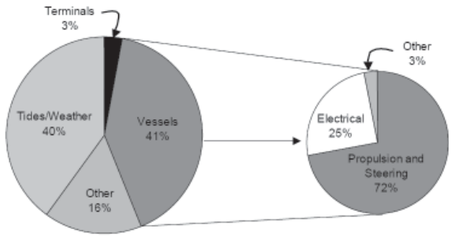
Trip Reliability
WSF measures, reports, and manages on-time performance and missed boats by route to improve customer service.

Most Common Trip Cancellation Causes



Emerging Directions

System efficiency is about aligning transportation system performance with customer expectations and getting the highest performance possible out of the existing system – this applies to all modes.

On roadways, including transit, throughput is a key measure of system efficiency.

- Basic maintenance and operations are essential to keep the system open and operating.
- As traffic grows, increasingly sophisticated management techniques are needed to maintain flow.
- Information technology will allow the next generation of management techniques.
- Advance communication will permit real-time information for travelers.
- In-vehicle ITS devices (such as On-Star) will be the next step, sharing weather, safety, and transportation system data with drivers, system providers, and first responders.
- Closer integration of modes (highway and transit) will need to address real-time system coordination.

The focus has been on system efficiency measures – the next frontier is point-specific applications to improve flow at specific chokepoints (such as truck performance at specific on-ramps).

- System pricing is emerging as one of the primary options to effectively maintain flow, because price allows the ultimate flexibility in matching roadway capacity to traffic demands.
- Operational approaches should be viewed as a part of a continuum and an integral part of our investment program: a commitment to maintain and operate the system; management techniques to maximize use of the system, and capital investment to expand the system where needed.

The Washington State Transportation Commission and the Washington State Department of Transportation are in the process of updating the Washington Transportation Plan. This long range plan is based on data analysis and is focused on ten issues: System Preservation, System Efficiencies, Safety, Transportation Access, Bottlenecks and Chokepoints, Economy and Jobs, Moving Freight, Future Visions, Health and Environment and Funding and Governance. This plan will shape future transportation budget proposals.

For more on this topic: **www.wsdot.wa.gov/planning/wtp**

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System Efficiencies

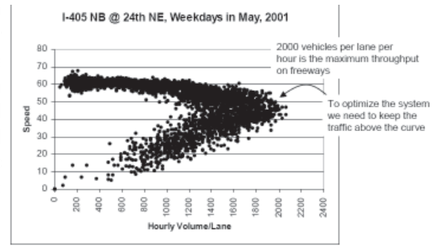
How can we best work toward optimizing how efficiently we derive the benefits of our current transportation system facilities and those we are able to create in the future?

Getting the highest possible performance from our existing transportation investments through operational strategies, from basic maintenance and operations activities to the application of sophisticated technologies, can make the system work better for customers and recover lost productivity. Several factors contribute to system inefficiency, including congestion caused by too much traffic or incidents, design issues, weather, mechanical failures in buses or ferries, uncoordinated operating schedules or traffic signals, and driver behavior itself. Operating programs can address many of these factors to improve how the system works.

Operating our roadways for maximum throughput is the key to getting the most out of the system

For most roadways, basic day to day maintenance activities such as snow plowing, picking up debris, controlling vegetation, and pothole patching are the activities needed to keep the road available for optimal use. When use of the roadway grows and congestion occurs, more sophisticated operating activities are needed to optimize use. Each roadway has an optimal capacity where throughput is maximized. The chart below is typical for a freeway, and represents real data from I-405.

The chart indicates that maximum throughput is about 2000 vehicles per lane per hour, and at this density, traffic is flowing at about 45 to 50 miles per hour. If demand increases further, speeds slow and throughput actually drops by as much as half of maximum throughput. This means that under congested conditions, the capacity of a roadway is actually less than if flow is maintained at a steady 45 to 50 miles per hour. Knowing that this is how roadways operate can lead to strategies aimed at maintaining flow and trying to prevent traffic from dropping “below the curve.”



Washington State Department of Transportation

Washington State Transportation Commission

System Efficiencies

Washington State Department of Transportation

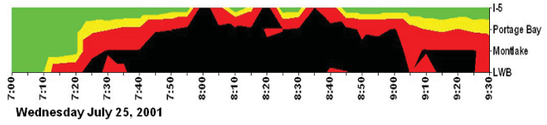
Intelligent Transportation System Technologies
As roadway congestion increases, Intelligent Transportation Systems are used to maintain vehicle throughput. We now use these types of technology including ramp metering, traveler information, incident response, border crossing technology, weather operations based on prediction tools, commercial vehicle information systems networks (CVISN), and coordinated signal technology.

Ramp metering has been in place in the Seattle area for years and has proven highly effective in maintaining and even increasing throughput. Ramp meters work by metering the traffic from a ramp onto the freeway mainline, allowing smooth merging and preventing the brake-tapping which can lead to reduced speeds. The chart below shows the effect of ramp metering on SR 520 in Seattle: the ramp meters all but eliminated stop-and-go traffic, and actually increased the flow across the bridge by almost 500 vehicles per hour. This represents restored capacity that had been lost to congestion. Similar to ramp metering, providing travelers with accurate, timely information on traffic conditions can help spread traffic to avoid local slowdowns thereby maintaining flow.

Ramp Metering

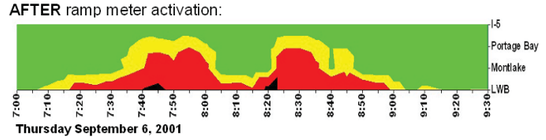
SR520 Westbound Ramp Meter Effects

BEFORE a series of ramp meters were activated: EB morning congestion, I-5 to Lake Washington Blvd:



Wednesday July 25, 2001

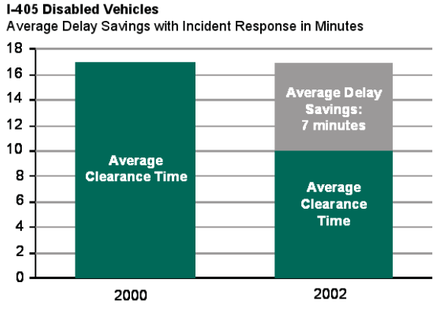
AFTER ramp meter activation:



Thursday September 6, 2001

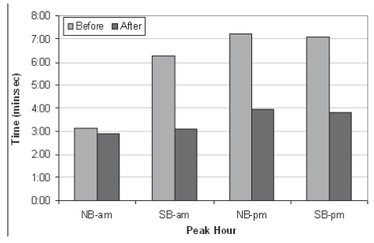
Wide Open Moderate Heavy Stop and Go

Incident response
Traffic accidents and other incidents can contribute to congestion two ways: the incident itself can close lanes or cause a distraction which reduces speed and throughput. However the primary incident often leads to secondary fender benders as traffic slows, exacerbating the problem. Incident response programs focus on responding quickly and clearing incidents to minimize primary impacts and prevent secondary collisions. In 2002, enhanced incident response patrols were instituted on I-405. These patrols have reduced the average clearance time for incidents on I-405 by over 40%.



Traffic Signals
Traffic signal synchronization is an issue that most drivers and riders can relate to. Like ramp metering for freeways, signal synchronization contributes to arterial operation efficiency similar to the maximum throughput concept on freeways. This example shows the effectiveness of signal synchronization on a 1.35-mile section of SR 527. Implementing signal optimization showed a reduction in average vehicle travel times up to 2 minutes 27 seconds (northbound evening commute). This reduced the travel time by nearly 38%.

Delay Reduction due to Signal Optimization on SR 527 from 228th Street to SR 624



Truck Operations
Trucks are required to be weighed , inspected, and registered for travel in Washington. Stopping at truck scales and ports of entry, however, can inconvenience and delay truck shipments. Advanced technology is being applied to improve efficiency, through the Commercial Vehicle Information Systems Networks (CVISN), to weigh the trucks, and check registration and inspection status without stopping at the scales.

Managed Lanes
Special use lanes, such as those restricted to High Occupancy Vehicles (HOV), have been used successfully to maintain flow. These lanes work by allowing limited numbers of vehicles to enter the lanes – in the case of HOV lanes, only those who meet certain occupancy requirements. By limiting the number of vehicles, maximum throughput can be maintained without breaking down into congestion. In addition, HOV lanes also improve the efficiency of the system by carrying more people than other lanes during peak traffic periods. In the Puget Sound region, some HOV lanes actually move more vehicles than the adjacent general purpose lanes because they maintain flow while the adjacent lanes are congested and have lost productivity.

Pricing
Information from other places clearly shows the huge potential of roadway pricing to maintain flow and capacity and prevent congestion. This is done by charging users a fee for using the roadway during congested times. The fee limits the vehicles using the lanes, keeping volumes at a level that allows smooth flow and maximum throughput. California and Texas have had success in charging a fee to use underused HOV lanes. These High Occupancy/Toll (HOT) lanes improve the utilization of the HOV lane, while maintaining smooth flow and a travel time advantage for transit and carpools. Pricing represents the next frontier and a real potential to maximize use of the system.

Improving Transit Operations

Transit agencies in Washington spend over $600 million per year (54% of transit expenditures) operating their systems. Improving the efficiency of these operations is important in a time of doing more with less. Strategies that transit agencies are pursuing to improve operational efficiency include:

System Operating Configuration
Designing how to operate a transit system often involves trading off system efficiencies with the quality of customer service. Some systems have chosen a transfer-based system, which brings people to a central point for timed transfers to other locations. This type of system contrasts with a direct point-to-point system, often used for commuter bus services at peak periods. Route deviated services have been developed to allow fixed route buses to go off route to serve special needs people, especially in lower density areas. Demand response service has been plagued by high operating costs, but technologies such as automatic vehicle locators and efficient routing programs have helped improve efficiency.

Improving Communications
Just like highway operations, communication technologies have improved the efficiency and effectiveness of transit services, including automated vehicle locators to manage the fleet and inform customers of bus arrivals; transit signal pre-emption and queue jumps at ramp meters; and on-line trip planning services.

HOV Lanes Strategies
HOV lanes provide a predictable and quick travel time for buses, allowing them to maintain schedules and a travel time advantage.

Park and Ride Lots
Park and ride lots provide efficient service access in low density areas, allowing transit agencies to pick up large numbers of people at one location as opposed to circulating through widespread neighborhoods.

Vanpools
Washington State has the largest public vanpool program in the country. There are approximately 1,310 vans operating in the Puget Sound region and statewide over 1,600 vehicles each workday. Additional vanpool vehicles are provided and used by nonprofit groups, employers, and private individuals.

Commute Trip Reduction (CTR)
The goals of the CTR Program are to reduce traffic congestion, air pollution, and fuel consumption by working with local jurisdictions and major employers to reduce drive-alone commuting. Nearly 1,100 worksites in Washington State participate in the program.

Travel Conservation
Efforts to affect the demand for transportation, diverting it to carpooling or transit, or to a less crowded time of day, have been effective through employer-based promotion programs, vanpool programs, and other ridesharing services.

Land Use Strategies
Research has shown a link between land use patterns and travel patterns – denser, mixed-use types of development with good pedestrian and transit access have shown higher walking, transit, and carpooling behavior than lower density areas.

Issues in Ferry System Efficiency

Operations are a large focus at Washington State Ferries (WSF), representing 62% of all expenditures on the system.

Congestion and Peaking in the System
The ferry system is affected by peak travel demand like all other travel modes, but ferries experience both daily commuter peaks as well as seasonal tourist peaks. Sizing the fleet for peaks is difficult, since vessels are expensive, and their capacity comes in large units – you can't add a half boat to take on a peak load. WSF has adopted boat wait standards to communicate peak capacity to users. WSF has also adopted zero boat wait standards for buses, walk-on passengers, pre-registered carpools and vanpools, and certain reservations and freight users.

Intermodal Connections
In Island and Kitsap Counties and on Vashon Island, transit service is timed and linked with ferry schedules. In downtown Seattle, there is very frequent transit service, but not specifically linked to ferry schedules. New intermodal connections issues will emerge with the construction of new intermodal ferry terminals in Mukilteo and Edmonds, that may have connections to commuter rail services.