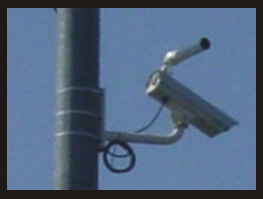

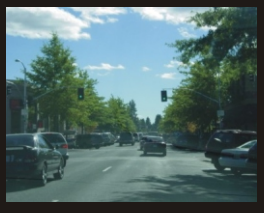

Executive Summary

Prepared for

Oregon Department of Transportation

For the Deschutes County ITS Plan

March 2005

Prepared by

DKS Associates
TRANSPORTATION SOLUTIONS

And

IBI GROUP

In association with

City of Bend
City of Redmond
Deschutes County
Bend Metropolitan Planning Organization
Deschutes County 911
Federal Highway Administration
Oregon State Police

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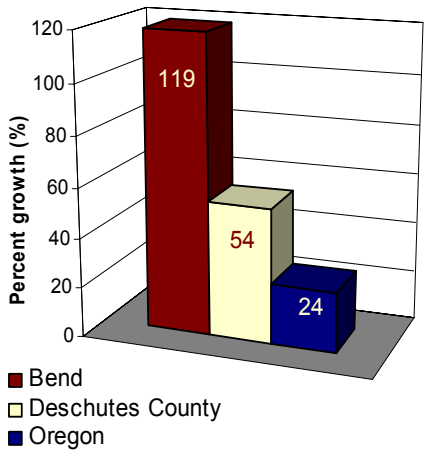
PROJECT BACKGROUND

T*he Deschutes County Intelligent Transportation System (ITS) Plan* was collectively developed by the Oregon Department of Transportation (ODOT), the City of Bend, the City of Redmond, Deschutes County, the Bend Metropolitan Planning Organization, Deschutes County 9-1-1 and the Federal Highway Administration (FHWA). The outcome of this plan is a 20-year deployment plan of ITS projects, which includes advanced technologies and management techniques, aimed to improve the safety and efficiency of the transportation system. This effort is consistent with plans put together in other regions statewide to ensure that ITS strategies used are integrated and complementary. This document presents the Executive Summary of the Final Report.

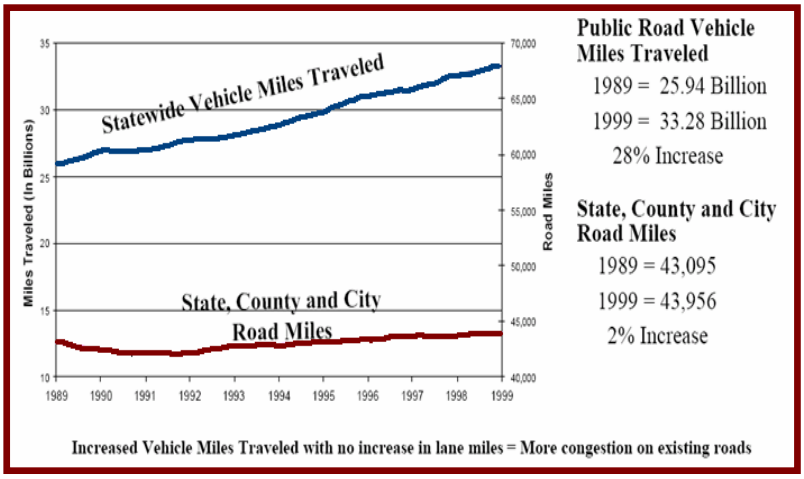
The Problem:
Increasing traffic congestion, due to recurring and non-recurring events, affects traveler mobility within Deschutes County. Congestion results in travel delay, reduced productivity, additional collisions and a frustrated driving public.

Population Growth (1990-2000)



The Deschutes County Area is unique compared to other metropolitan areas in Oregon due to high growth rates, high desert weather conditions, and booming tourism industries. While recurrent congestion occurs year-round, traffic peaks during the summer and winter months cause additional capacity and operation difficulties. During the winter, severe weather related emergencies and mountain pass conditions that change without warning pose additional hazards to travelers. Significant growth in the region over the past 10 years indicates a traffic problem that is worsening over time. Since 1990, Deschutes County has been the fastest growing county in the state. The 2000 census indicated a 54 percent growth in population between 1990 and 2000 in the county, compared to a 24 percent growth in the state of Oregon. Much of this growth has been concentrated within the Bend urban area, which experienced a 119 percent change over that same time period. Future forecasts for Bend, Redmond and La Pine indicate that the high growth rate will continue over the next 20 years.

In addition to the population growth trends, the number of motor vehicle trips in the county has also increased at a rate higher than the population growth. This rise in automobile usage is supported by the fact that there are now more registered passenger vehicle ownerships than people that live in Deschutes County[1]. Statewide, the number of vehicle miles traveled is increasing while the lane capacity remains about the same. This increase is a significant contributing factor to recurring congestion, but only shows half of the congestion problem that exists in Deschutes County.



Source: Association of Oregon Counties, Report to House Transportation Committee

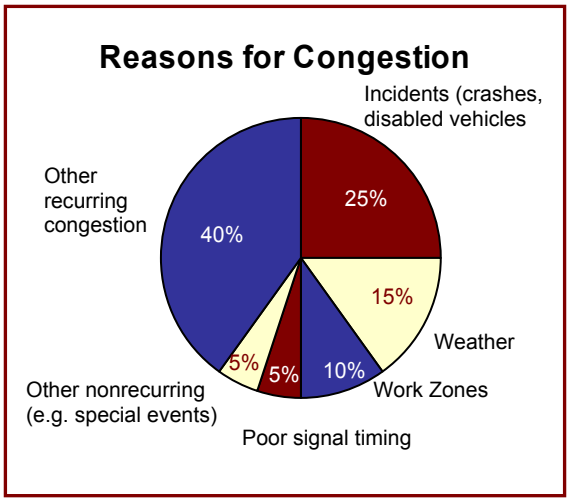
[1] Bend Transportation System Plan

PROJECT BACKGROUND

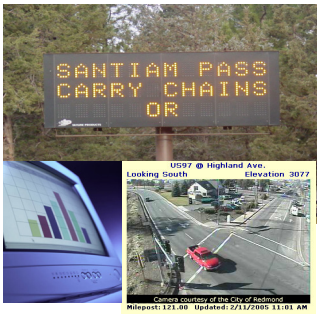
Over half (60 percent) of congestion results from temporary disruptions to traffic flow, caused from weather, work zones, special events and incidents, thus demonstrating a significant need for improvements specifically tied to these problem areas. These temporary disruptions take away use of the roadway and unanticipated disruptions have negative effects on travel time reliability for travelers and also for freight carriers, thus affecting economics. An integrated ITS system can help to reduce the impacts and return the system to full capacity, whereas simply building new roads and adding capacity can't solve these unexpected events. A focus on preserving operational capacity by managing operations day to day and creating and implementing a coordinated ITS plan will yield the most appropriate benefits for these scenarios.

The Opportunity:

ITS applications offer a significant opportunity to improve the safety and efficiency of the surface transportation system in Deschutes County. These applications help improve transportation system operations by performing a function more quickly or by providing a service that was not previously available. ITS helps improve the mobility of people and goods on the existing roadway infrastructure and also offers the potential for substantial savings on future construction, particularly on highways. Often the importance of investing in operations is overlooked, but is necessary to ensure that the traveling public makes safe and efficient use of existing roadways.



What is ITS?



Intelligent Transportation Systems (ITS) involve the application of advanced technologies and 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 make better travel decisions and to transportation system operators so they can better manage the system.

Why Develop an ITS Plan?

An ITS plan provides a framework of policies, procedures, and strategies for integration of a region's existing resources to effectively meet future regional transportation needs and expectations. In addition, the following points outlined below, provide the basis for developing an ITS plan for Deschutes County:

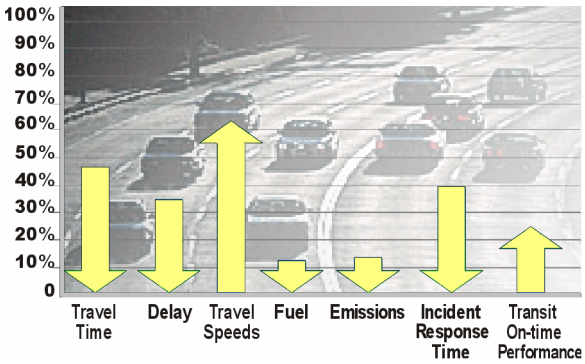
- The region is growing at a fast pace
- The region endeavors to maximize the efficiencies and improve the safety of the existing infrastructure.
- The public demands better information about traffic congestion and weather-related information.
- The plan fosters multi-agency coordination for system operations.
- The Federal Highway Administration requires that all ITS projects funded through the Highway Trust Fund shall be in conformance with the National ITS Architecture and applicable standards by April 2005.

PROJECT BACKGROUND

What are the Expected Benefits?

Intelligent Transportation System projects are aimed at improving the safety and operational efficiency of our 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 are benefits are highlighted below.

Coordinated Signal Timings

State-of-the-art traffic signal systems, with communication to a central computer and coordinated signal timing plans have proven to produce substantial benefits to the public. Examples from local coordinated signal timing projects in Oregon have produced the following benefits:

- 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 reduction in fuel consumption

Incident Management

The Oregon Department of Transportation, in association with the Oregon State Police, currently operates an incident management program in Region 2 to assist disabled vehicles.

The incident management program includes incident response vehicles that patrol the Region 2 roadways to assist motorists and reduce the duration of incidents and reduce the resulting traffic congestion. Based on an evaluation of the program, the following benefits have been identified:

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

Traveler Information

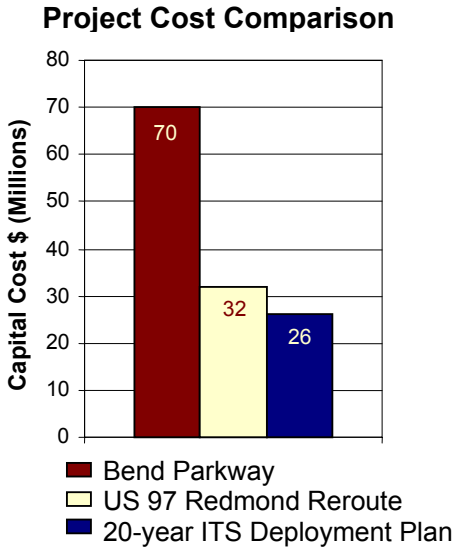
The dissemination of real-time traveler information provides travelers the ability to make informed travel choices, which could include changing a route, or selecting an alternate mode of travel. The resulting benefits include:

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

PROJECT BACKGROUND

Cost Comparison

ITS components can be deployed throughout Deschutes County for a fraction of the cost of large construction projects such as the Bend Parkway or the US 97 Redmond reroute.



Project Approach

Figure 1 illustrates the project approach used to develop this ITS plan for Deshutes County. The stakeholder outreach program has been a key component of every aspect of this plan development and ensures a plan that meets regional needs regardless of jurisdiction. A Steering Committee composed of key stakeholders from regional transportation agencies and the regional 911 center guided the project. Additional input came from expanded stakeholders, such as special interest groups and the chamber of commerce. Key outreach activities included the following:

- Monthly steering committee meetings
- Interviews with key stakeholders to collect existing conditions and transportation user needs information
- Two expanded stakeholder workshops (User Needs Workshop and Deployment Plan Workshop)

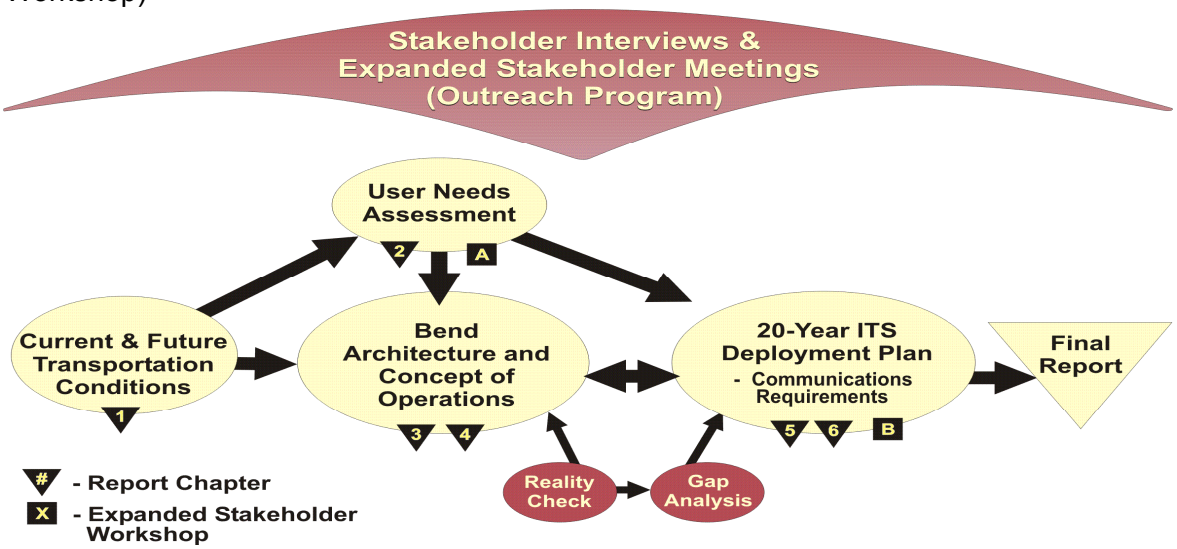
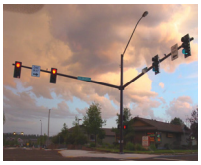
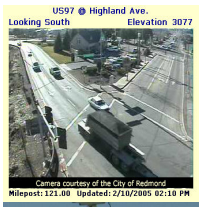


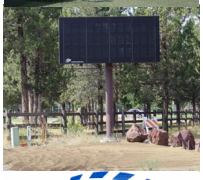
Figure 1. Project Approach

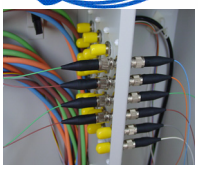
The following sections provide an overview of the results of the plan process for the 20-year Deschutes County ITS Operations and Implementation Plan, with particular focus on the following seven areas:

- Travel & Traffic Management
- Communications
- Public Transportation Management
- Emergency Management
- Information Management
- Maintenance & Construction Management
- Advanced Vehicle Safety Systems









MISSION, GOALS & OBJECTIVES

Deschutes County seeks 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 exiting system capacity and infrastructure, and providing real time traveler information.

Goal 1: Improve the safety and security of our transportation system.

- Reduce emergency response times.
- Reduce frequency, duration, and effects of incidents.
- Coordinate incident/security response with other local and regional agencies.
- Coordinate evacuation strategies with other local and regional agencies

Goal 2: Improve the efficiency of the transportation system.

- Optimize travel time for all transportation system users, including future transit vehicles, commuters, freight, and tourists.
- Reduce travel time variability.
- Reduce fuel consumption
- Reduce environmental impacts.
- Increase vehicle occupancy.
- Improve maintenance and operations efficiencies.
- Reduce Vehicle Miles Traveled
- Coordinate ITS efforts with existing and future TSM and TDM efforts.
- Provide weather information to transportation agencies to coordinate snow and ice removal.

Goal 3: Provide improved traveler information.

- Provide real-time traveler information for all users of the transportation system.
- Provide real-time road condition and weather information at key regional facilities.
- Provide advance and real-time information about construction activities and work zones.
- Provide real-time incident information.
- Disseminate regional and local traveler information by a variety of media.
- Provide traveler information prior to travel decision points.
- Provide one central location for dissemination of al regional and local traveler information.

Goal 4: Develop and deploy cost efficient ITS infrastructure.

- Deploy systems that are integrated with existing ITS infrastructure.
- Deploy systems that are integrated with future transportation infrastructure improvements.
- Deploy systems with a high benefit-to-cost ratio.
- Deploy systems that maximize the use of existing infrastructure.
- Integrate deployments with other local and regional projects.
- Coordinate funding opportunities.
- Coordinate deployment with existing plans.

Goal 5: Integrate regional ITS projects with local and regional partners.

- Build consensus among the Steering Committee members.
- Share infrastructure resources between local and regional agencies.
- Continue to coordinate and integrate projects with other agencies within the Bend Metropolitan Area and Central Oregon.
- Create and build public and private partnerships for ITS deployment, operations, and maintenance.

Goal 6: Monitor Transportation Performance Measures.

- Develop a transportation database accessible by all local agencies.
- Collect and record transportation data, such as traffic volume, speed, loop occupancy, and incident data.
- Maintain a GIS database of the transportation infrastructure, including ITS devices.

DESCHUTES COUNTY ITS ARCHITECTURE

The National ITS Architecture and the Oregon Statewide ITS Architecture provide the basis for the Deschutes County ITS Architecture. Figure 2 depicts the physical architecture for Deschutes County and includes key stakeholders, existing and desired services (or ITS elements), and the necessary interconnections required to ensure system compatibility and interoperability. Providing compatibility amongst jurisdictions will enable the region to fully maximize the use of ITS technologies and manage the transportation network on a regional scale.

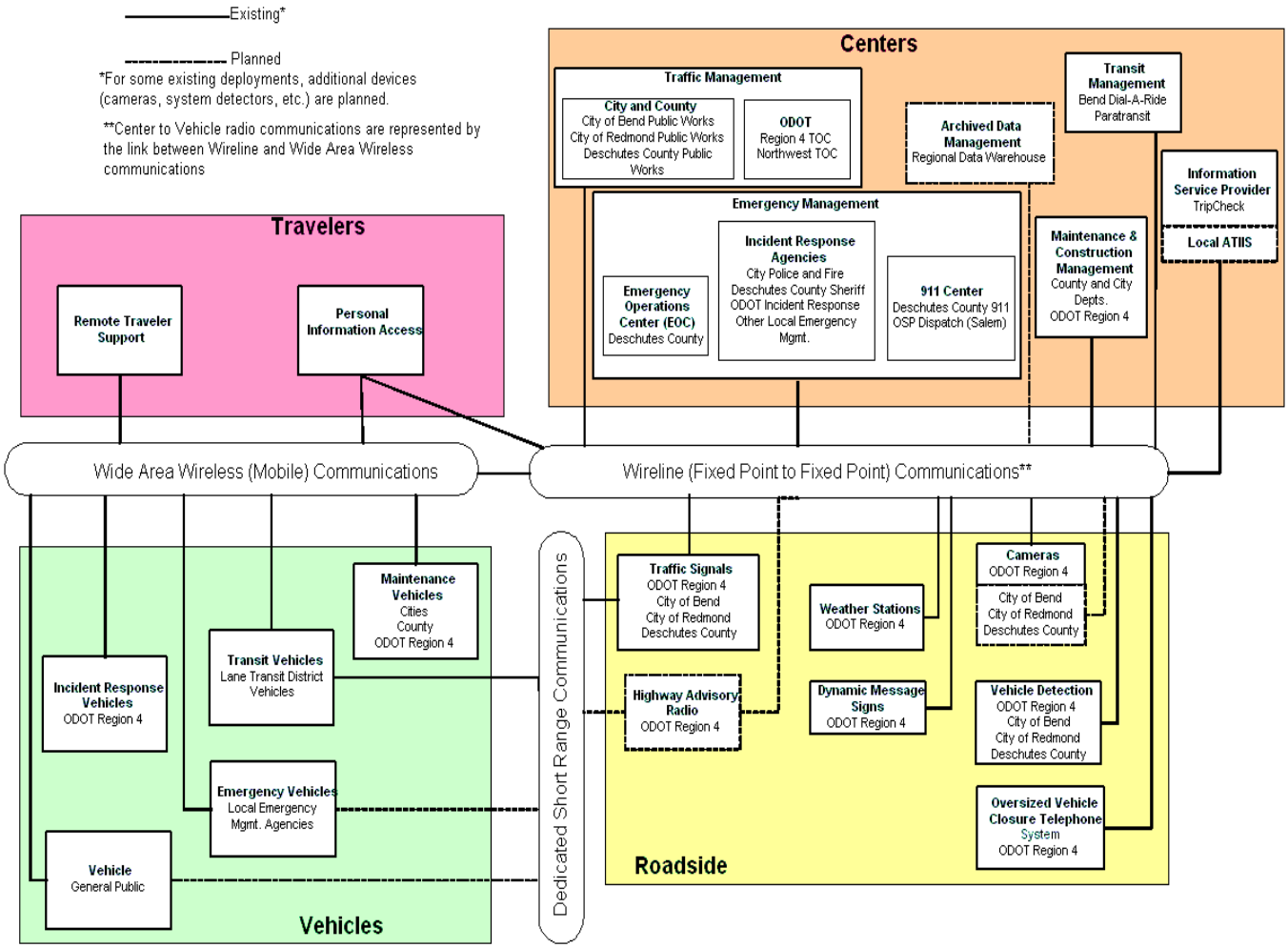


Figure 2. Deschutes County High-Level Physical Architecture

Operational Concept

The operational concept, which supplements the ITS physical architecture, defines the roles and responsibilities of the participating transportation and emergency management agencies and identifies information flows between the agencies in Deschutes County. The operational concept defines the responsibilities of the various agencies providing ITS services in the region for activities such as design, construction, integration, planning, operations and maintenance. In addition, the operational concept defines the level and types of information shared between agencies such as data, video, status, request and control.

ITS IMPLEMENTATION PLAN

Three time frames define the Deschutes County ITS Implementation Plan: 0-5 years, 6-10 years, and 11-20 years. Based on stakeholder input and key findings from system evaluations, the projects recommended for implementation in Deschutes County have been organized and described by the following program areas:

- Travel and Traffic Management (TM)
- Communications (CO)
- Public Transportation Management (PTM)
- Emergency Management (EM)
- Information Management (IM)
- Maintenance & Construction Management (MC)
- Advanced Vehicle Safety Systems

0-5 Year Plan	2005 - 2009
6-10 Year Plan	2010 - 2014
11-20 Year Plan	2015 - 2025

Figure 3 depicts field device locations for the full 20 year ITS Plan and Table 4 includes a brief description of each project included in the plan. The project numbers used in this table are for reference purposes only and although they generally follow the ranking developed by the steering committee, do not solely indicate project priority. Table 5 includes an implementation schedule which was determined based on a scoring exercise to determine project rankings. Criteria included: safety/crash prevention, traffic volumes, key traveler decision location, user needs, statewide consistency, relativity to other planned projects, short term funding availability, input from the steering committee, cost, expected benefits, technical and institutional feasibility and equitable distribution of projects.

Table 1. Capital Costs for Travel and Traffic Management

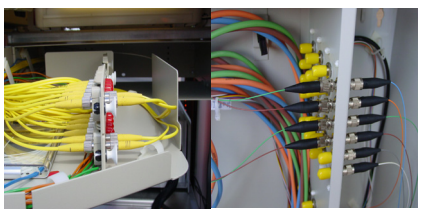
Travel and Traffic Management	Capital Cost
Install a central signal system	$1,422,000
Safety and Efficiency Improvements: Deploy CCTV, electronic message signs, count stations, and advanced signal timing improvements at the following locations:	
• Hwy 97 Business (3rd Street)	$903,000
• Hwy 97 (Redmond Reroute)	$714,000
• Hwy 97 (Redmond)	$1,005,000
• Hwy 97 (Bend Parkway)	$203,000
Bend Data Collection Project	$112,000
Regional Traveler Information System	$588,000
Downtown Bend Parking Management System	$147,000
ODOT Region 4 TOC Upgrade/Expansion	$95,000
Total:	**$5,189,000**

Travel and Traffic Management

Projects within this program area are focused on improving the safety and efficiency of the existing roadway system by providing tools to better manage the existing infrastructure, to coordinate with regional partners, and to provide traveler information to the public. Table 1 describes the projects included in the 5 year plan. The purpose of most of these projects is to improve travel time, to reduce crashes and the effects of crashes, to support incident management and to provide more traveler information.

Communications

The communication system provides the backbone for deployment of projects in the other five areas by providing a network for exchanging information to and from field devices and stakeholder agencies. The communication network will be deployed on a project by project basis through the next 20 years to support the ITS plan as needed. The communications infrastructure projects identified in this category fill in gaps in the overall planned communication network that are not included in a separate improvement project.



ITS IMPLEMENTATION PLAN

Public Transportation Management

Public Transportation Management technologies address two major aspects of transit operations: transit agency operations and management and transit traveler information systems. The projects in this program area are intended to enhance existing systems and to improve transit traveler information. Although, there is no existing fixed route transit system in Deschutes County, many of these technologies may be useful to the existing Bend dial-a-ride paratransit service, with further development and expansion into a fixed-route service in the 10 and 20-year plan categories.

Emergency Management

Projects included in this area focus on reducing emergency response times and integrating emergency management with transportation and transit management. Many emergency management projects included in the ITS Plan are included later in the schedule because they are highly dependent on travel and traffic management projects, but two key projects are included in the 5 year plan as indicated in Table 2.

Table 2. Capital Costs for Emergency Management

Emergency Management	Capital Cost
Information Sharing Between Traffic Management Systems and Emergency Service Providers	$550,000
Coordinated Emergency Response - Radio System Link	N/A*
Total:	**$550,000**

*This project would be funded as part of a regional communications consortium.

Maintenance & Construction Management

These projects are aimed at improving the safety of motorists and workers in construction zones, improving the efficiency of construction management and control, enhancing construction scheduling and tracking weather conditions that affect maintenance. Two key projects are shown in Table 3 and the 5-year deployment schedule, which are focused on meeting the demands of the OTIA construction projects on the state highway system.

(Source: International Road Dynamics)

Table 3. Capital Costs for Maintenance& Construction Management

Maintenance and Construction Management	Capital Cost
Maintenance and Construction Coordination System	$100,000
Work Zone Management and Safety Monitoring Systems	N/A*
Total:	**$100,000**

*This project would be funded as part local construction projects on a project-by-project basis

Information Management

Collecting, archiving, and managing various types of transportation-related data is a critical part of this ITS Plan. Since much of the data collection is closely tied to projects that deploy field devices and systems to collect data, the two information management projects are included in the 10-year plan.

Advanced Vehicle Safety Systems

These projects include a variety of sensing devices, vehicle control and communication technologies aimed at reducing accidents through effective and practical in-vehicle electronic driver aids and warning systems. Implementation of such systems alerts drivers to hazardous situation and impending collisions and can contribute to reduced collisions and overall safety improvements.

ITS IMPLEMENTATION PLAN

High Priority Projects

The highest priority projects are scheduled for deployment within the first five years. This section summarizes the key high priority projects.

Central Signal System: This project will install a central traffic signal control system and fiber optic traffic signal interconnect on 3rd Street (from ODOT building to Powers Road with communication spurs to the Bend Parkway). This will provide traffic engineers the ability to monitor and change signal timings remotely. This project also supports future arterial management and advanced signal timing projects and will include video for monitoring and count stations for traffic data collection.

Safety and Efficiency Improvements

The following areas have been designated as high priority locations for safety and efficiency improvements along the Highway 97 corridor:

- 3rd Street (Highway 97 Business in Bend)
- Redmond Reroute
- Redmond
- Bend Parkway

A combination of strategies discussed below will be used at these locations to enhance the transportation system for the motoring public, as well as management personnel by improving travel times, reducing crashes and the effects of crashes.

- Network surveillance: Provide traveler information for the general public and monitoring capabilities for traffic management, maintenance, and emergency management personnel on key corridors.
- Traffic Data Collection System: Collecting roadway performance data (volumes, speeds, occupancy, classification weights), real time congestion information, and support transportation planning and enforcement.
- Advanced signal timings: Improve the flow of traffic along the major arterials with improved traffic signal coordination and management techniques. Coordination traffic signals during peak periods will reduce travel times and contribute to reduced stops, fuel consumption and crashes.
- Traveler Information: Provide roadway condition information to travelers via TripCheck, electronic message signs, incident and construction information.

City of Bend Traffic Data Collection Project:

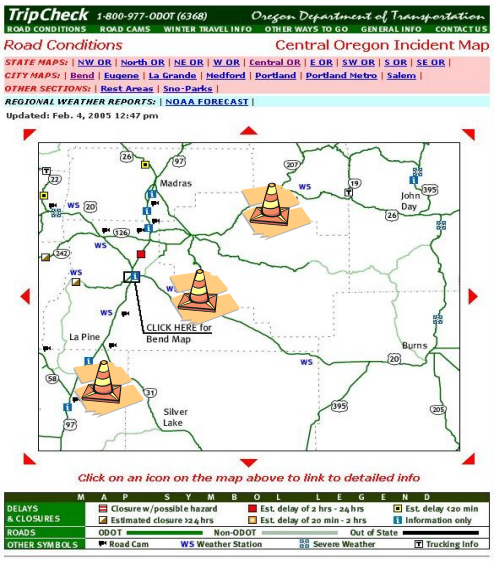
This project will deploy video traffic counting stations at bottleneck locations (e.g. Portland Street Bridge) to monitor traffic and collect volume data. The traffic data collected from these stations could be useful for conducting before/after studies for other ITS project implementations.

ITS IMPLEMENTATION PLAN

Regional Traveler Information System: The goal of this project is to develop an integrated system to disseminate traveler information to road users via 511, TripCheck, Advisory Radio, Cell phones or mobile data devices. Kiosks will also be included at key traveler locations, such as the Bend Parking Garage, truck stops and rest areas and will provide access to construction, incidents, congestion, video images, and weather information.

Maintenance and Construction Coordination System:

This project's purpose is to improve traffic mobility through the state of Oregon by providing a central source for all current and planned construction and region-wide/statewide maintenance activities. Deploying an information site that will include details about active and planned construction, weight and width restrictions, and travel times in work zones will ensure that there is always an east-west and north-south route within Oregon for goods movement.



Coordinated Emergency Response – Radio System Link

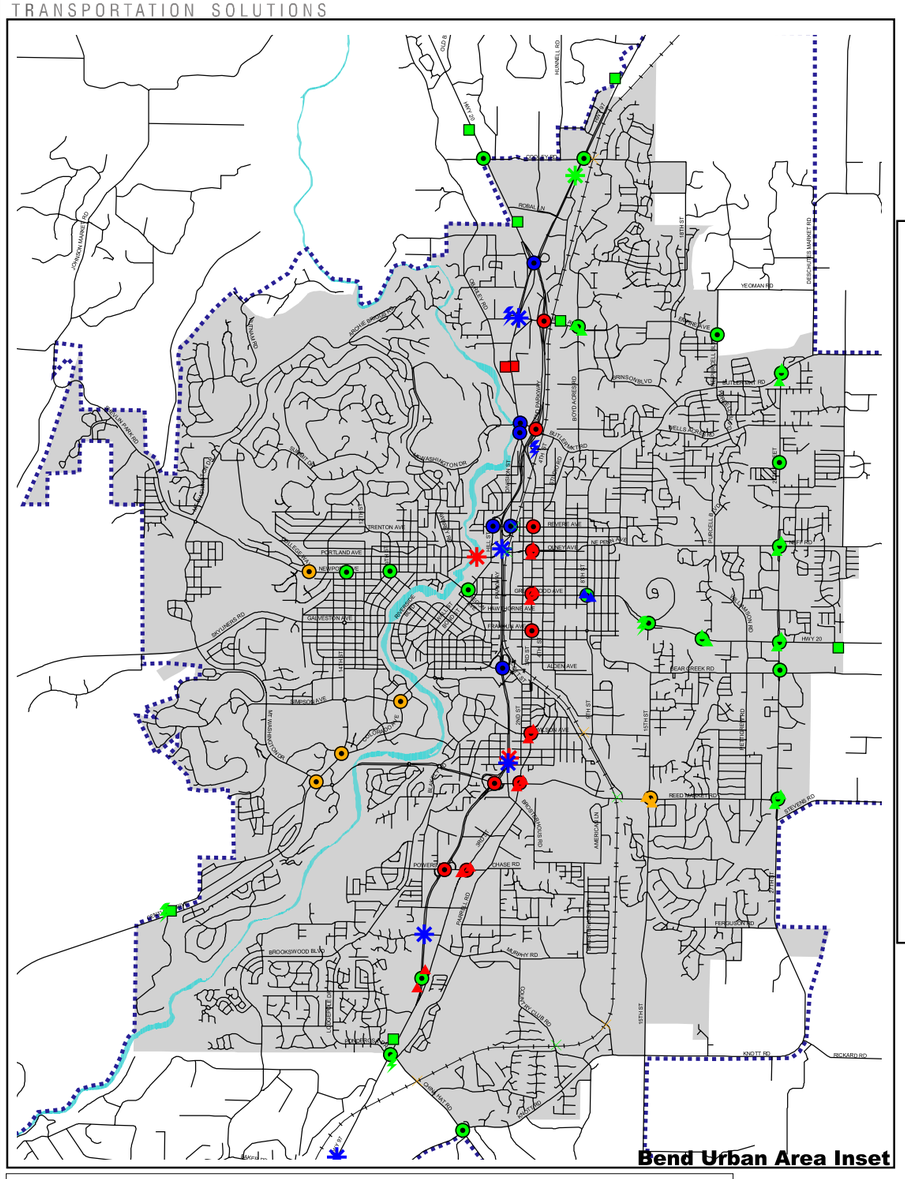
The goal of this project is to enhance the coordination and communication between stakeholders responsible for emergency management. The deployment of a radio system link will provide a common communication interface between agencies responsible for emergency management. This project is an important tool to support coordinated emergency response for evacuation routes and disaster response.

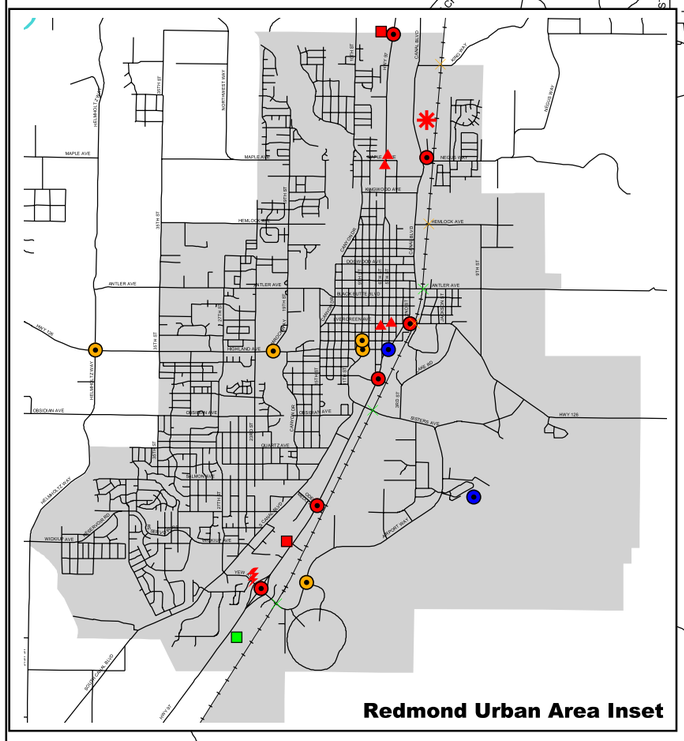
Information sharing - Traffic management systems/emergency service providers:

The goal of this project is to improve the communication and information flow between transportation management systems, 911 and emergency dispatch center. This project will share camera images, congestion flow map, emergency calls and mayday systems information between transportation and emergency management systems.

DKS *Associates*
TRANSPORTATION SOLUTIONS

Oregon Department of Transportation





LEGEND

Railroads

Bend MPO Boundary

Device Phasing

- Existing
- Proposed 0-5 Years
- Proposed 6-10 Years
- Proposed 11-20 Years

ITS Equipment

- CCTV Camera
- Variable Message Sign
- Weather Station
- Automated Traffic Recorder
- Count Stations
- Advanced Rail Warning System
- Dynamic Speed Limit Sign
- Speed Photo Enforcement

N

Not to Scale

Deschutes County
Intelligent Transportation Systems

Figure 3
ITS DEPLOYMENT PLAN
FOR 2005-2025

Table 4. Deployment Project List (Page 1 of 3)

Project Number & Title	Project Description
Travel & Traffic Management (TM)	
DC-TM-01:Central Signal System	Project will provide traffic engineers the ability to monitor and change signal timings remotely and will support future arterial management and advanced signal timing projects. The project will include the installation of a central traffic signal system, fiber optic traffic signal interconnect on 3rd Street, video monitoring and count stations for traffic data collection. and fiber optic traffic signal interconnect on 3rd Street.
DC-TM-02 Highway 97 Business Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control, electronic message signs, count stations, and advanced signal timing improvements.
DC-TM-03:Highway 97 (Redmond Reroute) Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control and automatic traffic recorders along the new Hwy 97 alignment.
DC-TM-04:Highway 97 (Redmond) Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control, electronic message signs, count stations, and advanced signal timing improvements.
DC-TM-05: Regional Traveler Information System	Develop an integrated system (coordinated with ODOT TATII) to disseminate traveler information (511, TripCheck, Advisory Radio, Cell phones or mobile data devices). Kiosks at key traveler points (Bend Parking Garage, truck stops and rest areas) are also included in this system. Information will include construction, incidents, congestion, video images, and weather information at a minimum.
DC-TM-06:Downtown Bend Parking Management System	Project would monitor parking garage occupancy to alert travelers if the garage is full and provide guidance to alternate available parking.
DC-TM-07:Highway 20/Greenwood/Newport Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control, electronic message signs, count stations, and advanced signal timing improvements.
DC-TM-08:Highway 97(Bend Parkway) Safety and Efficiency Improvements	This project will deploy video monitoring cameras with pan-tilt-zoom control and automatic traffic recorders along the new Hwy 97 alignment.
DC-TM-09:Century Drive (to Mt. Bachelor) Safety and Efficiency Improvements	This project will deploy video, electronic message signs, weather stations, dynamic speed limit signs, and speed photo enforcement on Century Drive between Bend and Mt. Bachelor
DC-TM-10: Incident Response Program-Staff and Vehicles	Develop a multi-jurisdictional regional incident response program to support emergency management agencies with incident management on state, county, and city roadways. This program includes vehicles, personnel, and dispatch. This program will coordinate with ODOT maintenance crew incident responders to maximize efficiency and pool resources.
DC-TM-11: Highway 97 (Bend to Redmond) Safety and Efficiency Improvements	Project will deploy video and electronic message signs to support incident management and traveler information
DC-TM-12:Highway 97 (South of Bend) Safety and Efficiency Improvements	Project will deploy video, electronic message signs, and weather stations
DC-TM-13: 27th/Empire/Knott Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control, count stations, and advanced signal timing improvements.
DC-TM-14: ODOT Region 4 TOC Upgrade	Expand/upgrade the existing TOC facility and equipment. Consider co-location with 911 center, EOC, or emergency response centers.
DC-TM-15: Special Event Management System	Project includes the deployment of traffic signal timing plans, portable dynamic message signs, parking management, and public transportation management at Deschutes County Fairgrounds and Expo Center and Sisters.
DC-TM-16:Highway 20 (Bend to Sisters) Safety and Efficiency Improvements	This project will deploy video, electronic message signs, and weather stations
DC-TM-17:Reed Market Road Safety and Efficiency Improvements	Project will deploy video monitoring cameras with pan-tilt-zoom control, count stations, and advanced signal timing improvements.
DC-TM-18:Expand the Incident Response Program - Plans	This project supports incident management in Deschutes County and includes identification of detour routes, management of traffic on Highway 97 and Highway 20 through Bend and Redmond to support the movement of north-south and east-west freight through Oregon. The program will include incident signal timing plans, electronic message signs, and congestion monitoring to support the incident responders and management of the roadway network during incidents.
DC-TM-19 :Advanced Rail Warning System	Deploy railroad crossing train detection and warning and transmit information for use by the TOC and emergency management agencies at the following locations:
	Bend (County Club Rd, Reed Market Road, Olney Ave, Revere Ave), Redmond (Airport Way, Sisters Ave, Antler Ave)
	Bend (China Hat Road, Brosterhous Rd, Wilson Ave, Cooley Rd), Redmond (Hemlock Ave, King)
	Transmit advanced crossing occupancy information to the public via message signs or in-vehicle navigation systems.

Table 4. Deployment Project List (Page 2 of 3)

Project Number & Title	Project Description
DC-TM-20: Mountain Pass Information System	Develop an information and dissemination system to provide travelers with Santiam Pass, US 26 Pass, Criterion Pass, and Century Drive conditions information. Include video, current and forecasted weather conditions, road temperature, and advisory radio information.
DC-TM-21:TOCS Software Upgrade	Add additional functionality to the TOCS software. This should include an interface to the central signal system for traffic signal status information.
DC-TM-22:ORE 126 (Sisters to Redmond) Safety and Efficiency Improvements	This project will deploy video, electronic message signs, and weather stations
DC-TM-23:S. Century Drive (Sunriver to Mt. Bachelor) Safety and Efficiency Improvements	This project will deploy electronic message signs to display information for drivers traveling from Sunriver towards Mt. Bachelor.
DC-TM-24:Advanced Vehicle System - Vehicle Probes	Collect travel time/traffic congestion information using vehicles as probes.
DC-TM-25:Advanced Vehicle System - Vehicle Navigation System	Deploy a system to transmit regional traveler information to in-vehicle navigation systems.
DC-TM-26:Advanced Vehicle System - Mayday to TOCS	Provide for information flow from vehicle Mayday systems to the TOC (notification of airbag deployment).
DC-TM-27:Roundabout Surveillance	Deploy video with pan-tilt-zoom capability in Bend at roundabouts to monitor traffic.
DC-TM-28: 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.
Communication (CO)	
DC-CO-01:Document Communication Design Standards	Document design standards for communications in the following areas to ensure standardization, compatibility, connectivity, and reliability between multiple jurisdictional agencies: - Conduit construction - Cable plant description - Minimum number of fibers - Network technology - Junction boxes - Fiber termination panels - Fiber connectors - Communication hub design - Fiber optic testing specification - Fiber optic installation
DC-CO-02:Communication Network	Expand the communication network to support additional field devices and connect operations centers to the regional communications network.
Public Transportation Management (PTM)	
DC-PTM-01:Automated Vehicle Location (AVL)/Computer Aided Dispatch (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 at the Bend Transit District dispatch center.
DC-PTM-02:Maintenance Management System	Upgrade the existing dial-a-ride maintenance system to integrate AVL technology with maintenance diagnostics.
DC-PTM-03:Real-Time Customer Information	Deploy real-time dynamic message signs at key locations such as transit centers and bus stops where multiple routes pass through, and at stops with large bus headways. Information could also be disseminated via a phone system and the Internet.
DC-PTM-04:Transit Security System	Install video monitoring equipment on the transit vehicle fleet and at transit centers.
DC-PTM-05:Transit Signal Priority	Install transit signal priority equipment and software at key intersections on transit routes and on transit vehicles. Actual technology used could include a point or zone detection system or a central management system using the real-time bus locations.
DC-PTM-06:Automated Passenger Counting	Install an automated passenger counting system that electronically records boardings at each transit stop
DC-PTM-07: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).
Emergency Management (EM)	
DC-EM-01:Information Sharing Between Traffic Management Systems and 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. This project will integrate the transportation information with existing computer aided dispatch systems and the emergency data with traffic management systems.
DC-EM-02:Coordinated Emergency Response - Radio System Link	Deploy a common communication interface between stakeholders responsible for emergency management. This project supports coordinated emergency response for evacuation routes and disaster response.
DC-EM-03:Real-Time Information to mobile data devices	Provide real-time traffic information to emergency responder's mobile data devices.

Table 4. Deployment Project List (Page 3 of 3)

Project Number & Title	Project Description
DC-EM-04:Ambulance-Hospital Information System	Enable the exchange of real-time information (video, audio, and data) between first responders and hospitals through the regional communication network (St. Charles micro-wave communication system).
DC-EM-05:Traffic Adaptive Emergency Response	Deploy an integrated emergency response system that provides for pre-trip planning, en-route guidance (static route plan), and dynamic route guidance (traffic-adaptive route plan) for emergency vehicles.
DC-EM-06:Provide Traffic Management System Information at EOCs	Provide an interface between the TOC and/or other traffic management systems and each of the emergency operations centers to allow access to traffic control devices during emergency situations at the EOCs as well as to share information between agencies. This would include workstations, monitors, and a communications interface at EOCs.
DC-EM-07:Responder Video System	Provide emergency responders with video cell phones and develop a link to the TOC to link video to other agencies.
DC-EM-08:Traffic Signal Preemption by Vehicle ID	Implement preemption equipment to provide traffic signal preemption by specific vehicle ID.
DC-EM-09:Advanced Emergency Vehicle Routing	Provide emergency vehicle priority between St. Charles Hospital and the Bend Airport.
DC-EM-10:Roundabout Preemption	Implement an emergency vehicle preemption system for roundabouts located on primary response routes.
Information Management (IM)	
DC-IM-01:Regional Data Management System	Implement a data management system for archiving data, collecting real-time data, and accessing data. The system should have geospatial capabilities and data should include at a minimum traffic counts, speed data, accidents (vehicles, pedestrians, and bicycles), traffic enforcement data, incident information, and transit information.
Maintenance & Construction Management (MC)	
DC-MC-01: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. The system will include active construction, planned construction, weight and width restrictions, travel times in work zones and other information necessary to manage traffic mobility in Oregon.
DC_MC-02:Work Zone Management and Safety Monitoring Systems	Deploy work zone safety enhancements and management techniques including variable speed limits, incident detection and management, lane merge controls, travel time estimates and queue detection with electronic feedback signs.
DC-MC-03:Roadway Automated Treatment	Includes environmental sensors and automated treatment (de-icing) at the planned US 97/S. Century Drive interchange.
DC-MC-04:Portable Construction Zone Equipment	Deploy moveable dynamic message signs and variable speed limit signs for use in work zones.
DC-MC-05:Maintenance Vehicle Tracking	Deploy GPS/AVL equipment in maintenance vehicles (e.g. snow plows). Provide route information for coordinating maintenance between agencies. Additional functionality could include environmental sensors (e.g. road temperature)
DC-MC-06:Automated Maintenance Logging System	Implement a system to automate coding of maintenance needs (e.g. potholes, wildlife removal, damaged signs) from vehicles.
DC-MC-07:Portable Sidewalk Closure Message System	Develop and deploy a sidewalk closure audible message system to re-route pedestrians and meet ADA requirements.
Advanced Vehicle Safety Systems (AVSS)	
DC-AVS-01:Road Weather Conditions	Install short-range communications equipment at weather stations to transmit road conditions (pavement temperature) to vehicles.
DC-AVS-02:Congestion Warning System	Deploy warning systems devices at entry points into urban areas to warn drivers of upcoming signals/queues.
DC-AVS-03:Intersection Collision Avoidance	Install short-range communications to transmit traffic controller information to in-vehicle collision avoidance systems.
DC-AVS-04:Wildlife Detection	Deploy wildlife detection equipment and short-range communications to transmit warnings to in-vehicle systems.

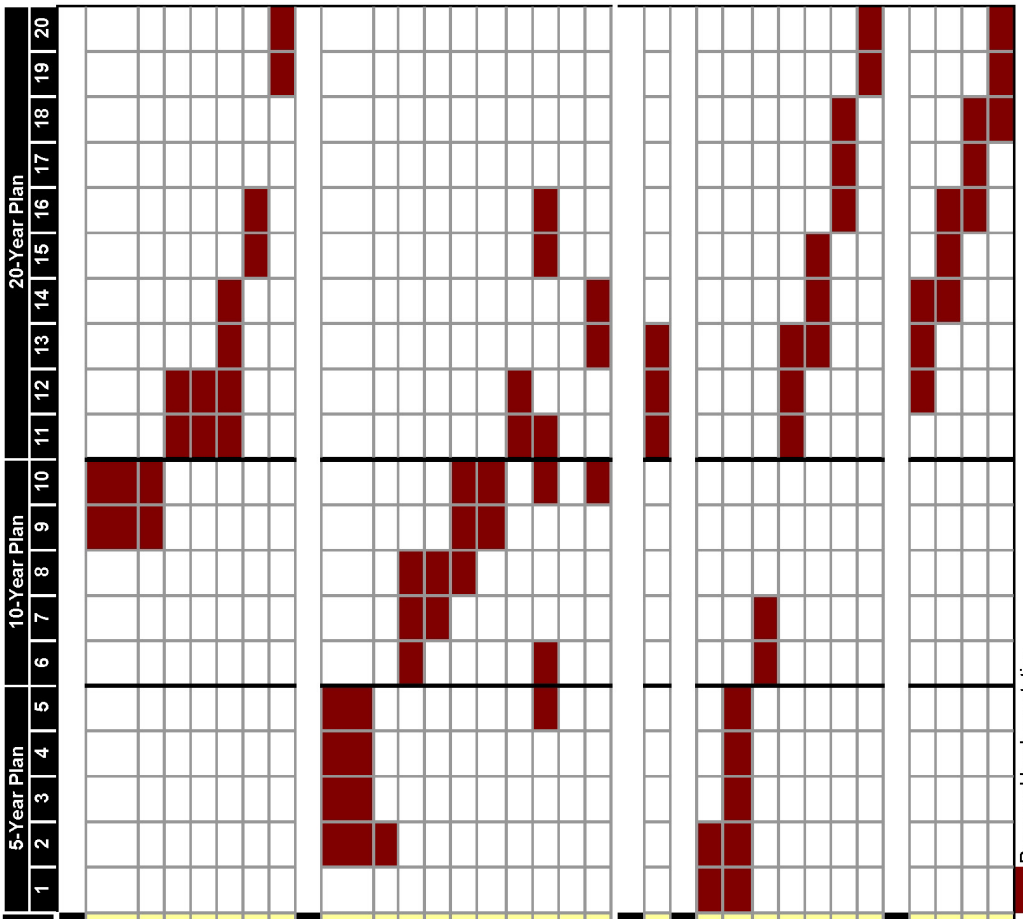
Table 5. Deployment Plan Schedule (1of 2)

Ref. No.	Project Title	5-Year Plan 1	2	3	4	5	10-Year Plan 6	7	8	9	10	20-Year Plan 11	12	13	14	15	16	17	18	19	20
Travel and Traffic Management																					
DC-TM-01	Bend Central Signal System	■	■																		
DC-TM-02	Hwy 97 (3rd Street) Safety and Efficiency Enhancements		■	■																	
DC-TM-03	Hwy 97 Reroute (Redmond) Safety and Efficiency Enhancements	■	■	■																	
DC-TM-04	Hwy 97 (Redmond) Safety and Efficiency Improvements			■	■																
DC-TM-05	Regional Traveler Information System				■	■															
DC-TM-06	Downtown Bend Parking Management System			■	■																
DC-TM-07	Hwy 20/Greenwood/Newport Safety and Efficiency Improvements						■	■	■												
DC-TM-08	Hwy 97 (Bend Parkway) Safety and Efficiency Improvements				■	■	■														
DC-TM-09	Century Drive (to Mt. Bachelor) Safety and Efficiency Improvements						■	■	■												
DC-TM-10	Incident Response Program - Staff and Vehicles							■	■	■											
DC-TM-11	Hwy 97 (Bend to Redmond) Safety and Efficiency Improvements					■	■	■													
DC-TM-12	Hwy 97 (South of Bend) Safety and Efficiency Enhancements								■	■	■										
DC-TM-13	27th/Empire/Knott Safety and Efficiency Enhancements								■	■	■										
DC-TM-14	ODOT Region 4 TOC Upgrade					■				■	■										
DC-TM-15	Special Event Management System										■					■					
DC-TM-16	Hwy 20 (Bend to Sisters) Safety and Efficiency Enhancements											■	■	■							
DC-TM-17	Reed Market Road Safety and Efficiency Enhancements												■	■	■						
DC-TM-18	Expand the Incident Response Program - Plans													■	■	■					
DC-TM-19	Advanced Rail Warning System						■	■				■	■							■	■
DC-TM-20	Mountain Pass Information System														■	■					
DC-TM-21	TOCS Software Upgrade															■	■				
DC-TM-22	ORE 126 (Sisters to Redmond) Safety and Efficiency Enhancements																■	■	■		
DC-TM-23	S. Century Drive (Sunriver to Mt. Bachelor) Safety and Efficiency Enhancements																	■			
DC-TM-24	Advanced Vehicle System - Vehicle Probes																	■	■		
DC-TM-25	Advanced Vehicle System - Vehicle Navigation System																		■	■	
DC-TM-26	Advanced Vehicle System - Mayday to TOCS																		■	■	
DC-TM-27	Roundabout Surveillance											■	■							■	■
DC-TM-28	City of Bend Traffic Data Collection	■	■	■																	
Communications																					
DC-CO-01	Document Communication Design Standards						■														
DC-CO-02	Communication Network	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

■ Proposed Implementation

Table 5. Deployment Plan Schedule (2 of 2)

Ref. No.	Project Title	Years
Public Transportation Management		
DC-PTM-01	Automated Vehicle Location (AVL)/Computer Aided Dispatch (CAD) Transit Management System	
DC-PTM-02	Maintenance Management System	
DC-PTM-03	Real-Time Customer Information Displays	
DC-PTM-04	Transit Security System	
DC-PTM-05	Transit Signal Priority	
DC-PTM-06	Automated Passenger Counting	
DC-PTM-07	Electronic Fare System linked to Smart Cards	
Emergency Management		
DC-EM-01	Integration Between Traffic/Transit Management Systems and Emergency Service Providers	
DC-EM-02	Coordinated Emergency Response - Radio System Link	
DC-EM-03	Real-Time Information to MDTs	
DC-EM-04	Ambulance-Hospital Information System	
DC-EM-05	Traffic Adaptive Emergency Response	
DC-EM-06	Provide Traffic Management System Information at EOCs	
DC-EM-07	Responder Video System	
DC-EM-08	Traffic Signal Preemption by Vehicle ID	
DC-EM-09	Advanced Emergency Vehicle Routing	
DC-EM-10	Roundabout Preemption	
Information Management		
DC-IM-01	Regional Data Management System	
Maintenance and Construction Management		
DC-MC-01	Maintenance and Construction Coordination System	
DC-MC-02	Work Zone Management and Safety Monitoring Systems	
DC-MC-03	Roadway Automated Treatment	
DC-MC-04	Portable Construction Zone Equipment	
DC-MC-05	Maintenance Vehicle Tracking	
DC-MC-06	Automated Maintenance Logging System	
DC-MC-07	Portable Sidewalk Closure Message System	
Advanced Vehicle Safety Systems		
DC-AVS-01	Road Weather Conditions	
DC-AVS-02	Congestion Warning System	
DC-AVS-03	Intersection Collision Avoidance	
DC-AVS-04	Wildlife Detection	



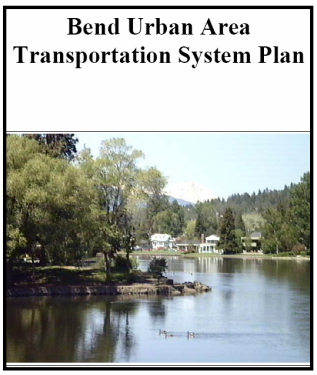
NEXT STEPS

This section outlines the steps to successfully implement the proposed ITS plan for Deschutes County over the next 20 years.

Deploy "Early" Winner Projects

A key to success of ITS in Deschutes County will depend on the deployment of early winner projects. The Bend central signal system is a potential early winner because it provides a communication backbone, provides traveler information, improves a key corridor in the study area and supports future arterial management. A key component to implementing "Early" Winner Projects is to conduct before/after studies of transportation conditions to document the benefits of each project.

Incorporate the ITS Plan into the RTP and Local TSP/SDC



The ITS devices and communication infrastructure identified in this plan should be installed on corridors concurrently with traditional transportation construction and maintenance projects. This approach will minimize reconstruction, maximize the use of resources, and result in the modernization of the regional transportation system. Where applicable, relationships to currently planned regional projects have been identified in the Deployment Plan chapter of the final report. In addition, the data collection, analysis, operational techniques and information sharing developed through the projects in this plan can become key elements of other regional efforts. The ITS deployment plan and communication maps, as well as the deployment plan project list, should be adopted in the Bend RTP and local TSPs. If adopted, ITS projects can become compents of local capital improvement plans and possibly SDCs. In addition, the adopted plan maps can be used to require the installation of conduit with roadway projects to support future ITS implementation.

Do Not Overlook Future Needs If They Fit With Current Opportunities

The region should pursue a flexible approach to implementing the plan. Opportunities may arise in early years to implement elements of the plan identified for later deployment. These opportunities may be possible due to new funding sources, coordination with roadway construction, or coordination with local agency/private initiatives. These opportunities should be seized when appropriate.

Define a Revenue Stream

Key stakeholders in Deschutes County will need to define a revenue stream for construction, operations and maintenance. This plan provides the basis for the funding needs and identifies opportunities for regional coordination and cost-sharing. The region must dedicate funding sources to implement each increment of the 20 year plan. Various possibilities exist for securing funding; to be successful the region should emphasize collaborative efforts that benefit a broad group of stakeholders. The total capital, annual operations/maintenance, and staffing costs for the ITS plan are provided in Table 6. Deschutes County will need an on-going commitment to operations and maintenance of the equipment and software to maximize the benefits of the ITS program. The ITS elements proposed within this program require consistent staffing for effective system operation, as well as requiring trained staff to do routine maintenance.

NEXT STEPS

Table 6. Estimated Capital, Operations & Maintenance and Staffing Costs for 20-Year ITS Plan

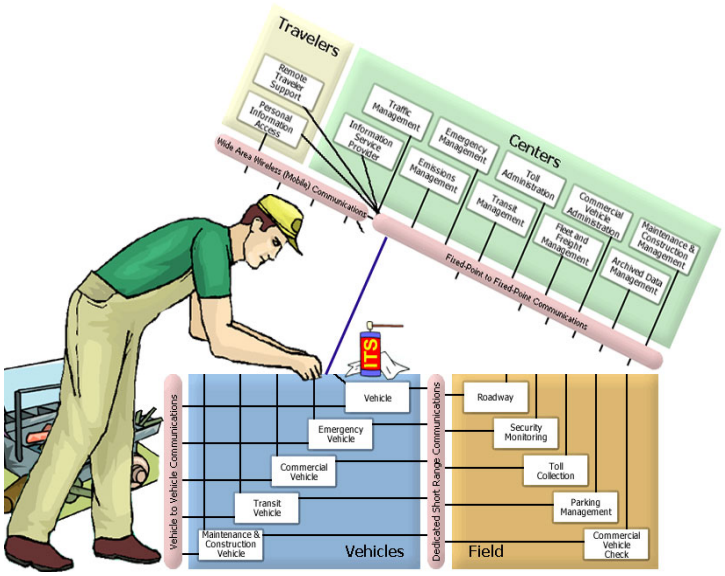
Implementation Stage	Estimated Implementation Capital Costs	Estimated Annual Operations & Maintenance Costs*	Estimated Annual Staffing Costs
5-Year Plan: 0 – 5 Years	$5,850,000	$55,000	$0
10-Year Plan: 6 – 10 Years	$9,744,000	$224,000	$600,000
20-Year Plan: 11 – 20 Years	$10,086,000	$178,000	$0
ITS Plan Management	$0	$100,000	$0
TOTAL	**$25,680,000**	**$557,000**	**$600,000**

*Annual operation and maintenance costs are per year for the associated stage

Lead Agency to Guide ITS Plan Implementation and Maintenance

One agency should be designated to lead and facilitate ongoing deployment, coordination, education and pursuit of funding. For Deschutes County, the Bend Metropolitan Planning Organization will fill that role. The Oregon Department of Transportation Region 4 will provide support as needed. Key responsibilities for the lead agency will include:

- Facilitate ongoing steering committee meetings
- Incorporate the ITS projects into regional project prioritization lists
- Coordinate funding applications for ITS projects
- Coordinate and track project implementation
- Maintain the regional architecture, including the Turbo Architecture file.
- Arrange public outreach sessions as needed.



(Source: FHWA)

Regional Architecture Maintenance

One of the keys to successful ITS plan implementation is the maintenance of the plan and architecture as ITS projects are implemented, as regional ITS needs and services evolve, and as new technologies emerge. The architecture must be maintained per federal requirements and the FHWA recommends updating the regional architecture for the following primary reasons:

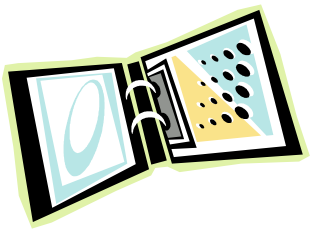
- Changes in regional needs
- Addition of new stakeholders
- Changes in scope of services considered
- Changes in statewide architecture or other architectures in adjoining regions
- Addition or deletion of projects
- Changes in project priority

NEXT STEPS

The architecture maintenance will be led by ODOT, who will also update the Turbo Architecture file, and the Steering Committee will provide input to any changes. Significant changes to the architecture may be made at any time as deemed necessary by the lead agency and the Steering Committee; the changes will be tracked using a change log.

Project Implementation and Conformity

The implementation of ITS projects in Deschutes County shall conform to the regional architecture per FHWA requirements. If the final design of an ITS project differs from the regional architecture, then the regional architecture shall be updated as described in this section. The FHWA requires a systems engineering analysis for all ITS projects on a scale commensurate to each project. The systems engineering analysis [2] shall include:



- Identification of portions of the regions ITS architecture being implemented
- Roles and responsibilities of participating agencies
- Definition of functional requirements
- Analysis of alternative system configurations and technology options to meet functional requirements
- Procurement options
- List of applicable ITS standards and testing procedures
- Operation and management procedures and resources

Steering Committee Roles

The Steering Committee, which consists of key stakeholders, helps foster interagency coordination and build consensus throughout the region. The continuing roles of the Steering Committee during the implementation of the ITS plan includes the following:

- Make decisions regarding project phasing. As opportunities arise (funding source, priority shift, or concurrent construction), adjust the project phasing as appropriate.
- Help with or coordinate funding applications
- Help with or coordinate project implementation
- Develop memoranda of understanding (MOUs) or intergovernmental agreements (IGA's) as required.
- Prepare plans and standards (incident management plans and standards for communication design, work zones, and data management)
- Review changes to the regional architecture

[2] Title 23, Code of Federal Regulations (CFR), Highways, Chapter 1: FHWA, Department of Transportation, Par 940: Intelligent Transportation Systems Architecture and Standards

GLOSSARY OF ACRONYMS

AVL	Automated Vehicle Location
APC	Automated Passenger Counting
ATMS	Advanced Traffic Management System
AVSS	Advanced Vehicle Safety System
BMPO	Bend Metropolitan Planning Organization
CAD	Computer Aided Dispatch
CCTV	Closed Circuit Television
CIP	Capital Improvement Plan
CO	Communications
CVO	Commercial Vehicle Operations
DMS	Dynamic Message Sign
EM	Emergency Management
EMS	Emergency Management Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
IM	Information Management
IGA	Inter-governmental Agreement
ITS	Intelligent Transportation System
MC	Maintenance & Construction Management
MDT	Mobile Data Terminal
MOU	Memoranda of Understanding
O & M	Operations and Maintenance
ODOT	Oregon Department of Transportation
OSP	Oregon State Police
PTM	Public Transportation Management
RTP	Regional Transportation Plan
SDC	System Development Charge
SPIS	Safety Priority Index System
TOC	Transportation Operations Center
TM	Travel & Traffic Management
TSP	Transportation System Plan
VMT	Vehicle Miles Traveled