A Summary of Rural Intelligent Transportation Systems (ITS) Benefits as applied to ODOT Region 1

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DISCLAIMER

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1. INTRODUCTION

The importance of transportation to the daily activities of life cannot be understated. In connecting people to employment, shipping goods to markets, providing access to medical and emergency services, broadening opportunities for recreational activities and many others, transportation's impact is enormous. As such, the nature of the transportation system can impact many aspects of the quality of life. As the quality of the transportation system is improved, it is anticipated that its benefits would be widespread.

In recent years, one major area of improvements to the transportation system is a group of solutions collectively known as intelligent transportation systems (ITS). These solutions are combinations of communications, computational and electronic technology that help to improve the safety and operation of the transportation system. The promise of ITS to save time, lives and money is significant, and has been documented in many studies across the country. Most of these benefits have been found in urban areas, where ITS deployment has been more accelerated in order to maximize the capacity of the transportation system under recurring traffic congestion conditions. However, it is likely that ITS may offer significant yet different benefits to the rural environment as well, as it addresses some of the non-recurrent congestion and safety issues that are more pronounced in rural areas.

In order to provide for the effective implementation of ITS, it is important to have an overarching strategic framework, that describes how ITS will work in conjunction with the rest of the transportation system in order to ultimately enhance its quality. Because ITS is still relatively unproven in rural areas, this need is critical in order to maximize the benefits of ITS investments for both operating agencies and the traveling public they serve.

The purpose of this document is to provide a brief overview of rural challenges in Oregon Department of Transportation (ODOT) Region 1, potential rural ITS deployments in Region 1 and documented benefits of these rural ITS deployments. This will help select and prioritize the suitable ITS deployments to meet the transportation challenges in rural areas of Region 1.

The plan starts with a brief overview of intelligent transportation systems and how they may be useful in a rural environment in Chapter 2. Chapter 3 provides a broad overview of the rural transportation challenges. Chapter 4 presents rural ITS benefits that have been measured nationally. Chapter 5 presents the rural transportation challenges and potential ITS solutions determined at the stakeholder workshop conducted in Portland as part of this effort.

Chapter 6 presents a list of national case studies as seen relevant to Region 1 needs adapted from Rural ITS Toolbox. Chapter 7 summarizes the potential benefits from the rural ITS applications described in Chapter 6.

2. WHAT IS ITS?

It is important to have an understanding of the overall role of ITS in the transportation system for effective and efficient use of ITS systems. The purpose of this chapter is to provide a cursory overview of the context for ITS, what ITS is, what it is intended to accomplish, and how it may be beneficial to rural areas

2.1. Context of ITS

As Chapter 1 indicated, transportation plays a significant role in everyday activities. The quality of the transportation system may contribute to the overall quality of life, by allowing people to get to destinations more quickly, more reliably, and in greater safety and comfort. As the transportation system fails under various pressures, including heavy demand, incidents and unusual weather events, it may contribute to lessening the quality of life.

Traditionally, the broad approach to addressing many transportation problems has been to build new roadway capacity and/or to enhance the design of existing roadways. This solution is generally falling out of favor for a couple of reasons. First, most states are finding it increasingly difficult to continue funding this approach, since roadways that were built thirty, forty and fifty years ago are now in need of significant rehabilitation or even reconstruction. Second, many of the problems experienced in the function of the transportation system occur only at certain times of day (e.g. peak commuting periods), certain seasons of the year (e.g. peak tourist season), and during certain largely unpredictable events (e.g. major festivals, incidents, weather events). It may be difficult to justify traditional solutions for many of these challenges on a cost-benefit basis.

As traditional solutions have fallen out of favor, a new package of solutions has emerged principally in the last ten years as an alternative to addressing some of these transportation challenges. This new set of solutions, called intelligent transportation systems (ITS), is intended to work in conjunction with the existing transportation system to improve its performance for both key operating agencies, such as departments of transportation and highway patrol, as well as for users, including commuters, transit users, tourists, freight concerns, and others.

Since ITS is designed to be integrated with the existing transportation system, it is important to understand that ITS may not represent a “magic bullet” that will solve every transportation problem that exists. In some locations for some problems, traditional solutions will be appropriate. In other cases, however, ITS may provide a more cost-effective and more reliable solution. ITS solutions need to be applied strategically and thoughtfully, to address specific challenges at specific locations in conjunction with the existing transportation system.

As shown in Figure 2-1, vehicle miles traveled (VMT) per year in Oregon have more than doubled each year since 1970. However, the number of lane miles for the same 30-year period (1970-2000) has increased by only about three percent. Intelligent Transportation Systems (ITS) can help meet this increase in demand by applying the latest technological advancements to our transportation systems and improving the quality, safety, and effective capacity of existing infrastructure. These diverse technologies include information processing and communications, traffic control devices, and electronics.

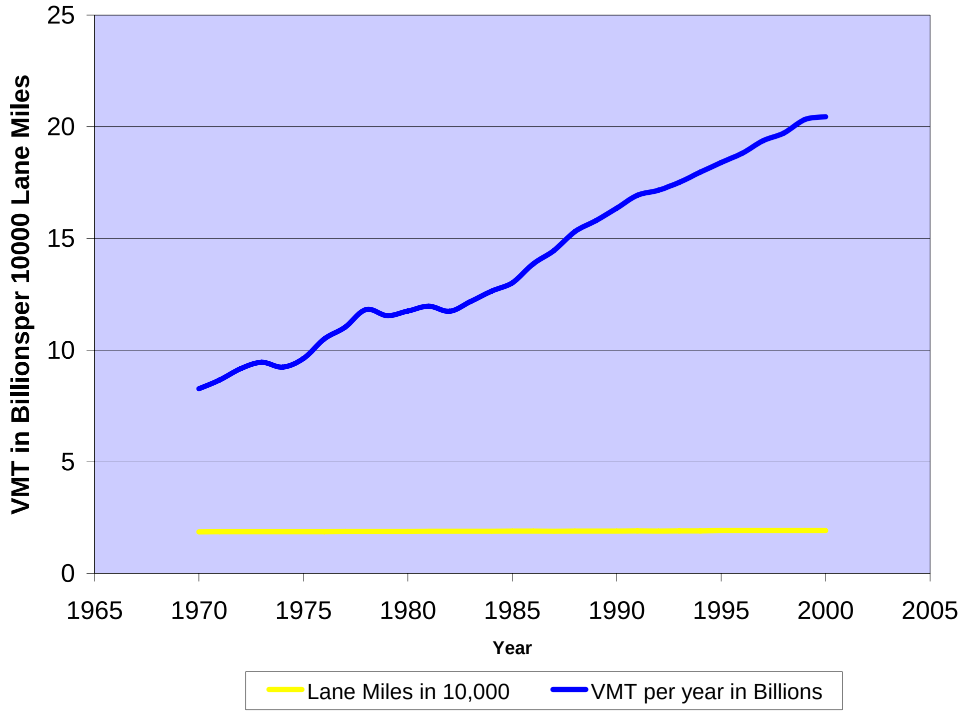

Figure 2-1 VMT per year and Lane Miles in Oregon From 1970 till 2000

As new ITS technologies are tested and implemented, they are regularly evaluated to allow for continual refinement and improve it's ITS program. Evaluations are critical to ensuring gradual integration and full technology deployment, as well as being essential to understanding the value, effectiveness and impact of broader ITS activities.

2.2. Definition of ITS

Broadly considered, ITS may be defined as the application of advanced communications, information processing, control and electronics technology to improve the transportation system in order to save lives, time and money. ITS is an open-ended term that is not restricted to a fixed group of technologies or solutions, but rather characterizes the method of approach to solving a problem.

ITS as a term has gained popularity in the last several years, primarily with the passage of Federal legislation entitled the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. This legislation, which served as the major re-authorization of transportation funding at the Federal level, designated separate funding to support research and operational tests of intelligent vehicle highway systems (IVHS). The legislation defined IVHS as "the development or application of electronics, communications, or information processing (including advanced traffic management systems, commercial vehicle operations, advanced traveler information systems, commercial and advanced vehicle control systems, advanced public transportation systems, satellite vehicle tracking systems, and advanced vehicle communications systems) used singly or in combination to improve the efficiency and safety of surface transportation systems." (1). Shortly after, the concept of intelligent vehicle highway systems was re-designated as intelligent transportation systems, to show that the concept reflects broader applications of technology beyond automobiles and vehicle control. The Transportation Equity Act for the 21st Century (TEA-21), passed in 1998 to succeed ISTEA, provided continued funding for ITS research and deployment across the country.

While ITS has been strongly encouraged by Federal support, it is an initiative that was not created at the Federal level. From a technological standpoint, many agencies have been experimenting with ITS technologies for years, even decades, before passage of ISTEA. Some would say that traffic signals, which have been around since the 1920s, may represent one of the first ITS applications in their use of electronics to improve the operation of existing intersections. In subsequent years, there have been numerous other applications of technology to the transportation system, such as changeable message signs to warn of low visibility conditions, installed on Interstate 5 near Albany, Oregon in the 1960s and 1970s, and similar signage in California's Central Valley near Fresno and Stockton during the same time period. Highway advisory radio has been around for decades as a way to inform travelers in a localized area of pertinent travel information, including incidents, construction-related detours, and tourist-site access and parking information. Improvements in computational power and manufacturing have improved the capability, reliability and usefulness of these technologies. While ITS may sound visionary and far-removed from reality, there are numerous real examples of ITS systems, products and services at place throughout the country.

The passage of ISTEA and TEA-21 did, however, inaugurate a new awareness of the potential to apply advanced technologies to the transportation system. The increased Federal emphasis, supported by funding, has enabled many states to adopt ITS for a variety of applications, such as streamlining commercial vehicle clearance procedures, providing better management of traffic on congested roadways, and obtaining information about incidents and weather conditions from remote conditions on a real-time basis.

The Federal role in ITS funding is anticipated to lessen over time. It has been said that the long-term goal for ITS financing is that 80 percent of the infrastructure would eventually be supported by the private sector. To accomplish this, there will need to be significant mainstreaming of ITS into the traditional transportation planning process as a solution that can supplement traditional transportation solutions. Furthermore, there will need to be a conscious effort to partner with the private sector to find ways in which they can earn a reasonable rate of return on ITS investments that will also provide clear net benefit to the traveling public as well as public-sector agencies.

2.3. Summary

ITS represents an initiative to use advanced technologies to improve the operation of the transportation system to save lives, time and money. It is a group of solutions that is intended to complement traditional solutions to transportation problems. Just as the transportation system impacts many aspects of life, so also there are many spillover benefits from ITS. While ITS has been deployed primarily in urban and metropolitan areas, it has unique areas of applicability in the rural environment as well, due to some of the unique challenges facing the rural transportation system. These rural applications should be pursued strategically on a regional and local basis, however, in order to address the deficiencies in the existing transportation system.

3. RURAL CHALLENGES

ITS has traditionally been employed in the context of metropolitan areas. The economics of ITS are quite obvious in the urban context, where recurring congestion can likely never be fully addressed by adding capacity to the roadway system – assuming that fiscal, social and environmental constraints even permitted such capacity to be added. Consequently, many early deployments of ITS have been focused on more urbanized areas.

It is important to emphasize that ITS may have special applicability to the rural transportation system for several reasons. First, it will be highly difficult to make a successful case for adding transportation system capacity in a rural area to accommodate non-recurring congestion, resulting from incidents or weather events. Economically, the cost-benefit analysis for a rural area will be a lot more challenging than in an urbanized area, because congestion occurs less frequently in the rural environment. Furthermore, many rural areas are constrained by challenges due to topography as well as protected lands, such as National Parks or Forest Service Land. While land costs may be cheaper in a rural environment than the urban environment, the costs of environmental mitigation and preservation will often be significantly higher. Strategically located ITS technologies may help to solve the problems at a lesser cost with a lesser impact on the adjacent environment than conventional solutions.

In addition, the larger distances and lower traffic volumes found in rural areas present some unique challenges not present in the urbanized area. A vehicle that overturns on an urban interstate in the evening will likely have another vehicle see the problem within seconds and notify emergency personnel, who would be able to respond within a few minutes. In the rural environment, it may be minutes or sometimes even an hour before the same incident is identified. In addition, the location of emergency services may be a long distance away. Consequently, the potential for lasting harm to the survivor of the incident would therefore be significantly higher in the rural environment.

Long distances and low volumes are not only critical for emergency response, but also for tourist traffic. A tourist bound for a destination in an urbanized area, such as a theme park, would have numerous hotels, restaurants, gas stations, and other services in very close proximity, in case they were in need of route or vehicle assistance, lodging, or food. For tourists in the rural area, however, these services are typically dispersed due to lower population levels. Consequently, a rural tourist may spend longer finding the destination if they receive bad directions, may have to drive many more hours in order to find accommodations, and face many other similar challenges. The consequences of bad information in the rural environment may pose a greater time penalty than in the urban environment.

Another effect of the distance across rural areas is to increase travel time for agencies responsible for operating and maintaining the roadways. This means that the time cost involved in any activities that are far from the dispatch center will be higher. It means that road closures due to incidents may last longer, if there is a long distance between the appropriate dispatch center and the incident location. It means that inaccurate information about snow or ice locations may cause significantly more wasted time for snowplows, and potentially increase the frequency and severity of incidents. ITS may be used to reduce the effect of this travel time by, at a minimum, providing better information to these agencies.

More than this, ITS could be used to automatically initiate corrective actions at key locations, to improve the safety and security of the traveling public.

Recognizing the potential applicability of ITS to the rural environment, while acknowledging that ITS solutions in metropolitan areas may not be fully transferable, a separate program was created in the national ITS program called Advanced Rural Transportation Systems (ARTS). ARTS is in a sense a subset of all other ITS programs. For example, Advanced Transportation Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS) have clear applicability to the rural environment in response to non-recurring congestion. However, it also represents a distinct focal area. Recognizing this, the ARTS Strategic Plan (2) describes seven critical program areas that focus on the specific needs of rural transportation users and providers, as follows.

Traveler Safety and Security addresses the need for improving driver ability to operate a vehicle in a safe and responsible way and for improving driver notification of potentially hazardous driving conditions (i.e., poor road conditions, reduced visibility, and so forth).

Emergency Services focuses on providing improved response when an incident occurs, including reduced emergency notification time, as well as providing additional crash details to enable improved response and care.

Tourism and Travel Information Services provides travel information and mobility services to travelers unfamiliar with the rural area and at tourist destinations.

Public Traveler Services/Public Mobility Services improves accessibility and reduces isolation for travelers using or relying on public transportation.

Infrastructure Operations and Maintenance addresses efficient and effective maintenance and operation of rural roadways and signals.

Fleet Operations and Maintenance provides for efficient scheduling, routing, locating and maintaining of rural fleets.

Commercial Vehicle Operations addresses regulation, management and logistics of commercial fleets and agricultural equipment to meet the needs of rural commercial vehicle operators.

The potential applications of ITS to the rural environment are limited by only a couple of factors: funding, provision of communications and power, and the creativity of transportation professionals.

4. RURAL ITS BENEFITS

ITS America, a non-profit organization which seeks to lead the public and private sectors in pursuing a national ITS agenda, cites the primary benefits of ITS as saving lives, time and money. This is true in both the urban and rural contexts. When effectively researched, developed, tested and demonstrated, ITS implementation can provide enhanced, safer, and more secure travel, while assisting rural transportation users and operators achieve improved levels of productivity. Some of the potential benefits of ITS applications in rural areas include the following.

4.1. Increase Safety

According to statistics from the National Highway Traffic Safety Administration (NHTSA), six million crashes occur on our nation's highways each year. These crashes kill more than 41,000 people and injure approximately 3.4 million others—at a cost of more than $230 billion (3).

National statistics also document that approximately 60 percent of fatalities occur in rural areas and of those fatalities, 70 percent are due to run-off-the-road vehicles. Advanced technology applications (ITS) may help to reduce accidents, reduce the impact of weather on driving conditions, reduce the impact of driver/ roadway operations characteristics, and reduce the impact of vehicle mix on safety.

ITS can also reduce crashes by collecting real-time travel data on traffic levels, road temperatures, weather conditions and hazardous conditions such as high winds and flooding. This information is used to warn drivers in advance through traveler information Web sites such as TripCheck.com, highway advisory radio, traveler information telephone services (1-800-977-ODOT or 511) and roadside electronic message signs in Oregon. This capability also speeds and improves incident response (i.e., the arrival of police or paramedics), which can save even more lives.

ODOT has implemented several projects to improve safety at specific sites in the state. For example, a downhill speed warning system has been installed on Emigrant Hill on westbound Interstate 84 in eastern Oregon. The purpose of the downhill speed warning system is to warn commercial vehicles when they are driving too fast based on the truck's weight. Evaluation of a similar system that has been deployed in the Eisenhower tunnel west of Denver, Colorado, showed a reduction in the number of truck-related crashes on the steep downhill grade sections, even though the truck traffic volume in the tunnel had increased by an average of 5 percent per year (4).

An advanced curve warning system being deployed at the Myrtle Creek curves on Interstate 5 uses a variable message sign (VMS) to warn motorists who are driving too fast to reduce their speeds. An evaluation of similar systems installed at five sites along Interstate 5 in northern California reported that the average speed of all trucks traveling through these curves was lower than the posted speed limits, and was reduced by an average of four percent after installation of these systems.

A queue detection system is also operational on State Route 99E near Dundee that uses vehicle detectors and a flashing sign to warn drivers when there is a line of stopped traffic ahead around a blind curve. There have been only 4 crashes in the 10-month period after installation, as opposed to 9 crashes in the 10-month period before installation of this system.

4.2. Improve Emergency Response

National statistics document that rural areas have approximately 2:1 greater response time to incidents and arrival at medical facilities. ITS may help to improve incident response time, emergency preparedness and hazardous cargo identification through automated incident detection and verification of needed services to respond to the incident.

Nationally, traffic congestion continues to increase and Oregon is no exception. An example of this increase is in the Portland metropolitan area, where the annual delay per traveler at peak hours (e.g., 7-9 AM on weekdays) has increased from five hours in 1982 to 47 hours in 2000. The cost of this delay is estimated to be $445 per person per year. It has also been estimated that traffic congestion is equally split between recurring congestion – i.e., normal rush hour traffic – and non-recurring congestion, which includes the effects of incidents, work zones, and weather (5). When non-recurring congestion is minimized through efficient management of incidents and traffic, especially during peak periods, ITS significantly reduces delay for drivers. CCTV cameras with pan, tilt and zoom options installed along highways has also been used in some incidents to verify the location of the incident, to determine the needed services to clear the incidents and to assess the impact of the incidents.

ODOT already has a network of approximately 140 closed-circuit television (CCTV) cameras across the state. These cameras provide extensive freeway coverage in the Portland area, and are located at major junctions, mountain passes and other critical rural locations throughout the state. One study has shown that the use of CCTV cameras reduces delays due to incidents by 10 to 45 percent (6). ODOT also provides road condition related information through toll free telephone services such as traveler information telephone services (1-800-977-ODOT or 511). This telephone service helps travelers that are on-route, to access real time information on the road conditions ahead and also helps travelers plan their trip before they start.

4.3. Improve Commercial Vehicle Operations (CVO)

Given that rural areas are dependent upon the efficiency of CVO, ITS can provide significant benefit to rural areas by streamlining CVO regulation and operation and improving CVO safety.

According to the Federal Highway Administration, trucks carried 220 million tons of freight worth $165 billion on Oregon’s highways during 1998 (7). By 2020, freight volume is projected to nearly double, while the value is expected to more than triple. Clearly, keeping trucks moving on Oregon’s highways is vital to Oregon’s continued economic vitality. For this reason, ODOT invests in a variety of technologies that are intended to reduce delay and improve safety for truckers.

For Example, ODOT’s Green Light Preclearance program is instrumental in reducing delay for truck drivers. Before implementation of this program, truck drivers had to wait in long lines at weigh stations to be cleared. Green Light allows vehicles to be electronically “read” while driving at normal highway speeds, and precleared without having to pull over into the weigh station. This technology, also known as "weigh-in-motion" (WIM), reduces delay for these trucks, as well as the trucks that continue to use weigh stations. It also improves safety for all drivers by reducing highway congestion. A survey of commercial vehicle drivers in Illinois assessed the driver acceptance level of WIM systems. This survey concluded that 91 percent found the WIM system reduces the hazards of merging and diverging at weigh stations and 88 percent advocated the installation of WIM systems (8).

Currently, there are more than 2,600 trucking companies with more than 24,700 trucks equipped with Green Light transponders. Twenty-one of ODOT’s weigh stations are equipped for the Green Light Preclearance Program and, in 2002, over 860,000 trucks were precleared at these stations. In considering an average delay reduction of five minutes, Green Light resulted in close to 72,000 hours of reduced delay for truckers in 2002 alone.

In a survey of trucking companies conducted by Oregon State University shortly after implementation of Green Light, 32 percent agreed that mainline pre-clearance would be beneficial to their companies, with 25 percent disagreeing. A benefit-cost study of electronic screening systems similar to Green Light for the mid-continental corridor (Interstate 35) reported a benefit-cost ratio between 6 and 12 which means that for every dollar spent on installation resulted in benefits worth 6 to 12 dollars (9).ODOT also provides useful real time road condition information to Commercial Vehicle (CV) Operators through toll free telephone services (1-800-977-ODOT or 511) so that CV operators can plan their trips efficiently.

In addition to keeping trucks moving, ITS can improve safety. In 2003, there were 1,126 commercial trucks involved in Oregon crashes, which resulted in 65 fatalities and 541 injuries (10). Some of these types of crashes occur when heavy vehicles go too fast down steep grades. For example, between April 1999 and August 2002, Emigrant Hill (mileposts 219 to 228 on Interstate 84) had 42 crashes involving trucks. In December 2002, ODOT installed a downhill speed warning system to help drivers select an appropriate vehicle speed before heading into an extended, curved 6 percent downgrade. This system uses Green Light information collected at the Emigrant Hill weigh station to provide a tailored advisory speed to each vehicle based on its weight. In Colorado, a similar downhill speed warning system on Interstate 70 decreased truck crashes 13 percent and reduced runaway ramp usage by 24 percent in the four years after implementation.

Using Green Light technology, ODOT has also implemented an overheight vehicle warning system on the Harrisburg Bridge on State Route 99E between Harrisburg and Junction City. The system uses infrared beams to detect when overheight vehicles are approaching the bridge, and then provides detour information.

4.4. Increase Travel Information and Trip Enhancement

Just as advances in technology have ushered in an information age, so have advances in Intelligent Transportation Systems (ITS) resulted in improved traveler information. ITS can help to improve the timeliness and usefulness of its traveler information, and giving customers the ability to make better travel decisions as a high priority.

ODOT’s TripCheck Web site is the primary traveler information gateway for pre-trip travel information in Oregon. The Web site includes images from approximately 140 cameras installed on highways throughout the state, which allow travelers to see current traffic and weather conditions. It provides weather data collected by the state's network of road and weather information system (RWIS) stations, and information on incidents and roadway construction that may affect driver delay.

Since TripCheck went on-line in 1998, site usage numbers have continued to increase. In December 2000, there were approximately 900,000 visits, in December 2001, there were 1.5 million visits and in December 2002, there were approximately 1.6 million visits to TripCheck.com.

ITS may also help to provide strategies and technologies to improve traveler information systems, so that accurate, complete and timely information is provided on a real-time basis to the traveling public.

A telephone-based survey of approximately 400 Oregonians by the University of Oregon in 2001 indicated that more than 60 percent of the commuters responding have used the Internet to access road and weather information. *About 83 percent of respondents considered traffic and weather related information to be either somewhat or very important*. This survey also concluded that 95% percent of respondents who had visited the TripCheck Web site found all the information they were looking for. ODOT also provides pre-trip traveler information to travelers through toll free telephone services (1-800-977-ODOT or 511).

Along with pre-trip information, it is also important that the drivers are dynamically warned of possible hazards on route. ITS can improve the timeliness, relevancy and driver adherence of en-route traveler information. Variable message signs are used throughout the nation to warn drivers of local incidents and provide detour information as needed.

A telephone survey in Orlando, Florida, concluded that 67 percent of commuters responding to the survey considered the information displayed on these signs to be reasonably accurate, while 58 percent considered it to be timely (11). A study on VMS effectiveness in Amsterdam, Netherlands suggests that VMS helped reduce the uncertainty in travel times by approximately 72 percent (12).

For environmental condition warnings – such as areas that frequently experience high winds, flooding and low visibility – ITS can provide advance notice to motorists through automated overlength vehicle restriction signs, snow zone signs, and wind warning signs. These ITS signs can provide timely and reliable information to motorists during difficult driving conditions.

4.5. Improve Interagency Communications

Communications, cooperation and coordination are essential to ITS effectiveness. Conversely, ITS may also help to create an environment where stakeholders might address institutional issues, determine methods and systems that assist in communication, and improve relationships with each other. Interagency agreements to share data and device control have usually been part of ITS strategic planning in various states. Washington DOT has signed interagency agreements with other agencies in the state to improve their interagency coordination. Conducting stakeholder workshops and providing them with ITS training has also benefited many states to better their shared and efficient use and maintenance of ITS infrastructure.

4.6. Reduce Congestion

Many of the rural roadways typically experience non-recurrent congestion (i.e., congestion caused by incidents) challenges, while recreational attractions such as national parks, national monuments, or ski areas, have recurring congestion challenges at gate entrances and visitor site-specific locations. ITS may help to improve traffic flow in these areas. As explained in the incident response section of this chapter, ITS can help improve managing incidents on highways.

In addition to detecting incidents, ITS also provides information that allows drivers to react quickly and safely. ODOT has installed over 40 variable message signs and several highway advisory radio stations that inform motorists of unusual conditions. These deployments help drivers to know what actions they should take (such as choosing an alternate route), when approaching an incident. Messages are posted by personnel in ODOT's four transportation operations centers. These transportation professionals are continually monitoring current conditions and seeking ways to make sure the transportation system functions effectively.

A telephone-based survey of about 400 Oregonians by the University of Oregon found that 63 percent of the survey respondents used radio to obtain road and weather information and 83 percent considered road and weather related information important. In Orlando, Florida, a telephone survey concluded that 67 percent of commuters responding to the survey considered the information displayed on these signs to be reasonably accurate while 58 percent considered it to be timely. A study on VMS effectiveness in Amsterdam, Netherlands, suggested that VMS helped reduce the uncertainty in travel times by approximately 72 percent (13).

4.7. Increase Economic Activity

As rural economies shift increasingly toward dependence upon tourism, ITS technologies may help to enhance the visitor experience, ultimately impacting economic activity.

As described in the traveler information section of this chapter, efficient, timely and reliable pre-trip and en-route traveler information can help enhance the visitor experience.

5. ODOT REGION 1 CHALLENGES AND POTENTIAL ITS APPLICATIONS

A stakeholder outreach workshop was conducted in Portland on November 19th, 2004 to identify the rural transportation challenges of ODOT Region 1. ODOT Region 1 Maintenance, ITS (Headquarters) and Traffic Engineering Units participated in this workshop. The participants were presented with a comprehensive list of rural challenges nationally and were asked to identify the challenges of most concern in Region 1. The participants were also presented with a list of potential rural ITS applications and case studies and asked to identify the best suited rural ITS solutions to address the challenges of most concern. The results of these efforts are presented here in the following two tables.

5.1. Rural Transportation Challenges of Region 1

Table 5-1. Rural ITS Challenges of Most Concern in Region 1

Challenges	Number of Votes	Priority Locations
Road and weather conditions and traveler notification	5	Mount Hood and Coast Range
Improved traveler information	4	Region Wide
Interagency and interstate coordination of incident response	3	Region Wide
Verifying what is specifically needed to respond to an incident (Getting Info. to Dist. Offices)	2	Region Wide
Improved interagency understanding of ITS (Traffic Management Coordination)	2	Region Wide
Improved understanding of the impact of an event or incident	2	Region Wide
More detection and verification of road conditions	1	Region Wide
Developing Incident Management Plans (Detour Route Planning)	1	Region Wide
ITS system maintenance (staff and funding)	1	Region Wide

The following other rural ITS challenges were also identified with out receiving any votes while prioritizing.

- Columbia River Gorge closures (traffic management, traveler notification)

- Mount Hood safety corridor (driver fatigue / inattention)
- Potentially incompatible routes (detour routes)
- Need better tools to use weather station information
- Need automated anti-icing systems
- High winds and mobile home issues
- Need signing for parallel/alternate routes (i.e. Highways 99E and 213)
- Lack of RWIS knowledge (how to use it)
- RWIS provides spot coverage (not corridor-wide)
- Rural incident response
- Timely notification of EMS (response time issues on Highways 6 and 26)
- EMS (9-1-1) integration in the regional system
- Animal-vehicle collisions
- Power and communications
- Land slides, avalanches, etc.
- Land slide and fire signing
- Fog problems on U.S. 26
- Black ice on Highways 6 and 26
- Fleet management (snowplows, AVL)
- Use of Highway Advisory Radio (HAR) (need more)
- Notification and coordination with other regions / states regarding incidents occurring in other areas that impact Region 1 (and vice versa)
- Information sharing among traffic operations centers
- Information sharing among Oregon State Police and county sheriffs
- Need for ITS training program / workshop
- Computer-Aided Dispatch (CAD) integration
- Facility security

5.2. Potential Rural ITS Applications for Region 1

The following table shows the different potential solutions in the order of priority as identified by the participants of the stakeholder workshop on Nov. 19th.

Table 5-2. Potential Rural ITS Solutions for Region 1

Potential Rural ITS Application	Number of Votes	Devices / Components
Dynamic Road Condition Signs	6	DMS / CMS, Automated Beacons
Closed Circuit Television (CCTV) cameras	4	CCTV, Communication Network
Training / Outreach among Multiple Jurisdictions	4	Work Shops

Dynamic Safety Signs (Warning Trucks of Roadway Geometry)	2	Automated Truck Rollover Systems , DMS / CMS
Variable Speed Limits (VSL)	2	DMS / CMS , Traffic Detection
Corridor Speed Detection	2	Communication Network, CCTV, Traffic Detection
Improved Weather Coverage	1	RWIS
Variable Message Signs (VMS)	1	DMS / CMS

A variety of other solutions were also discussed but did not receive a vote when prioritized. They include the following.

- Better weather decision support system
- Pavement temperature measuring devices
- Rest area kiosks
- Vehicles as probes for information/data gathering
- Institutional relationships
- Public notification of incidents
- Road Weather Information Systems (RWIS)

Based on these priorities identified in the workshop, selected list of case studies for the above ITS applications including information on costs are provided in the next chapter.

6. NATIONAL CASE STUDIES AND LESSONS LEARNED

There is significant amount of information available on the experiences of other state departments of transportation in the nation on deploying and maintaining ITS applications. This chapter provides descriptions of different ITS applications and also a compilation of selective number of case studies and lessons learned for the applications that were identified as the best suited to meet the rural transportation challenges in ODOT Region 1. The majority of these case studies and lessons learned presented within this chapter were adapted from the Rural ITS Toolbox document that was developed by FHWA in November 2001 (14).

Other components of successful deployment and use of ITS are continued evaluation and regular and preventative maintenance. Based on the priority concerns and potential ITS applications listed in Table 5-1and Table 5-2, case studies and lessons learned of potential applications were categorized in the following five areas in the order of priority for Region 1.

1. Crash Prevention
2. Traveler Information
3. Surface Transportation and Weather
4. Emergency Services
5. Traffic Management

From the FHWA Rural ITS Toolbox and other sources identified in the reference section, as much of the following details as possible are covered for all the case studies presented.

- Goals
- Approach
- Impacts
- Benefits Information

Most of these case studies were also presented in the stakeholder workshop conducted on November 19th, 2004 in Portland. The participants were presented information on most of these case studies before they were asked to identify the best suited rural ITS applications and prioritize them. Example deployment case studies of these systems are available in the Rural ITS Toolbox document that is available online at http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE/13477.html . The cost information for most of the systems can also be found in the Rural ITS Toolbox.

6.1. Crash Prevention and Driver Notification

Stakeholder workshop participants identified *road and weather conditions and traveler notification* as their top challenge in rural areas in Region 1. They also identified "*Dynamic Road Condition Signs*" as the best suited potential ITS application for Region 1. These choices indicate that detecting weather and road hazards and notifying the drivers is a top priority. There are numerous ITS applications that can help achieve this. Case studies and lessons learned from the deployments of such ITS applications are provided here.

6.1.1. Speed Warning Systems

These systems inform drivers of their traveling speed, based upon weather conditions, road geometry and this enables them to reduce their speed and maintain control of their vehicle. In addition to warning drivers they are driving too fast, the speed warning systems can also vary the posted speed limit based upon algorithms defined by the DOT. Typical speed warning systems can be composed of speed measurement technology, an automatic vehicle classification (AVC) system and a weigh-in-motion (WIM) system, and a DMS to communicate to the driver. The AVC and WIM technologies are primarily used for commercial vehicle operations (Refer to Page *76* of Rural ITS Toolbox for more details).

Expected benefits of these systems include the following

1. Less costs incurred in making repairs to crash locations;
2. Fewer fatalities and injuries;
3. Less costs incurred in repairs or insurance through avoiding accidents;
4. Less costs incurred in repairs, insurance and loss of shipments through avoiding accidents;
5. Favorable public perceptions of safety improvement schemes; and
6. Reduced incident management costs.

Selected Case Studies:

1. Truck Speed Warning System (Colorado) (Rural ITS Toolbox pg. 77)
2. Travel Aid on Snoqualmie pass (Washington) (Rural ITS Toolbox pg. 77 and 78)

6.1.2. Portable Speed Warning Systems

Police departments throughout the US are using portable speed warning systems to slow drivers on roads. Portable speed warning systems use a two-digit dynamic message sign, radar gun, computer, and generator to run the system. In most cases, the system is taken to a site that has seen a high number of speeders or is requested by community residents.

Recently, portable speed warning systems have been developed that will determine a vehicle's speed, take a picture of the vehicles license plate, and then issue a citation if the vehicle is speeding in excess of a certain threshold (Refer to Rural ITS Toolbox pg. 89 for more details).

Expected Benefits of these systems include:

1. Community residents see the system as pro-active
2. Data collection device

Selected Case Studies:

1. Leesburg Speed Monitoring Awareness Radar Trailer (Rural ITS Toolbox pg. 89 and 90)

6.1.3. Variable Speed Limit (VSL) Systems

VSL systems are a type of Intelligent Transportation System (ITS) that utilizes traffic speed and volume detection, weather information, and road surface condition detection technology to determine appropriate speeds at which drivers should be traveling, given current roadway and traffic conditions. These advisory or regulatory speeds are usually displayed on overhead or roadside variable or dynamic message signs (VMS / DMS). VSL systems have been around for the last 30 years and currently are successfully being used and/or tested in parts of Europe and Australia.

VSL systems are already being used in several states and could be implemented in appropriate areas across the United States. Oftentimes, the VSL system is part of a larger incident management, congestion management, weather advisory, or motorist warning system.

Expected benefits of these systems include the following.

1. Reduce driver error and speeds, and
2. Enhance the safety of our roadways through the use of innovative technology

Selected Case Studies:

1. Fuzzy Logic Based Variable Speed Limit System (Arizona) (4)
2. Dynamic Downhill Truck Speed Warning System (Colorado) (4)
3. Variable Speed Limit Signs (Nevada) (4)
4. Variable Speed Limit Systems (New Jersey) (4)
5. Truck Speed Warning System as part of “Green Light” Field Operational Test (Oregon) (4)

6.1.4. Dynamic Message Signs (DMS)

DMS provide text messages via a large lighted display, which can be varied in width and height. The text the signs display can be programmed from a remote location using a wireless transmitter or phone line and modem. DMS can have either a permanent or portable installation. Either way, DMS are useful in disseminating traveler information.

Metropolitan traffic management centers prefer a strategically placed permanent installation. Usually, the DMS are mounted as overhead signs or on overpasses and are hard-wired with a power supply and telephone line. These are used more for incident management, since traffic conditions can change by the minute. A permanent installation can also be used as part of some type of warning system, such as fog, avalanche or ice detection systems.

DMS can be used to inform travelers of other spot hazardous conditions, such as construction or other events that may cause traffic congestion or an area that extra caution needs to be taken when traveling.

Portable DMS offer special advantages. They are lower in cost (in terms of installation costs and the fact that a supporting structure is not necessary) and may be shared between agencies. Due to their mobile nature, they may be moved around to various locations as the need arises. They have the capability of being multi-purpose, for example they may post weather, event or incident information (Refer to Rural ITS Toolbox pg. 29).

Expected benefits of these systems include the following.

1. When there is construction in progress, travelers feel safer when they know what is ahead of them. The DMS may also post a detour, so travelers may feel more inclined to avoid the construction if they see the DMS. The use of detours will help to reduce traffic backups near the construction zone.
2. Portable DMS may be placed in an area with a notice that construction is set to begin on a certain date. This advance notice allows commuters time to plan a different route to work.
3. Safety of workers in construction zones is improved because travelers are warned ahead of time of conditions downstream and are less apprehensive about driving in the construction zone.
4. The blinking sign acts as a beacon, catching the attention of the drivers and gets them to make lane changes and detours as soon as possible.

Selected Case Studies:

1. Dane County Dynamic Message Sign Deployment (Wisconsin) (Rural ITS Toolbox pg. 29 and 30)
2. Colorado Incident Management Using DMS (Colorado) (Rural ITS Toolbox pg. 30)

6.1.5. Automated Visibility Warning Systems

Automated visibility warning systems use weather sensors to detect reduced visibility conditions (heavy rains, fog white-out) and then trigger a permanent or portable DMS with a message indicating the adverse driving conditions. In addition to triggering messages on DMS signs, the sensors could also trigger in pavement lights to turn on, or for information to be sent to a traffic management center for dissemination through traveler information systems (Refer to Page *84* of Rural ITS Toolbox for more details).

Expected Benefits of these systems include the following.

1. Decrease in crashes on roadway;
2. Decrease in major crashes involving a pile-up of cars and trucks due to fog or white-out; and
3. Favorable public perception of safety improvement efforts.

Selected Case Studies:

1. Visibility Sensors on I-64 (Virginia) (Rural ITS Toolbox pg. 84)

6.1.6. Automated Wind Warning Systems

Automated wind warning systems use either wind speed data from RWIS station or an anemometer to determine whether it is unsafe for heavy vehicles and passenger cars to travel and automatically turn on flashing beacons on top of static signs that read “ Caution : High

Winds Present When Flashing". Some of these systems also use dynamic message signs or changeable message signs to notify drivers of high wind warning automatically. Oregon has installed two of these systems on US 101 near Coos Bay and on Yaquina bay bridge. Researchers at Western Transportation Institute / Montana State University are evaluating these systems.

Expected Benefits of these systems include the following.

1. Decrease in crashes on roadway;
2. Decrease in road closure time and delay as crashes due to high winds may be prevented; and
3. Favorable public perception of safety improvement efforts.

Selected Case Studies:

1. Automated Wind Warning Systems in Oregon and California (Evaluation by WTI is available at http://www.coe.montana.edu/wti/wti/display.php?id=97)

6.1.7. Work Zone Safety Systems

Smart work zones are becoming more common, with an increased safety emphasis for both on-site field personnel and the motoring public. Smart work zones include the use of one or more of the technologies listed below, but are not limited to the following (Refer to Page *80* of Rural ITS Toolbox for more details)

1. Stationary and mobile DMS announcing detours or "construction ahead with possible delays";
2. Speed display signs to make the driver aware of their actual approach speed;
3. HAR to facilitate communications within the work site area among project manager and site supervisors;
4. Vehicle detection and surveillance (e.g., queue length detectors, closed circuit television);
5. Links to traffic control center; and
6. Connection to an advanced traveler information system (ATIS), with a Web site to provide travelers pre-trip information about preferred routes and potential delays, relieve congestion and also provide early incident detection with advanced detour notification capabilities

Expected Benefits of these system include the following:

1. Reductions in traffic delays, stops, and crashes experienced at highway work zones;
2. Savings to road users in accident costs and travel time costs;
3. Effective, efficient traffic management techniques that improve the public's perception of work zone management;
4. Reduction in frustration of traveling public if delays are experienced;
5. Implementation of technologies such as the queue length detectors provide additional data on the traffic situation;

6. Provides continuous and updated information to the traveling public as they approach or travel through the construction zones;
7. Provides motorists with an earlier notice of when incidences occur. This information helps the motorist to consider other options;
8. Improves emergency response time to the incident; and
9. Decreased variability of speed through work zones.

Selected Case Studies:

1. Mid-America Smart Work-Zone Deployment initiative (IA,NE,MO,KS) (Rural ITS Toolbox pg. 81)

6.2. Traveler Information

Improved traveler information was identified as the second most priority of all rural transportation challenges in Region 1. This section provides excerpts of experiences of different states with advanced traveler information systems.

6.2.1. Traveler Information Broadcast

HAR systems have been used by many DOTs throughout the US and have provided valuable information to system users. The primary advantage of HAR is that it reaches travelers using a device they already have in their vehicle: the radio. Most HAR stations broadcast at 10 watts or less, meaning their effective range is no more than a few miles. HAR can be broadcast on both AM and FM frequencies. Many HAR systems broadcast recorded information on traffic conditions and tourist-related activities to users in a limited geographical area; new recordings are made when conditions change sufficiently. Some systems provide the capability to remotely switch between alternative messages. Historically, these systems have been best deployed to meet the needs of travelers in tourist or work-zone areas where the information to be provided is reasonably predictable and as a result, significant effort is not required to update the system.

Information signs to indicate to the travelers that the service is operational are commonly used. As with dynamic message signs, travelers can become desensitized to the medium if information is not kept up-to-date or incorrect information is broadcast.

HAR systems can be deployed quickly to provide work-zone and tourist-related information for example. In the longer-term, enhancements to traditional HAR systems open up opportunities such as linking successive HAR broadcast towers in order to deliver a continuous message to travelers as they move between HAR coverage areas (Refer to Rural ITS Toolbox pg. 32).

Expected benefits of these systems include the following.

1. Easy access to statewide traveler information;
2. Provide reliable traveler information to the most number of people with minimal cost; and
3. Favorable public perception of DOT

Selected Case Studies:

1. Florida Traveler Information Network (Florida) (Rural ITS Toolbox pg. 33)

6.2.2. Traveler Information via Personal Communication Devices

Personal communication devices (PCDs) are small, portable, wireless devices for sending and/or receiving information. PCDs usually consist of a handheld computer device such as an organizer or palm top computer combined with some form of wireless communications. PCDs have varying degrees of processing capabilities depending on the design and the model. PCDs have been used for a number of functions, including: navigation, pre-trip information, traveler advisories, and emergency services. Pagers and cellular phones are the best examples, and the most widely used PCDs. Other handheld devices include AT&T's EO, Palm, Hewlett Packard has several, and Motorola and GTE both have personal digital communicators (Refer to Rural ITS Toolbox pg. 35).

Expected benefits of these systems include the following.

1. Better informed decision-making by travelers;
2. Potential to avoid incidents and congestion; therefore reducing emissions, reducing the possibility for secondary collisions, reducing delay, etc.;
3. Increased safety when used as a navigational aid and/or communication device.
4. Increased emergency response and shorter emergency response time due to automated location notification.
5. Potential for appropriate emergency responses.

Selected Case Studies:

1. Houston’s TranStar Smart Commuter (Texas) (Rural ITS Toolbox pg. 35 and 36)

6.2.3. Cable TV Traffic Channel

Disseminating traveler and traffic information to the most number of viewers with minimal infrastructure costs is important to ensure a traveler information system is a success. One hurdle that ITS has is installing the necessary, and sometimes expensive, infrastructure systems required for them to operate. Currently, a vast majority of the population own at least one television and many of these people subscribe to some sort of cable television service.

Providing traveler and traffic information through a dedicated traffic channel can reach a great number of people. The infrastructure needed will include a television studio and production facilities. The traveler and traffic cable TV channel can be set up to provide any type of information from traffic, transit and weather, to information about snow conditions at ski resorts and special events.

Expected Benefits of these systems include the following

1. Reduction in road rage accidents and emergency response due to better-informed travelers.
2. Reduction in road rage due to congestion.

3. Reduction in pollution levels due to decreased congestion.
4. Better informed traveling public.

Selected Case Studies:

1. SmartTraveler TV (Washington D.C. Metropolitan Area) (Rural ITS Toolbox pg. 37 and 38)

6.2.4. Integrated Traveler Information Systems

An Integrated Traveler Information System provides a platform for the collection, storage and dissemination of traveler information that maximizes the potential for private sector involvement. Typically, a base level of information will be made available in a standardized format and disseminated by the State DOT agency. This data may also be available to information service providers for repackaging and adding value for dissemination over private sector media outlets (Refer to Rural ITS Toolbox pg. 39)

Expected Benefits of these systems include the following.

1. Easy access to statewide traveler information;
2. Provide reliable traveler information to the most number of people with minimal cost; and
3. Favorable public perception of DOT.

Selected Case Studies:

1. Duluth / St. Cloud TOCCs (Minnesota) (Rural ITS Toolbox pg. 39 and 40)

6.3. Surface Transportation and Weather

Road and weather conditions and traveler notification and *More detection and verification of road conditions* were identified as two of the 7 challenges of Region 1. *Improved Weather coverage* was also identified as one of the top 7 potential rural ITS applications suited for Region 1. Some of the ITS applications that help improve the road and weather condition detection and notification are presented here.

6.3.1. Data Gathering and Processing Systems

Beyond the transportation industry, various other industries collect and process weather in real time. These include the National Weather Service, the Federal Aviation Administration, and others. Typically, it is common that these various agencies have very good coverage of weather sensors around a state, and each sensor may serve different industries. Coordination is the key to combining this data and assembling it together to develop as comprehensive a set of monitoring and reporting stations as possible. Once combined, the data from each of these stations can be used by all agencies to more accurately report current conditions statewide. In the transportation industry, statewide weather reports can be used to support modeling tools to forecast conditions and prepare for treatments (Refer to Rural ITS Toolbox pg. 121).

Expected benefits of these systems include the following.

1. More accurate and detailed weather reports and forecasts;
2. Less costs to deploy monitoring equipment if ties with other agencies are formed;
3. More appropriate treatment of roadway surfaces based on more accurate pavement forecasts which results in better LOS, and cost savings by the public agencies;
4. Better informed travelers.

Selected Case Studies:

1. State DOT rWeather Program (Washington) (Rural ITS Toolbox pg. 121 and 122)

6.3.2. Weather Information Dissemination Systems

Poor weather conditions affect transportation operations and traveler safety, and can have enormous consequences on society. To assist in minimizing the impacts of adverse weather conditions, it is important to provide detailed and accurate road and weather condition information to end users either pre-trip or while en-route. Users can include such groups as commercial vehicles; highway maintenance operators, leisure travelers and the general public (Refer to Rural ITS Toolbox pg. 123).

Expected benefits of these systems include the following.

1. Reduction in accidents and fatalities due to inclement weather
2. Reduction in societal costs from large storms
3. Improved knowledge of approaching weather conditions
4. Improvement in road maintenance operations from greater information dissemination
5. Improved lead-time to assist in developing and initiating a planned response to inclement weather conditions.

Selected Case Studies:

1. Emergency Managers Weather Information Network (EMWIN) (TX, DC, OK) (Rural ITS Toolbox pg. 123 and 124)

6.3.3. Integrated Weather Monitoring / Prediction Systems

RWIS allows for greater knowledge by operations and maintenance personnel of current and predicted conditions at remote locations. RWIS components include: Remote sensors that can measure precipitation, temperature, wind speed, and humidity; Communications that can transmit weather and roadway data to regional and central hubs; and Decision support systems that allow DOT personnel to respond to field conditions.

The incorporation of RWIS data with National Weather Service information, weather modeling capabilities and other environmental data sources allows the DOT to be better prepared for all types of extreme weather conditions. RWIS can be utilized in conjunction with traveler information systems, and dynamic speed limit technologies to provide current information to travelers doing pre-trip planning and via VMS en-route (Refer to Rural ITS Toolbox pg. 125).

Expected benefits of these systems include the following.

1. More detailed road and weather condition information available for maintenance supervisors to make operational decisions regarding winter maintenance activities
2. Providing maintenance supervisors with detailed forecasts to make overnight staffing decisions.
3. A decrease in labor and material costs from more timely and detailed information.
4. Increased traveler safety from having maintenance staff be able to view road and weather conditions and then be able to inform travelers of the conditions or close roadways if necessary before travelers get stuck.

Selected Case Studies:

1. FORETELL (Iowa) (Rural ITS Toolbox pg. 126)

6.4. Emergency Services

As described in previous chapters, emergency response times in rural areas have been documented to be as mush as double the response times in urban areas for comparable emergencies. Stakeholders attending the workshop also identified *interagency and interstate coordination of incident response* and *verifying what is specifically needed to respond to an incident* (i.e. getting information to district offices) as third and fourth top challenges in Region 1. They also identified *training and outreach among multiple jurisdictions* for better coordination to respond to incidents as a potential solution.

Some of the ITS applications that help achieve these goals are described below.

6.4.1. Mayday Systems

Mayday systems provide some kind of notification to a response center in case of a breakdown or accident. They utilize wireless communications from vehicle to call center and units and can be activated manually or automatically. They typically use GPS location technology to automatically identify the location of the vehicle.

Enhanced Mayday systems can detect and transmit crash information (e.g., crash primary direction of force, crash delta velocity, final resting position of the vehicle, etc.) to a call center that subsequently contacts an appropriate response organization (fire, ambulance, police) and provides them with all necessary data derived from the in-vehicle Mayday system. Responding to severe accidents within one hour (the so-called "golden hour") can significantly reduce fatalities (Refer to Rural ITS Toolbox pg. 125).

Expected benefits of these systems include the following.

1. Identification of location of traveler in need of assistance.
2. Communication of crash information to emergency response providers to enable most appropriate response team and equipment.
3. Reduced fatalities.
4. Reduced incident impacts.
5. More efficient use of emergency response resources

Selected Case Studies:

1. Minnesota Mayday Plus (Minnesota) (Rural ITS Toolbox pg. 7, 8, and 9)

6.4.2. Dispatching Systems

On-the-scene incident data, road condition or other data may be routed through a single dispatch center for processing. The dispatch center acts on the information request by dispatching the proper emergency personnel to a traffic incident. Road and weather conditions data may also be uploaded to a central source and disseminated via various means from the center. For example, police vehicles can act as an information provider for other emergency personnel. In-vehicle digital cameras and pen-based notebook computers with in-car printers are mounted in all police vehicles for crime scene and accident data collection, input and downloading to a central database for immediate availability to other vehicles responding to the scene, including emergency management personnel. Information is sent via radio frequency to a command center and then transmitted along fiber to the in-house dispatch system (Refer to Rural ITS Toolbox pg.14).

Expected Benefits of these systems include the following.

1. Enables emergency responders to be properly prepared for an incident scene before they get to the scene. This decreases response time and increases preparedness of emergency crews.
2. Enables State agencies, such as engineering and public safety, to research statistics on incidents for sections of roads. These agencies can mitigate any safety problems relating to roadway design or maintenance.
3. Transit dispatch centers will request that the closest transit provider pick up the customer and take them to their destination. This saves resources for all transit providers and participants form a stable transit network that can service entire counties.
4. Travelers and commuters do not have to search through separate sources to get their road, weather and traffic information. They can visit one source that will supply them with their weather information.

Selected Case Studies:

1. Dane County, Wisconsin Interagency Dispatch and Reporting Coordination (Wisconsin) (Rural ITS Toolbox pg.14)

6.4.3. Accident Investigation Systems

Law enforcement vehicles are equipped with laptop computers and in-car portable printers to automate accident-related reports and traffic citations. Field data are transmitted via radio frequency, disk or modem directly to a central database, where the data are stored and studied. This eliminates paperwork for the police officer filing the report. When they get back to the station, they do not have to enter their paper notes into a database. GPS is also integrated into the system to geo-code each incident in the database (Refer to Rural ITS Toolbox pg. 11).

Expected benefits of these systems include the following.

1. Less paperwork for the State Trooper to fill out in the car. Data is transferred directly to a central database.
2. The trooper has more time to deal with other incidents if needed.
3. Data is already compiled and can be manipulated as needed for incident statistics right in the database.
4. More accurate incident data collection since notes are already stored in the computer for ready use, and the trooper does not have to recollect the accident to write a report on the incident

Selected Case Studies:

1. Minnesota State Patrol Automated Field Reporting (Minnesota) (Rural ITS Toolbox pg. 11 and 12)

6.5. Traffic Management

ITS can help efficient and effective management traffic in rural areas as well as urban areas. Some of the ITS applications that can improve traffic management in rural areas are presented below.

6.5.1. Closed Circuit Television (CCTV)

CCTV technology used in combination with communications to view facilities allows monitoring staff to accomplish numerous activities such as incident detection and verification, weather and roadway conditions monitoring, DMS message verification, and event management. CCTV images can be sent back through wireless communication to an information clearinghouse, via cellular digital packet data (CDPD), and cellular telephone signals.

Wireless communication using CCTV has been used successfully in ambulances, allowing physicians at the destination medical center to view patients prior to their arrival, improving advice during transport and allowing better preparation at the receiving facility. However, other wireless communication applications are available. CCTV is proven effective in providing efficient response to incidents when a visual verification is made, and deploying the appropriate emergency personnel (fire, police, and ambulance) (refer to Rural ITS Toolbox pg. 46).

Expected benefits of these systems include the following.

1. Allow traffic management personnel quick confirmation of incidents and weather events.
2. Allow traveling public to view conditions before traveling.
3. Provide increased detection capabilities at known accident locations

Selected Case Studies:

1. Rural Cameras at Key Locations (Oregon) (Rural ITS Toolbox pg. 46 and 47)

6.5.2. Pager Activation of Warning Beacons

Warning beacon lights that are accompanied by advisory road signs can help convey critical safety messages to travelers. The lights may be set to flash when the safety message is especially urgent. The activation of the beacons to flash is either triggered according to the time of day or manually. The system described below enables beacons to be activated remotely using common pager services and low cost receivers on the road signs (Refer to Rural ITS Toolbox pg. 52).

Expected benefits include the following.

1. Efficient controlling of warning beacons
2. Savings due to reduction in a trip to activate the warning signs
3. Better on-time warning of drivers

Selected Case Studies:

1. Pager Activation of School Crossing Beacons (Oregon) (Rural ITS Toolbox pg. 52 and 53)

6.5.3. Route Diversion Systems

The low-cost route diversion system concept uses static guide signs and route markers to define permanent alternates to primary routes with recurrent problems.

Typically this is not an advanced system, but the static signs can be supplemented with highway advisory radio (HAR), road weather information systems (RWIS), or other advanced technologies to enhance their effectiveness in affecting driver behavior (Refer to Rural ITS Toolbox pg. 54).

Expected benefits of these systems include the following.

1. Low cost and effective route diversion tool
2. Minimal maintenance requirements
3. Easily utilized by visitors

Selected Case Studies:

1. VDOT Hampton Roads Route Diversion (Virginia) (Rural ITS Toolbox pg. 54 and 55)

6.5.4. Low – Cost Detection Systems

This simple solution uses less expensive audio technology to detect the presence of vehicles in order to determine lane occupancy, perform vehicle counts and detect vehicular speed. The following table summarizes the challenges that are addressed by the different systems presented above (refer to Rural ITS Toolbox pg. 65).

Expected benefits of these systems include the following.

1. The ability to install temporary vehicle detection during special events or temporary construction activities.

Selected Case Studies:

1. Acoustic Energy Sensor for Traffic Applications (AZ, TX, VA, Mass.) (Rural ITS Toolbox pg. 65)

Table 6-1. Summary of Potential ITS Applications and Region 1 Challenges

Tools	Lack of Road and Weather Condition Notification	Lack of Advanced Traveler Information	Lack of Interagency Coordination	Lack of Verification of Needs for an Incident	Lack of Interagency Understanding of ITS	Lack of Understanding of the Impact of Incidents	Lack of Detection and Verification of Road Conditions	Lack of Incident Management Plans (Detour Route Planning)	Driver Inattentiveness or Lack of Alertness	Non – Recurring or Seasonal Congestion	Traffic Management and Traveler Notification of Road Closures	Lack of RWIS Knowledge and Tools for Effective Use	Driver Disregard for Traffic Control Signs	Total Number of Concerns Addressed
Crash Prevention and Driver Notification														
Automated Visibility Warning Systems	X						X			X				3
Automated Wind Warning Systems	X						X			X	X		X	5
Work Zone Safety Systems	X			X					X	X	X		X	6
Speed Warning Systems	X						X		X				X	4
Portable Speed Warning Systems	X						X		X				X	4
Variable Speed Limit (VSL) Systems	X								X	X			X	4

Tools	Lack of Road and Weather Condition Notification	Lack of Advanced Traveler Information	Lack of Interagency Coordination	Lack of Verification of Needs for an Incident	Lack of Interagency Understanding of ITS	Lack of Understanding of the Impact of Incidents	Lack of Detection and Verification of Road Conditions	Lack of Incident Management Plans (Detour Route Planning)	Driver Inattentiveness or Lack of Alertness	Non – Recurring or Seasonal Congestion	Traffic Management and Traveler Notification of Road Closures	Lack of RWIS Knowledge and Tools for Effective Use	Driver Disregard for Traffic Control Signs	Total Number of Concerns Addressed
Traveler Information														
Broadcast Traveler Information		X	X							X	X			4
Traveler Information Services via Personal Communication Devices		X								X	X			3
Cable TV Traffic Channel		X								X	X			3
Integrated Traveler Information Systems	X	X	X							X	X			5
Surface Transportation and weather														
Data Gathering and Processing Systems		X		X			X				X	X		5
Weather Information Dissemination Systems	X	X								X		X		4

Tools	Lack of Road and Weather Condition Notification	Lack of Advanced Traveler Information	Lack of Interagency Coordination	Lack of Verification of Needs for an Incident	Lack of Interagency Understanding of ITS	Lack of Understanding of the Impact of Incidents	Lack of Detection and Verification of Road Conditions	Lack of Incident Management Plans (Detour Route Planning)	Driver Inattentiveness or Lack of Alertness	Non – Recurring or Seasonal Congestion	Traffic Management and Traveler Notification of Road Closures	Lack of RWIS Knowledge and Tools for Effective Use	Driver Disregard for Traffic Control Signs	Total Number of Concerns Addressed
Integrated Weather Monitoring / Prediction Systems		X								X	X	X		4
Emergency Services														
Mayday Systems			X			X		X		X	X			5
Dispatching Systems			X			X		X		X	X			5
Accident Investigation Systems										X	X			2
Traffic Management														
Closed Circuit Television (CCTV)		X		X			X			X				4
Pager Activation of Warning Beacons	X	X					X		X	X	X		X	7

Tools	Lack of Road and Weather Condition Notification	Lack of Advanced Traveler Information	Lack of Interagency Coordination	Lack of Verification of Needs for an Incident	Lack of Interagency Understanding of ITS	Lack of Understanding of the Impact of Incidents	Lack of Detection and Verification of Road Conditions	Lack of Incident Management Plans (Detour Route Planning)	Driver Inattentiveness or Lack of Alertness	Non – Recurring or Seasonal Congestion	Traffic Management and Traveler Notification of Road Closures	Lack of RWIS Knowledge and Tools for Effective Use	Driver Disregard for Traffic Control Signs	Total Number of Concerns Addressed
Route Diversion Systems		X						X		X	X			4
Low-Cost Detection Systems	X			X						X	X			4
Others														
ITS Training Program / Workshops			X		X	X								3
Better training on the Use of ITS devices (e.g. RWIS)			X		X							X		3

7. POTENTIAL RURAL ITS BENEFITS TO REGION 1

This chapter summarizes the potential benefits from the rural ITS applications described in Chapter 6 as seen relevant to Region 1 needs. The rural ITS benefits specific to ODOT Region 1 are highlighted here based on the Region 1 challenges identified at the workshop. Table 7-1 depicts these potential benefits to Region 1 in qualitative terms.

The benefits are classified into the following seven major categories. These categories are consistent with the benefit categories used in previous sections.

1. Increase Safety
2. Improve Emergency Response
3. Improve Commercial Vehicle Operations
4. Increase Travel Information and Trip Enhancement
5. Improve Interagency Coordination through Better Communication
6. Reduce Non-Recurring Congestion
7. Increase Economic Activity and Others

As it was presented in chapter 5, Increasing Travel Information and Trip Enhancement, Improving Interagency Coordination and Improving Emergency Response were identified to be the top three priorities for Region1.

Table 7-1. Summary of Potential Benefits to Region 1

Tools	Increase Safety	Improve Emergency Response	Improve CVO	Increase Travel Information and Trip Enhancement	Improve Interagency Communications	Reduce non-recurring Congestion	Increase Economic Activity / Other
Crash Prevention and Driver Notification							
Automated Visibility Warning Systems	Reduction in Crashes						
Automated Wind Warning Systems	Reduction in Crashes			Advance warning of drivers		Reduction in delay caused by wind related crashes	
Work Zone Safety Systems	Reduction in Crashes	Better emergency response time		Reduction in stops and delays, Decreased variability of speed through work zone		Efficient and effective traffic management	
Speed Warning Systems	Reduction in fatalities and injuries					Reduction in road closures and delays due to crashes	
Portable Speed Warning Systems	Reduction in fatalities and injuries					Reduction in road closures and delays due to crashes	
Variable Speed Limit (VSL) Systems	Reduction in fatalities and injuries		Better movement of CVs	Automated driver notification of delays		Reduction in road closures and delays due to crashes	
Traveler Information							
Broadcast Traveler Information			More travel info. for better CVO	More traveler information available and easy access	Improved info. sharing	Avoidance of incidents and delays	Favorable public perception
Traveler Information via Personal Comm. Devices	Increased safety when used for navigation	Possibly improved emergency response		Better informed decision making for travelers		Avoidance of incidents and delays	

Tools	Increase Safety	Improve Emergency Response	Improve CVO	Increase Travel Information and Trip Enhancement	Improve Interagency Communications	Reduce Congestion	Increase Economic Activity
Cable TV Traffic Channel		Better emergency response		Reduction in road rage		Reduction in congestion due to better informed travelers	
Integrated Traveler Information Systems				Easy access to statewide travel info.	Improved info. sharing		Favorable public opinion
Surface Transportation and weather							
Data Gathering and Processing Systems				More accurate and detailed weather reports and forecasts		Better informed travelers may lead to reduction in congestion	Favorable public opinion
Weather Information Dissemination Systems	Reduction in fatalities and accidents	Improved lead time for planned response		Improved knowledge of approaching weather conditions			
Integrated Weather Monitoring / Prediction Systems	Increased traveler safety			More accurate and detailed weather reports and forecasts			Help supervisors on overnight staffing
Emergency Services							
Mayday Systems	Reduction in fatalities	Improved ability to determine incident location			Improved info. sharing	Reduction in incident impacts	More efficient use of resources
Dispatching Systems	Reduction in fatalities	Increased preparedness for response crew		More information to emergency responders	Improved info. sharing	Reduction in incident impacts	More efficient use of resources
Accident Investigation Systems		More accurate information on incidents				Reduction in incident impacts	Efficient use of troopers' time
Traffic Management							

Tools	Increase Safety	Improve Emergency Response	Improve CVO	Increase Travel Information and Trip Enhancement	Improve Interagency Communications	Reduce Congestion	Increase Economic Activity
Closed Circuit Television (CCTV)		Quicker confirmation and response to incidents		Allow traveling public to view conditions before traveling		Increased detection capabilities leading to faster clearance	
Pager Activation of Warning Beacons	Reduction in crashes			Better and timely warning messages to travelers			Efficient means of controlling beacons
Route Diversion Systems	Reduction in crashes	Effective redirection of traffic around incidents	Better and more reliable CVO	Better and on-time information on alternate routes to travelers	Better info. sharing on incidents management	Reduction in incident impacts due to effective management	Favorable public perception
Low-Cost Detection Systems		Temporary vehicle detection during special events				Reduction in non-recurrent congestion	
Others							
ITS Training Program / Workshops		Better response due to better coordination			Better understanding of ITS		
Better training on the Use of ITS devices (e.g. RWIS)		Better response due to better coordination			Better understanding of ITS		

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