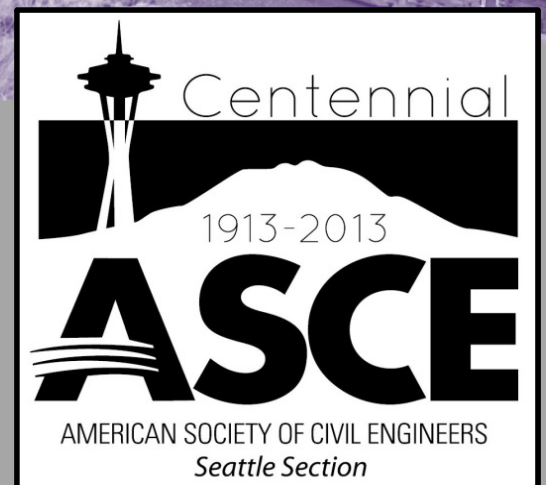
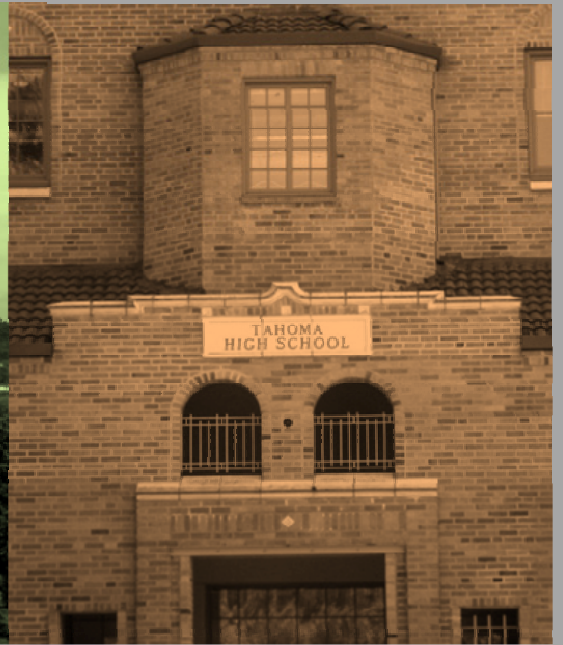
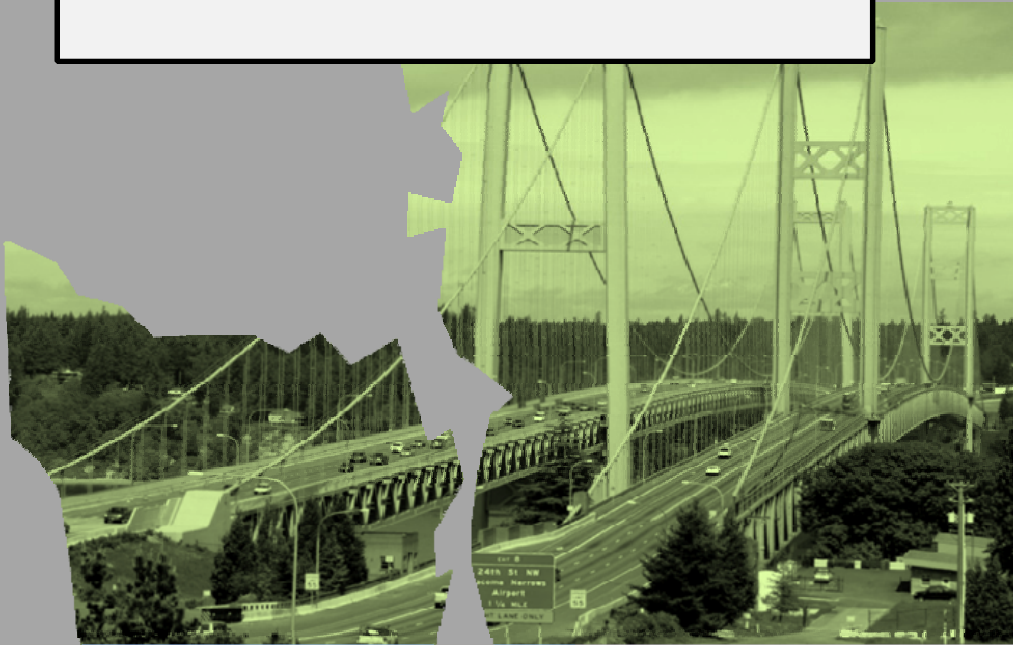


2013 REPORT CARD FOR
Washington's
INFRASTRUCTURE



2013 Report Card for Washington’s Infrastructure

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About Washington's Infrastructure

Infrastructure is the foundation of our economy and essential for our daily lives. Despite infrastructure's critical role in our communities, it is too often taken for granted. Without proper planning to fund and maintain Washington's infrastructure, these systems will continue to deteriorate, hurting Washington families and businesses.

The purpose of the *2013 Report Card for Washington's Infrastructure* is to offer the public and policymakers an easy to understand assessment of how our infrastructure is doing and what needs attention. This report finds that Washington's infrastructure earned a cumulative GPA of C. The analysis was conducted over the past year by a team of infrastructure experts from the Seattle Section of the American Society of Civil Engineers. The *2013 Report Card for Washington's Infrastructure* concludes that while Washington has many types of infrastructure and many great facilities across the state, a lack of planned and guaranteed funding and inadequate maintenance are reported across all nine categories - **Aviation, Bridges, Dams, Drinking Water, Rail, Roads, Schools, Solid and Hazardous Waste, and Transit.**

Just like a school report card, we provide a letter grade of A to F for each category. We examined the most up-to-date publicly available information, and summarized the most pressing issues for each sector. As civil engineers in the State of Washington, we have a responsibility to safeguard the life, health, property, and welfare of the public.

The 2013 Report Card provides us with a path ahead. Now, we must ask ourselves what kind of state we want to become. A C is unacceptable for anyone

concerned about Washington's ability to compete in a global world. Only by working together and investing in our communities can we hope to build a strong foundation for Washington's future.

in·fra·struc·ture *n.*

1. An underlying base or foundation especially for an organization or system.
2. The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons.

How Can We Raise Washington's Infrastructure Grades?

Recommendations for improvement specific to each infrastructure category are included with every summary, but these overarching recommendations are present in each category:

1. **Find Long-Term Funding.** Identify sustainable sources of funding and explore innovative financing.
2. **Use Regulation for Service and Safety.** Design standards are necessary to protect and maintain high level of service and safety standards.
3. **Plan to Implement Sustainability.** Continued assessment and planning efforts to identify and prioritize infrastructure needs. Implement maintenance and retrofit solutions to the extent practical.

ASCE's vision for infrastructure is to commit to bringing existing infrastructure into a state-of-good-repair in the short term, and in the long-term we work to modernize and build in a targeted and strategic manner. By focusing on these three recommendations, we believe we can raise the grades in Washington.

2013 Report Card for Washington's Infrastructure

Subject	2013 Grade	Facts and Status
Aviation	C	<p>Washington has a total of 136 airports that provide 250,000 jobs, \$15 billion in wages, and \$51 billion in economic activity to the state each year. As many as 18 million passengers depart from Washington's airports each year, and more than 600,000 tons of cargo is transported through the airport system. However, aging facilities, land-use policies and available funds have serious impacts on Washington's aviation system. Encroachments from land uses that are incompatible with aviation can limit future airport capacity. Long-term, viable funding sources are needed to maintain and repair aviation facilities and provide incentives to develop land use plans that are compatible with airports, allowing them to remain open and provide for increased capacity in the future. Finally, investing in advanced satellite navigation systems and implementing FAA's NextGen navigation systems will help improve safety, increase capacity, and facilitate business and economic opportunities across the state by providing increased access to large and medium sized communities where a range of different aircraft can land in any weather condition.</p>
Bridges	C-	<p>As of 2011, there were 7,743 bridges in Washington state. Of these, 5% (391) are structurally deficient. This places Washington state sixth in the nation for least number of structurally deficient bridges. However, the state maintains an aging infrastructure struggling to handle the demands of modern society. Already, 36% of Washington's bridges are over 50 years old. Many bridges last well beyond this age, but as time passes, the cost of repairs increase and functionality decrease. This is especially evident in the 20% (1,548) of bridges that are classified as functionally obsolete because they either cannot meet current traffic demands or do not meet current design standards. Over the next 20 years another third of Washington state's bridges will exceed their design life. State, city, and county departments of transportation have maintained a safe network of bridges to-date, but infrastructure must become a priority in order to provide the foundation for economic success.</p>
Dams	B	<p>There are 1,174 dams in Washington, close to 40% of which are categorized as significant or high hazard dams. Most of Washington's dams are regulated by the state Dam Safety Office (DSO). Most of the state regulated dams are privately owned. Washington dams are generally in acceptable condition, but some are aging and do not meet current seismic standards. Some dams have safety deficiencies and are considered unsatisfactory, but do not pose an imminent threat to public safety. Emergency action and O&M plans have been prepared for almost all of the state's high hazard dams. Continued funding of dam safety programs is essential to maintain or improve upon the current level of dam safety in Washington. No funding programs are on the horizon for repairing private dams.</p>
Drinking Water	C-	<p>Washington state is known for having great tasting, clear drinking water. Washington is served by many different types of water systems: private wells, large municipal water systems, and private water systems. This study focused on the public and private systems regulated by the state and serving predominantly residential homes. Larger systems often serve commercial and industrial uses too. While only a small percentage of the state's population is served by smaller water systems serving 25 people or less, they account for 85% of the state's water systems and are only regulated at the county level. In general, water system capacity for Washington's larger water systems was adequate to plentiful, while the smaller water systems do not have adequate capacity.</p>

2013 Report Card for Washington's Infrastructure

Subject	2013 Grade	Facts and Status
Rail	C-	<p>Washington's rail system provides essential freight and passenger rail services to Washingtonians. Reaching 3,215 miles across the state, the rail network is owned primarily by private freight operators that also share track with passenger rail. Capital investment in 2012 exceeded 100 million dollars. While the capacity of the rail system overall is adequate, some congested corridors and the condition of some of the short line rails are concerning. WSDOT's Freight Rail Investment Bank does make loans up to \$250,000 with a 20% match to support smaller projects or portions of larger projects and the Freight Rail Assistance Program provides grants to improve the state's freight rail system. However, by 2030, \$2 billion worth of improvements are needed and 90% of these projects are unfunded. By removing car to rail interaction at crossings, accidents have been reducing, but the trend has flattened in the past 3 years.</p>
Roads	D+	<p>There are more than 136,000 miles of roadways in Washington State, on which 87 million vehicle-miles are driven daily. The bulk of this system was built more than fifty years ago and has lasted for longer and carries more traffic than it was originally designed for. Just as maintenance and improvement needs are increasing, transportation funding is decreasing, accompanied by poorer average pavement condition and increased congestion. The existing methods to fund roads are not sufficient to maintain or expand this roadway system, so new means of funding and implementing roadway projects should be considered.</p>
Schools	C	<p>Washington has an estimated 2,050 school facilities with capacity for 1.2 million students. Some school facilities are over capacity and some under, but by 2018, 56 districts are anticipated to be under capacity by about 50,000 students. The Office of Superintendent of Public Instruction (OSPI) is charged with overseeing public kindergarten through 12th grade education facilities. Over the past 20 years, Washington state has contributed a total of approximately \$3.9 billion to help fund 1,315 school construction and renovation projects. For school facilities, OSPI administers the K-12 Capital Budget and School Construction Assistance Program (SCAP). This program assists local school districts with their school facilities and provides assistance for three categories of projects: new construction, modernization, and new in-lieu of modernization (replacement). During the last decade, districts who attempt to raise capital for school facilities locally have faced a 50% failure rate with voters. The state currently lacks a comprehensive statewide database for collecting and reporting information about K-12 facilities.</p>

2013 Report Card for Washington's Infrastructure

Subject	2013 Grade	Facts and Status
Solid/ Hazardous Waste	C	Over 16 million tons of waste was generated in Washington by citizens, industry, and manufacturing in 2010. Impressively, only 44% of this waste was disposed at landfills and the remaining waste was combusted in incinerators, composted, recycled, or otherwise diverted through reuse or recycling of construction debris. Municipal Solid Waste (MSW), or garbage, is the largest portion of the total waste generated in Washington but does not include industrial waste, inert debris, or contaminated soils. Hazardous waste in the form of household hazardous waste (HHW), industrial hazardous waste, and waste from toxics cleanup sites are also a key component of the waste management system in the state. Although Washington's diverted waste stream is nearing 50%, significant shortfalls with collection of household hazardous waste and funding for collection and outreach programs, result in an overall grade for Solid and Hazardous Waste of C.
Transit	D+	Transit operations run through cities and towns across the state. Washington has more than thirty public agencies that operate in large urban areas like the Puget Sound region as well as suburban and rural areas in Eastern and Western Washington. Twenty-two of the agencies are independently-created public agencies with unique boundaries. There are five city agencies, three county agencies, and one regional agency that overlaps other agency boundaries. More than 217 million trips were taken in Washington in 2011 totaling over 161 million revenue vehicle miles. The state's growing population has increased 38% since 1990, but in many jurisdictions transit maintenance and expansion has not kept up as transit competes for scarce dollars at the state and federal level. While this burgeoning population is straining the network, Washington is doing many things right for transit. However, a lack of long-term funding puts the system's future at risk.
GPA	C	

A=Exceptional B=Good C=Mediocre D=Poor F=Inadequate

Each category was evaluated on the basis of capacity, condition, funding, operations and maintenance, and public safety.

Methodology: About the Report Card Grading Process

The *2013 Report Card for Washington State* evaluates nine infrastructure categories: **Aviation, Bridges, Dams, Drinking Water, Rail, Roads, Schools, Solid & Hazard Waste, and Transit**. Grades for additional infrastructure categories including: **Levees, Ports, Stormwater, and Wastewater** are currently in development and will be released as an addendum to this document. In general, the following five fundamental grading criteria were considered in developing the grades for each category:

- **Capacity** – Evaluate the infrastructure's capacity to meet current and future demands.
- **Condition** – Evaluate the infrastructure's existing or near future physical condition.
- **Funding** – Evaluate the current level of funding (from all levels of government) for the infrastructure category and compare it to the estimated funding need.
- **Operation and Maintenance** – Evaluate the owners' ability to operate and maintain the infrastructure properly and determine that the infrastructure is in compliance with government regulations.
- **Public Safety** – Evaluate to what extent the public's safety is jeopardized by the condition of the infrastructure and what the consequences of failure may be.

To develop the *2013 Report Card for Washington State* grades, a quantitative and qualitative approach was used to arrive at each of the eight category grades. Each category uses the same criteria for grading as defined below.

A - EXCEPTIONAL: FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.

B - GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. The system is safe and reliable with minimal capacity issues and minimal risk.

C - MEDIOCRE: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

D - POOR: AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.

F - FAILING/CRITICAL: UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

About the American Society of Civil Engineers

The American Society of Civil Engineers, founded in 1852, is the country's oldest national civil engineering organization. It represents more than 140,000 civil engineers in private practice, government, industry, and academia who are dedicated to advancing the science and profession of civil engineering. The Seattle Section of ASCE is celebrating its 100 year anniversary in 2013.

ASCE's mission is to provide essential value to our members and partners, advance civil engineering, and serve the public good. In carrying out that mission, ASCE advocates infrastructure and environmental stewardship and has developed a national Report Card for America's Infrastructure since 1995. The most current National Report Card, published in March 2013, indicated an overall grade of "D+." This was a slight improvement compared to a "D" 4 years ago, which demonstrates improvements are possible where investments are made. The *2013 National Report Card for America's Infrastructure* is available at www.infrastructurereportcard.org.

Washington state has more than 3,700 ASCE members, and with the Washington Report Card we are joining over 40 other states and regions that have developed Report Cards to complement the national *Report Card for America's Infrastructure*. The last report card for Washington was completed in 1999 and focused specifically on King and Snohomish Counties. The *2013 Report Card for Washington State* was expanded to a statewide effort, the results of which would be beneficial to all representatives at our state legislature. The 2013 Report Card for Washington State is available at <http://www.seattleasce.org/reportcard/2013ReportCardWA.pdf>.

About the Seattle Section of American Society of Civil Engineers

The Seattle Section was founded on June 30, 1913 and has since grown to nearly 2,500 members within a nine-county geographic area comprising King, Snohomish, Skagit, Island, Whatcom, San Juan, Kitsap, Clallam, and Jefferson Counties. The Section is celebrating its centennial year anniversary in 2013. The Section's commitment to the advancement of civil engineers is demonstrated through its leadership, sense of community, and dedication to the profession. From organizing professional development opportunities to recognizing the outstanding achievements of local civil engineers, the Section has a longstanding history of fostering the growth of civil engineers and celebrating their successes. Additional information about the Seattle Section is available at <http://www.seattleasce.org/>.

Aviation

Washington has a total of 136 airports that provide 250,000 jobs, \$15 billion in wages, and \$51 billion in economic activity to the state each year. As many as 18 million passengers depart from Washington's airports each year, and more than 600,000 tons of cargo is transported through the airport system. However, aging facilities, land-use policies and available funds have serious impacts on Washington's aviation system. Encroachments from land uses that are incompatible with aviation can limit future airport capacity. Long-term, viable funding sources are needed to maintain and repair aviation facilities and provide incentives to develop land use plans that are compatible with airports, allowing them to remain open and provide for increased capacity in the future. Finally, investing in advanced satellite navigation systems and implementing Federal Aviation Administration's (FAA) NextGen navigation systems will help improve safety, increase capacity, and facilitate business and economic opportunities across the state by providing increased access to large and medium sized communities where a range of different aircraft can land in any weather condition.



Overview

Washington's state aviation system consists of 136 facilities that include 6 different classes of airports: commercial, regional, community, local service, rural essential, and seaplane bases. Table 1 provides the number of airports in each category, as well as a general description of the service provided by each type.

In 2005, the Governor signed the Engrossed Substitute Senate Bill (ESSB) 5121, which mandated that a comprehensive study of Washington's aviation system be performed in order to identify statewide air transportation needs and solutions. As a result of this bill, the members of the Airport Planning Council prepared the Long-Term Airport Transportation Study (LATS). The study recognized that Washington's aviation system is complex and diverse. One important conclusion of the LATS was the concept of treating the aviation capacity as a resource, and to protect, preserve and enhance this capacity through strategies focusing on airport operations, technology, safety, and land use.

Table 1 – Overview of Washington State Airports

Airport Class	Description	Number of Airports	% of Total	Example Airports
Commercial	Serve >2,500 passenger enplanements per year	16	12%	Seattle-Tacoma (Sea-Tac) International Airport, Spokane International Airport, and Bellingham International
Regional	Serve multiple communities	19	14%	Auburn Municipal Airport, Arlington Municipal Airport, and Snohomish County Airport/Paine Field
Community	Serve small- to medium-sized communities	22	16%	Pierce County Airport/Thun Field, Richland Airport, and Jefferson County International Airport
Local	Serve small communities	33	24%	Sunnyside Municipal Airport, and Methow Valley State Airport (Winthrop)
Rural Essential	Typically, serve recreation communities	38	28%	Crest Airpark (Kent) and Apex Airpark (Silverdale)
Seaplane Bases	Serve amphibious and float-equipped aircraft	8	6%	Kenmore Harbor Air

In 2012 an Economic Impact Study was performed by the WSDOT Aviation Division to investigate the role that airports play in the state and local economy to demonstrate how the aviation system contributes to the well-being of the state and local communities that they service. The three goals of the Economic Impact Study include:

- Measuring economic and fiscal impacts of each of the public use airports.
- Exploring how the aviation system supports economic development and competitiveness at the local and statewide levels.
- Building understanding of how the state’s aviation system creates economic value for people and communities across the state.

Together with the recommendations from LATS to preserve, and enhance airport capacity and the Economic Impact Study to demonstrate the effects of the airport system on our economy, action must be taken to address the recommendations and maintain and strengthen the aviation system within the state.

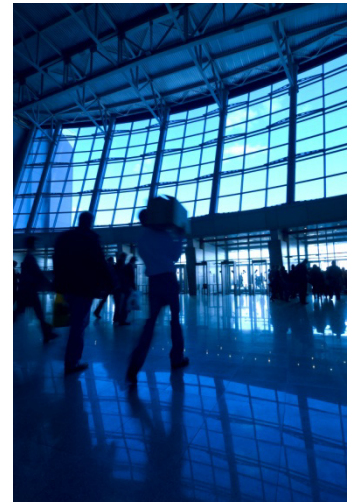
Capacity

Aviation capacity is the ability to provide facilities, infrastructure, and connections for airside and landside aviation activity. According to the FAA, airports operating at 60% capacity or more should begin planning for increasing the existing capacity. Generally, at an operating capacity of 70%, airports will begin to experience significant delays. At 100% capacity or more, severe limitations on operational efficiencies are to be expected. Capacity of the state’s public-use airport system was evaluated as part of the LATS. For this report card we selected three types of capacity that pertain to the airport system including:

- Airfield Capacity – ability of the airport’s runway system to accommodate take-offs and landings
- Passenger Terminals – ability of the airport terminals to accommodate airline passengers with adequate space for ticketing, security, and boarding
- Aircraft Storage and Parking – ability of the airport to provide hangers and tie-downs for aircraft

For these three capacity measures we have evaluated the existing capacity, as estimated in 2005, and the future capacity, as predicted for 2030. We did not evaluate capacity for air cargo as it makes up a small part of the overall airport system and air cargo activity is difficult to quantify.

Airfield Capacity: The first category, airfield capacity, is applicable to each of the six airport classifications. Airfield capacity is determined as the estimated number of operations (take-offs and landings) that an airport's runway system can accommodate per year. We evaluated the adequacy of capacity based on the demand (number of actual operations per year) versus the airfield capacity. Commercial service airports have the highest percentage of utilization at 37% of their airfield capacity, while regional service airports utilize about 31% of the total airfield capacity. The remaining four airport types utilize less than 10% of their airfield capacity.



Future airfield utilization predicted to occur by 2030, is 63% for commercial service airports and 46% for regional service airports. Community service airports are expected to reach a total utilization of 12% of their capacity, while essential rural and seaplane base airports will all remain under 10% utilized.

The LATS study also evaluated the operations demand versus capacity for individual airports. It shows that five of the state's airports are currently operating at about 60 to 70% of their annual runway capacity including Seattle-Tacoma International, Boeing Field, Harvey Airfield, Auburn Municipal, and Crest Airpark. It also indicates that the commercial service airport, Kenmore Air Harbor, Inc., is currently operating at over 100% capacity. Future demand is expected to exceed 100% of the existing annual airfield capacities at three airports in the next 17 years, including Boeing Field and Harvey Airfield, as well as at for Kenmore Air Harbor, Inc. Seattle-Tacoma International was also considered to reach greater than 100% capacity; however, addition of the third runway, as well as the increase in aircraft size used by airlines indicate the maximum capacity may be reached later than 2030.

In summary, the airfield capacity of Washington state's airport system is generally adequate for current capacity; however, four key airports in the state are experiencing demand in airfield capacity above 60%, the FAA minimum recommended for consideration of improvements to increase capacity. For future demand, as predicted by 2030, the commercial sector of the airport system is expected to have, on average, a demand greater than 60%. In addition at least three and possibly four airports will be operating at greater than 100% of their airfield capacity.

Passenger Terminals: Passenger terminal capacity applies to the 16 commercial service airports in the state. Terminal capacity is evaluated as the estimated peak hour capacity the terminal can accommodate. The LATS study indicated that four of the small commercial service airports experienced their peak hour terminal capacity in 2005, including Orcas Island, Anacortes, Kenmore Air Harbor, Inc. (Lake Union), and Kenmore Air Harbor SPB (Lake Washington). By 2030, the study indicates that Seattle-Tacoma International and Tri-Cities terminals are also expected to exceed their peak hour passenger capacity. For Seattle-Tacoma, that time may be extended with increasing passenger loading and projected increases in size of aircraft being used by the airlines, as well as recent improvements that have been completed. More than half of the future demand for enplanements will occur at terminals where demand is expected to exceed capacity.

Aircraft Storage: Aircraft storage is important for an airport to provide space to park aircraft based at the airfield and also provide places for visiting aircraft to park. Aircraft storage allows for general aviation aircraft to be stored in a location that is both safe and convenient. Aircraft storage across the state's public use airports was at about 84% utilization on average. In fact demand has exceeded capacity in Thurston County and the San Juan Islands. Aircraft

storage capacity by 2030 is expected to increase overall; however, this assumes that undeveloped airport land is converted to aircraft storage. One quarter of the airports are expected to have aircraft storage shortfalls. Boeing Field itself is predicted to have a demand that exceeds capacity by about 950 slots.

In summary, current capacity for airfield, passenger terminals, and aircraft storage is generally adequate across the state’s airport system up to approximately 2030 (17 years from now). Aviation capacity is a resource, which we have the opportunity to preserve, protect and, in many cases, enhance through actions that are designed to improve operations, technology, safety and integration with the state’s transportation system and transportation plans. It is also important to note that condition, maintenance, operations, and safety, all impact aviation capacity.

Condition

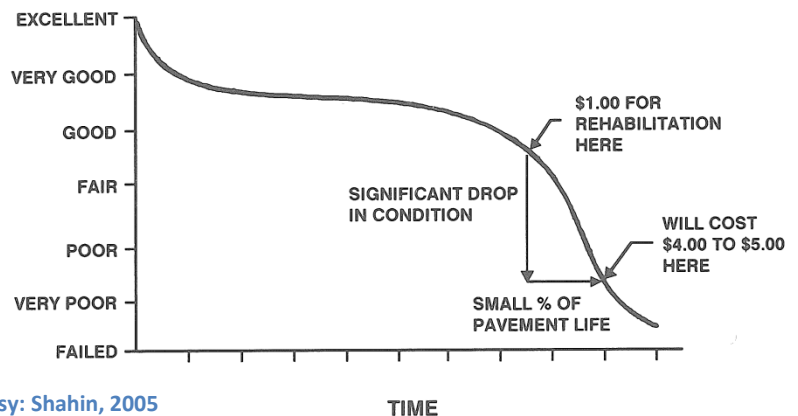
Condition of the aviation infrastructure was evaluated based on pavement condition of the state’s airports. Pavement condition was assessed using the Pavement Condition Index (PCI), as presented in Table 2. The PCI was developed to describe the visual condition of pavements and determine when maintenance and replacement of the pavement is necessary. We have considered overall pavement condition data from two studies. The first study was completed by WSDOT in 2005. The second study is currently on-going; however, WSDOT has provided preliminary data from the study. From these studies, the average PCI for runways was about 80 in 2005, and about 78, for the on-going study. The average PCI for taxiways was about 77 for both studies. The average PCI for aprons was about 74 in 2005 and is about 71 from the on-going study. These values indicate the pavement conditions, on average, are very good. Note that these values are provided for 97 airports in the state, as not all airports have pavement and WSDOT was not able to evaluate the pavement on a few of the larger commercial airports, such as Seattle-Tacoma, and Spokane International.

PCI	Rating
100-86	Excellent
85-71	Very Good
70-55	Good
54-41	Fair
40-26	Poor
25-11	Very Poor
10-0	Failed

Operation and Maintenance

We consider pavement maintenance to be critical to airport operations as it impacts the capacity of the system. Preventative maintenance is important as it noted that the PCI rating for the pavements. For example, it costs as much as seven times more to reconstruct pavement than it does to seal cracks when they first form. The cutoff level between a pavement that can be sustained through maintenance (such as a slurry seal) and one that will need major rehabilitation (such as an overlay) varies depending on the type of distress present and the rate of deterioration. However, pavements generally require major rehabilitation when they reach between a 60 to 70 PCI. Complete replacement is typically required at a PCI of about 40. However, note that the rate at which pavement deteriorates accelerates over the service life of the pavement. Over about 75% of the pavement’s life, the decrease in PCI is on average about 40%. The deterioration of PCI for the next 40% only takes an additional 12% of the pavement life.

PAVEMENT CONDITION RATING



Courtesy: Shahin, 2005

The 2012 pavement evaluation indicates that the pavement PCI, while still very good, decreased from the values observed for the study from 2005. The PCI for runways decreased by about 2 points, taxiways changed by about 0.5 points, and aprons decreased by about 3 points. Given that the PCI over the aviation system still meets the PCI performance objectives, we consider the maintenance has been adequate to date, but PCI will likely degrade further if maintenance of pavement is not addressed for the future.

Operation

Navigational aids for aircraft in transit between airports is important to allow for aircraft operations (takeoffs/landings) at night and in low visibility conditions. These navigation aids help to minimize the amount of time that an airport can support aircraft takeoffs and landings. The navigation aids evaluated for this report card included lighting, instrument approaches and weather reporting. We evaluated the number of airports in each category that met their respective performance objectives as provided by WSDOT. The overall percentage reported here is taken by applying a weighted average based on the percentage of the total number of operations contributed to the annual operations for that respective airport type.

Lighting: Lighting is important to allow operations to continue at night. Lighting requirements vary from medium intensity lighting for commercial, regional, and community service airports to low intensity lighting at local service airports and reflectors at rural essential airports. Based on the data the percentage of airports that meet the lighting requirements is about 86%. For comparison, all of the state's commercial airports meet the performance objectives for lighting while only 26% of the rural essential airports meet the performance objective.

Instrument Approach: The instrument approach allows airports to continue to operate in low visibility conditions, which in the Puget Sound is as much as 50% of the time. The performance objectives provided by WSDOT recommend all commercial, regional, and community service airports to have an instrument approach. For commercial and regional airports, the recommendation is to have an approach that allows a lower than $\frac{3}{4}$ mile visibility minimum. For community service airports the recommendations to have an approach that allows a one mile visibility minimum. Only 63% of commercial airports meet the performance objective for instrument approaches, while only 37% for regional airports and 22 % for community service airports. The resulting weighted average for instrument approach is 46%.



Weather Reporting: Weather reporting on a real time basis is important to keep pilots, traffic control operators and ground crew members informed of current weather conditions, particularly in areas where weather changes rapidly. The performance objective for commercial and regional airports is an automated airport weather station, more specifically either an Automated Weather Observing System (AWOS) or an Automated Surface Observing System (ASOS). Community service airports are recommended to have a Super-Unicom system, which is also a type of automated system, that provides up-to-date weather information to pilots within radio range. All the commercial airports in the state meet the performance objective, except for the two Kenmore Air Harbor Seaplane

Bases. Eighty-four percent of regional airports meet the object while only 48% of community service airports meet their objective. The weighted average for weather reporting is thus about 80%.

Land Use

As incompatible land development increases around airports, the airports' operational costs increase due to complaints and litigation as well as the need to change approaches, departures, and en route procedures from the original facility plans. Required changes can cost the airport and airlines millions of dollars in lost revenue, and on occasion, they can make commercial service cost prohibitive. Five different categories were evaluated, including appropriate zoning, compatibilities in the comprehensive plan, control of runway protection areas, height hazard zoning, and zoning that discourages incompatible development. Of these, the height hazard zoning has the highest rate of adoption. About 95% of all commercial and regional airports have land use plans that meet this criterion. Appropriate zoning is provided at about 90% of the commercial airports, but only at 60% of the regional airports. About 70% of commercial airports have adequately controlled runway protection areas, compared with about 80% for regional airports. Less than half of all airports in most classes did not address compatibilities in the comprehensive plans and did not have provisions that discourage incompatible development.

Incompatible development is generally an issue in more densely populated areas, particularly in the Puget Sound region. As such the WSDOT Aviation Division and the Puget Sound Regional Council (PSRC) have been working with public agencies to provide guidance for implementing appropriate land use plans. For example, in 2011 the PSRC published the Airport Compatible Land Use Program Update which evaluated 28 airports in the Puget Sound Region. In this report PSRC is addressing airport compatibility planning issues by identifying land use compatibility issues and working with cities and counties to develop solutions. It also includes the need for civilian and military compatible land use programs, particularly with respect to Joint Base Lewis-McChord, which is located in the growing area south of Tacoma.

The existing condition for implementation of the compatible land use objectives is poor to fair. However, although the existing condition of plans and zoning may be less than ideal, the state and regional (PSRC) compatible land use programs are, perhaps, the most advanced work anywhere in the nation.

Safety

Airport safety was evaluated based on two items: (1) the number of airports meeting the WSDOT Aviation performance objective for runway safety areas and (2) the presence of obstacles within a runway's primary approach surface. With regard to runway safety areas: About 86% of commercial airports had adequate runway safety areas, while about 70% of all airports had them. From the land use perspective, about 70% of all commercial airports have full control of their runway safety areas. Each of the runway approaches for the 64

Land Use Issues

Land use influences an airport's ability to increase capacity in the future. If development occurs in close proximity to an airport that is not compatible with aviation activities, it may be difficult for the airport to expand to provide for the increased demand.

Incompatible land uses also drive up the cost of commercial service by producing litigation and changing approach and departure services. These changes can cost millions of dollars to the airport and airlines, which are then passed onto the consumer.

NPIAS airports in the state was evaluated to further investigate the severity of the obstructions. Based on this review, about 35% of the runway approaches had an obstruction within the assigned primary approach surface.

Funding

Of the state's airports, 64 or about half are included in the FAA's system of airports, known as the National Plan of Integrated Airport Systems (NPIAS). NPIAS airports are generally supported by Federal Funds through the FAA's Airport Improvements Program (AIP). In recent years the Federal AIP grants typically covered 95% of the funding with a 5% provided by state and local sources. However, in 2012, Obama signed the FAA Modernization and Reform Act which changed the Federal portion to 90%, thus increasing the percentage of matching funds to 10%. This increase affects the appropriation of funds and generally diverts money away from non-NPIAS airports to meet the matching funds requirements for NPIAS supported airports. Federal grant money awarded to Washington airports in 2011 was \$73 million dollars.

Grant funding for airports also comes through the State Capital Improvements Program (SCIP), which evaluates programmed preservation and improvement projects for all 136 of the public use airports. The program works to evaluate the short-term needs (0 to 5 years) and provide a mechanism to program long-term needs (5 to 30 years) of the airport. The program considers airports eligible for FAA funding from the nation-wide Airport Improvement Program (AIP), and airports that are only eligible for WSDOT Airport Aid Funding. The state grant program only funds about \$2 to 3 million per biennium with the majority directed to non-NPIAS Airports. Grant requests for the state grant program totaled \$4 million from 39 airports. However, only \$1 million was available, which was distributed among 23 airports. Taking the \$1 million provided by the state fund and dividing it by the total number of airports in the state, an average of \$7,400 is spent per airport in the state.

Average state spending per airport per year = \$7,400

Based on the information obtained from the LATS study, Washington the next 20 years \$600 million will be needed to cover the shortfall for facility needs. This funding gap is the amount of money needed to address the performance objectives identified for each classification. Performance objectives included issues such as maintaining pavement condition and addressing facility needs for new navigation measures for NextGen (lighting, taxiway, runway length, etc.). The performance measures are addressed in the Washington Airport System Plan for all public use airports. Adequate funding for airport maintenance now save money in the future, as illustrated by the difference in cost between sealing pavement cracks versus pavement reconstruction.

Additional sources of funding will be needed in the future to preserve the state's NPIAS and non-NPIAS airports. Washington state is currently committing only about \$1.2 million dollars annually to fund airport infrastructure projects. Over a period of 20 years this results in only \$12 million compared to the need of \$600 million. Meanwhile airports bring in about \$550 million in tax revenue that is applied to the state's general fund. Various methods have been proposed for increasing funding for airports, such as eliminating some of the aircraft fuel tax exemptions. Another method would be to reallocate a greater percentage of the tax revenue from aviation related taxes to go to aviation rather than the general fund. For example, the Senate Bill SB 5430, currently before the Washington state Legislature, proposes to increase the allocation of the aircraft excise tax revenue to the aeronautics account rather than the general fund. Based on information provided by the WSDOT Aviation division, if the state reallocates about \$550,000 to the aeronautics account, it results in about \$7.4 million for infrastructure projects (based on matching funds from Federal and local sources). Furthermore, it returns about \$517,000 to the general fund in tax revenue.

Recommendations

Given the significant benefit of airports on the state's economy, state and local governments should be aware that we need to protect, preserve, and improve the state's aviation facilities. Specific recommendations for aviation include:

1. Continue investing in preservation, maintenance, and safety to meet growing capacity demands and realize the economic benefits of the system.
2. State and local airport sponsors should routinely evaluate pavement condition, assess needs, and invest adequate resources in the airport system's runways, taxiways, and aprons.
3. Improve land use practices by:
 - Strengthening state law to better regulate man-made airspace hazards near airports.
 - Providing better incentives for developing land use plans that are compatible with airports to reduce costs and allow for needed future expansion.
 - Encouraging local agencies to implement the WSDOT Airports and Compatible Land Use program.
 - Amending state law to avoid placing new noise sensitive uses (schools, hospitals, senior centers, etc.) within critical flight paths (traffic pattern) of airports. Currently state law regulates these types of uses from locating in environmentally sensitive areas such as flood plains, but no provisions are made for regulating these uses near airports. These types of uses are considered incompatible land uses when located within an airport traffic pattern and as airports and aircraft change to address air transportation needs they place a burden on airports.
4. Enhance airport system safety by meeting runway safety area standards, adequate runway protection zones, and obstruction removal, marking, and lighting.
5. Invest in NextGen systems that advanced satellite navigation systems and airport infrastructure by providing increased access to large and medium sized communities in all-weather conditions for a range of different aircraft. Provides an added benefit is to facilitate business and economic opportunities across the state.
6. Adequate funding is critical to preserve, maintain, and enhance the state's airport system. Existing financial resources are not adequate to meet current and projected needs. In addition, some existing revenues collected from airport system users (fuel tax, aircraft registration fees, and pilot registration fees) are not retained within the airport system. The legislature should review the current aviation system funding program and make adjustments to provide increased revenues to support the state airport system.

Resources

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Bridges

As of 2011, there were 7,743 bridges in Washington state. Of these, 5% (391) are structurally deficient. This places Washington state sixth in the nation for least number of structurally deficient bridges. However, the state maintains an aging infrastructure struggling to handle the demands of modern society. Already, 36% of Washington's bridges are over 50 years old. Many bridges last well beyond this age, but as time passes, the cost of repairs increase and functionality decrease. This is especially evident in the 20% (1,548) of bridges that are classified as functionally obsolete because they either cannot meet current traffic demands or do not meet current design standards. Over the next 20 years another third of Washington state's bridges will exceed their design life. State, city, and county departments of transportation have maintained a safe network of bridges to-date, but infrastructure must become a priority in order to provide the foundation for economic success.



Overview



Tacoma Narrows Bridges; Courtesy: WSDOT

The Federal Highway Administration (FHWA) manages the National Bridge Inventory (NBI), which requires each state to maintain and submit an inventory record of all bridges characterized as: spanning over 20 feet, located on a public roadway, and carrying vehicular traffic. Additionally, any structure crossing a federal, state, or otherwise important route needs to be included. The majority of this report is based on data from the NBI and excludes bridges that are not included in the NBI unless stated otherwise. Excluded bridge structures are primarily community access bridges or culverts. Currently, there are over 350 state owned structures and over 1,000 locally owned structures that fall in this category in Washington state.

State departments of transportation are primarily responsible for managing bridges carrying traffic over state routes and interstate highways, while city and county departments of public works are responsible for managing nearly all other bridges. Funding for bridges is driven primarily by their structural condition; while funding is limited for addressing the functional condition of bridges.

Engineers conduct cost benefit analyses to determine how funds are divided between replacement and preservation needs. Purely focusing on fixing the worst bridges first would risk neglecting the maintenance needs of bridges in fair to good condition. This results in even more bridges falling into disrepair and requiring more costly repairs. A safer and more cost effective approach is to extend bridge life through proactive preservation while simultaneously fixing severely structurally or functionally deficient bridges.

Capacity

Travel delays cost Washington state drivers and businesses 32.5 million hours a year. These delays costs Washingtonians about \$1.1 billion annually. Bridges often provide the only access to difficult to reach regions. Often when bridge traffic capacity is exceeded by traffic demands, significant delays will occur. Nationally, bottlenecks cause 40% of traffic congestion; a breakdown of other congestion causes is shown in Figure 1.

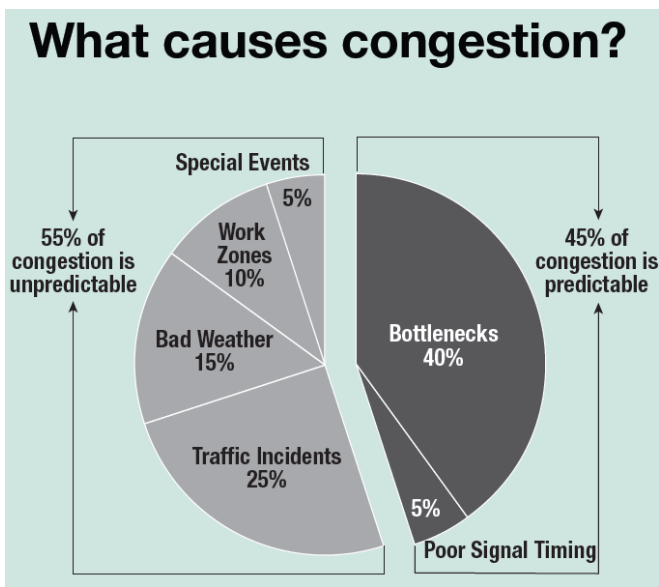


Figure 1. Congestion. Data reflects national estimate. Source: FWHA 2004.

Bridge Condition Definitions

Structurally Deficient (SD): This rating means a bridge is in a structurally deteriorated condition and does not adequately carry its designed traffic loads. The SD rating is applied if a bridge meets one of the following condition codes: superstructure, deck, and/or substructure rates at “4 out of 10” (poor condition) or less; or any of the appraisal codes for structural adequacy or waterway adequacy are coded at “2 out of 10” (very substandard) or less. Weight restrictions or closures may be posted depending on the limits of the bridge’s load carry capacity.

Functionally Obsolete (FO): This rating means the bridge does not have adequate approach alignment, geometry, clearance, structural adequacy, or waterway adequacy to meet the intended traffic needs; or is below accepted design standards. The FO rating is applied if any of the measures mentioned above are rated at a “3 out of 10” (substandard) or less. FO bridges often tend to bottleneck traffic or lack many safety features.

Sufficiency Rating (SR): This is a qualitative value that measures the bridge’s relative capability to serve its intended purpose. The value is generated from a formula that combines inspection data regarding: structural adequacy and safety; serviceability and functional obsolescence; essentiality for public use; and special conditions. A sufficiency rating will vary from 0 to 100, with a smaller value indicating a lower sufficiency. The bridge replacement program requires a sufficiency rating of 80 or less to qualify for repair, and a sufficiency rating of 50 or less to qualify for replacement.

Over 67 million vehicles cross Washington state bridges every day. According to estimates in the National Bridge Inventory (NBI), within 30 years annual average daily traffic (AADT) volumes are predicted to increase by 46%, to a total of 98 million vehicles per day. In 2011, 25% of all bridge traffic crossed at least one of the 1,548 functionally obsolete bridges. While not all features considered in determining functional obsolescence directly correlate to

traffic congestions, the majority of these bridges lack the capacity to handle Washington state's expanding population and the associated traffic needs.

In response to growing traffic congestion, the Washington State Department of Transportation (WSDOT) initiated the program Moving Washington to alleviate traffic congestion. The program uses a three-prong approach: add capacity strategically, operate efficiently, and manage demand. With a quarter of the state's traffic crossing functionally obsolete bridges and traffic demands projected to increase at a rate greater than the departments of transportation can increase traffic capacity or mitigate congestion with their current resources.

Condition

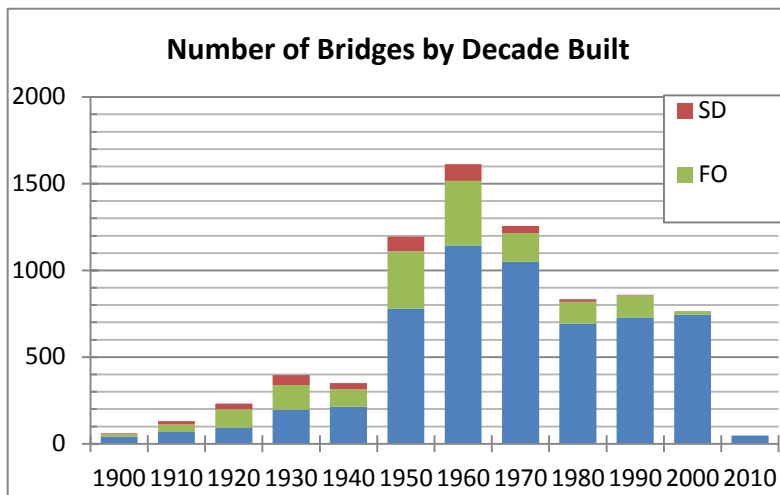


Figure 2. Number of Bridges by Decade Built and Current Condition
Source: NBI 2011 Washington State Data

Washington state has maintained conditions with an average sufficiency rating (SR) of 81 with only 5% (391) of bridges structurally deficient (SD), ranking Washington state sixth nationally for lowest percentage of structurally deficient bridges and conditions for state and local agencies mirror each other. However, Washington only ranks thirtieth in the nation when functionally obsolete (FO) bridges are included. Of the state's bridges, 20% (1,548) are classified as such, as opposed to the national average of 13%.

The numerous functionally obsolete bridges reflect the growing age of Washington's infrastructure. Currently, the average bridge age in Washington is 43 years; modern design and construction methods are expected to result in a

75 year life. The spike in construction from the Dwight D. Eisenhower Federal Aid Highway Act of 1956 is shown in Figure 2. Bridges from this era usually had shorter design lives than modern bridges and will have greater preservation needs as they age. A rapidly aging infrastructure will leave 71% of Washington state's bridges over 50 years old within the next 20 years.

Funding

A backlog of \$28.1 billion was estimated from the 2011 NBI data for total project improvement costs for all bridges in Washington that currently qualify for replacement (SR<50) or repair (SR<80). It will cost \$6.3 billion for only structurally deficient bridge improvements and \$15.1 billion for only functionally obsolete bridge improvements. Total project improvement costs include bridge construction, roadway construction, right-of-way, detour, extensive roadway realignment, preliminary engineering, and other incidental costs.



Magnolia Bridge, Seattle, Washington, has a SR of only 18; Courtesy: KIRO 7

Washington's Projects Adding Capacity

Alaskan Way Viaduct Replacement Program: The \$3.14 billion Alaskan Way Viaduct Replacement Program will replace the viaduct that runs along Seattle's downtown waterfront with a 2-mile-long, 4-lane tunnel. Included in the program is adding a new Alaskan Way surface street, replacing the deteriorating seawall, and redeveloping the waterfront. The viaduct was damaged in the 2001 Nisqually Earthquake and is a bottleneck for downtown traffic. The tunnel is scheduled to open in 2015 and the program is scheduled to be finished by 2019.

SR-520 Replacement: The \$954 million SR 520 program is set to replace the existing SR 520 Bridge across Lake Washington with the longest floating bridge in the world. After nearly 50 years of heavy use, the current SR-520 bridge's pontoons are vulnerable to windstorms, columns are seismically vulnerable, and traffic has major delays. The new bridge will have two general purpose lanes and one transit/HOV lane each way, as opposed to the two lanes each way on the existing bridge. Additionally, the bridge will be resistant to 89 mph windstorms, have wider shoulders, have a pedestrian/bicyclist lane, and have the ability to accommodate possible future light rail plans. Unexpected spalling and cracking in the pontoons has caused delays and extra costs, but the bridge is still scheduled to be opened to traffic by July 2015.

Columbia River Crossing: The \$3.5 billion Columbia River Crossing Project is set to replace the existing I-5 bridge in 2020. The current bridge experiences significant safety and mobility problems. The new bridge will have three through lanes and two add/drop lanes in each direction; have light rail underneath the southbound lanes, have pedestrian/bicyclist lanes under the north bound lanes, and be a continuous span with a 116 foot clearance instead of the original lift span. The new bridge is expected to reduce congestion by 70 percent when compared to a no-build scenario. This will equate to reducing delays by 6.8 million hours per year, or \$435 million in travel time savings per year in 2030.

*Megaprojects, such as the examples above, have accounts separate of the general bridge funds.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) signed by President Obama in July of 2012 provides stable federal funding through 2014. Regrettably, a long-term plan has yet to be created. In MAP-21, states are allowed more flexibility in how they distribute funds. Using sufficiency rating as a qualifier for funds does not necessarily reflect the infrastructure needs. For example, a bridge that needs a deck overlay may have a SR of 95, above the SR maximum of 80 currently needed to request federal funds for repair. The new act allows for alternate methods such as elemental data to pinpoint where funding is needed.

State funds are generated primarily through fuel tax, licenses, permits, fees, and tolls. For the 2011 to 2013 biennium, a sum of \$196.6 million was targeted toward bridge preservation. Over the next 10 years WSDOT projects a need of \$1.27 billion, or an average of \$259 million per biennium. If current levels of funding continue, there will be a shortfall of \$58.2 million per biennium. To match the shortfall, the budget will need to be increased by an average of 30% of the 2011 to 2013 biennium.

For local agencies to maintain their current bridge conditions, an investment of \$3 billion will be needed over the next 10 years. However, bridges often have high investment needs that are beyond a local municipality's resources; consequently, they rely heavily on federal funds to support these projects. Foremost among the federal funding sources is the Highway Bridge Program (HBP), which awards approximately \$100 million per biennium. In 2012, \$130 million was awarded to 70 Washington state local agency projects. The program calls for local agencies to meet 20% of project costs and then HBP funds the remaining 80%. The Transportation

Improvement Board and the County Road Administration Board also occasionally fund local bridge projects. As of 2011, only 22% of bridges with a SR less than 50 were funded.

Operation and Maintenance

Washington follows the NBIS and the Washington State Inspection Standards.

Inspections are conducted at least every 24 months. Bridges deemed safety risks are inspected more frequently, such as the Alaskan Way Viaduct, which is inspected every 6 months. Results are recorded in the state’s database and sent to the NBI. Federal bridge engineers along with state and local program managers conduct annual reviews of the state agency to assure compliance with the NBIS. The state agency, in turn, conducts similar quality assurance reviews of the local agencies and sends a comprehensive report of the year’s reviews to FHWA annually. Many of the local agencies depend on the county or the state to provide the resources to conduct their bridge inspections, but with recent budget constraints, securing this aid is becoming increasingly difficult.

Washington has prioritized maintenance as the highest priority, followed by replacement and rehabilitation. WSDOT’s current funding and their projected 10-year needs are shown in Table 1. In order to meet the projected 10-year needs, a 30% increase in the average biennium budget would be necessary to meet preservation needs for state bridges.

For all agencies, constraints on how the budget is spent often lead to postponing strengthening measures and posting load restrictions until replacement or rehabilitation funds can be secured. Federal funds usually require the bridge to need replacement or rehabilitation and be greater than 20 feet long. This has stymied proactive strengthening projects and efforts to maintain community access bridges, which are often less than 20 feet long and provide the sole access to critical resources. Currently, 171 locally managed bridges have weight restrictions with 25 of them hindering primary freight routes.

Table 1 – Summary of 10-year WSDOT Bridge Funding Needs

WSDOT	2011-2013 Biennium Need (in millions)	10-year Need (in millions)
Bridge Replacement/ Rehabilitation	\$101	\$285
Bridge Repair and Moveable Bridges	\$17	\$100
Steel Bridge Painting	\$39	\$566
Concrete Deck Rehabilitation	\$13	\$156
Seismic Retrofit	\$22	\$152
Scour Mitigation	\$3.2	\$15
Total	\$195.2	\$1274

Note: Excludes Local Agencies bridges.
Source: Gray Notebook, June 2012



Columbia River Bridge in Bridgeport undergoing steel repainting; Courtesy: WSDOT.

Safety

Traffic Safety

When the structural conditions degrade, studies are conducted to determine the new capacity of the bridge and if necessary, load restrictions are posted. If the bridge is deemed unsafe to cross, it is closed to traffic. As of 2011, there were a total of 218 bridges with load restrictions posted and 19 bridges closed to traffic statewide. The reasons for bridge closures can vary from being under contract for major rehabilitation, repair or replacement; waiting to secure funding, or that they are in critical condition.

FHWA requires states to report on the adequacy of four bridge traffic safety features: bridge railings, transitions, approach guardrail, and approach guardrail ends. For 2011, only 56% of these four features were up to current standards or not applicable, for all Washington state bridges. These standards have continued to change, hurting the accuracy of state reports. To meet future safety needs, WSDOT has established the “Target Zero” plan, which is discussed in the Roads Section of this report.

Seismic Vulnerability

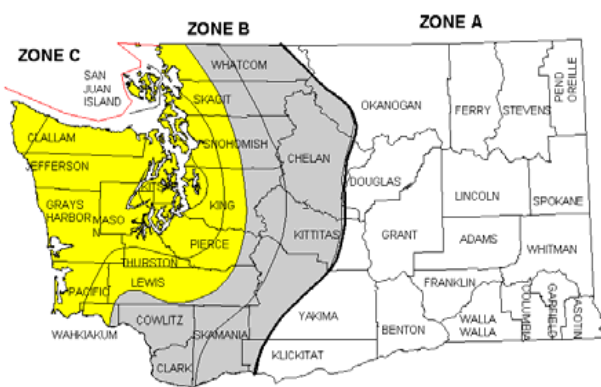


Figure 3. Seismic Zones. Source: WSDOT. “Washington State’s Seismic Retrofit Program”

According to a Federal Emergency Management Agency study done in 2001, Washington has the second highest economic loss risk in the nation for earthquakes, surpassed only by California. The most recent earthquake was the Nisqually Earthquake in 2001, which registered at 6.8 on the Moment Magnitude Scale. The earthquake resulted in one death, 700 injuries, and approximately \$2 billion in damages. WSDOT has mapped different seismic zones (Figure 3) by using Peak Ground Acceleration (PGA) data collected by U.S. Geological Survey (USGS). The Puget Sound region has PGA values exceeding 0.20 times the force of gravity, classifying it as high risk (Zone C). The surrounding counties have PGA values between 0.10 and 0.20, placing them at moderate risk (Zone B). East of the Cascade Mountain Range only experiences PGA values of 0.10 or less, resulting in a low risk region (Zone A).

WSDOT prioritizes bridges for retrofit based on a set of identified essential lifelines and seismic risk zones with the goal of finishing bridges in high risk zones and along major corridors first. Lower risk bridges along a major corridor, such as I-90, may have a higher priority than a high risk bridge along a minor route because it is paramount to ensure major corridors are open, maintaining access for emergency responders and evacuation. As these areas are completed, projects in moderate and low risk areas will be added according to highest levels of total Annual Average Daily Traffic (AADT) and AADT of trucks.

In addition to location, WSDOT considers the element of risk as well. In-span hinges were the highest priority, then bearings and joints at piers, followed by single column piers. WSDOT is presently into the phase of multi column piers. The last phase will be to deal with the foundations.

WSDOT established a seismic retrofit program in 1991 and has invested over \$100 million to date. To date, 901 bridges have been selected for retrofit and all newly constructed bridges are designed to current seismic standards. As of June 2012, 272 bridges have been completely retrofitted; the remaining 629 projects sum to a total of \$1,441 million. WSDOT has received an average of \$40 million per biennium dedicated to seismic retrofits.

However, only \$22 million was allocated for the 2011 to 2013 biennium. At this rate it will take 144 years to fully fund the program. To meet the 10-year projections, \$152 million, or \$30 million per biennium, is needed.

Currently, local seismic needs compete with all other bridge needs, such as painting, scour, and repairs for funding. According to USGS Survey Data, at least 40% of local bridges are in seismic hazard zones. 1,591 local bridges have been identified in these zones, and of these 1,052 were constructed before 1990. In 1970, engineers began using ductile detail in bridge columns and joints to accommodate for the motion caused during seismic activity. By 1990, the criterion was fully implemented, but bridges constructed before then may be seismically vulnerable. The full extent of the danger to the bridges will be unknown until further studies are conducted.

Scour Assessment

As of 2011, Washington has 5,862 bridges crossing waterways. Of these bridges, 12.5% (734) were scour critical. Scouring is caused by waterway currents removing sediment from around the bridge's foundation. When enough material has been removed to cause the foundation to become unstable it is labeled as scour critical. Scour is the number one reason for bridge failures in the nation. Washington has 71 recorded bridge failures since 1923, 43 of which were from scour. WSDOT owns 315 of the scour critical bridges and has a projected need of \$15 million for scour mitigation repair from 2013 to 2023. They received \$3.2 million for the 2011 to 2013 biennium; if funding continues at this rate, mitigation projects will be funded within the 10-year goal.

Recommendations

1. Explore alternate financing methods to meet the growing funding gap. For example, using State Infrastructure Banks (SIBs) enables states to use their Federal apportionments to establish a revolving fund that, much like a private bank, offers low-cost loans and other credit assistance to help finance highway and transit projects.
2. Encourage Public Private Partnerships which allow private contractors to take on more responsibility including: design, finance, long-term operations, and traffic revenues, which reduces the capital burden of the state and can provide faster project delivery.
3. Establish a comprehensive seismic retrofit program for local agencies. Currently, seismically vulnerable bridges are competing against deficient and aging bridges for contracts. Consequences of this could cause bridges in otherwise good condition to take severe and costly damage during the next earthquake that could have been mitigated with proactive retrofitting.
4. Streamline the permitting process to reduce the time delays and resources spent in bridge construction.

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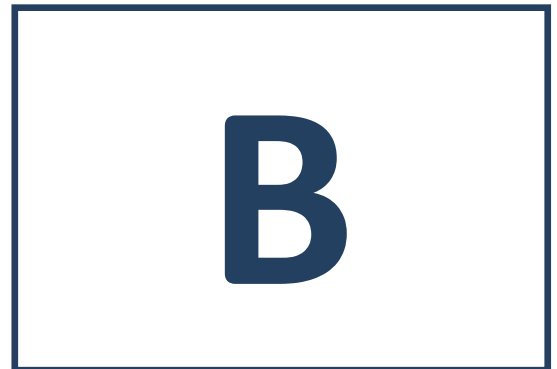
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I-90 Lake Washington Crossing. Courtesy of Michael Brunk at NW Lens.

Dams

There are 1,174 dams in Washington (Figure 1), close to 40% of which are categorized as significant or high hazard dams. Most of Washington's dams are regulated by the state Dam Safety Office (DSO). Most of the state regulated dams are privately owned. Washington dams are generally in acceptable condition, but some are aging and do not meet current seismic standards. Some dams have safety deficiencies and are considered unsatisfactory, but do not pose an imminent threat to public safety. Emergency action and O&M plans have been prepared for almost all of the state's high hazard dams. Continued funding of dam safety programs is essential to maintain or improve upon the current level of dam safety in Washington. No funding programs are on the horizon for repairing private dams.



Overview

About 12% of the total (145) Washington dams are either federally owned (86) or are hydropower dams (59) regulated by the Federal Energy Regulatory Commission (FERC). The remaining 88% of the dams in Washington are regulated by the Washington State Department of Ecology Dam Safety Office (DSO), and are mostly privately owned (Figure 2). Most of the federally owned and regulated dams are classified as significant or high hazard dams due to their size and the presence of downstream hazards. Dams that are regulated by the DSO are not power producing dams, and are operated by owners with a wide range of resources. Some private dam owners are challenged to comply with dam safety requirements due to insufficient funding.

In 2010, about 8% of the state regulated, significant or high hazard dams were found to have deficiencies. Significant hazard dams have possible loss of human life and likely significant property or environmental destruction in the event of failure. Dams are classified as high hazard if loss of at least one human life is possible. Eleven of the high hazard dams had serious safety deficiencies. The DSO has been effective in collaborating with dam owners to develop practical solutions for correcting deficiencies.

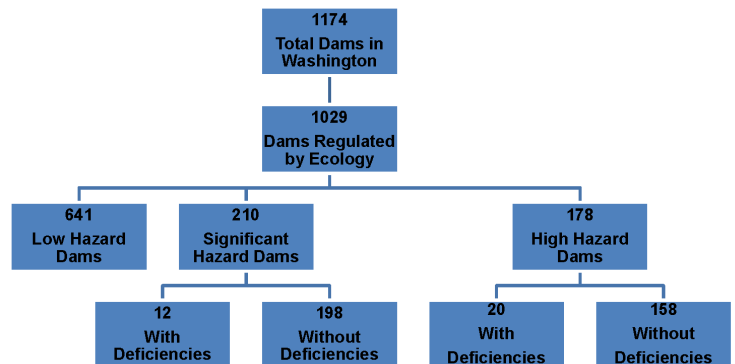


Figure 1. Hazard Classifications of Dams in Washington. Source: Ecology 2011.

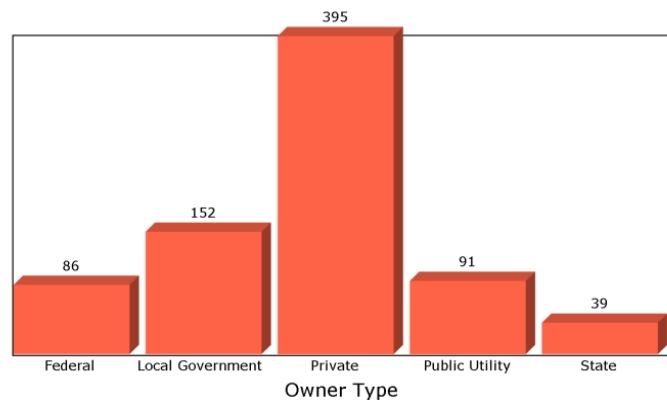


Figure 2. Dams by Primary Owner Type. Source: USACE 2013.

Accordingly, Washington has a good track record for correcting serious safety deficiencies.

According to the Stanford University National Performance of Dams Program (NPDP) database and the 2010 DSO

There have been no injury-producing dam incidents in Washington for 20 years. In 2010, only one Washington dam had an unsatisfactory safety rating.

Report to Legislature, there have been four documented dam safety incidents between 2000 and 2010. These incidents did not result in injuries, although some property damage occurred as a result of the incidents. The number of incidents reported for the 2000 to 2010 decade is a notable reduction compared to the prior decade (1990 to 2000) when there were 13 incidents resulting in three injuries and over \$8 million in property damage.

A large proportion of dams in Washington are over 50 years old, and development conditions downstream of many dams have significantly increased since the dams were built. Upstream development has altered the volume of water that reaches dams. Additionally, understanding of seismicity in the Pacific Northwest has increased dramatically in the past 30 years, resulting in previously unknown seismic hazards. These and other factors have raised Washingtonian’s exposure to dam safety risks over time.

Safety

This section focuses primarily on the safety of non-federally regulated dams as they comprise almost 90% of the dams in Washington, and federally regulated dams are generally found to be compliant with safety regulations. The state DSO regulates non-federally regulated dams, and has a staff of professional engineers who performs inspections (Figure 3), reviews and approves construction permits, and provides valuable resources for dam owners and engineers.

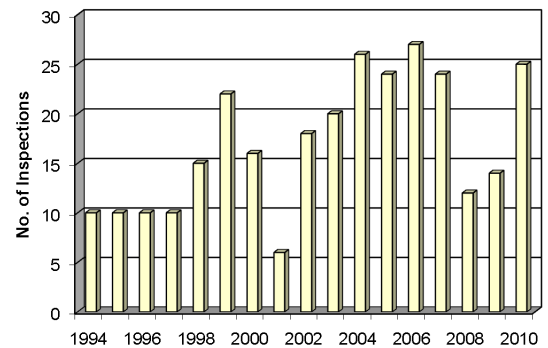
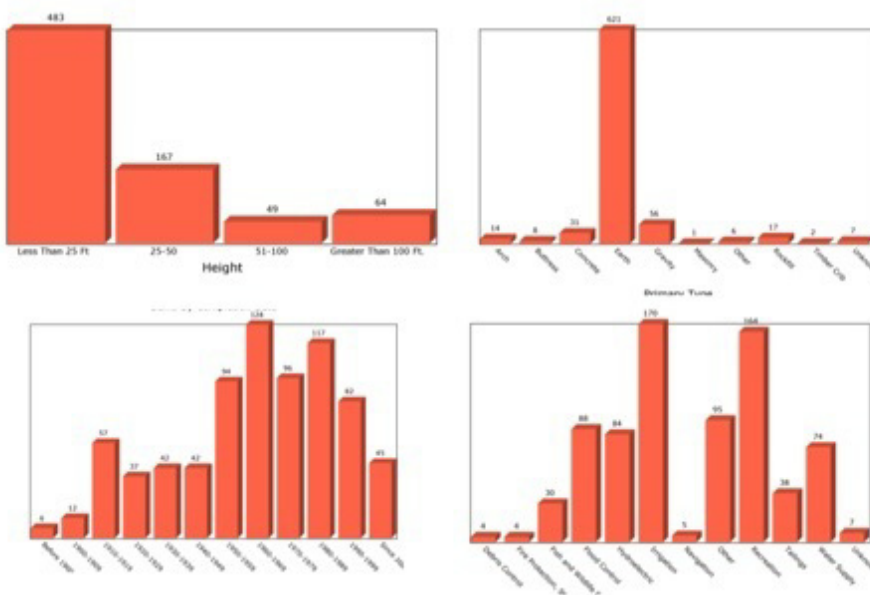


Figure 3. Summary of Periodic Inspection Activity on High hazard Dams since 1994. Source: WSDOE 2011.

The safety of dams owned by federal agencies, such as the U.S. Army Corps of Engineers (USACE) and U.S. Bureau of Reclamation, is overseen by dam safety experts within the owner agencies. Dam safety programs within these agencies are generally robust, and funding for these dams is generally adequate. Dams that are regulated by FERC

are generally owned by power utilities. FERC requires that independent experts undertake periodic safety evaluations of the dams under their purview. As power producers with rate-paying customers, owners of FERC-regulated dams generally have an adequate funding stream for proper operations and maintenance of their dams.



Figures 4a through 4d. Washington Dam Characteristics (Height, Type, Purpose, Completion Date). Source: USACE 2013.

A comprehensive database of Washington’s dams is available online at: www.ecy.wa.gov/pubs/94016.pdf. That report is output from the DSO database and includes introductory text, summary charts dam characteristics, and listing of

individual dams with detailed characteristics. The DSO has published a biannual dam safety report to the state legislature, with the most current available report being from 2010. Dam safety reports for federally regulated dams are not readily available to the public. However, the USACE maintains a National Inventory of Dams (NID), which includes limited data summaries available to the general public. The NID includes about 70% of Washington's dams. Summary graphs from the NID showing dam height, construction type, purpose, and age are provided on Figure 4.

The DSO has a downstream hazard classification system, which is based on downstream population at risk, potential for economic loss, and potential for environmental damage. The hazard classifications include low, significant, and high. Figure 5 shows the number of low, significant and high hazard dams in Washington, as reported in the NID. According to the 2010 Report to the Legislature, 641 dams in Washington are defined as low hazard dams, 210 significant hazard (12 with safety deficiencies) and 178 high hazard (20 with deficiencies).

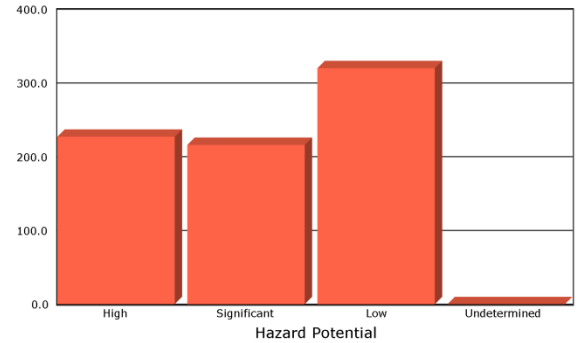


Figure 5. Washington Dam Hazard Classifications. Source: USACE 2013.

The DSO also has a condition rating system that includes satisfactory, fair, poor, and unsatisfactory, depending on the severity and immediacy of safety deficiency risks. Only one high

hazard dam in Washington was rated as unsatisfactory in the 2010 Association of State Dam Safety Officials (ASDSO) Dam Safety Performance Report for Washington. About 80% of Washington's dams were rated satisfactory, and the remainders were rated as fair or poor. Fair or poor ratings usually require repairs, but do not pose an immediate threat to public safety.

An unpermitted dams initiative by the Washington state Dam Safety Office in 2008 revealed 55 regulated dams, 47 of which are classified as high or significant hazard, and 20 of which had safety deficiencies.

In 2010, there were 388 significant and high hazard dams regulated in Washington, an increase of 55 dams since 2006. This sharp increase was primarily due to the discovery of dozens of dams under an initiative undertaken by the DSO in 2008 to find, inspect, and

eventually bring into compliance dams of jurisdictional size constructed without prior approval design review, or construction site visits by the state.

Given the potentially catastrophic effects of dam failures, the infrastructure grade for dams in Washington focuses on dam safety. Primary factors for evaluating dams in this report include condition, operations and maintenance, and funding. The following sections provide information on how the grade for dams was determined.

Capacity

For dams, capacity mainly applies to flood control dams, which comprise only a small portion of the state's dams. The dams in Washington provide a variety of water resources management solutions, but only a small portion function primarily as flood control to retain a defined capacity of

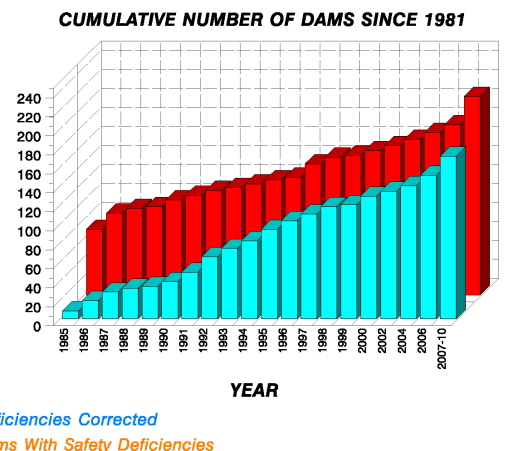


Figure 6. Cumulative Summary of Corrective Actions. Source: Ecology 2011.

water. Flood control dams are important, but are only part of the overall flood control system, which includes public education/awareness, floodwalls, and levees. Therefore, capacity of dams was not considered for grading dams in this report.

Condition and Safety

The condition of dams is strongly correlated to potential public safety and property damage concerns. Preparedness is another important element of public safety. Because of the potential threat to human life and property damage as they relate to dam conditions, this metric contributes to 50% of the basis for the infrastructure grading.

Statistics pertaining to safety deficiencies and condition ratings for DSO-regulated dams were evaluated as part of establishing the Condition and Public Safety portion of the grade for dams in Washington. The correction of dam deficiencies has been on an improving trend, as illustrated on Figure 6. Other factors that were considered include:

- In 2010, safety deficiencies were found in 11% of state-regulated significant and high-hazard dams in Washington. This is slightly better than the national average for this statistic.
- Only one high hazard dam that is regulated by the Washington DSO received an unsatisfactory rating. This is significantly better than the national average.
- Four incidents/failures occurred from 2000 to 2010 with no injuries and minor damages compared to 13 incidents from 1990 to 2000 with three injuries and over \$8 million in damages. In the past several decades, there has been an improving trend with respect to safety incidents.

Another component of the Condition and Public Safety component of the grade for dams in Washington is Emergency Preparedness. Figure 7 shows the number of high and significant hazard dams with Emergency Action Plans (EAPs), as reported in the NID.

- EAPs have been approved for 96% of high hazard dams regulated by the DSO, compared to the national average of 66%. A high hazard dam is defined as a dam where greater than seven people and/or 3 inhabited structures would be at risk in the case of a failure. A significant risk dam is a dam where 1 to 6 people and/or up to two inhabited structures are at risk. The recent discovery of previously unknown dams, or construction of new dams, has resulted in the gap with EAPs. The DSO has a goal of ensuring 100% EAP compliance for high hazard dams, and expects to reach that goal in 2013.
- The percentage of significant or low hazard dams with EAPs is much lower, on the order of 35%. The DSO has a goal of establishing EAPs for significant hazard dams within about 5 years.

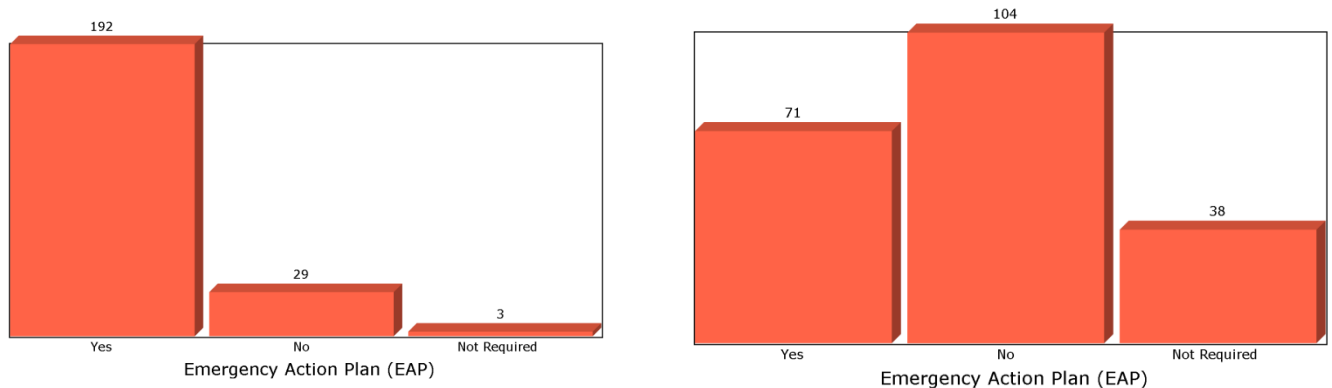


Figure 7a and 7b. Number of High Hazard and Significant Hazard Dams with EAP. Source: USACE 2013.

- The DSO has used a FEMA grant for a staff position to track compliance and to assist private owners of significant and high hazard dams in drafting EAPs, which helps them operate safer dams and gets them in compliance with regulations. The DSO has found this approach to be more effective in achieving EAP compliance than simply citing deficiencies.

Operation and Maintenance

An appropriate operation and maintenance (O&M) program, including annual inspections, routine maintenance, and timely rehabilitation, are important factors for a satisfactory condition assessment rating. Federally-owned and -regulated dams generally have ample staff and resources to maintain an acceptable O&M program. O&M for dams that are regulated by the DSO is the responsibility of the dam owners, who have varying resources available for O&M programs. All owners of jurisdictional dams in Washington are required to perform and submit annual inspections; staff focus is on increasing annual inspection submittal compliance on high and secondarily on significant hazard dams. In addition, the DSO performs thorough, independent inspections of high and significant hazard dams every 5 years at a minimum.

As of 2010, safety deficiencies were identified by the DSO on 209 dams, and 182 of those deficiencies have been either fully or partially corrected. The Washington Dam Safety Program has been compared with the ASDSO Model State Program, and has been found to be over 86% compliant, which is greater than the national average of 77%.

Funding

Funding for O&M and inspections of dams is limited. Federally owned and regulated dams generally have adequate funding streams through their agencies or from rate payers to maintain inspection and O&M programs. The state DSO program is primarily funded by the state general fund. In addition, owners of all high and significant hazard dams pay an annual inspection fee and a construction permit fee is assessed for the construction of all new dams or the modification of any existing dam.

The 2011 DSO budget was \$1.33 million in 2011, down from \$1.412 million in 2010. The current number of Washington DSO staff is such that there is an average of about 120 dams per regulator and 21 high-hazard dams per regulator. The model state program recommends staffing for 25 dams per regulator. However, the national average for state programs is 208 dams per regulator, so Washington has a relatively well-funded program compared to other states.



Chief Joseph Dam; Courtesy: U.S. Army Corps of Engineers

DSO safety grants from the Federal Emergency Management Agency (FEMA) between 2007 and 2010 totaled over \$250,000. These monies were used to fund the unpermitted dams initiative, improve emergency preparedness, and provide outreach and education to dam owners. However, funding for the DSO was reduced between 2010 and 2011, and accordingly the number of regulatory staff has also decreased. A high dams-to-DSO staff ratio exists in Washington, which strains available resources for dam safety oversight.

The DSO's philosophy for correcting deficient dams is to work collaboratively with the owner in an effort to gain voluntary compliance, and only use formal enforcement action as a last resort. Some owners of deficient dams struggle to obtain sufficient funding for repairs. Unless outside grants or loans become available for repairing and maintaining existing dams, many owners will not be able to afford repairs. While legislation has been introduced in Congress to create a federal loan fund for repairing the nation's unsafe high-hazard potential, non-federal publicly-owned dams, no funding programs are on the horizon for privately owned dams. In spite of these challenges, the gap between deficient and corrected dams has been steadily closing for over 25 years, as shown on Figure 6.

Some private owners of non-power-producing dams lack funds for O&M. There are currently no grant or loan programs available to assist them. For situations where dam owners are unable to correct unsafe situations, the DSO has authority to require changes to dam operations as necessary to make it safe. In extreme cases, DSO has authority to decommission unsafe dams.

No current data were found to quantify the funding gap for the future need in terms of dam maintenance and repair.

Recommendations

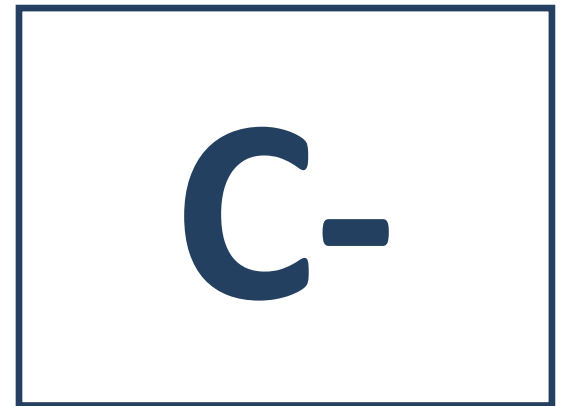
1. Maintain adequate funding of federal and state dam safety programs to allow for timely and appropriate inspections, tracking of corrections made to deficient dams, permit reviews, education, and training.
2. Use enforcement actions when necessary to mitigate safety concerns where deficiencies exist, and to maintain updated EAPs.
3. Continue outreach to dam owners to educate them on compliance requirements.
4. Create low interest loan programs to assist private dam owners with needed repairs and maintenance.

Resources

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Drinking Water

Washington state is known for having great tasting, clear drinking water. Washington is served by many different types of water systems: private wells, large municipal water systems, and private water systems. This study focused on the public and private systems regulated by the state and serving predominately residential homes. Larger systems often serve commercial and industrial uses, too. While only a small percentage of the state's population is served by smaller water systems serving 25 people or less, they account for 85% of the state's water systems and are only regulated at the county level. In general, water system capacity for Washington’s larger water systems was adequate to plentiful, while the smaller water systems do not have adequate capacity.



Overview

Washington's regulated water systems are generally divided into two types of systems: Group A public systems and Group B public systems. Group A public systems are all those systems serving more than 15 connections and provide water to more than 25 people per day. Group B systems serve fewer than 15 connections and supply water to 25 people or less per day. Close to 90% of the state's population is served by either a Group A or B water system. The remaining 10% of the state's population is served by individual wells or water systems serving two households. The breakdown of the state's public water systems is shown in Table 1.

Table 1 - Washington State Public Water System				
System	Number of Systems	Number of People	% of Systems	% of People Served
Group A Community Water Systems				
Large Systems > 1,000 Connections	240	5,344,636	2%	90%
Medium Sized Systems ≥ 100 and ≤ 1,000 Connections	561	377,662	4%	6%
Small Systems < 100 Connections	1,438	131,113	9%	2%
Group B Water Systems	13,000	110,000	85%	2%
Total	15,239	5,963,411	-	-

As shown in Figure 1, the vast majority of Washington’s population is served by large water systems with more than 1,000 connections, despite the fact that two-thirds of the state's Group A systems have fewer than 100 connections. While only a small percentage of the

state's population is served by Group B systems, they account for 85% of the state's water systems. Today, Group B systems are no longer monitored by the state as funding was eliminated from the state's budget in 2009. Counties

often regulate and monitor Group B systems. The level of County involvement in ensuring Group B systems meet public safety and health standards varies by County and is dependent on budget constraints and priorities. In just Pierce County itself, with a population of 808,000 people, there are between 1,500 and 1,800 Group A and B systems. Pierce County also has the most Group A water systems in the state.

In-depth interviews were conducted with seven different water system managers ranging in size from 19 connections to more than 95,000 connections. To develop the grade, five criteria were analyzed:

1. Water System Capacity and Supply-whether the system could meet current and future demands (e.g. fire flow, adequacy of metering) and whether there is adequate source supply for the jurisdiction.
2. Water System Condition-what is the condition of their collection, pipe, storage, pump, and treatment systems. This included how often they had system failures.
3. Funding-whether their rate structure supported adequate reserves. Whether the jurisdiction felt there were adequate government monies available for low-interest loans or grants to maintain and upgrade their system.
4. Operation and Maintenance-whether the system had adequate levels of personnel to operate and maintain the system.
5. Public Health & Safety-whether their system had a clean, safe water supply that was also protected from contamination concerns.

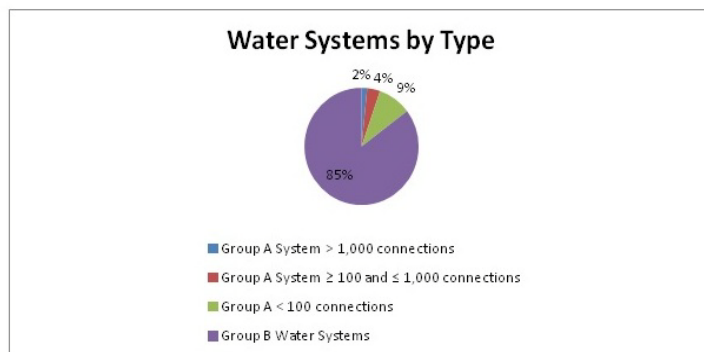
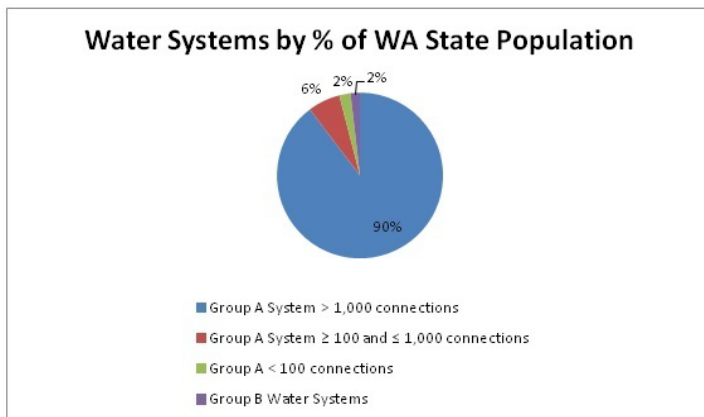


Figure 1. Group A Water System Service Charts.

The overall grade for drinking water systems is a C- in the state of Washington. However, this grade does not really depict what is happening with water systems across the state. Some of the larger water systems with more than 1,000 connections are in excellent shape, while some of the medium (with at least 100, but fewer than 1,000 connections) and smaller systems (with fewer than 100 connections) face serious needs in several areas.

In general, the smaller systems have a higher probability of having problems, since they do not have the customer base or financial wherewithal to support regular maintenance and upgrades. More than three-quarters of the Group A water systems in Thurston and Island Counties have less than 100 connections. Most of these smaller Group A systems were constructed more than 20 years ago with many of them constructed in the late 1960s and the 1970s and therefore, are now more than 40 years old. State law changed recently to require a certified water operator to manage all Group A systems, which has improved smaller systems

operations, since the systems are now getting regular attention by a professional. Many of the smaller systems are dependent on grants and low-interest loans to maintain the integrity of their drinking water because of inadequate rate base.

Water Capacity and Supply

In general, water system capacity for Washington's larger water systems was adequate to plentiful, while the smaller water systems did not have adequate capacity. An example of this is Vader which is a small city with about 350 connections and is suffering from inadequate reservoir capacity. Walla Walla, a larger system with 10,500 connections, is completely metered but needs to upgrade the meters as they fail to give reliable readings. System capacity was evaluated for adequacy of residential, commercial, industrial, and fire flows, and whether the system was metered and could accommodate future growth.

Many areas of the state do have adequate to abundant water supplies, while some areas do not. Research included whether there was adequate residential, commercial, and industrial supplies; if there was adequate water availability for drinking and fire flow; and whether there was adequate supply for future growth.

Of the jurisdictions contacted, the larger jurisdictions and water systems reported predominately adequate water supplies. Often, these jurisdictions have had the financial resources and personnel to secure additional water rights through the laborious Washington State Department of Ecology (Ecology) process. One example of adequate supply is Walla Walla. The city has plentiful water rights because canneries, once a vibrant city business with large water needs, have closed. The wine industry that is fueling some of Walla Walla's growth does not have as large a water demand as the canneries did. The excess water rights are now available to serve the city's future needs for many years to come.

Some of the smaller water systems, such as the City of Vader, do not have adequate water rights or supply. Vader remained small during the economic boom years in the 1990s and 2000s, and, therefore, did not have the financial resources to secure additional water rights.

Condition

Water system conditions fared significantly worse than other categories. Several jurisdictions have good or excellent systems, such as the cities of Tacoma and Camas. Tacoma has been investing regularly in their water system and has minimal system failures. Even though Tacoma still has pipes to replace, it is on a reasonable replacement schedule. The City of Tumwater, another larger system with 7,700 connections, has been acquiring many smaller water systems, which need improvements, and integrating them into their larger, more robust system. Integrating these smaller systems has significant costs.

Walla Walla, with more than 10,000 connections, also needs significant repairs as they are losing 33% of their water to pipe leaks, and their unfiltered surface supply does not meet current water quality standards. North Bend, with 2,200 connections, is losing 30% of its water because of leaky pipes. Alternatively, Tacoma, which has more than 95,000 connections, has been on a significant replacement program and is reducing their water loss.

What Happens When a Water Main Breaks?

Vader, Washington, April 22, 2011—The Lewis County Public Works Director, overseer of the Vader water system, was woken at 6:15 a.m. to the announcement of a Vader watermain break. The Code Red system was immediately implemented notifying registered customers via telephone and e-mail of a boiled water advisory. A vulnerable section of pipe had ruptured that had prior breaks. Once the system was repaired and flushed, and samples taken, the boil water advisory was lifted, two days later.

In contrast, the smaller systems need significant repairs and upgrades to their systems. An example is Webster Hill, a small system with 19 connections serving about 60 people in western Washington, recently hired Thurston Public Utility District (PUD) to manage their system. The Webster Hill system was built in the 1970s by a developer to serve this community. With subpar management the past 40 years and no ability to connect to a larger system, the community reached out for assistance.

Funding

Washington state is fortunate to have multiple funding sources for water system replacement and upgrades. These sources typically do not fund growth. Funding sources available for jurisdictions and water systems include:

- Community Development Block Grant (CDBG) Program funded by the U.S. Department of Housing and Urban Development, as a grant program.
- United States Department of Agriculture (USDA) Rural Development Program for water and sewer projects, as a grant and loan program.
- Public Works Assistance Account (PWAA), also known as the Public Works Trust Fund (PWTF), administered by the Washington Public Works Board (PWB), as a low-interest loan program.
- Drinking Water State Revolving Fund (DWSRF), administered by the Washington State Department of Health with assistance from the PWB as a revolving fund with additional new monies contributed by the U.S. Environmental Protection Agency (USEPA).
- Water System Acquisition and Rehabilitation Program (WSARP) administered jointly with the Washington State Department of Health and the PWB, as a grant program, when funded by the legislature.
- Capital Reserves as set aside by the water system from rate payers.
- Bonding capacity, used predominately by larger jurisdictions.

Water systems and the water drinking public have benefited immensely from these funding sources. Through grants and loans, drinking water rates have been kept affordable.

In its 26-year history, the PWB, managed in accordance with Revised Code of Washington (RCW) 43.155, has loaned \$2.6 billion to local jurisdictions with total project costs of \$4.6 billion, creating more than 46,000 jobs. PWB funding makes loans for six different systems types, including sewer, water, stormwater, roads, bridges, and solid waste; therefore, not all of the \$2.6 billion has funded drinking water projects. In the 2012 and 2013 funding cycles, the PWB loaned \$123 million and \$69 million, respectively, to water system clients. Additional funds were also loaned to the other systems.

In the 2010 and 2011 funding cycles, the Washington State Department of Health's DWSRF program loaned \$71 million for 27 projects and \$69 million for 38 projects across the state, respectively.

The CDBG program is a vital grant program for small water systems to update and upgrade their infrastructure. This is typically a smaller amount of money than the other programs and usually less than \$20 million per year. CDBG grants are a federally-funded grant program and many smaller, undercapitalized jurisdictions are dependent on this money to maintain safe drinking water standards. Whether the current U.S. Congress will continue to fund the CDBG program is unknown.

With the recent recession, many of these programs have been financially challenged. In the 2007 to 2009 biennium, the PWTF was re-appropriated by the Washington legislature, swept into the General Fund, thereby funding minimal infrastructure projects for 2 years. (Several special targeted programs for infrastructure were funded, but at significantly less economic value than was available in the PWTF for that biennium.) Further, funding from the federal government has continued to be available, but with the congressional gridlock, grant and loan money has become less certain.

Many jurisdictions also have a stable rate base, which allows them to accrue capital reserves to fund upgrades and maintenance of their systems over the long term. Camas is fortunate by serving its population with rates (\$21.50 per 1,000 cubic feet [cf]) that are significantly less than the average rate according to the Association of Washington Cities (\$33.82 per 1,000 cf). Camas also has reserves available for capital improvements.

The City of North Bend charges \$39 per 1,000 cf for residential rates, while the City of Seattle's rate is about \$40 per 1,000 cf in the winter. (Seattle raises its rates in the summer to encourage conservation.) In contrast, Webster Hill's has significantly higher rates and no capital reserves and a small customer base, which makes it difficult to self-fund, issue bonds, or acquire other debt for any improvements.

Operation and Maintenance

Many of the systems have had to reduce their operations and maintenance budgets and staffing during the recession. Walla Walla has had to significantly reduce hydrant flushing and Tumwater has limited valve flushing. Both Walla Walla, North Bend, and the City of Vader have significant water loss in their systems. Webster Hill has spent money recently toward maintaining their system and needs a significant infusion of money to upgrade and replace their system. Overall, operations and maintenance grade for drinking water systems were adequate. The smaller jurisdictions, generally, warranted concern that maintenance needs were not being fully met or were reactive while the larger jurisdictions were more able to perform preventive and normal maintenance.

Public Health and Safety

Safety of the public water system was evaluated by looking at frequency of contaminated or questionable water, non-compliance decrees, and whether the system was protected from intruders and consequences of failures. As found with other elements of the water systems, larger systems have had the financial resources and motivation to make public safety improvements, while the smaller systems have had to concentrate more on basic water availability improvements.

Conclusions

Every 4 years, the EPA, at the request of the U.S. Congress, performs a drinking water needs assessment to determine what level to fund the DWSRF loan and grant program. The DWSRF program is administered by the Washington State Department of Health with assistance from the PWB and is available to 1) expand or upgrade drinking water systems to meet the needs of existing customers or 2) to replace or rehabilitate existing undersized or deteriorated water systems.

According to the *2007 Drinking Water Infrastructure Needs Survey and Assessment, Fourth Report to Congress* prepared by the EPA, there is a \$9.7 billion, 20-year water system need in Washington with projects meeting the criteria for the DWSRF. Even with \$332 million loaned through the PWTF and DSWRF programs in the last biennium (2011 to 2013), the rate of water system upgrade and replacement is not keeping pace with the need to provide drinking water to the people of Washington state.

The legislature and the U.S. Congress need to understand the value of ensuring drinking water quality. Funding drinking water projects creates short-term jobs, while creating a long-term investment in the future.

Recommendations

1. Fully fund the Public Works Trust Fund (PWTF) as it will make low interest loan funding for investment more readily available.
2. Encourage federal government to fund the Drinking Water State Revolving Fund (DRSWF).
3. Encourage smaller water systems that are able to connect to larger systems to do so. By combining systems, jurisdictions can combine costs over a greater number of customers.
4. Educate drinking water customers that good water requires adequate funding. Some capital funding must be earned through the rate structure.
5. Raise awareness among elected bodies that govern water systems of the need to develop a system to acquire capital reserves for long-term planning once their system is operating well again.
6. Support Ecology's water rights division to enable jurisdictions to acquire water rights as needed.

Resources

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U.S. Environmental Protection Agency (USEPA). 2007. *Drinking Water Infrastructure Needs Survey and Assessment, Fourth Report to Congress for the Environmental Protection Agency*. Office of Water, Office of Ground Water and Drinking Water, Drinking Water Protection Division.

Washington State Department of Health. 2012. *Drinking Water State Revolving Fund Fact Sheet*. December.

Organizations Interviewed:

City of Camas Public Works

City of North Bend Public Works

City of Tumwater Water Resources

City of Vader

City of Walla Walla Department of Public Works

Lewis County Public Works

Pierce County, Department of Health

Tacoma Public Utilities

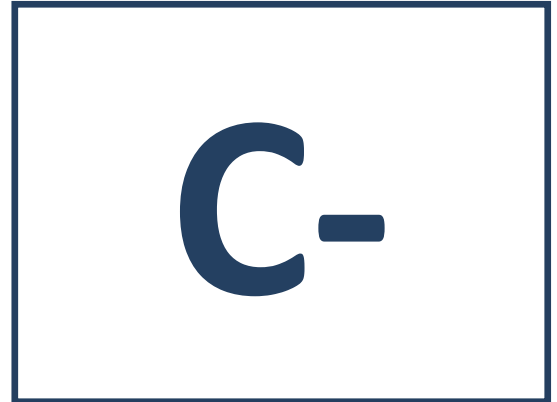
Thurston Public Utility District

Washington State Department of Health, Office of Drinking Water, Policy & Constituent Services

Webster Hill Water System

Rail

Washington's rail system provides essential freight and passenger rail services to Washingtonians. Reaching 3,215 miles across the state, the rail network is owned primarily by private freight operators that also share track with passenger rail. Capital investment in 2012 exceeded 100 million dollars. While the capacity of the rail system overall is adequate, some congested corridors and the condition of some of the short line rails are concerning. WSDOT's Freight Rail Investment Bank does make loans up to \$250,000 with a 20% match to support smaller projects or portions of larger projects and the Freight Rail Assistance Program provides grants to improve the state's freight rail system. However, by 2030, \$2 billion worth of improvements are needed and 90% of these projects are unfunded. By removing car to rail interaction at crossings, accidents have been reducing, but the trend has flattened in the past 3 years.



Overview

Washington's rail system provides essential freight and passenger rail services to Washingtonians. The freight rail system provides access to national and international markets allowing for distribution of Washington's agricultural and manufacturing products. Portions of the privately owned freight rail system are shared with the public for public passenger rail services. The sustainability and efficiency of rail transport is making rail a more competitive option; one ton of freight can be moved 468 miles using just 1 gallon of diesel fuel. Investment in rail is essential, as use of the rail system reduces congestion and the reliance on Washington's roadways.

The majority of the rail system in Washington is privately owned by large, Class 1 railroads, BNSF Railway Company (BNSF) and Union Pacific Railroad (UPRR). The remaining rail lines are owned by nine shortlines, eleven public entities or five port authorities. Funding for the ongoing maintenance of the rail lines is supplied by the owners. For example, BNSF spent \$106 million on track maintenance and capacity improvements of their lines in Washington in 2012. Some public funding has been provided for improvements to support the Amtrak High Speed Rail Corridor and the Sounder Commuter rail trains that run on privately owned tracks. Public funding has also been used to preserve low volume rail lines such as the Palouse River and Coulee City Railroad, which the state owns and maintains. The current adequacy (0 to 5 years) and future adequacy (6 to 20 years) were rated under each of the following categories.

Capacity

The Washington State Department of Transportation (WSDOT) *State Rail Capacity and Systems Needs Study Final Report* was reviewed to determine levels of traffic versus the available



capacity. The capacity of the rail system overall is adequate with two areas of concern. The BNSF Stevens Pass Line is overloaded between Everett and Wenatchee. Another area of congestion is the north-south I-5 corridor line. The I-5 corridor is nearing capacity as more passenger service is being added to the existing system for the operation of the Amtrak Cascades high speed rail line and the Sounder commuter rail service in Puget Sound. The I-5 corridor is expected to reach capacity by 2018. The total freight tonnage moved over the state rail system is expected to increase 2 to 3% per year over the next 20 years, which will further limit the capacity on this shared usage track.

Condition

The overall rail system's condition was difficult to confirm as no overall system condition information is available through WSDOT. It was assumed to be adequate. The Class 1 rail lines provide ongoing maintenance and renewal of their lines according to their long-term asset management plans. The short line railroads have a more difficult time maintaining the condition of their tracks. As the condition of the lines deteriorates, often speed restrictions are put in place, reducing the lines' capacity while maintaining safety. Because of the overall age of the rail system and the limited amount of maintenance work occurring on the short lines, condition remains a concern.

Funding

The historic and short-term funding of the rail system is good, with recent major investments occurring on the I-5 corridor. WSDOT programs have supported the short line systems within the state. WSDOT's State Rail and Marine Office supports the Freight Rail Investment Bank program at \$5 million per biennium. The Freight Rail Investment Bank program is a loan program available to the public sector. This program is available for either smaller projects or for smaller portions of a larger project, where state funds would enable the project to be completed. Loan amounts are limited to \$250,000 and require a 20% match. WSDOT also funds the Freight Rail Assistance Program at \$2.75 million per biennium. This is a grant program available to public and private sector projects. Projects must be shown to improve the state's freight rail system.

State and federal funding has been provided to the I-5 corridor to improve the reliability of the high speed rail system, which runs mostly on privately owned BNSF tracks. Recently, major improvements have been occurring on the I-5 high speed rail corridor due to funding from the American Recovery and Reinvestment Act (ARRA) of 2009. This funding source for high speed rail improvements has provided \$800 million to Washington and \$8 billion nationwide. Future funding sources, however, are not identified. However, the State 2010 to 2030 Freight Rail Plan identified \$2 billion worth of needed improvements, and currently, 90% of these projects are unfunded. High speed rail corridor improvements have received state and federal funding to improve connections at ports and yards, as well as the Point Defiance by-pass project.

Federal funding for Amtrak operations will end in 2013, possibly causing the reduction of service by one train daily. Funding for the Amtrak Cascades line will need to come from Washington state, Oregon, and British Columbia, Canada. Due to the lack of long-term dedicated funding to support the long list of needed projects and the uncertainty of federal funding, future adequacy of funding remains a concern.

Operation and Maintenance

Operations and maintenance are provided by the rail line owners. Public money is typically not provided for these

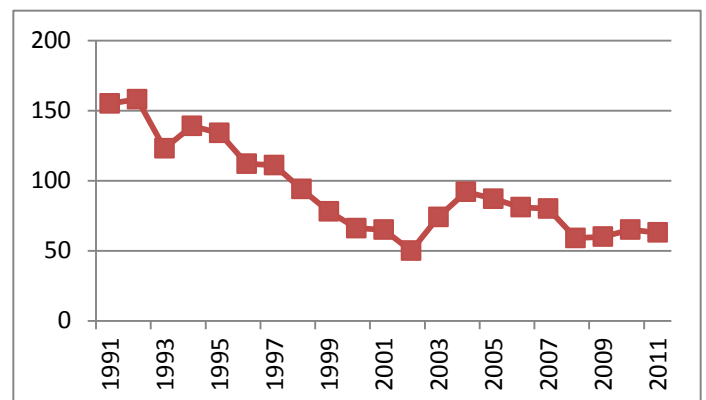


Figure 1. Total Rail Crashes and Injuries Washington from 1991 through 2011.

functions. Ongoing issues have occurred on the BNSF line used by Sounder north of Seattle. A record number of 70 slides have occurred during the winter of 2013, causing multiple disruptions to service. Funding has been made available from the federal ARRA program to improve the corridor at the locations of the slides. Operations and maintenance are addressed on the Class 1 railroads; however, as discussed in the Condition section, it is more of a challenge on the short line railroads.

Safety

Safety improvements have been a high priority in the past to remove at-grade crossings where roadways cross the rail lines at the same level. The grade crossing closures are accomplished by closing some crossings and consolidating the auto traffic at fewer locations or by constructing bridges to create grade separated crossings. In general, grade crossing accidents have been declining over the last 20 years. Grade separation projects are part of the planned and funded improvement for the high speed rail corridor. This will benefit both the freight and passenger rail systems operations and safety. Due to the positive trend in accident reduction, a positive grade is warranted, but the trend has flattened out over the last 3 years.

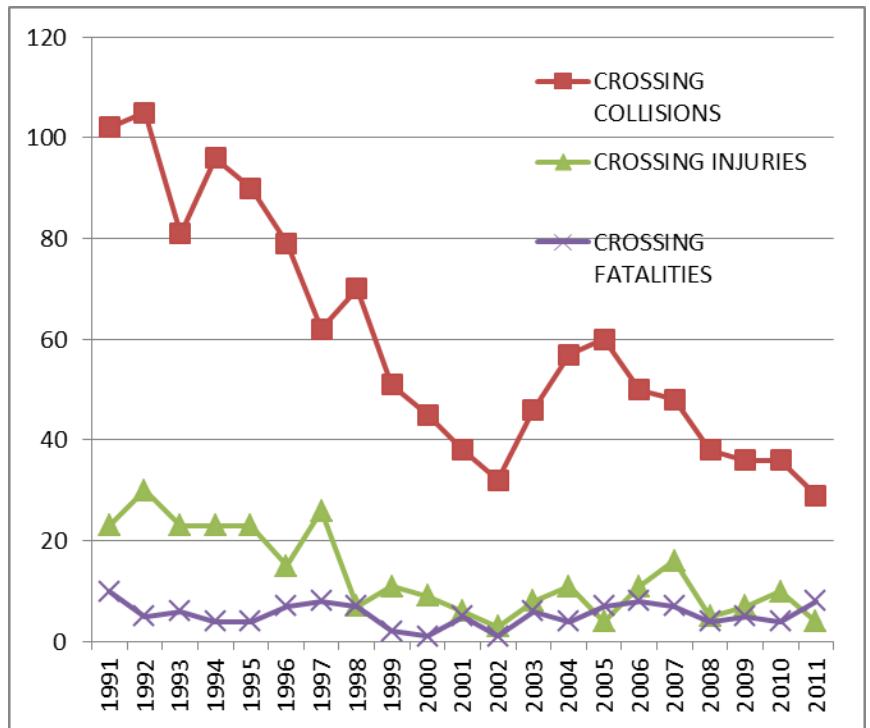


Figure 2. Washington state railroad crash statistics. Source: www.utc.wa.gov

Conclusion

Many positive improvements have been occurring on the I-5 corridor as upgrades have happened to accommodate the high speed rail corridor and the Sounder commuter rail. These improvements for passenger rail operations have beneficial consequences to the freight rail mobility as well. Ridership has steadily increased on the Amtrak Cascades line since its opening in 1995. This trend should continue with the improvements in infrastructure, resulting in faster more reliable service. Washington has made great progress in working collaboratively with the railroads to provide support to improve and maintain this system that is also used by the public yet privately owned. The state rail plans have identified many needed improvements for the rail infrastructure now finding a dedicated source of ongoing funding is the next step to make these plans a reality.

Recommendations

1. Identify sustainable sources of funding for the ongoing operations and maintenance of the passenger rail system.
2. Increase funding to WSDOT's Freight Rail Investment Bank and the Freight Rail Assistance Program to provide for necessary maintenance of the shortlines and continue trends of improvement in the state's freight rail system.
3. Dedicated funding sources are needed to provide for a stable, predictable financial basis for ongoing planning, maintenance, and operations of the state rail system.
4. Expand passenger rail service to other communities in the state where viable and efficient according to the state rail plan.

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Roads

Washington state's streets and highways are reaching a crisis, and this can be felt in pocketbooks, traffic jams, and worn shocks. The system, much of which was built 50 to 60 years ago, is struggling under: 1) increasing congestion in spite of the recession with 6% in major urban areas over the last 3 to 4 years; 2) higher construction costs and lower gas tax on a per-mile basis as vehicles become more fuel-efficient; 3) reduced maintenance causing an 11% increase in state highway paving backlog and 32% decrease in county road paving; and 4) uncertain funding with 33 months between federal transportation funding bills, 2009 to 2012. The agencies that maintain these roads are working within these constraints, but soon will reach a critical juncture where they can no longer deliver a world-class system that efficiently meets the needs of the state's citizens and businesses.



Overview



Congestion in Vancouver; Courtesy: WSDOT

Washington state has a large network of streets and highways running through every city and town. The state owns 18,600 lane-miles of highway, while cities own 38,000 lane-miles of streets and counties 80,000 lane-miles of roads. This system is maintained and improved through state funding of \$9 billion every two years and local funding of \$3 billion annually.

On this system, more than \$37 million worth of freight is moved every hour and 87 million vehicle-miles are driven daily. The state's population, the source of much of this traffic, has increased 38% since 1990 and vehicle ownership has grown even faster than the state population, almost 40% since 1990. There are even more registered vehicles in the state than licensed drivers.

While this burgeoning population is straining the network, Washington is doing many things right in transportation. Washington state has the lowest traffic fatality rate in state history (458 in 2011, or 0.80 fatalities per 100 million vehicle miles traveled), and compares favorably against other states in many safety measures. Washington State Department of Transportation (WSDOT) has constructed the country's third largest high-occupancy vehicle (HOV) system in central Puget Sound, where more than a third of rush hour travelers use carpool and bus, making more efficient use of freeway space. Construction on the state's roadways over the last several years has been carefully planned using taxpayer money, delivering projects on-time and on-budget. As well, the state has established a reputation nationally for being proactive on investigating climate adaptation vulnerabilities in infrastructure.

Capacity

Capacity is a measure of the maximum flow of vehicles that can travel on a roadway. Capacity of the state’s roads is evaluated through several measures including the volume/capacity ratio, traffic speed relative to posted speed, travel time, and costs from delay for excess gas consumption and unproductive time. About 70% of the state system is in rural areas and does not suffer from capacity issues (with the exception of holiday traffic along major state highways). In these areas, the *capacity* of rural roadways is not so important as the amount of area *accessed* by them.

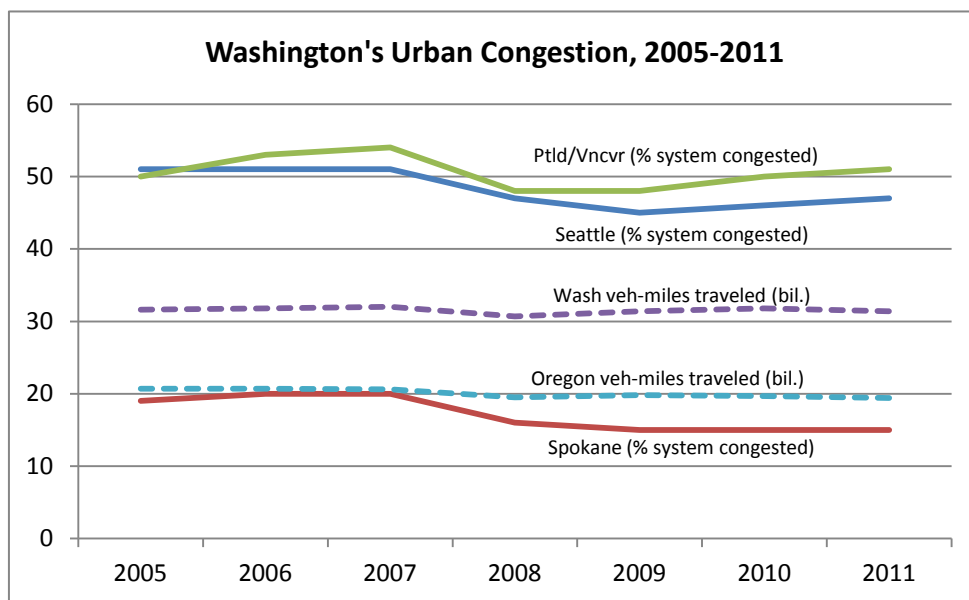
However, the remaining 30% of the state highway system in the three major urban areas—Seattle/Tacoma, Spokane, and Vancouver/Portland—suffers with comparatively more congestion while serving 60% of the state’s population. Seattle/Tacoma ranked tenth in the nation in the Texas Transportation Institute’s (TTI) 2012 *Annual Mobility Report* for the Travel Time Index, which is a composite measure of how long commutes take during rush hour compared to normal conditions. The Portland/Vancouver area had even longer commutes, at sixth worst nationally and Spokane came in at seventy-fourth nationally. TTI estimated that, during rush hour, 15% of Spokane’s network, 47% of Seattle/Tacoma’s network, and 50% of Portland/Vancouver’s network was congested in 2011. All three metro areas have experienced worsening trends in travel time, congestion cost, and delay over the last several years, despite recessionary economic conditions.

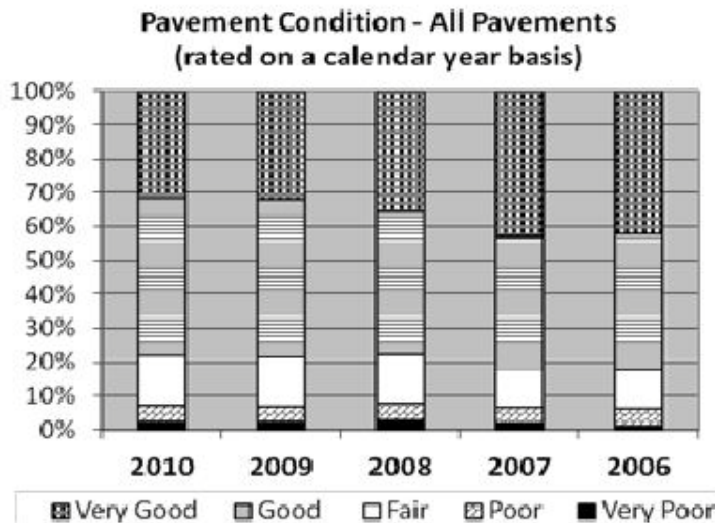
Traffic Management:

Washington’s traffic management measures that have been deployed on freeways and arterials to manage traffic within existing lanes, such as ramp metering, courtesy service patrols, surveillance cameras, HOV lanes, traffic signal coordination are making an impact on congestion. These measures reduced almost 13.4 million hours delay in the 3 major urban areas in 2011!

Condition

Roadway condition is a measure of the pavement smoothness and cracking and is often a function of the type of pavement used (concrete or asphalt). Pavement is graded in Washington using two systems—the International Roughness Index (IRI) and the Pavement Structural Condition (PSC)—and graded on a scale from very poor to very good. In 2011, approximately 85% of the concrete pavement in Washington state—13% of the network primarily on freeways—was more than 20 years old, the length it was originally designed to last. In addition, concrete pavement carries two to five times more traffic than engineers anticipated when it was constructed. While concrete pavement is a strong, long-life material, the combination of age and heavy use takes a substantial toll. The portion of the state system rated “very good” has been declining as more pavement sections degrade to “fair” and “poor” ratings.





Washington Tolled Facilities:

As revenue sources are being squeezed, Washington has been increasingly using tolled roads as a means to fund new construction. Examples of these facilities include toll bridges and managed HOV-Toll (HOT) lanes such as:

- Tacoma Narrows Bridge, the first modern toll bridge in Washington, which started tolling in 2007 to pay off the second span.
- SR 520 Lake Washington Bridge, which began tolling in December 2011 to help pay for construction of a replacement bridge due in 2015.
- SR 167 HOT Lanes, the first such lanes in Washington, which allow solo drivers to use the existing HOV lanes for a fee.
- I-405 HOT Lanes, similar to the SR 167 HOT Lanes, which are presently under construction.
- Columbia River Crossing, expected to start construction in 2014, and the Alaskan Way Viaduct replacement tunnel, presently under construction, which are both expected to levy tolls as part of their financing.

While conditions on state highways are still adequate for the loads they carry, city and county roads are not so fortunate. The percent of city arterials rated fair or better dropped 2.4% to 81% from 2006 to 2010 while the same percent of county arterials dropped more than 6% to 89% from 2006-2012. The County Road Administration Board (CRAB) reports that the rural freight roadway system, a necessity given Washington is one of the most trade-dependent states, has been declining in quality to the point that just over half the system was adequate in 2011. The Association of Washington Cities *State of the Cities 2011* survey of its 281 cities found that almost a quarter of cities rated their street conditions “inadequate” and another 43% rated only “fair.”

While state highways meet WSDOT’s policy of 90% or more rated “fair” or better, the percentage meeting this rating has been trending downward. Fewer county and local roads rate “fair” or better and these conditions are expected to accelerate downward as maintenance and funding decrease (discussed later).

Funding

Washington has a relatively robust funding structure in place compared to other states, with the 9th highest gas taxes in the nation and voters that have recently shown support for infrastructure funding, such as the Nickel tax in 2003 and Transportation Partnership Account (TPA) tax in 2005. State transportation funding comes from several sources: state motor vehicle license fees and gas taxes (46%), federal infrastructure spending such as MAP-21 and the American Recovery and Reinvestment Act (ARRA) of 2009 (18%), local reimbursement for work WSDOT performs for other agencies (2%), and bond sales to private investors (34%).



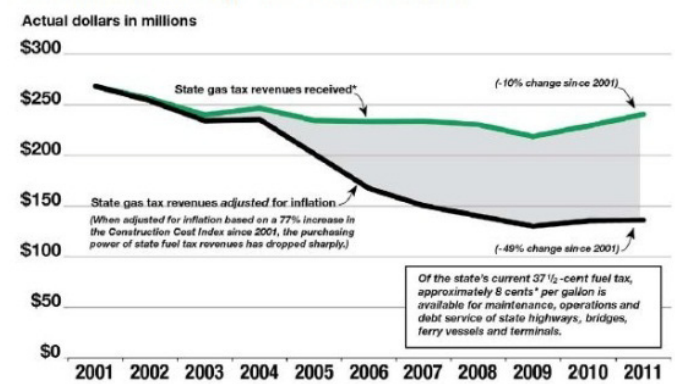
I-90 Construction; Courtesy: WSDOT

Counties derive their transportation funding primarily from state distribution of gas taxes and local property taxes, supplemented by state and federal grants. While the gas tax has risen through the Nickel and TPA taxes, cities and counties only saw one-half cent of additional funding from these increases in 2007 and 2008, and this has been more than negated by the decrease in gas consumption. Another third of county road funding comes from property taxes, which are limited by state law and voter-passed initiatives. However, state regulations also permit taxes that have been collected for roads to be diverted or shifted to a county's general fund. As counties struggle with falling revenues, they

have been relying more and more on shifts and diversions of money that is supposed to be used for roads, climbing from \$30 million in 2007 to \$51 million in 2010.

Road construction spending in Washington state has peaked during 2011-2013 due to funding from the Nickel and TPA taxes as well as the federal stimulus ARRA in 2009. As this construction peak is reached, the need for future funding has been growing without any future funding sources identified. Conservative road infrastructure need estimates total \$134 billion over the next twenty years for the entire system. Additionally, the bulk of this present funding peak is going to megaprojects to increase capacity and not to maintain existing infrastructure. As a result of the previous two tax votes, almost 50% of gas taxes at present go to paying off bonds for projects under construction or complete.

Gas tax revenue buys less than it used to

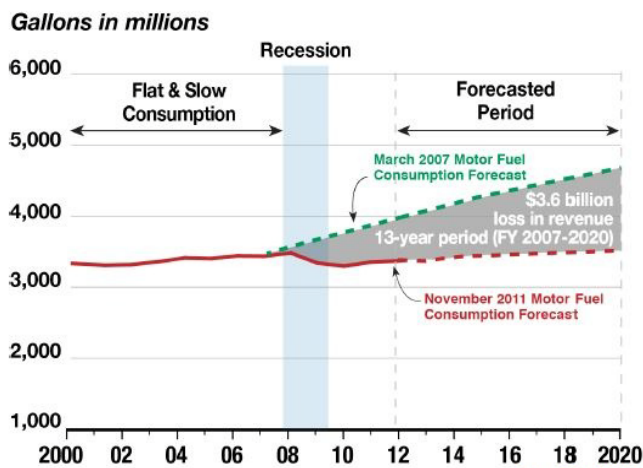


* Includes maintenance, preservation, safety improvements, and other department operations.
 ** Less Debt Service.

Source: WSDOT, 2012

The remaining funding for construction is dropping in value because of two concurrent trends—inflation in the cost of construction and reduced gas consumption from improved fuel economy and use of alternative fuels, which will lead to reduced gas tax revenue. The recent economic recession, combined with increased competition among contractors has led to a decline in some construction costs over the last two years but inflationary pressure on construction materials, labor, and equipment over the last decade has substantially exceeded this. WSDOT estimated that inflation caused a 49% decrease in effective funding from 2001 to 2011, as shown above.

Gross fuel consumption - forecast has gone down



Source: WSDOT, 2012

At the same time, gas tax collections are starting to drop as the state's automobile fleet gets younger and more efficient. Revised fuel consumption estimates by WSDOT suggest a lost of \$3.6 billion from 2007 to 2020 (based on changing fuel consumption rates between 2007 and 2011), as shown at left. The recent adoption of higher fuel standards by the federal government and automakers may drive these revenues down even further.

Washington's local and state agencies have been taking measurable steps to make the state's roadways safer and more resilient to natural disasters. However, renewed design, enforcement, and policy steps are required to continue safer momentum to reach a goal of zero traffic fatalities.

Operation and Maintenance



Rockfall on North Cascades Highway; Courtesy: WSDOT

Maintenance and operation of the state's roadways includes preservation not only of the roadway surface but all of the auxiliary services that enable the roadway to function—systems such as traffic signals, stripes, culverts, mowing, illumination, and snow removal. Without this preservation, the massive investment in constructing roads would swiftly deteriorate. As local and state budgets are stretched further, these services are being cut back and the condition of the roadway system *is* starting to deteriorate.

Pavement backlog is a measure of the portion of the roadway system that requires repavement or patching in order to maintain structural integrity. WSDOT's annual pavement backlog reporting through the *Grey Notebook*

has projected a pavement backlog of more than 1,600 lane-miles (almost 15% of the state highway network) in need of repaving, an increase of 11% over 2010. Counties have

similar pavement backlogs costing \$10-15 million annually while the yearly county paving has dropped 32% from 2005 to 2012.

Fueling this rise in paving backlog, WSDOT has projected a \$1.4 billion reduction in pavement preservation funding from 2000 to 2018. The overall maintenance backlog (including other services) had reached \$68 million in 2011. According to the Association of Washington Cities' *State of the Cities* survey, 8-12% of municipalities also lack the resources to make needed repairs and maintenance to city arterials and local streets. These funding shortfalls are forcing road-owning agencies to get creative with their dollars. WSDOT is in the process of converting 2,300 lane miles from higher quality asphalt-cement concrete to chip seal to save maintenance costs. The City of Auburn lowered speed limits and added truck weight limits in June 2012 on local streets due to a lack of road maintenance funding; a maintenance bond for Auburn was rejected by local voters prior to the move. Because maintenance and operations efforts have been scaled back and receive less funding across all jurisdictions, system conditions are deteriorating and the trend appears to be worsening.

Infrastructure Resilience:

Washington State's roads are already vulnerable to natural events—forest fires, rockfall, landslides, and avalanches. There are continued risks of rockfall on major corridors due to a lack of mitigation funding, although WSDOT has been more successful at reducing the impacts from avalanches in the Cascade highways and has also been recognized nationally for taking proactive steps to evaluate and reduce the risks that climate change will place on its road network.

Public Safety

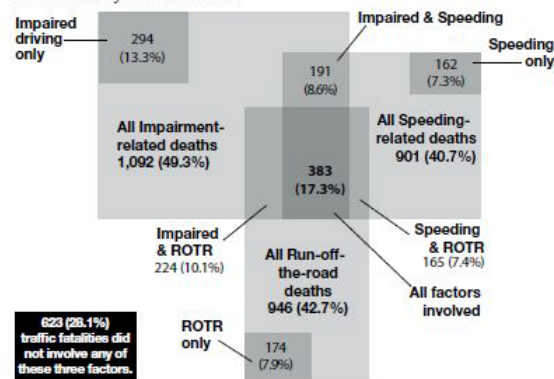
Washington state adopted the Target Zero program in 2000 with the goal of reducing fatalities and serious injuries from driving to zero by 2030. This ambitious goal requires an average reduction of at least 23 deaths and 130 serious injuries every year. Great strides have been made in fatality reduction, with the eventual goal of zero fatalities in 2030 a definite possibility. However, some of this drop in fatalities can be attributed to reduced driving due to high gas prices and the recent economic downturn; it remains to be seen if the reduction is sustainable over the long-term.

Three factors—alcohol-impaired driving, high speed, and run-off-the-road—played a role in almost three-quarters of all traffic fatalities from 2006 to 2009, as shown at left. Infrastructure design must go hand-in-hand with education and enforcement, but for purposes of this report card, infrastructure generally only plays a role in run-off-the-road and intersection (not broken out at left) fatalities. According to the National Highway Traffic Safety Administration, total fatalities and run-off-the-road fatalities decreased in Washington state at a rate faster than the Target Zero goals from 2006 to 2011; total fatalities dropped 28% and run-off-the-road fatalities dropped by 36%. Per-capita vehicle-miles driven have dropped 5% in that same time span, due to the recession, and this is responsible for some of the drop in fatalities. Improvements to infrastructure, vehicle safety systems, and emergency response can be credited for a large portion of the drop as well.

However, intersection fatalities are dropping at a far slower rate, from 120 in 2006 to 102 in 2011; they amounted to roughly half the total of speeding fatalities. Intersection-related fatalities can be caused by impaired or high speed driving or infrastructure design. This variety of causes makes finding a solution complicated, but the inter-agency cooperation through Washington’s Target Zero program helps to overcome this obstacle. Recent research

The role of impairment, speed, and run-off-the-road in traffic fatalities, 2006-2009

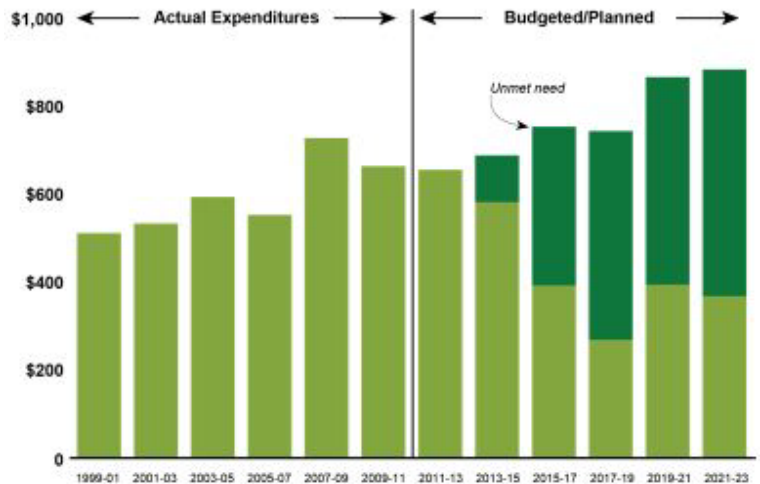
Data derived from 2,216 total traffic fatalities; 71.9%, or 1,593 deaths, involved driver impairment, speeding, run-off-the-road (ROTR), or a combination of these behaviors.



Data source: Fatal Accident Reporting System (FARS) and WSDOT Statewide Travel and Collision Data Office (STCDO).

Highway Preservation

Dollars in millions



from the University of Minnesota suggests that Washington’s program is decreasing the state fatality rate faster than states without a similar program.

Unfortunately, at the local level, funding constraints are creating a block to safety improvements to keep up with the overall statewide fatality reduction. The AWC *State of the Cities 2011* survey found that a full quarter of public works departments had potentially unsafe street conditions that could not be addressed with existing resources. Rural county roads, which have the highest fatality rate of all classes of roads, have no dedicated source of funding for safety improvements, and the bleak outlook for county road funding suggests there will not be substantial gains at this level.

Washington’s local and state agencies have been taking important steps to make the state’s roadways safer and more

resilient to natural disasters, but further steps will need to be taken to ensure they can maintain their current momentum.

Recommendations

In order to raise the grade of Washington's roads, reliable funding and more innovative use of that funding are both required. The need for sustainable infrastructure is readily apparent but at the same time, the present political climate does not lend itself to large increases in public debt or taxation, so local and state agencies should continue to improve the methods they use for infrastructure delivery and maintenance in a high-quality and cost-efficient manner. The following list of recommendations have all either been rolled out in other states and countries or is being investigated; the ideal combination is one that involves several of the recommendations to fairly balance impacts to all road users.

1. **Consider more use of innovative project financing:** New financing methods allow for the private sector (contractors, designers, financiers) to be more integrated into a traditional construction project. Examples of this process include *design-build* (the designers and contractors team together on a project) and *design-build-operate* (the project team has maintenance and operations obligations after the project is completed). There is substantial evidence that these types of projects can reduce cost and impacts to the public when contracts are carefully managed and transparent and team selection is based on qualifications.
2. **Improve efficiency of road maintenance:** Road maintenance has traditionally been in the realm of public works agencies in the United States, but has been successfully contracted out to the private sector in other countries. WSDOT evaluated contracting maintenance in 2005, but did not implement it. The issues raised in 2005 could be mitigated through attracting managers and contractors familiar with this business model. If maintenance contracting were to be implemented on a larger scale, such expertise could be drawn to Washington on both sides of the table.
3. **Increase use of the state infrastructure bank:** State infrastructure banks are government-owned banks that lend to agencies for infrastructure projects. The FHWA estimated that state banks could leverage almost \$4 of private investment for every \$1 in taxpayer investment. Washington established an infrastructure bank in 1997 but it is less utilized (\$8.7 million from 1997 to 2012) than the leading states—South Carolina (\$2.8 billion), California (\$2.1 billion), and Florida (\$1.2 billion). Increased use of Washington's infrastructure bank could substantially increase infrastructure improvement funding with a smaller taxpayer contribution.
4. **Broaden infrastructure funding with innovative and dedicated revenue sources:**
 - **Index state gas tax to inflation:** Inflation continually causes construction costs to increase so existing taxes gradually lose their value over time. Automatically indexing existing taxes to inflation would cause them to retain their intended value without any political interference.



Road maintenance; Courtesy: WSDOT

- **Increase user fees for specific road user groups:** User fees are a good means by which to match impact with mitigation. Road users with a disproportionate impact on the state's infrastructure include vehicles with studded tires, trailers, and large commercial trucks. Such users already pay user fees but these are not proportionate to their impacts on pavement.
 - **Increase use of tolled roadways:** Toll roads and HOT lanes are a form of user fees that are already in use in Washington state. In the past, tolling has generated controversy for being repurposed for other uses and further tolling implementation will require careful thought and education as to how it is used.
 - **Implement congestion pricing cordon in major urban areas:** Congestion pricing cordons around Washington's urban areas could serve to spread out the impacts of tolling and reduce congestion. This idea has been researched on a large scale previously in Seattle (1995 and 2008) and did not have widespread public support, but may become more viable in the longer term (20+ years).
5. **Investigate wider use of road safety audits:** Road safety audits are formal reviews of construction projects and existing roadways by panels of safety experts independent from either the contractor or owning agency. These audits are commonly used abroad in the United Kingdom, Australia, and New Zealand to make objective and proactive investigations. While Washington is moving toward a goal of zero traffic fatalities in 2030, it will take extra effort like audits to reach it.
6. **Implement road-usage charging (RUC):** As a replacement for the present gas tax, road-use charging would be levied based on how far a motorist travels as opposed to how much gas is required to travel that distance. This new usage charge would counteract the present trend of declining revenues as the motor vehicle fleet becomes more fuel efficient. Both Oregon and Washington are studying mileage-based revenue collection systems and have determined that it is a viable and sustainable approach to long-term infrastructure funding.

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Courtesy: Bellevue School District

Schools

Washington has an estimated 2,050 school facilities with capacity for 1.2 million students. Some school facilities are over capacity and some under, but by 2018, 56 districts are anticipated to be under capacity by about 50,000 students. The Office of Superintendent of Public Instruction (OSPI) is charged with overseeing public kindergarten through 12th grade education facilities. Over the past 20 years, Washington state has contributed a total of approximately \$3.9 billion to help fund 1,315 school construction and renovation projects. For school facilities, OSPI administers the K-12 Capital Budget and School Construction Assistance Program (SCAP). This program assists local school districts with their school facilities and provides assistance for three categories of projects: new construction, modernization, and new in-lieu of modernization (replacement). During the last decade, districts who attempt to raise capital for school facilities locally have faced a 50% failure rate with voters. The state recently started developing a comprehensive statewide database for collecting and reporting information about K-12 facilities.



Capacity

Washington state has approximately 2,050 school facilities covering approximately 14,000,000 square feet as well as approximately 4,000 portables. These facilities house approximately 1.03 million public school students. Four size categories were created using the following working definitions of district size:

Table 1 - Summary of Districts by District Size Category, 2011

District Size Category	Number of Districts	2011 Total Enrollment	Percent of Total Enrollment
Large	30	566,583	54.6%
Medium	119	422,704	40.7%
Small	104	46,776	4.5%
Very Small	42	2,120	0.2%
<i>Total</i>	<i>295</i>	<i>1,038,183</i>	<i>100%</i>

Source: OSPI, Enrollment 2011.

- Large: Enrollment greater than 10,000.
- Medium: Enrollment greater than 1,000 but less than 10,000.
- Small: Enrollment greater than 100 but less than 1,000.
- Very Small: Enrollment less than 100.

Table 1 summarizes the number of districts in Washington that fall into each district size category. Approximately half the student enrollment is contained in only 30 districts. Most of these large districts are centered around the urban regions of the state. Figure 2 summarizes the actual and projected student enrollment for the state from 2004 to 2018. Actual student enrollment is shown from 2004 to 2012, while enrollment projections are shown from 2013 to 2018. Enrollment has steadily increased approximately 0.5% per year from 2004 to 2012 while enrollment is projected to grow approximately 1% per year from 2012 to 2018.

There is an overall capacity for 1,279,997 students based on existing facilities capacity assumptions made by OSPI. This would indicate that there is enough capacity for current and future enrollments. However, looking at school district enrollment figures in more detail, some districts are shown being over capacity while some are under capacity. Looking at district-wide data, 36 districts were under capacity by about 16,500 students in 2011, and 56 district would be under capacity by about 50,000 student in 2018. Overall, this represents a 1.5% shortage of capacity in 2011 and 4.5% in 2018.

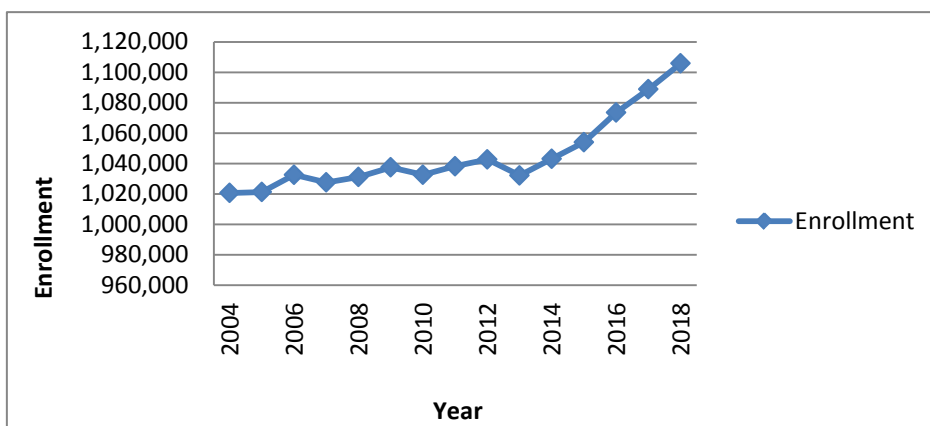


Figure 1. Actual and Projected Washington state School Enrollment, 2004–2018.
Source: Actual Enrollment OSPI, Projected Enrollment OSPI Report 1049.

A true measure of overcrowding, however, is difficult to ascertain unless you look at each district’s individual Facilities Master Plan and their Six-Year Capital Facilities Plan, which is required by the Washington state Growth Management Act. Many school districts show a lower facility capacity because they based their capacity calculation on various district guidelines such as number of students per classroom, type of facility or

reduced state funding. Also, districts have been using portables as permanent classrooms for years, which OSPI does not count. Future capacity also does not reflect any new or replaced facilities. Many school districts show a lower facility capacity because they based their capacity calculation on various district guidelines such as; number of students per classroom or the type of facility.

Condition

The state currently lacks a comprehensive statewide database for collecting and reporting information about K-12 facilities. Currently, OSPI requires school districts to fill out a “Building Condition Evaluation Form” as part of a report for districts applying for state funds. However, this data is limited to districts that apply for state funding. About 40% (118) of the state’s 205 school districts have submitted this type of data to OSPI in the past 6 years. The data is submitted on paper or compact disc, meaning they cannot be analyzed across districts.

The state legislature has an interest in K-12 facilities because the legislature appropriates state assistance funds for school construction and wanted to compare districts across the state. In 2008, a pilot project was developed using several school districts of varying size, location, and fiscal capacity to establish the Inventory and Condition of Schools (ICOS) web-based system in 2012 where inventory details about the facilities operated by districts and current condition of those facilities will be documented and stored. This system will be populated whenever school districts apply for state funding assistance so it is estimated that it will take approximately 6 years to complete the database.

Due to the fact that OSPI does not currently have a central database of all school facilities and that there are a large number of school facilities in the state, only certain large, medium, and small districts were rated. Based on the criteria, data from 30 school districts in 11 counties representing approximately 570,000 students were requested. These represent approximately 50% of total student population of Washington.

For this report, existing school facility condition information was obtained from the most recent reports submitted by school districts to the offices of OSPI Facilities & Organization. It should be noted that some of these reports are more than 6 years old. The Building Condition Evaluation Form (BCEF) in the reports was used to review the condition of each facility which evaluates the condition of the building exterior and interior, mechanical systems, safety and building code systems, and provisions for the disabled at each school building. A composite BCEF score between 0 and 100 is computed for each school. Additionally, a BCEF suitability code is also determined for each school. These codes are defined as follows:

Washington state's share of Capital Outlay for School Construction ranked the state 26th in the country and 11th for per student spending, (2005–2008).

- 4 = Building makes positive contribution to education environment
- 3 = Building is suitable
- 2 = Current use of space is compatible with intended use but needs remodeling
- 1 = Current use of space is not compatible with intended use or design

A facility should be considered for replacement or significant modernization when it has a BCEF suitability code of 1 or 2. Based on the school districts data analyzed, the average composite BCEF score was 73 with an average BCEF Suitability of 3.4. This would indicate that on average the facilities are in good condition and the building is suitable for the use intended.

Funding

Over the past 20 years, the state has contributed a total of approximately \$3.9 billion to help fund 1,315 school construction and renovation projects. During the 2011 to 2012 biennium the state released \$514 million in new funds for the state match for school construction projects. Since 1999, the state has been able to provide construction assistance for all eligible projects that have been submitted for funding.

Funding for K-12 school construction comes from a variety of federal, state, and local revenues.

- Federal: mineral and impact aid
- State: trust land revenue, trust land transfer program, education savings account, education construction account, common school permanent account interest, state general obligation bonds, and general fund excess reserve
- Local: school district general obligation bonds, capital levies, impact and mitigation fees, reserve, and other miscellaneous revenue

State financial assistance through SCAP is available for new construction projects or additions needed to accommodate enrollment growth, and for modernization projects that upgrade existing buildings to new educational standards or building codes. State funding assistance is limited by formula and the costs recognized within that

formula. The formula establishes the maximum amount of state funding based on enrollment projections, space, and cost allocations set by the legislature, and the state funding assistance percentage. Here is the formula to calculate the maximum allowable state funding assistance:



Eligible Area - The eligible area for new construction projects is calculated by comparing the current district-wide capacity (in square feet) to the district’s project enrollment growth (projected number of students in either the next 3 or 5 years) and future space needs (based on a square feet allowance). For modernization projects, instead of current capacity the square footage of “Improved Space” is deducted. The allowance is only used for purposes of determining eligibility for state assistance and does not necessarily reflect the true need for education space as determined by school districts. Construction of space that is ineligible for or in excess of these state allocations is entirely funded with local funds.

Table 2 shows national and regional space data comparing Washington square feet per student and recent Washington school bids. There has been very little change in nationally recorded space need over the decade. However, Washington square feet per student rate is still falling short of the national average.

Table 2 - Medians of Square Feet per Student in New Schools Currently Underway^{1,2}

Medians	2001	2003	2005	2007	2009	2009 WA Compared to National
Kindergarten-Grade 6						
National	111.6 ft ²	114.4 ft ²	120.0 ft ²	122.2 ft ²	115.4 ft ²	
Mountain West	108.3 ft ²	117.8 ft ²	100.0 ft ²	113.3 ft ²	104.4 ft ²	
Northwest	108.4 ft ²	111.8 ft ²	151.7 ft ²	107.4 ft ²	118.0 ft ²	
<i>Washington – SSA</i>					90.0 ft ²	-22.0%
<i>Washington – Median of Recent Bids</i>					125.0 ft ²	8.3%
Grades 7-8						
National	142.5 ft ²	136.7 ft ²	143.8 ft ²	143.8 ft ²	136.0 ft ²	
Mountain West ³	139.5 ft ²	130.9 ft ²	106.0 ft ²	135.0 ft ²	134.7 ft ²	
Northwest	130.4 ft ²	114.0 ft ²	115.1 ft ²	150.0 ft ²	138.8 ft ²	
<i>Washington – SSA</i>					117.0 ft ²	-14.0%
<i>Washington – Median of Recent Bids</i>					129.0 ft ²	-5.2%
Grades 9-12						
National	164.4 ft ²	154.2 ft ²	167.0 ft ²	166.7 ft ²	155.0 ft ²	
Mountain West	103.0 ft ²	207.5 ft ²	222.2 ft ²	216.7 ft ²	163.8 ft ²	
Northwest	200.0 ft ²	146.4 ft ²	150.4 ft ²	210.0 ft ²	161.3 ft ²	
<i>Washington – SSA</i>					130.0 ft ²	-16.1%
<i>Washington – Median of Recent Bids</i>					151.0 ft ²	-2.6%

1 Mountain West states include CO, MT, ND, NM, SD, UT, and WY and are reported as “Region 10.”

2 Northwest states include AK, ID, OR, and WA and are reported as “Region 12.”

3 Grades 7-8 Mountain West data are from 2000; 2001 was unavailable in the report.

Source: OSPI Analysis of the School Construction Assistance Program Formula Allocation, September 2009

Construction Cost Allocation - Construction Cost Allocation (CCA) is the maximum construction cost per square foot set by the state and used to determine the level of state funding assistance. OSPI submits requests to the legislature every biennium for periodic increases in the CCA to keep pace with inflation, but does not necessarily reflect the true cost of construction. For the latest biennium, 2011 to 2012, the CCA was set at \$188 per square foot. State assistance in modernization of school facilities is limited to projects for which the estimated cost of construction is 40% or more of the estimated cost of replacement, represented by the CCA. Districts need to provide actual construction bids to receive funding.

Table 3 shows the CCA and actual average costs for new construction and modernization from 2002 to 2011. As the table shows, average costs for new construction have steadily increased from \$153 per square foot in 2002 to 2003, to \$271 per square foot in 2011 to 2012, a 77% increase in the 10-year period. Modernization costs have increased from \$98 per square foot to \$214 per square foot over the same period, a \$118 increase. In contrast, the CCA has been increased from \$110 to \$188, a 71% increase; this is just enough to maintain the existing cost gap difference since 2002.

Table 3 - Construction Cost Allowance and Actual Cost for New Construction and Modernization, 2002-2008

Fiscal Year	OSPI Construction Cost Allowance	Average Cost: New Construction	Difference in New Construction Costs	Average Cost: Modernization	Difference in Modernization Construction Costs
2014-15 ¹	\$200	-	-	-	-
2013-14 ¹	\$194	-	-	-	-
2012-13	\$188.55	-	-	-	-
2011-12 ²	\$188.55	\$271	30%	\$214	12%
2010-11 ²	\$180.17	\$247	27%	\$192	6%
2009-10 ²	\$174.26	\$221	21%	\$208	16%
2008-09 ³	\$168.79	\$215	22%	\$213	21%
2007-08 ³	\$162.43	\$240	33%	\$175	7%
2006-07 ³	\$154.22	\$262	41%	\$164	6%
2005-06 ³	\$141.95	\$205	31%	\$146	3%
2004-05 ³	\$129.98	\$184	29%	\$131	1%
2003-04 ³	\$125.32	\$172	27%	\$118	-6%
2002-03 ³	\$110.32	\$153	28%	\$98	-12%

¹ Source: 2013–2015 Capital Budget Request and 2013–2015 Capital Plan, October 2012.

² Source: OSPI Summary of New Construction Projects Bid.

³ Source: OSPI K-12 School Construction Funding Formula Transparency Study, December 2009.

Funding Assistance Percentage - The state applies a funding assistance percentage to equalize state funding. The percentage accounts for differences across school districts in wealth and ability to generate revenues through property taxes. Wealthier districts receive a 20% match ratio while poorer districts may receive almost 100%, but the goal is to provide, on average, a 50% match ratio statewide.

Overall, Washington state school districts are holding the line in modernizing and building new school facilities. Facilities are in relatively good condition with minor overcrowding in some locations. Due to the recent recession and state budget cuts, additional funding sources for school construction are not likely. Specifically, the effects of a recent ruling by the Washington Supreme Court on the “McCleary vs. State” case will affect future funding for school facilities. The ruling stated that the “state has not complied with Article IX, Section 1 of the Washington state Constitution which states, “It is the paramount duty of the state to make ample provision for the education of all children within its borders, without distinction or preference on account of race, color, caste, or sex.” The court did not mandate specific remedy, deferring that to the state legislature. It has found the state has failed to provide school district with a level of resources that falls short of the actual costs of basic education program including: transportation, materials and supplies, operating costs, all day kindergarten, reduced class size, teachers’ salaries, and increased instructional time. The state’s plan to fully implement education reforms is required to be implemented by 2018. A Legislative Joint Task Force on Education Finance report issued in December 2012 detailed an eventual cost of about \$4.5 billion dollars per biennium in additional funding needed to meet the courts requirement.

Local Funding

The cost of constructing or remodeling school buildings or acquiring certain other school property is accounted for in the school district’s Capital Projects Fund (CPF). If the school district sells bonds (usually general obligation bonds) to finance school construction or remodeling, the bond proceeds are deposited in the school district’s CPF. Property taxes collected for payment of principal (which is often 20 to 30 years in length) and any interest earned on the bonds is deposited in the school district’s Debt Service Fund. The statutory limit for school district voted and non-voted debt is 5%, which includes a 0.375% limit without a vote and 2.5% limit with a vote. The district may submit two bond elections to the voters per calendar year in the event the first doesn’t pass. School bond measures require a supermajority of 60% of voters approving to pass. The district may construct any facilities it desires without OSPI’s approval or state funding assistance whenever local funds are available or when they don’t qualify for state funding assistance.

The bond passage rates vary significantly over time with no obvious short- or long-term trends. Table 4 presents a summary of school district bond measures submitted for voter approval from 2002 to 2012 and bond failure percentage for those years. Average bond failure is around 50% during the last decade.

Table 4 - School Construction Bonds, 2002-2012

Year	Total State School Construction Bond	Total Bonds ¹	Bonds Amount Passed	Bonds Passed	Bonds Amount Failed	Bonds Failed	Percent Failed
2011	\$1,174,399,702	27	\$91,490,000	5	\$1,082,909,702	23	85%
2010	\$1,044,155,000	17	\$544,995,000	9	\$499,160,000	8	47%
2009	\$1,849,772,588	25	\$600,896,550	13	\$1,248,876,038	14	56%
2008	\$2,867,727,845	26	\$1,002,122,000	8	\$1,865,605,845	21	81%
2007	\$2,923,470,735	39	\$1,066,782,891	20	\$1,856,687,844	24	62%
2006	\$4,372,582,484	48	\$2,548,648,970	27	\$1,823,933,514	25	52%
2005	\$1,024,713,425	28	\$355,215,839	16	\$669,497,586	14	50%
2004	\$945,646,443	31	\$474,388,785	13	\$471,257,658	19	61%
2003	\$1,936,877,839	44	\$867,987,062	24	\$1,068,890,777	23	53%
2002	\$1,946,895,050	34	\$1,006,632,066	16	\$940,262,984	20	58%
2001	\$1,570,537,064	33	\$971,542,500	17	\$598,994,564	16	48%

¹ Districts submitting multiple bond issues may be shown here both as success and failures.

Source: OSPI School District Property Tax Levies, Report 1463-BI

Operation and Maintenance

Facility operations and maintenance is the continuous process required to maintain a facility and its campus over the course of its useful life. These services include daily cleaning, routine maintenance, inspections, and preventive and emergent maintenance of major building systems (i.e., heating, ventilation and air conditioning, electrical, plumbing, etc.). The goals of facility maintenance and operations are to:

- Maintain a safe and healthy learning and work environment for students and staff
- Maximize building efficiency
- Protect the state's and local district's capital investments

In Washington state, there is no separate funding mechanism for the maintenance and operations of school district facilities. The funds spent on these activities are determined in each individual district through their own budget process based on the perceived needs and priorities of those districts. The main sources of funds are the state apportionment and local levy funds. Unfortunately, when the facility needs are in competition with educational priorities in the budget process, difficult choices are made, and the facilities suffer. However, the condition of a school has a direct effect on student achievement and teacher performance. Studies have documented the effects of factors such as air quality, lighting, and noise, as well as the condition that furniture and lockers have on student achievement. Well-maintained buildings can bolster students' comfort, concentration, and success.

At the 2008–2009 funding levels, the general apportionment allocation for facilities operation and maintenance covered 60% of total maintenance expenditures, and districts paid for the remaining 40% with local funds. Even at these enhanced spending levels, evidence suggests that districts are not able to make sufficient investment in preventive maintenance. In a January 2009, the OSPI conducted a survey of districts to identify the outstanding need for school repairs. One hundred and seventy-nine districts identified a need for school repairs totaling \$1.8 billion. A 2011 OSPI School Facilities Needs Assessment Survey of 196 districts identified a need of \$2.2 billion. Major needs included electrical, exterior system, heating, ventilation, and air conditioning (HVAC)/boiler, roofing, structural, lighting, and mechanical/equipment.

Public Safety/Resilience

Because Washington state has no comprehensive assessment for school facilities and only 15% of Washington school districts have disaster mitigation plans, OSPI has initiated a 2-year Pre-Disaster Mitigation project funded by a grant in March 2012 from the Federal Emergency Management Agency. This project will identify the risks from natural hazards to students, teachers, and school facilities, and develop a statewide hazard mitigation plan for Washington state K–12 facilities. This pilot project will only include 25 to 35 volunteer school districts. The analysis and final plan will increase the understanding of the risks to school facilities from nine natural disasters (wind storm, earthquake, tsunami, flood, forest fire, drought, volcano, landslide, and snow).

Recommendations

1. OSPI School Facilities and Organization should work on completing the new ICOS database for all districts as soon as possible.
2. Increase the allowable square footage per student based on educational needs.

3. OSPI should commission a study to determine the average square foot space needs for all spaces by grade span, which would define the student square foot space allocation. This base standard should include recent policy and educational requirements (e.g., all-day kindergarten, expanded science labs).
4. Increase the Construction Cost Allocation to be based on the true costs of construction.
5. OSPI should commission a study to determine the appropriate level of the construction cost allocation and to establish an appropriate methodology for adjusting the construction cost allocation over time.
6. Complete the Pre-Disaster Mitigation project for all school districts in the state.

Resources

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Solid and Hazardous Waste

Over 16 million tons of waste was generated in Washington by citizens, industry, and manufacturing in 2010. Impressively, only 44% of this waste was disposed at landfills and the remaining waste was combusted in incinerators, composted, recycled, or otherwise diverted through reuse or recycling of construction debris. Municipal Solid Waste (MSW), or garbage, is the largest portion of the total waste generated in Washington but does not include industrial waste, inert debris, or contaminated soils. Hazardous waste in the form of household hazardous waste (HHW), industrial hazardous waste, and waste from toxics cleanup sites are also a key component of the waste management system in the state. Although Washington's diverted waste stream is nearing 50%, significant shortfalls with collection of household hazardous waste and funding for collection and outreach programs, result in an overall grade for Solid and Hazardous Waste of C.



Overview

Recycling rates, also called the MSW recycling rate, is the percent of waste generated in homes and businesses that is collected for repurposing. The recycling rate has climbed steadily since tracking began in 1986, and in 2010, the rate was 49%. Organic materials are the largest component of MSW (See Figure 1). Efforts continue to be implemented by Washington State Department of Ecology (Ecology), counties, and municipalities in Washington to reduce the amount of waste that ends up in a landfill using recycling to recover useful materials and composting to collect organic waste and turn it into a useful product. Source reduction through product design has been identified as a goal by the state, but is not yet being implemented on a large scale.

Household hazardous wastes are products that contain ingredients that are toxic, flammable, reactive, or corrosive; such as car batteries, oil-based paint, fluorescent lights, and some electronics. These household hazardous wastes are not allowed in MSW landfills, but many landfills have drop locations for these wastes.

Solid and hazardous waste infrastructure in Washington includes landfills, transfer stations, drop-off locations, curbside collection vehicles, and long-haul transportation systems. With the exception of recyclables and compost, waste is typically picked up from homes at curbside locations and unloaded from collection trucks or transported in household vehicles to local transfer stations. Recyclables and compost is usually transported directly from curbside pick up to processing facilities. From transfer stations, waste is transported to landfills via truck and rail; however, this report card focuses mainly on the final locations where waste is collected: the landfills.

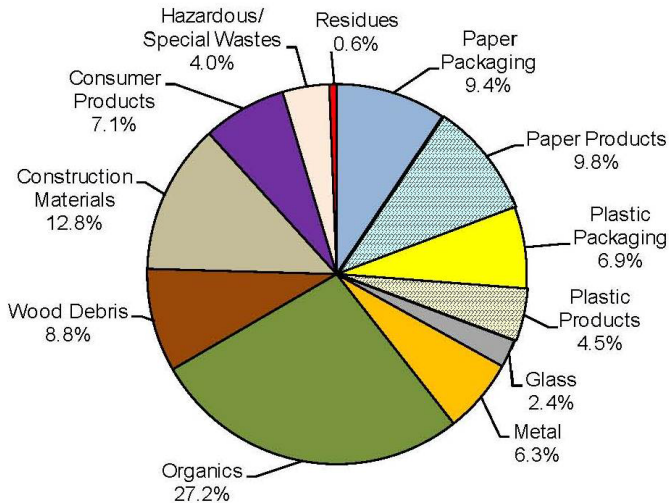


Figure 1. Overall Statewide Disposed Waste Stream Composition by Material Class, 2009. Source: Solid Waste in Washington State 20th Annual Status Report.

The intent of waste handling and landfill requirements are defined on the federal level under the Resource Conservation and Recovery Act (RCRA). RCRA broadly defines rules for disposal of non-hazardous waste under Subtitle D and for the disposal of hazardous and dangerous waste under Subtitle C. Washington state law for solid waste handling is defined in the Revised Code of Washington (RCW) 70.95.030 and includes requirements for management, storage, collection, transportation, treatment, utilization, processing, and final disposal of waste.

Modern landfills are engineered facilities that are designed and operated to meet federal, state, as well as local laws and regulations. Landfills typically have liners and other safeguards used to protect the environment from contaminants in waste. Routine monitoring is usually conducted

at landfills to ensure protection of groundwater. On-site monitoring systems monitor for landfill gas and many modern landfills capture the landfill gas and convert it to energy. Federal standards for MSW landfills include location restrictions, composite liner requirements, leachate¹ collection and removal systems, operating practices, groundwater monitoring requirements, closure and post-closure care requirements, corrective action provisions, and financial assurance. The focus on solid and hazardous waste in Washington state is on reduction, recycling and composting. This is evidenced in the *Solid Waste in Washington State 20th Annual Status Report* which states, “The importance of reducing waste and using waste as a resource—a priority for 22 years in our state—is only increasing, as are calls for policies and programs toward these ends.”

Capacity

In Washington, 8.2 million tons of waste, including MSW, contaminated soil, medical, industrial, demolition, and other wastes were disposed of in 2010, but not recycled, diverted, or composted (See Figure 2). Of the total waste disposed, approximately 4.9 million tons was disposed at landfills in Washington and the remainder was disposed at one of the three landfills used in Oregon. There are 15 active landfills in Washington accepting solid waste. There are also 26 inert landfills, 14 limited purpose landfills, and 53 composting facilities.

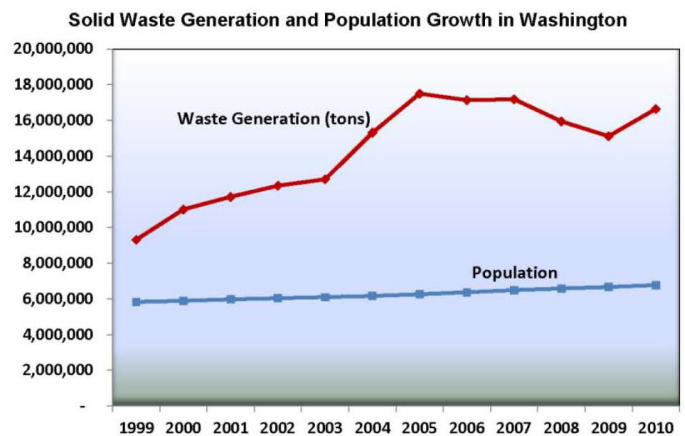


Figure 2. Solid Waste Generation and Population Growth in Washington. Source: Solid Waste in Washington State 20th Annual Status Report.

¹ Leachate is liquid that has travelled through the landfill and has levels of soluble contamination from contact with the waste in the landfill.

All landfills in Washington report closure dates to Ecology, and these closure dates are based on individual landfill capacities and the amount of waste each landfill receives every year (refer to Figure 3). The total remaining Washington landfill capacity was estimated in 2010 as 270 million tons. Assuming no annual increase in the total waste generation, these landfills have a total remaining capacity of 55 years. State goals to increase recycling and composting help reduce the amount of waste that reaches landfills, but the rising population counters this, and the quantity of waste disposed annually continues to climb. If it was assumed that there was a 0.5 million ton per year increase in the amount of waste disposed and all waste went to landfills in Washington (instead of about half going to Oregon), the landfills would be at capacity in approximately 20 years.



Figure 3. Remaining Permitted MSW Landfill Capacity as of April 2011.
Source: Solid Waste in Washington State 20th Annual Status Report.

The landfill capacity range of 20 to 55 years is likely short of the actual capacity because garbage collection, transport, and disposal are typically completed through public-private contracts; meaning that landfill selection is the responsibility of the private companies and could be out of state.

Remaining landfill capacity in the state is reliant on public-private contracts that are subject to change. This process allows open market competition but also means that waste may be transported to other states, giving uncertainty to the landfill capacity range in Washington. Washington is estimated to have 20 to 55 years of landfill capacity, which is reasonable number of years to plan and develop new landfill capacity. Additionally, given the potential for waste to be disposed in other states, the landfill capacity is considered to be conservative.

Condition

All waste generating locations must have solid waste management plans that discuss the management concepts for handling, utilization, and disposal of waste consistent with state laws. Local county health departments have landfill permitting authority. These departments review compliance reports and monitoring data for landfills, but not all counties have the time, resources, or expertise to adequately complete these reviews, which means that regulations may not always be fully enforced or enforced equally between counties. For example, some counties may be less focused on environmental effects from poorly maintained landfills.

Evaluation of the condition of waste transfer stations and drop locations in Washington was based on the condition of facilities in King County. Information from other counties was not available for review. Although just under 30% of the state population resides in King County, King County waste transfer stations and drop locations are not assumed to be representative of the state as a whole because the population density and resources available are higher than in other parts of the state, indicating better condition. For example, resources for the maintenance and repair of operating facilities in many counties are not adequate. Because of this, the grade assigned for Condition is presented as a "best case" grade for the state, based on the information available. There are 10 drop locations and transfer stations in King County that are used by waste collection services and individual citizens. King County is in the process

of updating their aging transfer stations through renovation and replacement. The replacement or renovation of four transfer stations was completed by 2011 and renovation and expansion of a fifth transfer station will be completed in 2013. A sixth transfer station is scheduled to be renovated, and two new recycling and transfer stations will be built by 2018.

Waste collection is nearly everywhere across Washington and all citizens in Washington have access to curbside pickup or drop locations. Waste collection is considered reliable and safe. Similarly, recycling collection has improved and is widely available. Recycling in commercial centers is also improving and Ecology continues to implement plans targeted at eliminating waste and using wastes as a resource. Rural areas still need investment in recycling infrastructure to support curbside pickup, drop off locations, and transfer facilities. In 2010, there were 174 cities and unincorporated county areas offering curbside collection of recyclables (38% of all Washington cities and unincorporated areas) and 136 cities and unincorporated areas offering curbside collection of yard waste (30% of all Washington cities and unincorporated areas).

Recycling markets are improving and are split between local markets and the Pacific Rim countries. Cardboard, construction debris, some paper, and glass (when it is collected) are typically recycled locally. The primary recyclables being shipped overseas before being manufactured back into new products are plastics and mixed paper. Additional markets and manufacturing capacity are needed in Washington in order to minimize the need to ship materials overseas and increase the glass recycling capabilities. Processing facilities for organic material are also insufficient. The recycling infrastructure is not consistent across the state.

Of the 15 county health departments that license and monitor landfills, annual reports were readily accessible to the public only for King County. Based on data from King County's Cedar Hills Regional Landfill, the landfill appears to be in compliance with federal, state, and local laws and codes and is in good working condition. The landfill has carefully managed incoming wastes and has extended their closure date by several years. The Cedar Hills Regional Landfill has a closure plan and closure funds set aside for future management and monitoring. Pierce County has 32 closed landfills and describes the status of the landfills in a landfill closure report. They recommend monitoring in some form at approximately 75% of their closed landfills, indicating that long-term landfill condition is a potential issue.

Funding

Ecology's Waste 2 Resources Program, whose mission is to reduce the amount and the effects of wastes generated in Washington state, had their budget cut by \$7 million for the 2012 to 2013 fiscal year. This reduction resulted in suspension, reduction, or delay of numerous state funded programs including litter collection, construction and demolition material recycling programs, organics and composting programs, electronics recycling programs, the waste to fuels program, and Waste 2 Resources staff reductions. Staff reductions impact the 1-800-RECYCLE Hotline, staff that provide outreach and information sharing with local governments, waste to fuels technology research programs, and biosolids and compost facility permitting, to name a few.

Although there has been a reduction in funding to state programs, Ecology awards Coordinated Prevention Grants to local governments every two years and in 2012 awarded more than \$18.8 million in state funds to 95 city and county government agencies. These grants are funded by a tax on wholesale distributors of petroleum and hazardous materials and are awarded to help communities manage solid and household hazardous wastes, prevent illegal dumping, and promote recycling and composting programs. Ecology estimates the 2011 to 2013 grant funding will support 393 jobs in Washington state.

State funding is provided to local counties and cities for waste reduction and recycling programs. However, as discussed in the Condition section above, funding for maintenance and repair of operating facilities is insufficient for the maintenance and upkeep of existing facilities in many communities. As recycling and waste redirection activities increase, the tonnage of material entering landfills is reduced, resulting in reduced profitability of the

landfills. This may cause even greater funding shortfalls for facility maintenance and upkeep in the future at landfills. This may be offset by the revenues and profitability that collectors and local governments incur on recyclables and composting. Because of the funding shortfalls for state program development, landfill operation, maintenance, and repair, and the budget reductions, funding is a concern.

Operation and Maintenance

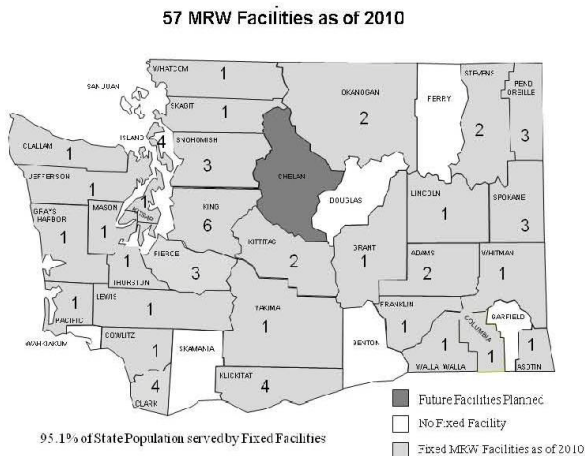


Figure 4. Number of Fixed MRW Facilities by County. Source: Solid Waste in Washington State 20th Annual Status Report.

participant is increased due to the size of the programs. For example, in 2010, household hazardous waste programs in King and Pierce Counties cost between \$40 and 62 per participant, while HHW programs in Clallam and Kittitas Counties cost between \$143 and 160 per participant. These funding challenges are resulting in reduced operations in smaller counties. There are still 5 counties in the state with no fixed facility for collection of moderate-risk waste (MRW) which includes household hazardous waste, and waste from conditionally exempt small-quantity generators (see Figure 4).

To evaluate O&M, the status of regulatory oversight and law enforcement for solid waste landfills was reviewed. Comments received from the solid waste community and stakeholders in 2011 to inform potential regulation changes identified the following issues that relate to landfill operations and maintenance: 1) enforcement authority in the law is lacking; 2) local governments need clear authority and statutory avenues for many solid waste enforcement issues, including landfill operations and moderate risk waste collection facilities; and 3) the authority of local governments to enforce on many solid waste issues is not provided for under the current law, including enforcement on a facility not meeting regulatory requirements. Current regulations surrounding Waste Incinerator and Landfill Operators and current training was inadequate, and requirements for all operators to be certified were burdensome, expensive, and not necessary. Development of guidelines and training programs for permit authorities of landfills was suggested as

There are both public and privately owned landfills operating in Washington state. Operation and Maintenance (O&M) issues at public landfills appear to be focused around funding shortfalls. With decreases in revenue, publically managed landfills are responding by reducing hours of operation and reducing or discontinuing collection events and programming. This has included eliminating household hazardous waste collection and electronics collection. Smaller counties appear to be impacted operationally by funding shortfalls, as the cost per

Where Does Rural Washington's Household Hazardous Waste Go?

In June 2010, the only Benton County HHW Facility in Richland was destroyed by fire. The facility provided all Benton County residents and small businesses a place to safely and legally dispose of HHW. In addition, HHW collected in Kennewick and at solid waste drop-off sites in Prosser and Benton City was also transferred to the Benton County HHW to be processed. All of these sites have had to reduce what materials they can collect or completely stop collection. At this time there are not sufficient funds to rebuild and staff a new HHW collection facility. It may be a considerable length of time before a new facility will be constructed.

potential methods to provide consistency across the state.

Ongoing monitoring, as required by law, at closed landfills can be expensive for small counties. State law requires monitoring at landfills for 30-years past the closure date (Washington Administrative Code [WAC] 173-351-500). The closed Horsethief Landfill in Klickitat County costs the county over \$20,000 annually for long-term groundwater monitoring at the closed landfill. Keeping up O&M depends on available funding for publicly operated facilities and resolving the shortcomings identified in current regulation.

Safety

The primary public safety concerns with solid and hazardous waste in this evaluation was the number of unidentified and unregulated closed landfills and illegal dumping sites, and the quantity of HHW, or moderate-risk wastes (MRW) generated in the state that are not disposed of properly (See Figure 4). According to the 2010 *Solid Waste in Washington State 20th Annual Status Report*, over 29 million pounds of MRW was collected in Washington from households and conditionally exempt small quantity generators. This waste was collected from less than 206,000 households, while the state population exceeds 2.8 million households. This equates to less than 8% of households in the state participating in hazardous waste collection. This seemingly low participation percentage suggests a significant volume of MRW may be entering MSW landfills, sanitary sewers, storm drains, or illegal dumping grounds. This generates a significant risk to public safety, and there is an "obvious need for a better waste management system that captures more MRW." The current state plan recognizes that the system, as is, cannot manage all MRW with the level of resources available.

Outreach and educational programming provided by Ecology's Waste 2 Resources Program is comprehensive, and includes programs for: waste prevention, green buildings, environmentally preferable purchasing, children's safe products, recycling programs, mercury-containing lights product stewardship, composting and biosolids, litter cleanup programs, materials exchange, and school awards, to name a few. All of these programs provide an opportunity to educate the public on ways to make smarter choices for waste reduction, and proper management of waste materials. However, funding cuts have suspended or eliminated a significant number of Waste 2 Resources programs, as discussed earlier in Funding.

Grant funding provided to local governments is improving public safety by providing services to residents at the local level. These programs are able to prevent toxic exposure, reduce waste, and encourage proper management and disposal. As an example, these grant-funded projects have collected nearly 108,000 tons of hazardous waste annually for proper and safe disposal from facilities and recycling events including material from private households, large and small quantity generators in the state. Local governments are helping communities reduce disposal and burning of organic material by building regional composting facilities, setting up commercial and residential food waste collection programs, and offering yard-waste chipping options. These programs diverted nearly 370,000 tons of organic material from landfills in the past 3 years. Unfortunately, the low percentage of household hazardous waste that is properly collected and disposed of in the state, and the suspension of significant public education and assistance programs, increase concerns about safe disposal of hazardous waste.

Recommendations

1. The State of Washington should continue expanding recycling efforts and work with businesses and industry to create a stable recyclable market in Washington.
2. Washington State Department of Ecology should provide for the proper disposal of HHW by assisting smaller counties with education and drop-off locations.

3. The state should adequately fund the continued rule development for the mercury-containing lights stewardship program, the solid waste handling standards for composting, and the criteria for MSW landfills aimed at liner design.
4. Counties and municipalities should work to remove all organics from their community's waste streams through composting.
5. The state should sufficiently fund existing programming to allow for achievement of long-term planning outlined by the state's Beyond Waste Plan.
6. The state should develop guidelines and training programs for permit authorities of landfills for more consistent enforcement of landfill operations and maintenance regulations.

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Transit

Transit operations run through cities and towns across the state. Washington has more than thirty public agencies that operate in large urban areas like the Puget Sound region as well as suburban and rural areas in Eastern and Western Washington. Twenty-two of the agencies are independently-created public agencies with unique boundaries. There are five city agencies, three county agencies, and one regional agency that overlaps other agency boundaries. More than 217 million trips were taken in Washington in 2011 totaling over 161 million revenue vehicle miles. The state's growing population has increased 38% since 1990, but in many jurisdictions transit maintenance and expansion has not kept up as transit competes for scarce dollars at the state and federal level. While this burgeoning population is straining the network, Washington is doing many things right for transit. However, a lack of long-term funding puts the system's future at risk.



Capacity and Operation

Washington's transit service capacity can be measured by the number of unlinked passenger trips and revenue hours of service. Transit ridership per capita in Washington state has been higher than the national rate in recent years. While Washington was similar to the national average of trips in 2005, the statewide average of passenger trips per revenue vehicle hour in 2011 was around 34 trips as compared to a national average of 32. Statewide, the highest rates are found in the Puget Sound Region, consisting of King, Pierce, and Snohomish counties. Urban Transit systems in medium-sized cities in the state, such as Spokane Transit and Whatcom Transportation Authority, have transit ridership rates slightly below the statewide average.

The majority of the state's transit agencies are located in urban or suburban areas that suffer from traffic congestion. However, in the towns and highways outside of urban areas, there is generally excess roadway capacity to handle transit service, but not always the density to support quality service.

The amount of transit service available for riders dropped in recent years. There has been a 16% decrease in local sales tax revenue from 2007 to 2011. This local revenue, combined with fares, makes up 80% of transit revenue. The revenue shortfalls forced many transit agencies to reduce and realign service, cut staff, and delay capital purchases and projects. Total revenue vehicle hours have recently declined in Washington, despite an increase in ridership. From 2010 to 2011, total unlinked passenger trips increased by 2.4%. During that same period vehicle service hours, the amount of time transit travels or is scheduled to travel during revenue



Route 44; Courtesy: Oran Viriyincy

service, decreased by 2.3%. While the increase of unlinked passenger trips per revenue vehicle hour may be partly attributed to improved efficiency, the overall capacity of the system has reduced in recent years.

Washington and Puget Sound Region’s transit ridership and available service are strong nationally, but they fall behind many Northeastern states and peer cities in California and Oregon. These cities have robust high-capacity transit systems that include Bus Rapid Transit and Rail Transit with the capacity to move more passengers than many transit lines in Washington. Some local agencies have made strides to add higher capacity transit, including *Swift* by Community Transit and Everett Transit in Snohomish County, RapidRide by King County Metro, and LINK Light Rail by Sound Transit. Most agencies, however, have not added these types of services.

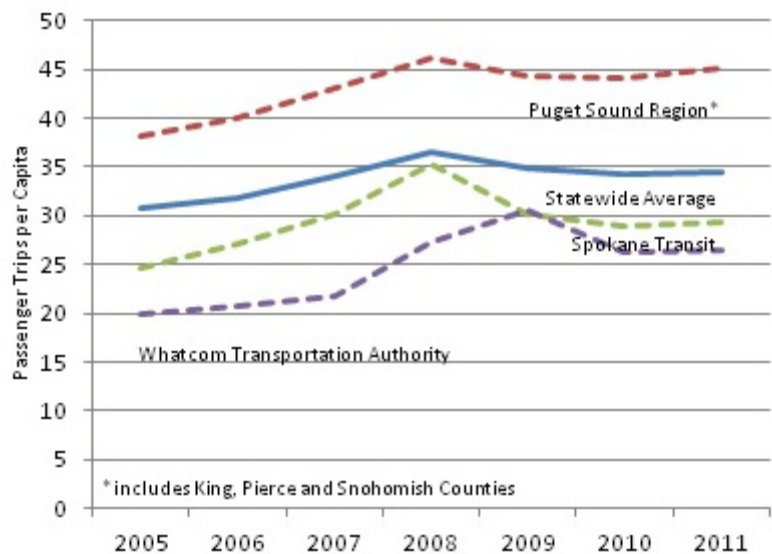


Figure 1. Transit Ridership in Washington State (2005–2011).

The overall capacity of the system has decreased in recent years despite increased demand. Washington has fallen behind on these investments due to the loss of significant state and federal funding and shortfalls in local revenue, while other states have made high-capacity transit a priority.

Condition and Maintenance

The condition of a transit system is impacted by how much transit service is provided, the maintenance that is needed, and operations. To measure the condition of transit in Washington, the average age of the fleet of vehicles and the number of mechanical failures per 1,000 miles traveled were compared against the national average. Spare ratio was the third consideration to assess condition since it represents the percent of fleet vehicles that are not in use during peak service.

HIGH CAPACITY TRANSIT:

Bus Rapid Transit, RapidRide, and Light Rail Transit have the capacity to move thousands more passengers than during a typical day than fixed route bus service. Transit services such as Swift and LINK are providing higher capacity transit service for riders in the Puget Sound Region.

Washington state buses have an average fleet age of 7 years, which is slightly better than the national average of 7.4 years. Compared against similar states, the average number of mechanical failures per 1,000 miles traveled is higher in Washington (0.13) than both Illinois (0.10) and California (0.10). Oregon (0.16) has a slightly higher rate, but it should be noted that all of the states’ failure rates are relatively similar.

A standard spare ratio for transit agencies with more than 50 buses is 20%, according to the Federal Transit Administration. But spare ratio has become more complex over time with fleet diversity with varying bus size, operational characteristics, and alternative fuels. *Bus Fleet Management* states that 25% may be a reasonable ratio but should be flexible depending on local conditions. For instance, a higher spare ratio may be legitimate if road conditions are poor due to the excess wear and tear this may cause. Washington state’s spare ratio has ranged very

close to these values. The spare ratio of Washington buses has ranged from 25 to 35% between 2001 and 2011 with no apparent trend. The spare ratio for 2011 was 33%. To improve our understanding and increase our ability to maintain and operate a quality transit system, all transit agencies should be required to develop and implement sound asset management programs and make this information publicly available. State law requires every transit agency who receives state funding to have an asset management plan and Washington State transit agencies have rigorous preventative maintenance programs that have allowed their fleets to last beyond the national average.

Safety

Washington's transit systems have historically fared well as a safe mode of transportation. There have been few to no passenger fatalities each year between 2006 and 2011. The rate of passenger injuries has dropped during that time.

Standard safety performance measures are currently instituted by local or state laws. In addition, 25 of the public transit agencies are members of the state transit insurance pool (WSTIP), which works to reduce the cost of risk by improving safety. WSTIP establishes safety metrics and best practices, provides safety training, and collects and reports on data about safety performance and incidents. Others, such as King County Metro, also have safety metrics and offer extensive safety training. MAP-21 will require a standardized safety performance program to better understand safety trends and acceptable risk utilizing this data. Ultimately this will help the nation better manage hazards in transit systems.

There is currently no statewide bus safety program, nor is transit considered in Washington's Traffic Safety Corridor program. However, many of the state's laws mirror the federal safety regulations for commercial vehicles. In addition, the Washington State Transit Training Coalition provides safety training statewide and transit agencies conduct in-house training.

Funding

Transit service in Washington state is primarily funded by local revenue (80% of revenue comes from local sales taxes and fares, 18% is federal funding, and 2% is state funding). Local sales tax rates for transit are capped at 9/10ths of 1% of sales tax. The local taxing districts are determined by the boundaries of the transit authority, of which eight are part of city or county governments. Sound Transit is the state's only Regional Transit Investment District. Current state law allows Transportation Benefit Districts to levy a 9/10th of 1% sales tax and up to a \$100 car tab fee by approval of a majority of voters within the taxing district. Much of this funding goes towards roads maintenance and projects. Sales tax has been a volatile funding source and has seen significant declines across the state, particularly in the years following the recession.

Operations of the 31 transit agencies in Washington State were analyzed from the beginning of the recession to the present. Since 2007, 11 transit agencies have had successful local ballot measures to increase sales tax revenue for transit, five are at their maximum local tax rate, and four ballot measures failed; 24 transit agencies have increased

DISASTER PREPAREDNESS:

Washington state's transit systems provide an important role in the event of a large-scale disaster, such as earthquakes, tsunamis, or another emergency event.

While many counties and cities in Washington have detailed emergency preparedness plans, explicit use of transit during these events is not always addressed. Unfortunately, this is an issue nationally as one study found that few U.S. cities include mobility services for people without personal transportation (*Evacuation Station: The use of Public Transportation in Emergency Management Planning*).

fares at least once; and 15 have cut service. Additional cuts are likely if revenue shortfalls continue and new local options are not authorized for the five agencies at their maximum tax rate.

Revenue authority of the 31 transit agencies was analyzed to determine if agencies had additional revenue authority to increase service in the future. Residents within five transit boundaries, including King County Metro, one of the largest in the nation, are not able to support increased service because there is no additional revenue authority available to their transit agency. Without additional state revenue or local revenue tools, King County Metro may be forced to cut 17%, or 600,000 hours, of transit service.

Best practices in transit funding shows that diverse, sustainable and equitable revenue sources are critical to long-term and stable funding. Diverse funding sources include sales tax, motor vehicle excise tax, payroll taxes, tolling revenue, user fees, gas tax, property taxes, and VMT taxes as well as state funding. Sustainable revenue sources are tied with increased demand for transit service, and equitable funding sources are those that do not overburden those least able to pay additional taxes.

Funding for transit almost exclusively comes from sales tax and fares, with some federal funding for capital and a small contribution from state government. While not directly linked to the largest generators of transit demand such as density and employment, sales tax is also not unrelated, especially with relation to employment and economic activity and was therefore scored as a sustainable funding source. However, sales tax is perhaps the most regressive transit funding source and is, therefore, not necessarily able to meet the state's long-term funding needs.

Recommendations

Transit is vital to Washington's economic success and is a crucial piece of statewide infrastructure that needs to be improved, maintained and expanded. In order for transit to succeed in Washington, there are several improvements that can be made through the following recommendations:

1. Continue to increase ridership and visibility by improving access to service, reliability and comfort.
2. Require all transit agencies that operate in the state to have an asset management program.
3. Improve accountability by making asset management and safety program information available and easily accessible to the public.
4. Develop sustainable funding sources at the local and state level to support transit service.

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