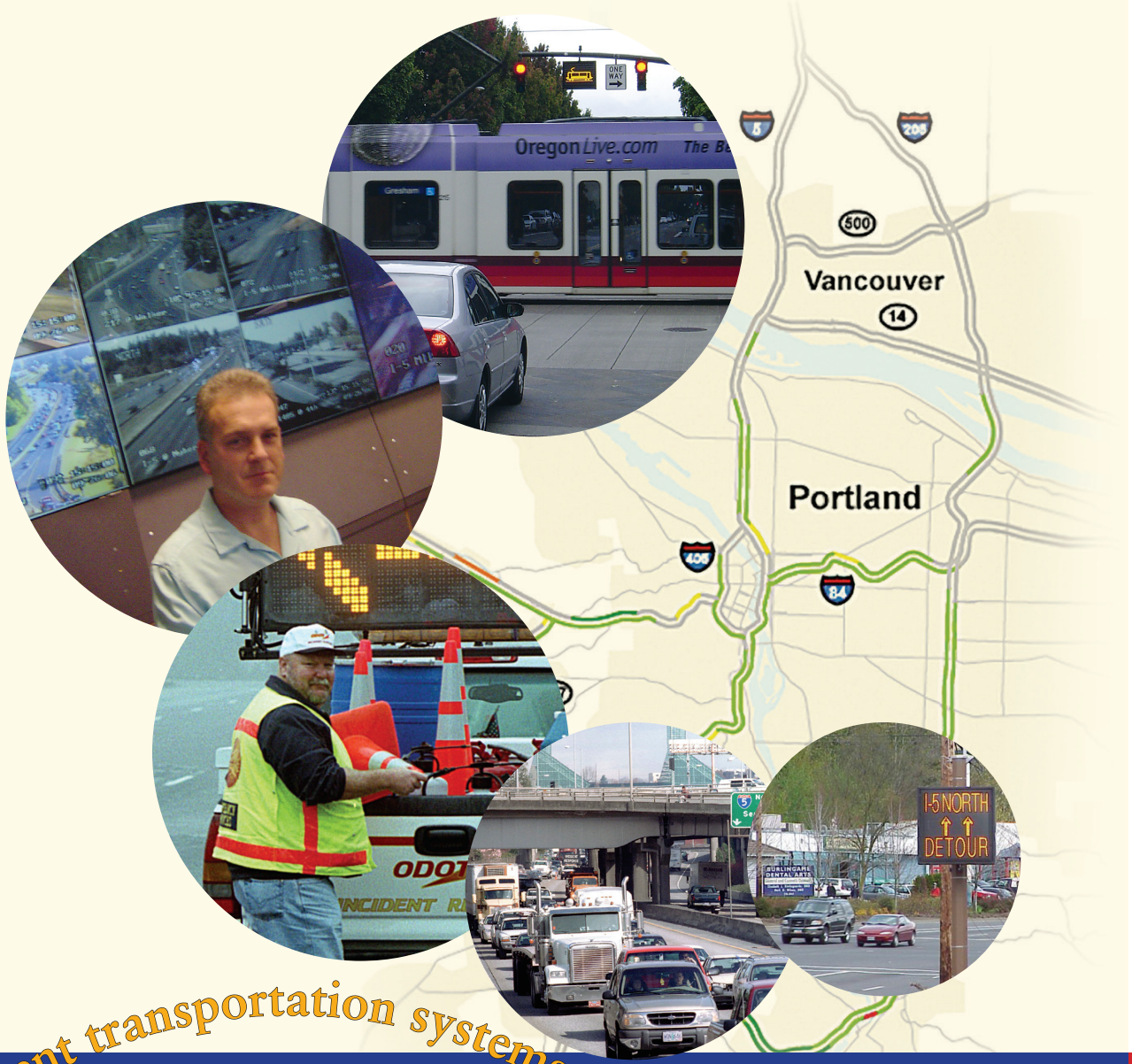

Intelligent transportation systems: a smarter way to go

Metropolitan Mobility
The Smart Way

The State of Intelligent Transportation Systems in the Portland Region

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People places • open spaces

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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Acknowledgements

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TRANSPORT
TRANSPORTATION PORTLAND

What is mobility the smart way?

"We've known all along, the solution to road congestion isn't just pouring new concrete and paving new roads."

– Mary Peters,
Secretary of Transportation

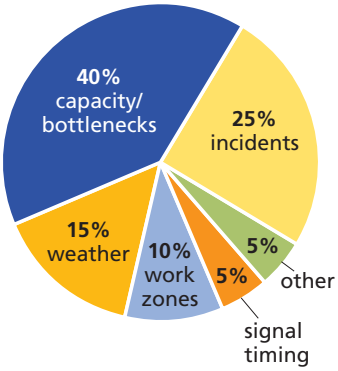
Metropolitan Portland has traditionally taken an intelligent approach to transportation: new infrastructure is tied to land use plans, transit is free in the urban core, and recent investments have earned it national recognition for accommodating bicyclists. These are just a few examples of the resourceful ways the region has achieved its current quality of life and economic vitality. If it is going to maintain this success amidst continued and accelerating growth, however, transportation agencies in the region must make this intelligent approach even smarter. The purpose of this short report is to highlight some ways to accomplish this through the application of advanced technology.

The "Cost of Congestion" study released by Metro in December 2005 warns that by 2025, congestion could cost Portland 6,500 jobs as well as $844 million per year in wasted time and fuel. With so much of its economic engine driven by transportation-intensive export industries, Portland is more sensitive than most other regions to unreliable transportation systems, especially with more and more businesses depending on "just-in-time" deliveries. Cities such as Los Angeles, New York, San Francisco and Boston have heavy traffic congestion, but they also have an economic emphasis on entertainment and financial services that are less reliant on transportation.

In May 2005, the United States Department of Transportation (USDOT) released the National Strategy to Reduce Congestion on America's Roadways. The plan reports that in the country's 10 most congested areas, rush hour travelers lose between $850 and $1,600 in fuel and time annually, spending the equivalent of nearly 8 full days a year stuck in traffic, and that medium-sized cities like Portland can expect to reach these levels of congestion within the next 10 years if trends continue. At the launch of the new initiative, former Secretary of Transportation Norman Mineta said, "We need a new approach and we need it now."

Two trends have recently converged to underscore the importance of taking a new, intelligent approach to congestion management. First, there is growing awareness and understanding that half of congestion delay can be attributed to "non-recurring" sources, including crashes, construction zones and special events. Second, metropolitan areas and states, including Portland and Oregon, are facing unprecedented fiscal constraints on transportation investments. In

Portland can expect to reach the levels of the country's most congested cities within the next 10 years if trends continue.



More than half of all congestion is caused by incidents and other sources that can be addressed using system management and operational strategies.

policy terms, this perfect storm of transportation challenges adds up to a renewed interest in strategies that fall under the heading of "transportation system management and operations."

Indeed, the National Strategy to Reduce Congestion emphasizes "low-cost operational and technological improvements" as one of its six points. Similarly, the draft Oregon Transportation Plan's second goal is "to improve the efficiency of the transportation system…with improved operations and management." Furthermore, the key to many operational strategies is advanced technology, fittingly referred to by transportation professionals as **intelligent transportation systems or ITS**. In fact, one of the Oregon Transportation Plan's key initiatives is to "optimize system capacity and safety through information technology and other methods."

The first goal of this report is to increase awareness and understanding among the region's decision makers regarding ITS and the ways in which it can help transportation agencies in the Portland metropolitan area manage congestion and improve safety in a cost-effective manner. For example, clearing broken-down vehicles faster is a common and popular operational strategy employed by the Oregon Department of Transportation (ODOT) on area highways. Technologies, including traffic sensors and closed-circuit cameras, shorten the time it takes to detect and respond to a motorist in distress.

The second goal of this report is to focus attention on the benefits of collaboratively implementing system management strategies and intelligent transportation systems. Technology and regionalism are two of Portland's winning attributes and ITS is a context in which they can come together. ODOT and the Portland Office of Transportation (PDOT) have partnered since 2003 to jointly manage Interstate 5 and SW Barbur Boulevard where the two roads run parallel south of downtown Portland. When a crash occurs on I-5, PDOT and ODOT have developed a protocol for diverting traffic onto Barbur Boulevard until the roadway has been cleared. Technology enables dispatchers at each agency's operations centers to detect when an incident occurs, verify the nature of the incident, set the variable message signs accordingly, and implement new signal timing on Barbur Boulevard to accommodate the diverted traffic.

About this report

Following this introduction, the report presents a series of case study fact sheets, each describing how an ITS application has supported system management around the Portland metropolitan region. The case studies include examples from most of the region's agencies and jurisdictions. Because ITS projects generally have multiple benefits, each fact sheet will include benefits the project has with respect to mobility, safety and cost-effectiveness.

The conclusion of the report presents opportunities for success at a regional scale. Most jurisdictions and transportation agencies have an ITS plan in place. For these organizations, the technologies identified in each plan are tools in the transportation management toolbox. However, the report's principal conclusion is that to achieve mobility the smart way, these agencies need to collaborate at a regional level. Management strategies and the technologies that support them need to be as seamless as the transportation system itself.

What is the state of ITS in the Portland region?

Cell phones, MP3 players, RFID, DVD players, microwave ovens, digital cameras, MRI machines, GPS devices, the Internet: the list of technologies that continue to transform our daily lives is long and growing. Portland is well known as a technology-friendly region, with the "silicon forest" and plans for free, ubiquitous internet underway. It should come as no surprise, therefore, that Portland is on the cutting edge when it comes to using technology to manage and operate the transportation system.

ITS applications have many benefits, from saving gas to reducing congestion. The case studies presented here cover many of these but, for the sake of simplicity, this report organizes the benefits into three categories: mobility, safety and cost-effectiveness.

Mobility is prominent because, as demonstrated by the 2005 "Cost of Congestion" report, traffic jams and delays could cost the region $844 million annually by 2025. For individuals and businesses alike, continued economic vitality depends on keeping the region moving. ITS includes managing traffic signals to minimize stop-and-go driving. ITS also includes the ability to quickly detect congestion and warn drivers about it, which can mean the difference between being stuck in traffic or being on time.

Technology also helps to increase transportation safety. Monitoring devices collect and transmit real-time weather information that is then shared with the general public. Having accurate information about dangerous conditions on the mountain passes helps fleet dispatch managers steer their drivers away from delays and the risk of loss or damage to the cargo.

Finally, while technology is only one tool in the toolbox for dealing with transportation issues, many ITS applications are among the most cost-effective solutions. Coordinating traffic signals generally yields a benefit-cost ratio of 30:1. Technology can also help avoid or postpone major capital expenses. When the City of Portland and TriMet collaborated to coordinate signal timing with certain bus routes, TriMet increased service quality so much that it could put off adding additional buses – at $300,00 per vehicle – for several years.

Dozens of ITS projects have been implemented around the Portland metropolitan area, many of them involving multi-agency coordination. An illustrative set of examples has been captured here in very brief case studies. The ITS project fact sheets listed below illustrate the mobility, safety, and cost-effectiveness potential of investments in transportation technology.

ITS Project Fact Sheets

- Traffic Signal Coordination
- Truck Weigh-in-Motion
- Transit Signal Priority
- Real-Time Traveler Information
- Truck Safety Signal
- ITS Lab at PSU
- Integrated Corridor Management
- Airport Parking Prepayment
- Advanced Incident Response
- Freeway Ramp Meters
- Road Weather Information

"By providing real-time information on arrival times for a bus or MAX train, ITS makes riding transit easier and more conveniet for our riders."

– Fred Hansen,
General Manager, TriMet

Signs like the one above help drivers estimate how long their trip will take.

Signal technology at this intersection keeps cars from turning when a train is approaching.

Transit Signal Priority

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Technology partnership with the City of Portland helps TriMet to keep buses on time and to increase rider satisfaction.

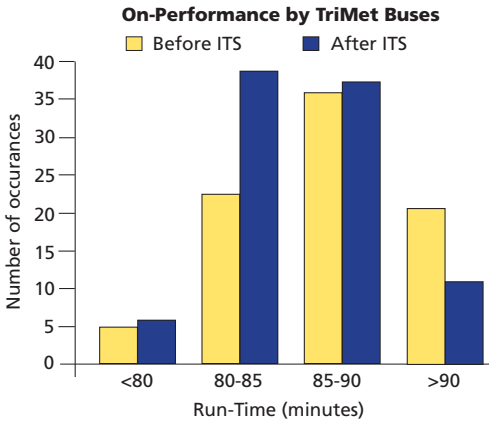
BENEFITS

Mobility: Extended green signals allow buses to stay on time.

Cost effectiveness: Increasing bus performance reduces the need to purchase extra vehicles.

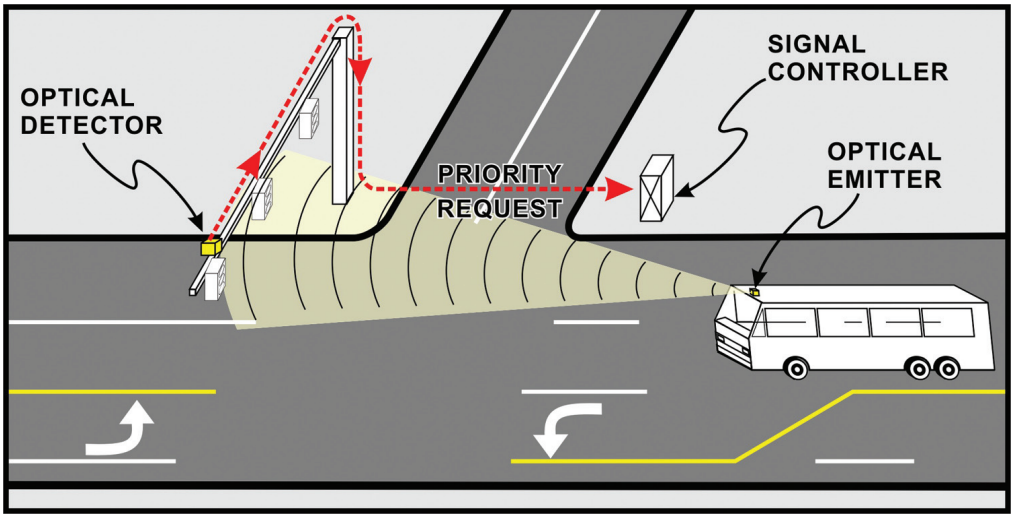
On-time performance and reliability are essential characteristics of a transit service that succeeds in attracting and retaining riders. Although schedules provide extra time during peak periods to account for congestion and longer dwell times, buses face numerous challenges in arriving at each stop on time. Many of these challenges are out of anybody's control but recent collaboration between TriMet and the City of Portland has shown that traffic signals can help keep buses on schedule.

By installing an emitter on a bus and a detector on a traffic signal, it is possible for a bus to "request" a longer green light or a shorter red light when it approaches an intersection, as shown below. In the first phase of this project, the City of Portland has upgraded 275 signals, all of which are located along TriMet's high-frequency bus routes. To avoid disrupting the signal system, TriMet buses can only request the priority treatment when they are running at least 30 seconds behind schedule.



As shown in this graph, fewer buses exceed 90 minutes on this route and overall reliability increased after implementation of the Transit Signal Priority project.

The benefits of this investment have been significant and immediate. As the graph above illustrates, far fewer buses were late after the "transit signal priority" project was implemented. What is more, the graph shows that the service became more reliable: more buses completed the route in a consistent amount of time. In terms of achieving the goal of increasing ridership and customer satisfaction, these early results – especially the increased reliability – show that this technology is helping make a good service even better.



Traffic signals can give buses an extended green light when they need to make up time.

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Real-time Traveler Information

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Where are the traffic jams? When is the bus coming? Websites and hot lines from ODOT and TriMet provide knowledge, power.

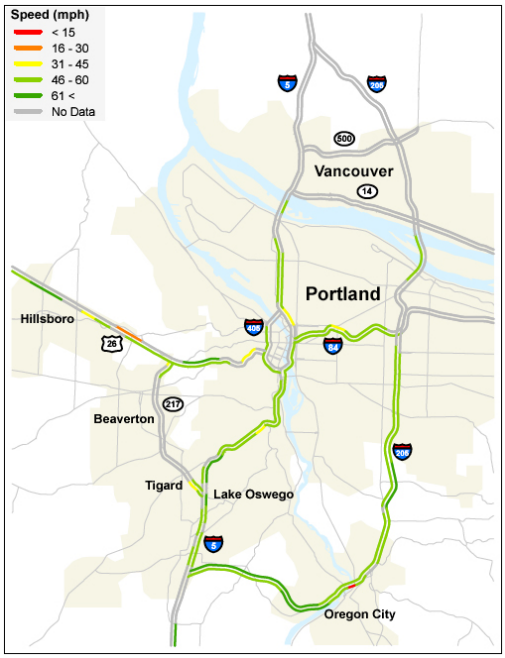
BENEFITS

Mobility: Real-time information about traffic conditions helps drivers avoid delays or gives them peace of mind.

Safety: Real-time information about snow, ice and other hazards helps drivers avoid or be prepared for danger.

Cost effectiveness: Public agencies have expertise to collect data and private media have skills to publish it.

Construction zones, breakdowns, parades and other disruptions often add to existing congestion levels but the impact on travel time is generally hard to predict. For time-sensitive trips, including the delivery of goods, this uncertainty easily turns into wasted time. Leave too early and time is wasted at the destination; leave too late and the delivery or appointment is missed. The solution to this problem involves creating and providing information to travelers in real-time so that they can know what is happening and possibly adjust their plans.



ODOT's TripCheck Speed Map shows real-time traffic conditions for area highways.

In Portland, the primary forms of real-time traveler information come from the Oregon Department of Transportation (ODOT) and TriMet. ODOT's service, called TripCheck, includes a hotline (511 from any phone) and a webpage (www.tripcheck.com). The webpage, for example, allows users to view live traffic cameras, check weather stations, and use the "speed map" to identify congested highways.

For TriMet Riders, GPS devices on every bus and MAX mean it is possible to forecast the actual arrival time of any vehicle in the system. The information is available online (www.trimet.org/transittracker/) or by phone (238-RIDE). The value of the service means a rider can spend less time waiting at the curb or at least knows when the bus will actually arrive.

TriMet's Transit Tracker allows transit riders to find out when buses will actually come.

Both ODOT and TriMet work with partners in the private sector to disseminate the information. The TripCheck speed map is a fixture of morning television news and Google uses Transit Tracker data to let users compare, in real time, the time and cost of driving with taking transit. These partnerships create cost-effective win-win relationships, especially for the traveling public.

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Truck Weigh-in-Motion

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Roadside technology allows trucks to skip the inspection line and save time, money.

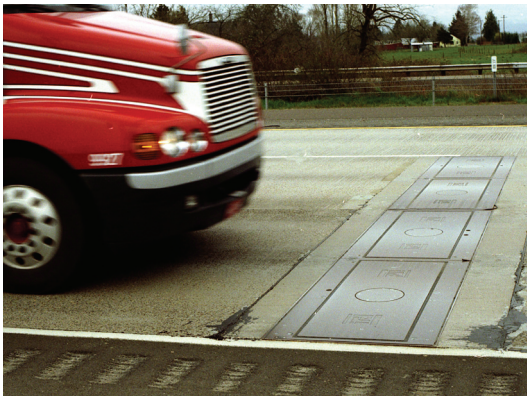
BENEFITS

Mobility: Trucks are weighed and have credentials scanned without stopping.

Safety: Avoiding the weigh station means fewer high speed merges on the freeway.

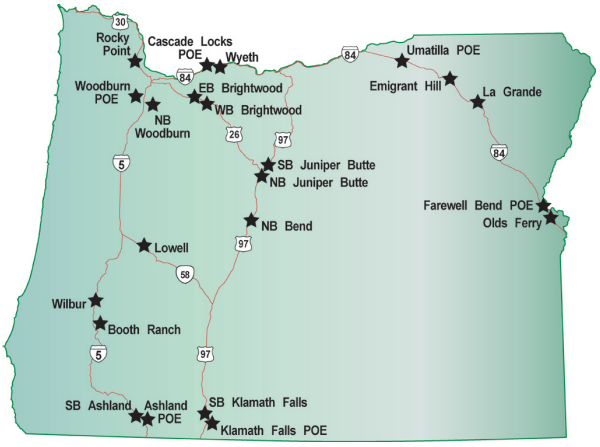
Cost effectiveness: Roadside technology reduces labor costs.

Weigh stations may be a fact of life for trucks but they still represent a loss of valuable time. In a world of just-in-time deliveries, transportation agencies recognize that the business community expects weighing a truck and checking its credentials to take as little time as possible. At border crossings and other gateways, electronic communications are helping trucks save time. In Oregon, as in many other states, a combination of in-road and road-side technology is enabling ODOT to get all the information it needs about a truck – including the weight – without the driver needing to stop for even a minute.



Scales in the pavement weigh trucks as they pass while sensors above check their credentials.

At 22 locations around the state, ODOT has installed special sensors in the pavement of the roadway that can weigh a truck while it is in motion, even at highway speeds. For trucks that carry a transponder device, information about the truck and the driver can be received by an overhead receiver and combined with the measurement of the truck's weight. If everything is in order, the truck can proceed without having to enter the weigh station at all. Only the trucks that have a problem or that do not have a transponder have to pull off the highway for a traditional inspection.



ODOT's Green Light preclearance system is deployed in 22 locations throughout the state.

In its first seven years, ODOT's weigh-in-motion initiative, nicknamed Project Green Light, is estimated to have saved trucking companies 524,000 hours of travel time and $39 million in operating costs.

"Truckers save time and fuel that would be spent getting on and off the road and idling in weigh station lines, chances for accidents are lessened, and the state and taxpayers save money that would have been spent on added staffing and weigh station facilities."

– John Sallack,
Director of Safety, Oregon Trucking Association

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Airport Parking Prepayment

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

New payment technology saves travelers time at the toll booth.

BENEFITS

Mobility: Visitors spend less time waiting in line to pay for aiprort parking.

Cost effectiveness: Less cash handling and fewer staff hours needed in parking payment booths.

Air quality: Reduced idling has cut emissions of carbon monoxide by an estimated 2.26 tons per year.

Drivers pay for their mobility in a variety of ways, including gas, tolls, and parking. In each case, the cost includes not only the price but also the time spent waiting in line to pay. This delay represents a nuisance to the consumer, a business risk for the vendor, and often a source of environmental harm, considering the emissions from idling cars. At Portland International Airport, the exit plaza from the parking facility involved all three of these problems as well as an opportunity to achieve some labor efficiency.

Drivers with prepaid parking tickets enjoy shorter queues when exiting the airport.

The solution is a system called QuickPay that allows drivers who park at the airport to pay for parking between the terminal and their cars, as pictured below. By pre-paying, drivers are allowed to bypass the queue at the exit plaza. According to Airport Parking Manager Steve Koester, "the transaction time at the exit plaza has dropped from 1 minute to just 13 seconds." With 80 to 85% of customers now using the QuickPay system, the appeal of saving time and fuel is apparent.

While the QuickPay system represents a time savings for customers, it also has environmental benefits. Carbon monoxide emissions from cars coming to the airport are estimated to be reduced by 2.26 tons per year as a result of decreased idling at the exit plaza. The system is also a good business model for the airport, allowing staff freed from ticket booths to provide other, more appreciated, customer services.

"QuickPay" kiosks allow airport visiters to pay for their parking before getting into their cars.

Quick·Pay

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ITS Lab at Portland State University

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Researchers use data from transportation technology to help agencies refine policies and improve programs.

BENEFITS

Mobility: Lab work helps transportation planners make better–informed operational and investment decisions.

Safety: ITS lab works with local agencies to promote community traffic safety.

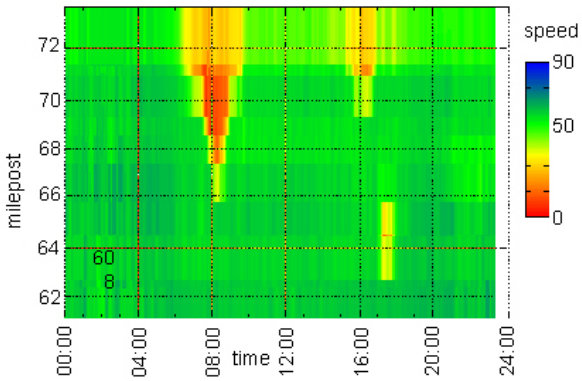
Cost effectiveness: Federal funding matches local investments in ITS research.

Just as bus schedules undergo periodic revisions, intelligent transportation systems often require active management. Ramp meters and traffic signals, for example, need to be monitored and evaluated to determine if they are functioning properly and having the desired effect on traffic. Transportation agencies, however, are generally stretched thin and resources for measuring effectiveness are limited.

The ITS lab is located in PSU's new state-of-the-art engineering building.

The creation of an ITS laboratory at Portland State University has emerged as part of the response to this challenge. Transportation agencies have data but no time to analyze them while the University has a laboratory with researchers in search of real-world situations to study. The arrangement benefits from the willingness of transportation agencies in the region to collect and share data with each other and with the university. ODOT's highway traffic sensors, TriMet's GPS-equipped buses and even the airport's parking garages feed this information-sharing system. In sum, this enables the ITS lab to support the creation and refinement of system management strategies throughout the region.

In addition, the ITS lab is an important part of the region's efforts to develop a stronger relationship between real-time operations and strategic planning. The lab maintains the Portland Oregon Regional Transportation Archive Listing (PORTAL), which stores vast amounts of data from ITS devices such as ODOT's in-road traffic sensors. By giving transportation planners a substantially more precise understanding of transportation activity. This operational data enables better decision making for future capital investments.



The ITS Lab's diagnostic tools include graphics like the one above, which shows traffic speeds on US26 eastbound. Congestion at the Sunset Tunnel in the morning appears as a red V-shape.

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Road Weather Information

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Monitoring devices provide early warning of dangerous road conditions to drivers and maintenance crews.

BENEFITS

Mobility: Travelers can avoid weather conditions that might cause congestion.

Safety: Allows drivers to plan alternate routes or be prepared for dangerous road condtions.

Cost effectiveness: Allows road managers to deploy weather treatments without a site visit.

Treacherous driving conditions, from the West Hills to Blue Box Pass, can become serious safety problems. Conditions that warrant chains or traction tires may be the most obvious examples but even less severe weather, such as rain and fog, can increase the probability of collisions. The two challenges associated with addressing this problem are (1) collecting accurate, real-time information about road-weather conditions and (2) communicating that information to the traveling public in an efficient and dependable manner.

Monitoring devices collect weather information that is distributed via websites (inset), hotlines and message signs.

ODOT and other agencies use a set of technologies that are known collectively as Road Weather Information Systems (RWIS). The devices continuously monitor temperature, precipitation and wind; some stations can actually measure the temperature and moisture content of the pavement. ODOT collects these raw data and uses them to create valuable information that is disseminated to travelers via message signs, the TripCheck website and hotline, and the media.

The primary benefit of the RWIS is safety, namely equipping motorists with complete information about road conditions. With this information, drivers can prepare for or avoid dangerous situations, perhaps by taking an alternate route or waiting until a storm has passed. Another benefit of the data is to public works departments, which use the information as the basis for resource allocations. For example, during a snow/ice event, sensor data can help prioritize which roads get treated or plowed first.

"TripCheck allows our company to access highway conditions and reroute our trucks during periods of inclement weather."

– Bruce Leonard,
Director of Safety for Portland-based Market Transport

"Using the data from our RWIS station has allowed us to more cost effectively deploy our limited resources, including personnel and equipment."

– Joe Marek,
Clackamas County Traffic Engineer

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Freeway Ramp Meters

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Managing traffic on entrance ramps reduces delay and accident rates.

BENEFITS

Mobility: Metered entrances allow freeways to keep flowing smoothly during peak travel.

Safety: Less conflict during high-speed merges decreases the risk of collisions.

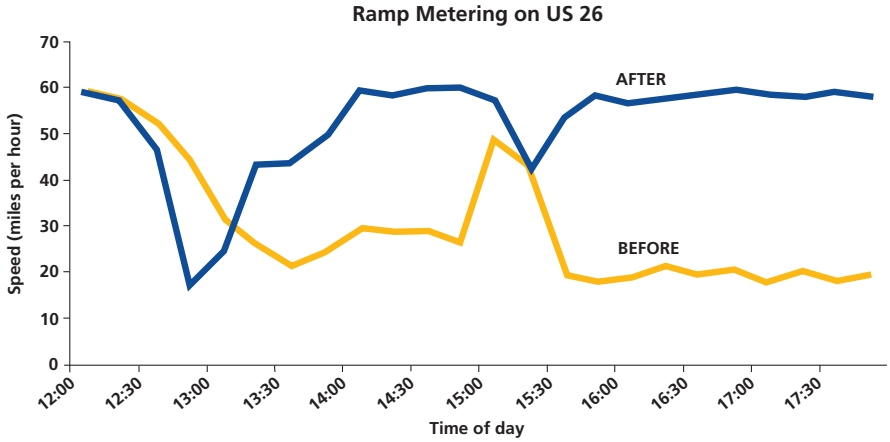
Cost Effectiveness: Reduced delay and fuel consumption on the freeways without physical expansion.

Merging lanes of traffic – and highway onramps in particular – are common locations at which to find congested bottlenecks. The weaving patterns, poor visibility and speed differentials between vehicles frequently create traffic jams as well as fender benders. Because this pattern tends to be worse when large numbers of cars try to merge into heavy traffic, transportation agencies around the country have installed ramp metering systems. Ramp meters create space between vehicles entering a freeway, which makes the merge more efficient and decreases the risk of collision. Furthermore, the meter can be adjusted in real-time based on the freeway's level of congestion.

Ramp metering reduces the delay associated with traffic merging onto freeways.

ODOT has installed ramp meters at 118 on-ramps along Interstates 5, 205, 405, and 84 as well as the Sunset Highway and Route 217. In one evaluation, ODOT found that the ramp meters on the Sunset Highway save an average of 15 minutes for a trip from Hillsboro to downtown Portland. The most comprehensive analysis on the benefits of such implementations comes from the Minneapolis-St. Paul metropolitan area where the region's ramp meters were shut down temporarily in response to customer dissatisfaction. During the five-week experiment, throughput on the freeways declined by 14% and crashes increased by 26%.

ODOT's ramp meters rely on sensors that are installed in the lanes of the freeway to measure traffic volumes. The data used to program the ramp meters are also used to create real-time traveler information.



Traffic speed increased after ramp metering was implemented on the Sunset Highway.

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Traffic Signal Coordination

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Linking signals along a corridor reduces stop-and-go driving, benefiting air quality and public safety.

BENEFITS

Mobility: Synchronized traffic signals reduce delay by limiting stop-and-go traffic.

Air quality: Less stop-and-go traffic results in lower vehicle emissions.

Cost effectiveness: To improve the flow of traffic, coordinating signals costs much less than adding lanes.

According to the Federal Highway Administration, 5% of congestion is due to poorly timed traffic signals. Stop-and-go traffic increases air pollution and gas consumption, produces greater wear and tear on vehicles, and costs people and businesses money in the delay it imposes. In addition, poorly timed signals limit the capacity of the roadway, creating unnecessary congestion.

The City of Portland's $533,000 partnership with the Climate Trust paid for a signal retiming program, which is expected to abate 169,000 tons of carbon dioxide emissions.

Improving signal timing involves only moderate capital costs but it does take considerable staff time to analyze traffic patterns and develop an optimal timing scheme. In 2005, the City of Portland used $533,000 from the non profit organization Climate Trust to retime 150 intersections. By helping traffic move smoothly, the new timing plan saves an estimated $3 million in gas and eliminates 169,000 tons of carbon dioxide emissions each year. Signal timing also improves the performance of the roadway by reducing congestion and delay, an outcome that is obvious to any driver who has seen one light after another turn green in a steady progression.

The City of Gresham has gone one step further and implemented a signal timing system that adapts in real time to changing traffic conditions. In contrast to traditional signal coordination plans, which vary only by time of day, Gresham's system is able to adjust to above- or below-average traffic volumes. The benefit-cost ratio of the project was calculated as 30:1 – slightly higher than the benefits of a traditional signal coordination initiative.

Well-timed signals let drivers reach many green lights in a row, reducing delay and frustration.

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Advanced Incident Response

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Sensors and cameras help ODOT rapid-response teams limit delay after a breakdown or fender-bender.

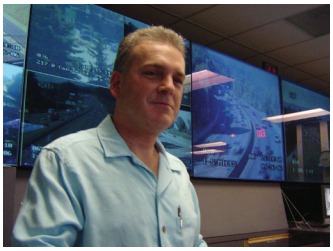
BENEFITS

Mobility: Responders help clear crashes and other incidents quickly, keeping traffic moving.

Safety: Shorter response time reduces the likelihood of secondary crashes due to distracted driving.

Cost effectiveness: It is much cheaper to preserve capacity by clearing incidents quickly than to build a new lane.

More than half of congestion can be attributed to "non-recurring" sources, including incidents, weather, construction, special events and traffic signals. An incident on the highway – from a mechanical breakdown to a fender-bender – quickly disrupts traffic, especially during a peak period. It also creates a safety risk as passing drivers "rubberneck" trying to catch a glimpse of the scene, sometimes leading to a secondary crash.



Detectors in the pavement, cameras along the freeway and central operations centers enable incident detection.

ODOT's incident response team is intended to limit the duration of such incidents in order to minimize their impact and restore freeway operations to normal as quickly as possible. Incident response trucks are dispatched by operators who use real-time traffic data and Closed-Circuit TV (CCTV) camera feeds to detect and verify incidents on area freeways. The trucks carry basic repair tools and traffic control equipment as well as variable message signs and a communications system.

By detecting and clearing incidents quickly, the incident management program keeps traffic moving and helps avoid secondary crashes. For a congested freeway, this kind of operational strategy preserves the capacity of the existing infrastructure, which can offset some or all of the need to build additional lanes.

The incident response solution may be low-tech but ITS devices play an important supporting role. For example, when a breakdown causes traffic to slow down, the traffic sensors that ODOT has installed in the pavement detect the change and alert one of the operators in the dispatch center. The operator can then use a CCTV camera to verify that an incident has occurred and determine the appropriate response. A flat tire may require only an incident response team truck but a collision is likely to require a police car and, possibly, a fire truck or ambulance. At the same time, the dispatch operator can post information on the variable messages signs to alert other drivers.

ODOT's incident response trucks clear incidents safely and quickly.

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Integrated Corridor Management

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

Collaboration between PDOT and ODOT means one crash won't wreck the whole region.

BENEFITS

Mobility: Technologies promote and manage detours when incidents or breakdowns stop traffic.

Safety: Strategy speeds emergency response times, reduces risk of secondary crashes.

Cost effectiveness: Automated incident detection and pre-existing protocol save staff time.

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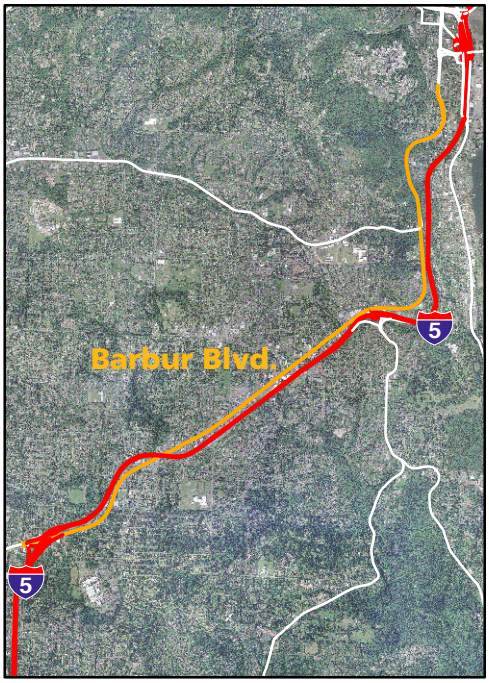
When a crash or a breakdown brings traffic to a halt on a major road, congestion mounts quickly while emergency vehicles try to reach the scene. Some of this congestion can be mitigated by diverting traffic onto an alternate route, if one exists. However, diverting large volumes of traffic onto arterial streets can lead to secondary problems if the situation is not managed carefully. Compounding the complexity of the situation is the fact that different roads are managed by different agencies. In other words, there are both technical and institutional challenges to using parallel arterials to mitigate incident delay on the freeways.



Because Barbur Boulevard and I-5 run alongside each other, they make ideal alternate routes when one is heavily congested.

PDOT and ODOT found an opportunity to implement the concept of "Integrated Corridor Management" south of downtown Portland, where I-5 and Barbur Boulevard run parallel, as shown in the map to the right. The system, which went live in 2003, utilizes in-pavement vehicle detectors to detect incidents, video cameras to observe the scene, and variable message signs to communicate with drivers. When an incident occurs, staff in ODOT's and PDOT's operations centers activate these devices so that drivers are encouraged to follow the alternate route.

The combination of technologies can perform two different functions. On one hand, the system can help Barbur Boulevard cope with the significant increase in volume when traffic is diverted from I-5. On the other hand, the system can enhance the performance of the links between Barbur Boulevard and I-5.

When Barbur Boulevard is used as a detour for traffic stuck on I-5, variable message signs can help direct traffic back to I-5 at the appropriate time.

This project demonstrates two important lessons about intelligent transportation systems. First, the technology (detectors, cameras, message signs, signal systems) enable a valuable strategy, in this case integrated corridor management. Second, the value of the technology is enhanced by extensive coordination between ODOT and PDOT, which was achieved through the development of shared protocol for different incident scenarios.

Truck Safety Signal

INTELLIGENT TRANSPORTATION SYSTEMS IN THE PORTLAND METROPOLITAN REGION

New approach to traffic signals means fewer trucks run red lights in North Portland.

BENEFITS

Mobility: Fewer red-light conflicts keep traffic moving smoothly.

Safety: Less red-light running reduces crash hazards for trucks and passenger cars.

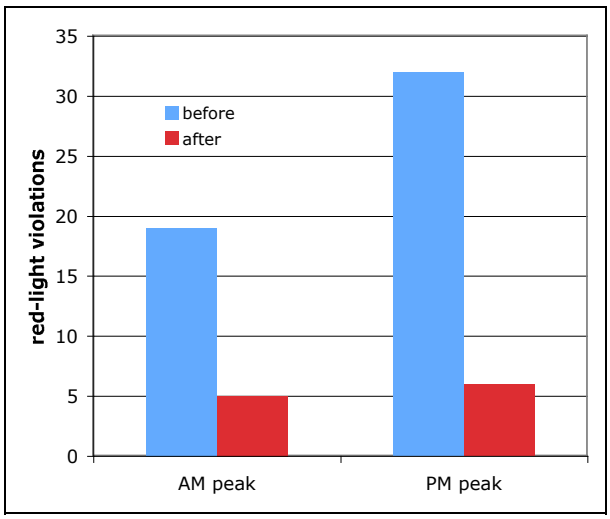
Cost effectiveness: Small investment yields a great return in saving lives and reducing damage.

Red-light running is one of the greatest dangers in transportation safety. In contrast to negligence, there are occasions when a driver simply miscalculates the window provided by the yellow light. For a tractor-trailer, which takes much longer to stop than a typical sedan, this is a serious problem, especially on routes that have high truck volumes.

Red-light running is always dangerous, and trucks have more trouble stopping at lights than smaller vehicles.

To address this issue, the City of Portland has installed a combination of devices at the intersection of Columbia and Macrum that detects an approaching truck and, in the appropriate circumstances, extends the yellow light just long enough for the truck to pass before turning red. The installation – the first in a demonstration program – had an immediate impact, as shown in the graph below. During the afternoon peak the day before the system was activated, 32 trucks ran the red light; only 6 did so after activation.

According to Bill Kloos, manager of the Signals and Street Lighting Division of PDOT, "This is a heavily traveled freight corridor where we can do something extremely cost-effective to improve safety. The project has given us an opportunity to demonstrate how this technology works before considering a broader deployment."



Truck detection on Columbia Boulevard at Macrum reduced red-light running among trucks dramatically the day it was implemented.

For more information, visit
www.metro-region.org

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What's next for ITS in the Portland region?

When the Intermodal Surface Transportation Efficiency Act (ISTEA) was passed in 1991, Congress asserted that the era of interstate highway construction was over and a new era, marked by metropolitan planning and intermodalism, had begun. Intelligent Transportation Systems were an integral part of this new era but they were considered in isolation from the new approach to regional planning and project development.

Almost all of the projects highlighted in the previous section were planned during the 1990s, in large part as the result of ITS plans that were developed by individual transportation agencies around the region. Portland's culture of collaboration resulted in these projects achieving a high degree of interagency integration.

More recently, national policy has shifted again. In the late 1990s, the Federal Highway Administration began to emphasize the integration of ITS into transportation plans and to promote the formalization of interagency relationships regarding ITS. In the new federal transportation legislation (SAFETEA-LU), instead of focusing on deploying ITS, national policy promotes the development of system management strategies that, in turn, are enabled and enhanced by the application of technology.

Once again, Portland has been ahead of the curve. Interagency integration has traditionally been strong in the region, especially in terms of intelligent transportation systems. TransPort, a regional ITS coordinating committee, has been meeting since the early 1990s, providing a forum for technical staff to share ideas and project updates. Moreover, many of the ITS deployments around the metropolitan area have been linked to management strategies. The ramp metering, incident response and TripCheck programs run by ODOT, for example, are all pieces of a broad freeway management approach.

"In the future, our approach to intelligent transportation systems should directly mirror the region's collaborative approach to transportation planning, which has led to nationally recognized success."

– Rex Burkholder, Metro Councilor

Due to the nature of the region, cost-effective strategies such as incident response and traveler information will need to be as seamless as the facilities they serve.

Opportunities for regional success

As a response to the Cost of Congestion study, the purpose of this report was, on one hand, **to increase understanding of intelligent transportation systems** and, on the other hand, **to inform decision-making for future investments**. As a response to evolving national policy, the purpose of this report was also **to identify opportunities for regional collaboration** on intelligent transportation systems. With ITS plans in place at most transportation agencies around the region, the need is not for new project ideas but for opportunities to link technology, system management strategies, and regional transportation plans. Some examples of such opportunities are summarized below.

> **Corridor Management:** The PDOT/ODOT project that manages I-5 and Barbur Boulevard as a single corridor has been mentioned before in this report. A similar project is now being implemented in the I-205/82nd Avenue Corridor that involves PDOT and ODOT as well as Clackamas County. There are numerous other multi-facility corridors, some of which include transit infrastructure in addition to roadways. Local streets, major arterials and freeways may be owned by different agencies but users expect the system to operate seamlessly. When a crash disrupts traffic in

Traveler information services, such as TriMet's Transit Tracker *are growing in popularity and familiarity.*

one place, the region needs the relationships, strategies, and technologies in place to minimize the impact it has on traffic and the economy.

Traveler Information: Like the infrastructure itself, the customer expects real-time information about construction or other delays to be seamless. This means that if the City of Portland, ODOT and TriMet – as well as their counterparts in Vancouver – are going to use information to help travelers make good route, mode, and timing decisions about their travel, the systems are going to have to be integrated. For example, a message sign on northbound I-5 in Portland can alert drivers to delays across the river in Washington because the DOTs in Oregon and Washington share information with each other.

Freight Management: With the exception of local deliveries, many trucks that travel in, around, or through Portland also visit other states. Each of these states and regions is considering or implementing strategies such as weigh-in-motion (requires onboard ITS devices) and traveler information (requires active engagement by the drivers). As previously noted, the customer – in this case, the truck driver – expects such systems to be seamless. This requires coordination and cooperation among agencies in different parts of one region. Without coordination, drivers are less likely to adopt technology or utilize information and without widespread participation, the return on investment is limited.

Electronic Payment: In other parts of the country, as electronic payment has caught on, individual agencies have invested in their own technologies, only to make expensive conversions later to integrated systems. For a person to be able to use the same technology to pay for parking, highway/bridge tolls and even transit, there must be considerable coordination among the agencies. An electronic payment consortium has united almost all of the states in the mid-Atlantic and New England, with the network now reaching into the Midwest. Ultimately, this integration benefits not only the customer, who needs only one device, but the agencies, which can share the cost of purchasing equipment as well as expertise.

In addition to these strategic opportunities, there are also more immediate actions that can be taken to enhance the state of ITS in the region.

- The region would benefit from a new strategic plan for ITS. Such an endeavor would help identify and prioritize regional initiatives like those described above. A strategic plan could also incorporate a benefit-cost analysis of the many possible ITS investments.

- Transportation agencies in the region should take advantage of the data generated by ITS devices. Already, data from ODOT's traffic sensors are supporting transportation planning activities. As more data are created, agencies will need to cultivate the skills and tools needed to maximize this opportunity.

• ITS planning and transportation planning need to be fully integrated. For example, a regional strategic ITS plan should be coordinated with the Regional Transportation Plan (RTP) that is developed by Metro every four years. The RTP as well as local plans should consistently consider ITS, especially as it relates to system management strategies.

Conclusion

Transportation planning is being defined more than ever by the scarcity of funding. In Portland and many other parts of the country, federal state and local funding for transportation is failing to keep pace with current needs, to say nothing of the growth expected in this region in coming decades. In this context, the risks associated with bad decision-making are tangible and the stakes are high.

In the context of congestion management, one of the major risks is that opportunities to solve problems in the most cost-effective way will be missed or overlooked. The National Strategy on Congestion promotes system management and operational solutions, some of which involve ITS, but these approaches are not as familiar among decision-makers as are traditional capital enhancements. With such high stakes, it is understandable that leaders might hesitate to invest in strategies that are perceived as new or exotic. **Better decision-making for congestion management depends on leaders having a solid understanding of the cost-effective strategies, including ITS, that are promoted by national, statewide and regional policy.**

The other major risk associated with congestion is that it will be approached with local rather than regional objectives. All too often an investment targets a bottleneck but not the underlying problem. This results in the congestion being moved but not managed. More money can be spent on the new hot spot but absent a regional strategy, it will do nothing to manage congestion. **Better decision-making for congestion management depends on regional coordination of both capital enhancements and system management strategies.**

Intelligent Transportation Systems may not be the perfect solution to every problem but they are an important tool in the toolbox for cost-effectively managing congestion as well as other issues, from safety to air pollution. If transportation decision-makers in the Portland metropolitan area are going to succeed in lowering the cost of congestion, they are going to need to understand how to use every tool in their toolbox.

Additional Resources

If you are interested in more information about ITS in the region or in general, we encourage you to visit the websites of the Oregon Department of Transportation (**www.oregon.gov/ODOT/HWY/ITS**) and the Intelligent Transportation Society of Oregon (**www.itsoregon.org**).

If you are interested in learning more about the work of a specific agency or jurisdiction, the directory below provides some useful points of contact.

ITS Oregon
Hau Hagedorn, President
Hau.hagedorn@odot.state.or.us

Federal Highway Administration
Nathaniel Price, ITS/Operations Engineer
Nathaniel.price@dot.gov

Oregon Department of Transportation
Galen McGill, ITS Program Unit Manager
galen.e.mcgill@odot.state.or.us

Oregon Department of Transportation
Dennis Mitchell, Region 1 Traffic Manager
dennis.j.mitchell@odot.state.or.us

City of Portland
Bill Kloos, ITS Division Manager
bill.kloos@pdxtrans.org

TriMet
David Zagel, Project Planner
zageld@trimet.org

Metro
Jon Makler, Transportation Operations Program Manager
maklerj@metro.dst.or.us

Port of Portland
Scott King, Senior Planner
scott.king@portofportland.com

Portland State University
Robert Bertini, ITS Lab Director
bertini@pdx.edu

Washington County
Abbas Shafii, Traffic Engineer
Abbas_shafii@co.washington.or.us

Multnomah County
Bikram Raghubansh, Senior Civil Engineer
Bikram.rahubansh@co.multnomah.or.us

Clackamas County
Joe Marek, Traffic Engineer
joem@co.clackamas.or.us

City of Gresham
Jay McCoy, Transportation Engineer
mccoy@ci.gresham.or.us

City of Beaverton
Randy Wooley, Transportation Engineer
rwooley@ci.beaverton.or.us

SW Washington RTC
Bob Hart, Project Manager
bob@rtc.wa.gov

C-TRAN
David Daily, ITS Coordinator
davidd@c-tran.org

Washington State Department of Transportation
Stan Markuson
markuss@wsdot.wa.gov

City of Vancouver
Ali Eghtedari
Ali.eghtedari@ci.vancouver.wa.us

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