$0.3	\$1.8	\$4.8
2019	\$6.9	\$3.9	\$0.7	\$4.6	\$11.6	\$3.0	\$1.6	\$0.3	\$1.9	\$4.9
2020	\$6.9	\$4.2	\$0.7	\$4.9	\$11.8	\$3.0	\$1.8	\$0.3	\$2.0	\$5.0
2021	\$6.7	\$4.5	\$0.7	\$5.1	\$11.9	\$2.9	\$1.9	\$0.3	\$2.2	\$5.1
2022	\$6.6	\$4.7	\$0.7	\$5.4	\$12.0	\$2.9	\$2.0	\$0.3	\$2.3	\$5.1
2023	\$6.5	\$5.0	\$0.7	\$5.6	\$12.2	\$2.8	\$2.1	\$0.3	\$2.4	\$5.2
2024	\$6.4	\$5.2	\$0.6	\$5.9	\$12.3	\$2.8	\$2.2	\$0.3	\$2.5	\$5.2
2025	\$6.3	\$5.4	\$0.6	\$6.1	\$12.4	\$2.8	\$2.3	\$0.3	\$2.5	\$5.3
2026	\$6.2	\$5.7	\$0.9	\$6.6	\$12.8	\$2.7	\$2.4	\$0.4	\$2.8	\$5.5
2027	\$6.1	\$5.9	\$0.9	\$6.8	\$12.9	\$2.7	\$2.5	\$0.4	\$2.8	\$5.5
2028	\$6.0	\$6.1	\$0.9	\$7.0	\$13.0	\$2.6	\$2.6	\$0.4	\$2.9	\$5.5
2029	\$5.9	\$6.3	\$0.9	\$7.2	\$13.1	\$2.6	\$2.6	\$0.4	\$3.0	\$5.6
2030	\$5.8	\$6.5	\$0.8	\$7.4	\$13.2	\$2.5	\$2.7	\$0.4	\$3.1	\$5.6
<b>Totals</b>	<b>\$166.5</b>	<b>\$87.4</b>	<b>\$13.1</b>	<b>\$100.5</b>	<b>\$267.0</b>	<b>\$71.5</b>	<b>\$36.4</b>	<b>\$5.4</b>	<b>\$41.9</b>	<b>\$113.4</b>

Source: Base data from ODOT's *Financial Assumptions for the Development of Metropolitan Transportation Plans 2005-2030*. Calculations of additional revenue and conversion of figures to constant 2006 dollars by ECONorthwest.

### Federal discretionary (non-formula) grants

Most federal grants, such as those through the Surface Transportation Program (STP) are formula-based, with little room for increase other than through population growth relative to other jurisdictions. But there are discretionary federal grants such as those through the High Priority Projects Program (HPPP) that Bend may be able to access. The HPPP is for capital projects.

As described above, ODOT's appendices to its *Financial Assumptions* document show that, based on having received no HPPP or other federal discretionary funds in the past 18 years, the Bend MPO might expect to similarly receive no HPPP or other federal discretionary funds in 2005-2030. But the ODOT analysis also illustrates that if these funds were distributed on the basis of population, the Bend MPO would receive an average of \$856,000 annually, for a total of \$20.6 million over 2007-2030 in constant 2006 dollars.

The possibility of qualifying for the HPPP or other federal discretionary grants should be explored. Redmond will receive about \$14 million and Klamath County \$5.1 million in HPPP funds for improvements related to US 97 over the 2006-09 period. Given this funding in other jurisdictions, it is entirely possible that the Bend area could access

HPPP funds in future legislation. For the forecast of reasonably available revenue in Chapter 19, we assumed that Bend would not receive any HPPP. ODOT's *Financial Assumptions* also suggests the following:

*“Where there are specific projects that (1) are a high priority for the region, (2) can only be built with large federal earmarks, and (3) the likelihood of obtaining such earmarks is questionable, one alternative is to place the projects on an ‘illustrative projects list.’ These lists describe projects ‘that would be included in the adopted long-range transportation plan if reasonable additional resources beyond those identified in the financial plan were available.’ When funding becomes available for these projects, they could quickly be moved into the official long-range transportation plan.”*

### **Increased system development charges**

Bend increased its Transportation SDCs in July 2006, and the fees are now at the maximum allowable level. The Transportation SDC rate will increase with changes in construction costs. Additional increases in the Transportation SDC are not possible unless additional projects are added to the City's SDC Street Inventory that is the basis for estimating SDC rates. Given the history of opposition to SDCs in Bend, and that the rates are currently set at the maximum level, increasing Bend's Transportation SDC rates does not appear to be an option for generating additional revenue.

Deschutes County does not charge SDCs. If it did, it could generate revenue from development in the unincorporated part of the Bend MPO that could pay for projects required to serve that growth. Rates would depend on the cost of SDC-eligible projects and the amount of development across which this cost could be distributed. The 1996-2016 Deschutes County TSP modeled the revenue effect of a \$250 SDC and an \$800 SDC.

### **Property tax increase (including bond levies and road maintenance districts)**

It appears that tax rates in the City of Bend are already at or very near the Measure 5 limit of \$15 per \$1000 assessed valuation. Therefore no property tax increase is likely unless it is a bond levy for specific capital projects. Bond levies need to be passed by a double-majority; that is, a majority of eligible voters need to vote, and a majority of those voting need to approve the measure.

The City of Bend had an assessed property value in 2005-06 of approximately \$6 billion. A levy of \$0.10 per \$1000 assessed value would raise about \$600,000 annually. A house valued at \$200,000 would pay \$20 annually to support this levy. Deschutes County could similarly propose a bond levy for transportation projects in the tax districts within the MPO but outside the Bend city limits.

Besides bond levies for capital projects, the County might also be able to propose local option levies for O&M within the unincorporated MPO area, as it has done with a few

rural road districts. This would be similar to the Urban Road Maintenance District used by Washington County.

Since property taxes are paid by all property owners, they are best used for projects that benefit all property owners. Local Improvement Districts (LIDs) place a special assessment on properties within the district that are deemed to benefit from funded improvements. The City of Bend receives approximately \$12,000 annually from an existing LID.

Another property tax-related option would be to increase the amount of transfer from the General Fund to the Road Fund. The City of Bend transferred \$215,000 in FY2005 and just over \$200,000 the year before in this way. The disadvantage to this way of increasing transportation funding is obviously that it takes funding away from other municipal activities.

## **New revenue sources**

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New sources for transportation revenue potentially include:

- Local option gas tax
- Local option vehicle registration fee (VRF)
- Transportation utility fee
- Fee per vehicle-miles-traveled (VMT)
- Peak-period pricing (tolls)

### **Local option gas tax**

Counties in Oregon are allowed to implement a local option gas tax if approved by voters. Multnomah County and Washington County are the only two counties with this local gas tax, at 3 cents and 1 cent per gallon respectively. Cities can also have a voter-approved local tax on both gasoline and diesel. Currently 11 cities in Oregon have this tax, ranging from 1 cent in several cities to a high of 5 cents per gallon in Eugene.<sup>1</sup> Fuel tax revenue can be used for capital projects and O&M costs.

Fuel sales data are not available at the city or county level in Oregon for jurisdictions without a local gas tax. Based on vehicle registration data, however, we can estimate Deschutes County's likely gas tax revenue as a percentage of Washington County's. At the end of 2005, Deschutes County had approximately 193,000 vehicle registrations, or about 44% of the Washington County total. If we assume that Deschutes County gas sales follow the same proportion, we estimate about 97 million gallons of annual gas sales in Deschutes County (based on an estimated 220 million gallons of annual gas sales in Washington County). A countywide gas tax of 1-cent per gallon would result in about \$968,000 revenue. The 1996-2016 Deschutes County TSP assumed that 45% of any local gas tax revenues would be distributed to cities within the county, based on population. If this were true, the City of Bend would probably receive around \$331,000 annually based on its 76% share of incorporated cities within Deschutes County.

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<sup>1</sup> Other cities with a local gas tax are Woodburn, Springfield, Cottage Grove, Veneta, Tillamook, The Dalles, Stanfield, Sandy, Oakridge, and Dundee.

Another option would be for the City of Bend to impose its own local fuel tax. Because most fuel sales within Deschutes County are probably made within the Bend city limits, the city would probably receive more revenue than it would with a countywide gas tax apportioned as described above, even allowing for some shift of sales to the nearby cities of Redmond, Sisters, and La Pine. If we assume 80% of fuel sales in Deschutes County are within city limits and 76% of those city sales are in Bend in proportion to its population, Bend could expect around \$589,000 annually from a one-cent per gallon local gas tax.

### **Local option vehicle registration fee (VRF)**

Counties can impose a local vehicle registration fee (VRF) on top of the state fee (currently \$55 per biennium). This could be used for capital projects or O&M. State law requires 40% of the fee to be distributed among the cities within a county. No counties in Oregon currently have this fee, though Benton County unsuccessfully attempted to gain voter approval through Ballot Measure 02-14 in 2002.

The 1996-2016 Deschutes County TSP modeled a fee of \$15 for autos, \$9 for motorcycles and \$30 for trucks, which it said would have resulted in over \$700,000 in annual revenue to be shared between the County and cities.

Because vehicle registrations in the County have increased considerably since that time, we estimate much higher potential revenue from a VRF of that magnitude. Even assuming the fees above would be biennial, the VRF would result in about \$1.2 million per year from cars, trucks and motorcycles. The City of Bend would receive about 76% of the 40% city share, or about \$365,000 annually.

### **Transportation utility fee**

A transportation utility fee (TUF) is in place in at least ten Oregon cities and has been used in four Oregon counties. In some places it is known as a street maintenance fee. It is typically charged monthly on all existing residents and businesses, sometimes in proportion to the property's expected trip generation. The fees do not have to be approved by voters; they can be approved by ordinance.

These fees cannot be used for capital projects but can be used for O&M. If O&M needs are already met, this could replace some of the flexible funds, freeing them up for capital projects.

As an example, Wilsonville charges \$4 per month for a single-family housing unit, \$2.60 per month for a multi-family unit, and varying amounts for commercial development. Tualatin charges a single-family home \$1.42 per month plus \$1.50 per month for a street tree and sidewalk maintenance fee.

Of the cities with TUFs, Medford (pop. around 70,000) is closest in size to Bend. If Bend were to adopt fees at Medford's level, it could expect an amount comparable to the \$4.6 million in revenue reported by Medford for FY2005.

In 2006, Medford is charging \$0.57 per “trip-end,” with different land uses having a different number of monthly trip ends. For example, a single-family home is charged for 10 monthly trip ends, or \$5.70 per month. A dwelling in a multi-unit building is charged for 6.6 monthly trip ends, or \$3.76 per month. It is important to note that getting support for these fees takes time. Medford reports that it took 4 years of effort before the fees were instituted in 1992. Clackamas County rejected a TUF recently after much consideration.

### **Fee per vehicle-miles-traveled (VMT)**

A fee based on actual vehicle-miles-traveled (rather than predicted trip generation) has been suggested but not yet implemented in Oregon. Metro’s 2004 RTP considered a one cent per mile Tri-County fee but has taken no steps to implement it. In theory, such a fee could be used for both capital and O&M. It would also link the payment of transportation-related costs very directly to those who benefit from the system. In practice, getting support for and administering such a system in the Bend area seems less than straightforward, and waiting for state direction on this method may be advisable.

### **Peak-period pricing (tolls)**

Peak-period pricing involves charging a toll or other fee to users of a transportation facility, with lower fees or no fees at off-peak times. Outside Oregon, tolls have been used to repay construction bonds for new capital projects (e.g. a new highway or new highway lanes), and to pay for ongoing O&M (e.g. the New York State Thruway). Within Oregon, there are no toll roads at present, though they are being considered for a Newberg/Dundee bypass, an expansion of I-205 South in the Portland area, and the Sunrise Corridor from I-205 towards Damascus.

It is uncertain whether any of the roadway projects in the Bend MPO area would be good candidates for tolls. Larger facilities like US 97 and US 20 might, however, support toll lanes in the future, depending on urban growth and the need for congestion relief.

# APPENDIX K

## Plan Updates & Amendments

**Plan Updates & Amendments Appendix  
to be completed at a later date**