

WSDOT's Approach to Performance-Based Programming

Processes and Roles in Risk-based Asset Management

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Secretary of Transportation

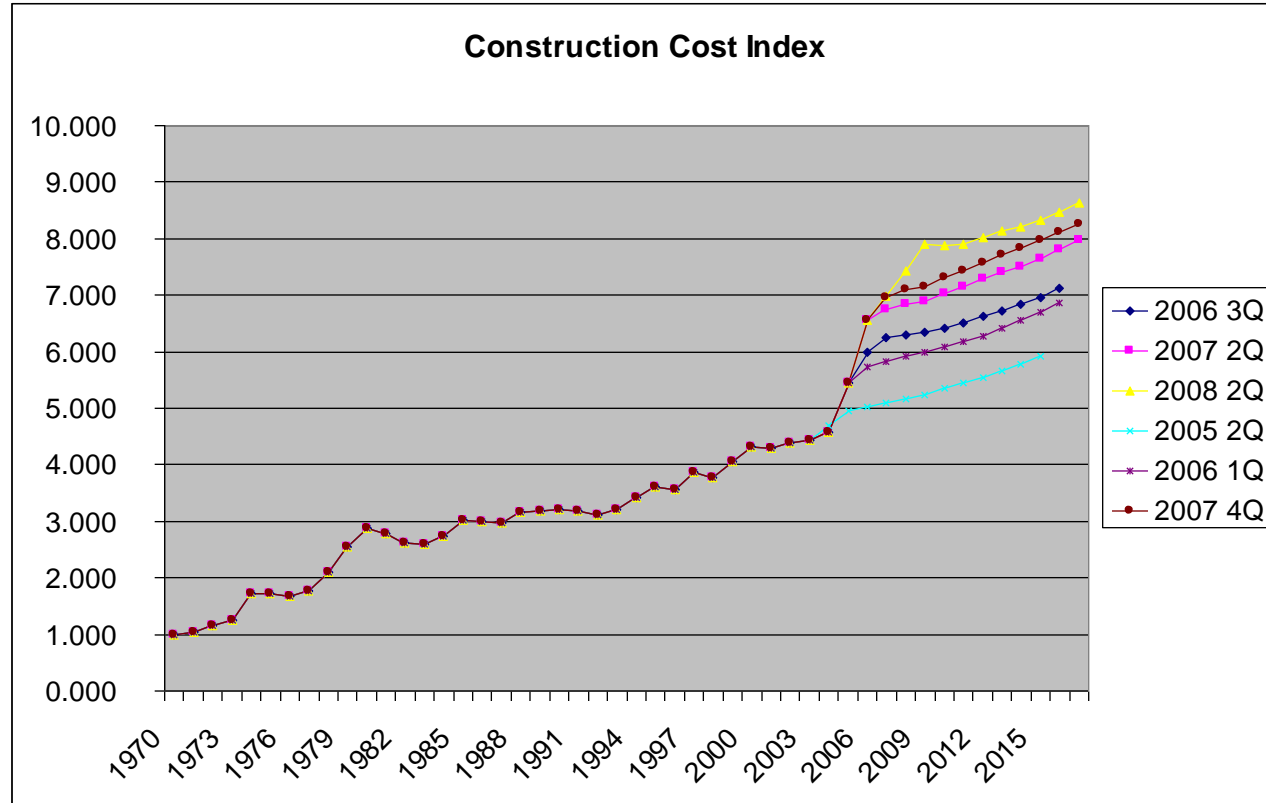
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Program Development & Management

**Rocky Mtn West Pavement Preservation
Partnership Conference
October 8-9th, 2013**



Cost of Construction

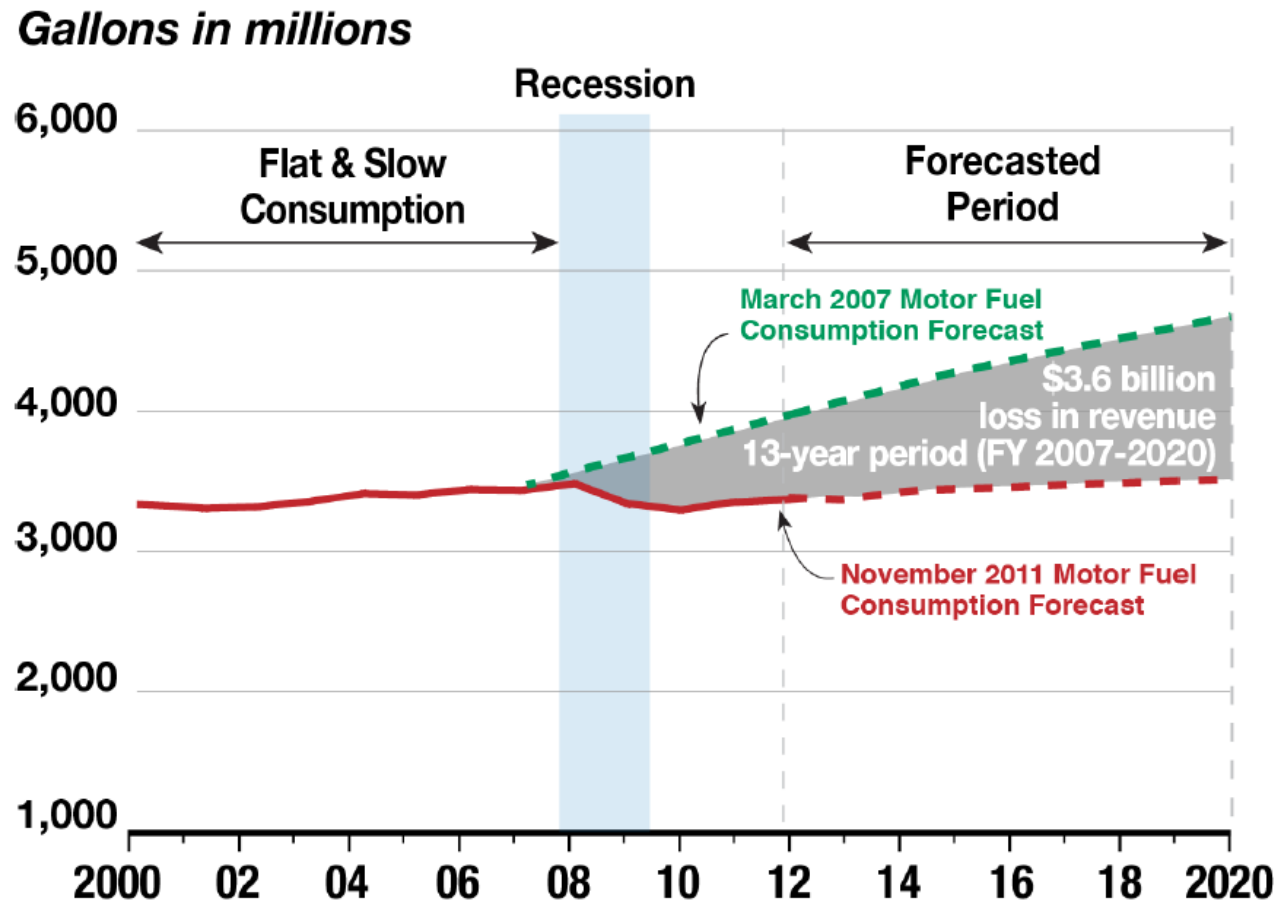
- Averaged 4% betwn 1970 and 2006
- 1974 – OPEC Oil Embargo
- 1980 – 2nd OPEC Oil Crisis
- 2006 – 2009 Material Cost increase



Gross fuel consumption - forecast has gone down

Fuel-efficient vehicles, weak economy impact fuel sales

Fewer gallons sold = reduced gas tax revenue projections



- The state gas tax funds 76% of all transportation investments.
- Since March 2007, projected fuel tax revenues will fall by \$3.6 billion over the 13-year period.

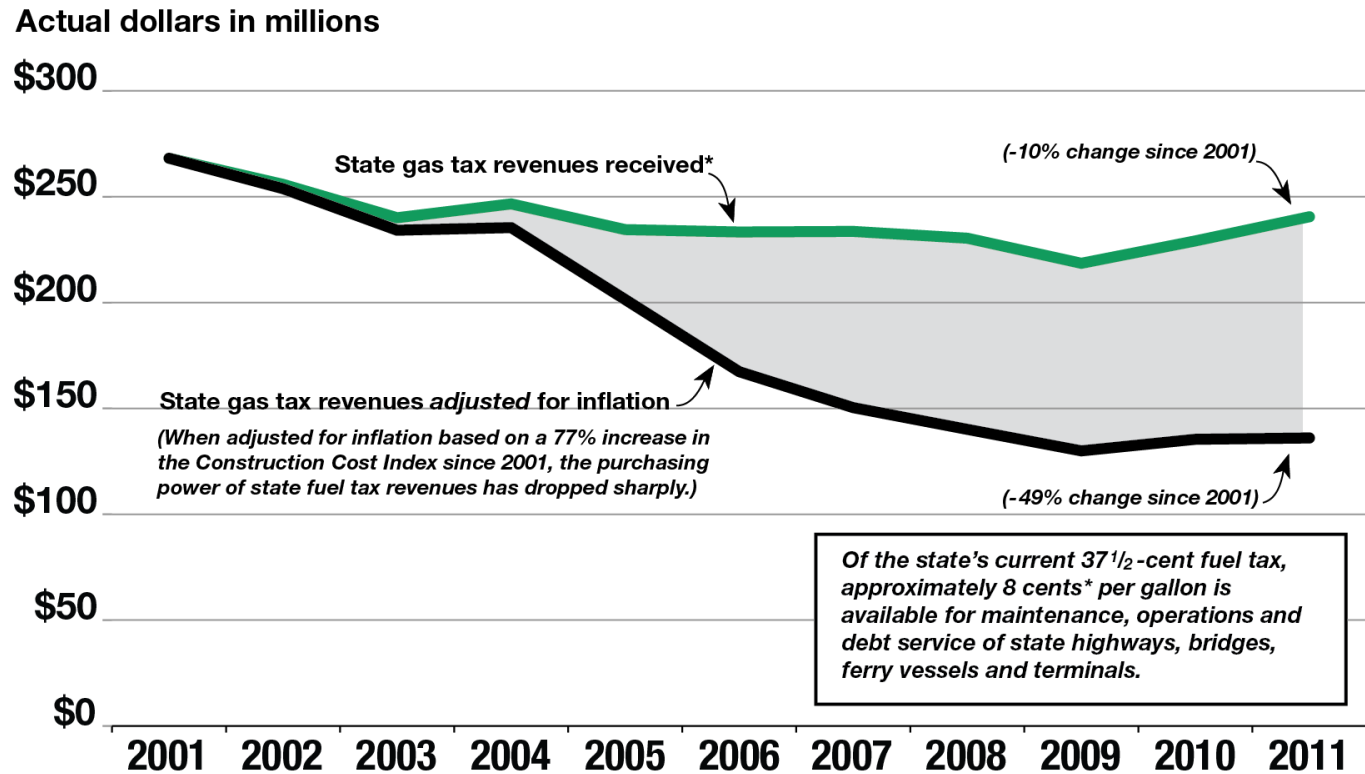
Gas tax purchasing power declines over time

Gas tax not indexed to inflation

...and compelling communication is more important than ever

Funding crisis

- Revenue significantly under projections
- Inflation increasing cost of maintenance and construction
- Challenge in getting another tax increase



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

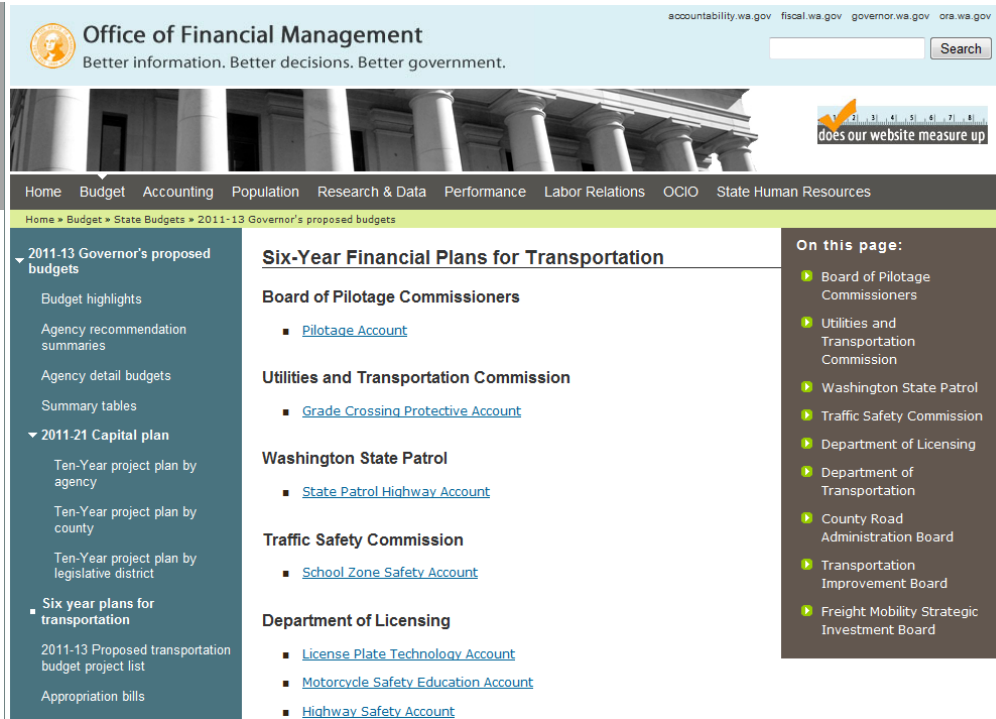
** Less Debt Service.

State Transportation Needs Exceed Future Funding

- Concrete Pavements – > \$1 B (10 years)
- Flexible Pavements – > \$1 B (10 years)
- Backlog of bridge painting – \$0.4 B
- Seismic Retrofitting in high ground motion zones - \$0.25 B
- Several large congestion issues
- Safety goal of no fatal/serious injury collisions - \$ 1B (10 year)
- Federal law suit to replace blocked culverts for fish - \$2.4 B (17 years)
- Storm water retrofit in Puget Sound
- Major Electrical Rehab of signals, ITS & lighting
- Ferry Boats & Terminals

Legislative Vision for Transportation Budgeting

The State Legislature finds that solutions to state highway deficiencies have become increasingly complex and diverse and that anticipated transportation revenues will fall substantially short of the amount required to satisfy all transportation needs. Difficult investment trade-offs will be required



The screenshot shows the website of the Office of Financial Management. The header includes the logo and the text "Office of Financial Management" with the tagline "Better information. Better decisions. Better government." Below the header is a navigation menu with links for Home, Budget, Accounting, Population, Research & Data, Performance, Labor Relations, OClO, and State Human Resources. The main content area is titled "2011-13 Governor's proposed budgets" and lists various budget highlights and tables. A sidebar on the right, titled "On this page:", lists several transportation-related entities and their accounts, including the Board of Pilotage Commissioners, Utilities and Transportation Commission, Washington State Patrol, Traffic Safety Commission, Department of Licensing, County Road Administration Board, Transportation Improvement Board, and Freight Mobility Strategic Investment Board. The main content area is titled "Six-Year Financial Plans for Transportation" and lists accounts for the Board of Pilotage Commissioners, Utilities and Transportation Commission, Washington State Patrol, Traffic Safety Commission, and Department of Licensing.

The Governor's Office of Financial Management shall propose a comprehensive ten-year investment program for the preservation and improvement programs defined in this section, consistent with the policy goals described under RCW [47.04.280](#).






Legislative Guidance for Developing Strategic Investment Options (1993 Study)

- **Legislative policy guidance**
- **Performance Outcome based on policy guidance**
- **Needs Criteria (based on lack of performance)**
- **Evaluate alternatives to restore performance**
- **Identify/evaluate risks**
- **Cost to restore (Important when capital is limited)**
- **Predict performance outcome**
- **Establish priorities (based on Engineering Economics)**
- **Recommend Investment Tradeoffs to Legislature**


Washington's Transportation Attainment Reports provide a high-level assessment of the state's progress in achieving its transportation goals using key performance measures and data.

Statewide Transportation Goals

In 2007, the Washington State Legislature amended RCW 47.04.280 to establish five statewide transportation policy goals to guide the planning, operation, performance of, and investment in the state's transportation system. They are not prioritized.

-  *Safety*: To provide for and improve the safety and security of transportation customers and the transportation system.
-  *Preservation*: To maintain, preserve and extend the life and utility of prior investments in transportation systems and services.
-  *Mobility (addressing congestion)*: To improve the predictable movement of goods and people throughout Washington state.
-  *Environment*: To enhance Washington's quality of life through transportation investments that promote energy conservation, enhance healthy communities and protect the environment.
-  *Stewardship*: To continuously improve the quality, effectiveness and efficiency of the transportation system.

In 2010, the Legislature added a sixth goal:

-  *Economic vitality*: To promote and develop transportation systems that stimulate, support and enhance the movement of people and goods to ensure a prosperous economy.

Highway Construction Program

PRESERVATION (P)

Roadway (P1)

Paving

Structures (P2)

Preservation

Catastrophic Reduction

Other Facilities (P3)

Rest Areas

Weigh Stations

Safety Restoration

Unstable Slopes

Major Drainage & Electrical

Program Support (P4)

IMPROVEMENT (I)

Mobility (I1)

Urban

Rural

Urban Bicycle

Core HOV

Safety (I2)

Collision Reduction

Collision Prevention

Economic Initiatives (I3)

All Weather

1995 2007 Rest Areas (In Safety)

Scenic Byways

Freight System

Restricted Bridges

Bicycle Touring

Environmental Retrofit (I4)

Stormwater

Fish Barriers

Noise Reduction

Air Quality

Program Support (I5)

Chronic Env Deficiency

Wildlife Connectivity

Mgmt of Environmental Mitigation Sites

Federal Safety Stewardship Agreement




- Agreement with Federal Highways to qualify paving projects for federal aid without safety improvements
- Equivalent funding for safety improvements to standards on paving projects will be invested in the Safety Program
- Historical approach of HES reduction and prevention (network-wide strategies)
- Adopting SafetyAnalyst for the future (random occurrence of collisions due in large part to driver behavior in the last 18 years)

2012 BIENNIAL TRANSPORTATION ATTAINMENT REPORT

WASHINGTON'S TRANSPORTATION SYSTEM: GOALS, OBJECTIVES AND PERFORMANCE MEASURES

GOAL 2. PRESERVATION

To maintain, preserve and extend the life and utility of prior investments in transportation systems and services.

<i>Measures</i>	<i>Objective</i>	<i>Status</i>	<i>Progress</i>	<i>Five-Year Trend</i>
Measure 2.1 Highway Pavement Percent of state highway pavement in fair or better condition	Extend the useful life of pavement	92.7% of state highway pavement in fair or better condition in 2011	◆	
Measure 2.2 Bridges Percent of state bridges rated structurally deficient (SD)	Keep bridges safe and open to traffic	5% of bridges were rated SD in 2011, a 0.3% improvement from 2008	✱	
Measure 2.3 Ferry Terminals Percent of state ferry terminal systems in fair or better condition	Extend the useful life ferry terminals and vessels	86 % rated fair or better in 2011, a 2% increase from 2008	✱	

Asset Classes with Deficiency Criteria

- Pavements
 - Rutting – ½ inch
 - Cracking Index – 45/100
 - Ride – 220 “ per mile
- Bridges
 - Painting – rusting > 2% surface area
 - Decks – delamination > 3% surface area
- Unstable Slopes – risk factors > 350 of 891
- Rest Areas
 - Sewer & Water
 - Building & Site

Classes with Criteria Under Development

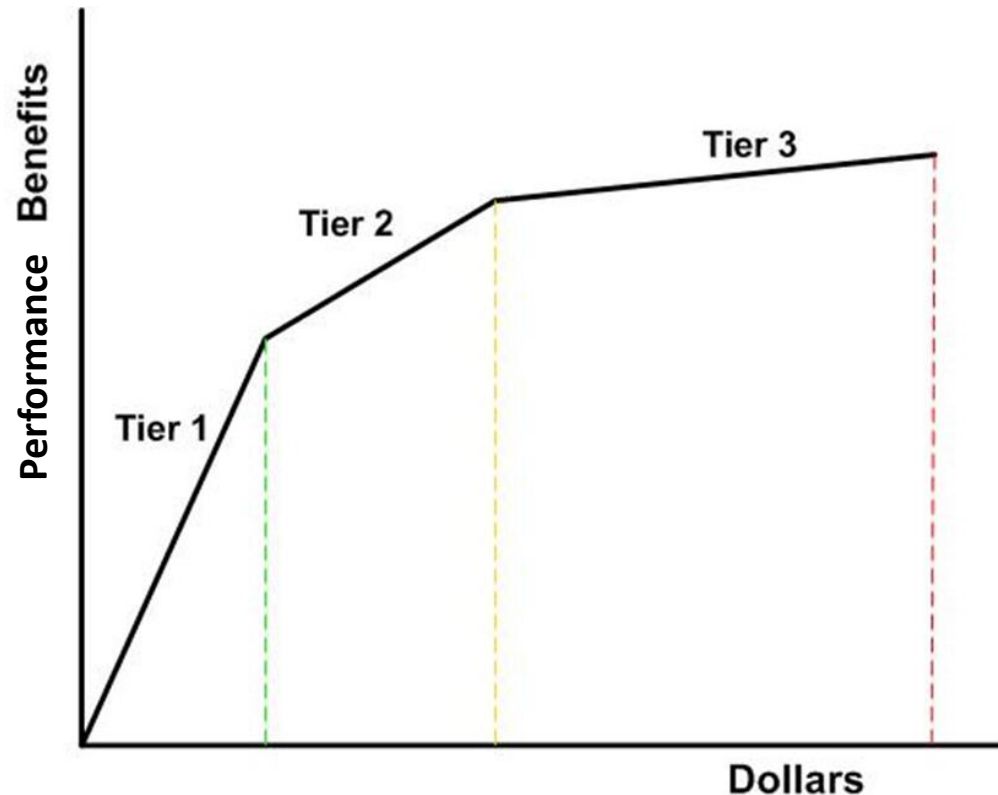
- Drainage Features
 - Culverts
 - Enclosed Systems
- Electrical
 - Traffic Signals
 - Illumination Systems
 - Intelligent Transportation Systems
- Weigh Stations
 - Site
 - Buildings
- Safety Restoration
 - Guardrail
 - Median Barrier

Inventory & Condition Assessments

- Pavements
 - Mainline (1lane/direction) - Yearly
 - Ramps & Other Auxiliary Lanes – As Needed
 - Remaining mainline Lanes (concrete) – Every 4 Years
- Bridges
 - Decks and Painting – Yearly/Biennial
- Unstable Slopes – Every two years
- Rest Areas – Every two years
- Electrical – Inventory Complete, Need Condition Data
- Drainage – Inventory almost complete, Maintenance gathering “Level 1 condition data” during cleaning
- Safety Restoration – Inventory complete except for Interstate guardrail. Discussing how to determine condition assessment
 - **Policy Issue: Data versus Predictive Models**

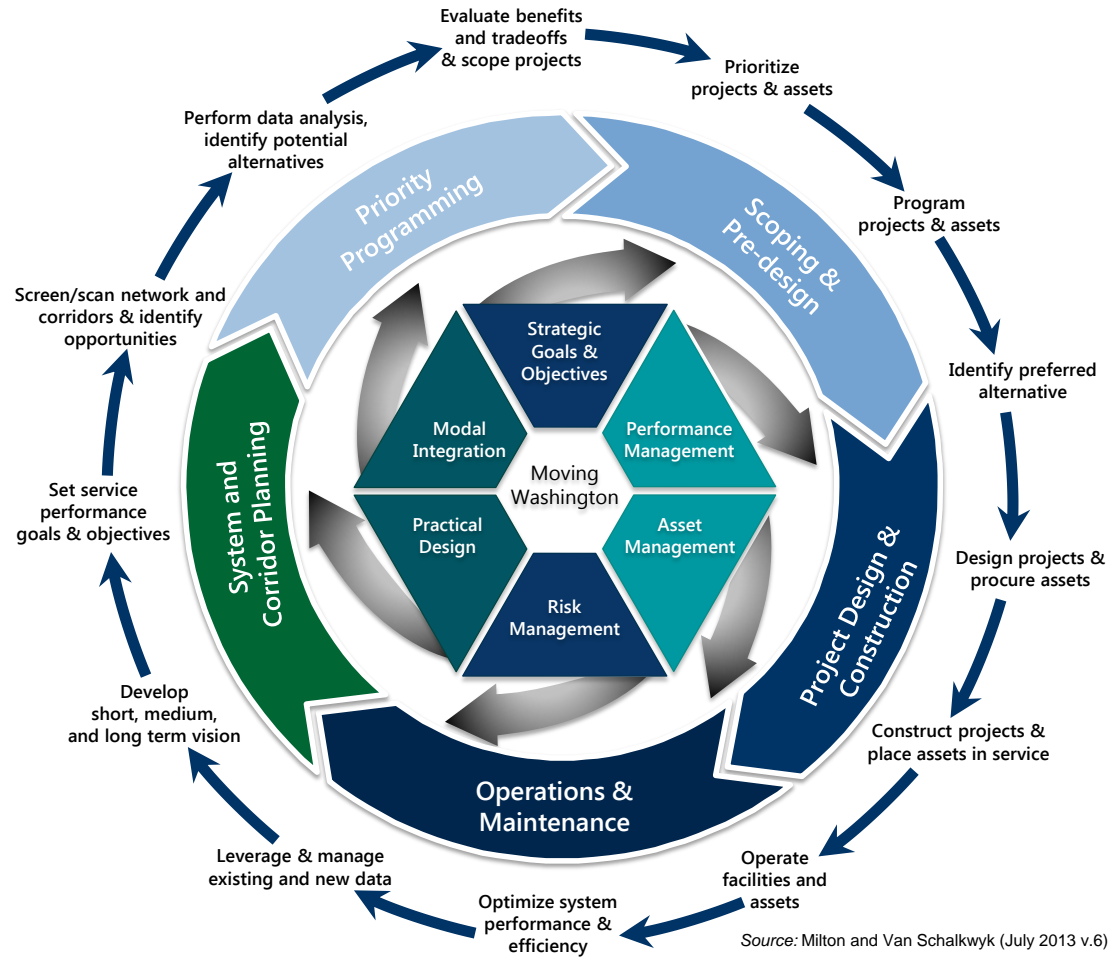
Restoring Performance and Minimizing Risk with Sustainable Initiatives

- Lower cost approaches
- To improve performance
- To become more efficient than full scale replacement or upgrade
- Lower risk and tradeoffs
- Meet multiple goals with limited budget



Integrating Enterprise Risk Management

- Chip Seal Conversion
- Chip Seals in wetter & cooler climates
- Selective concrete panel replacement versus replacement
- Steel bridge washing
- Painting in segments
- 2nd gen bridge decks
- Timing of guardrail replacement
- Culvert lining
- Reduced lighting
- Replace signal with roundabout



Investment Tradeoff

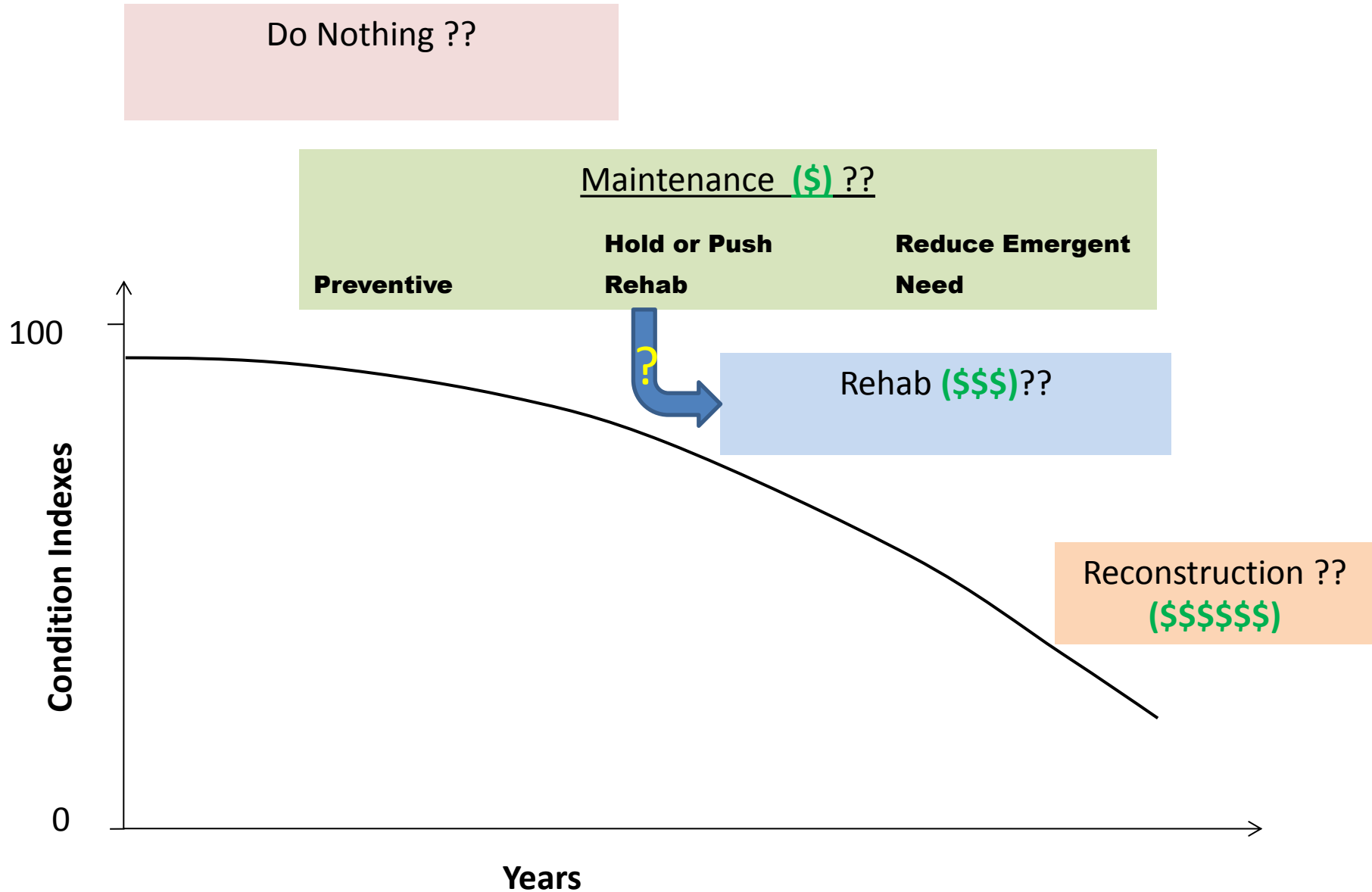
Target Setting

- Started with goals and performance objectives
- Identified performance needs for 6-10 years (range of dollars)
- Developed cost effective solutions to maximize performance
- Determine investment amount to meet objective
- Allocate existing revenue amongst categories and predict performance

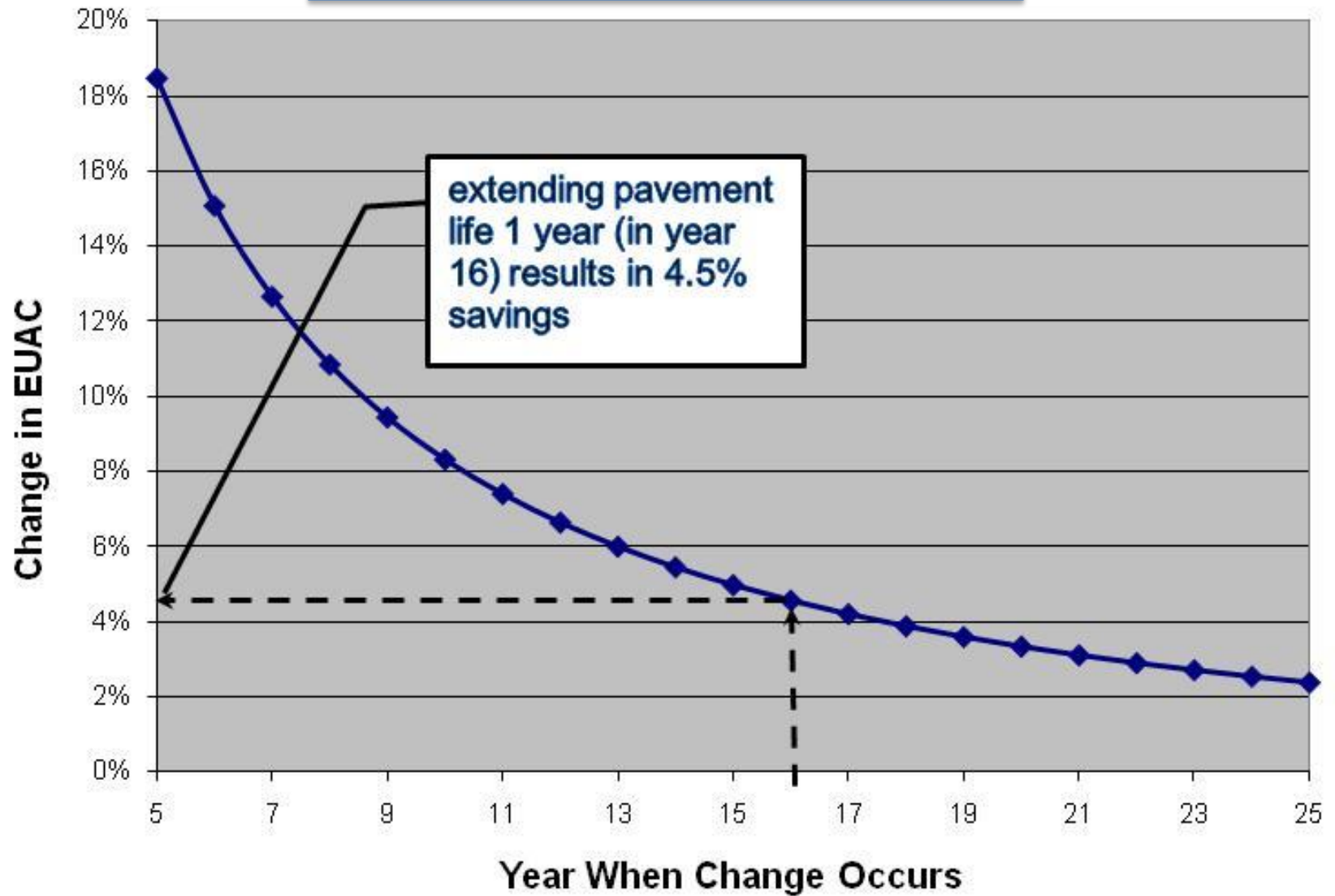
Tradeoff Risks

- Accuracy of 6-10 year needs
- How to hold needs for which there is no funding?
- How many additional projects should be designed as backup?
- How much weight should be given to a potential risk versus a known need such as;
 - Seismic
 - Guardrail upgrade versus new

Asphalt Pavement Preservation Decisions



Change in EUAC per Year Change in Pavement Life



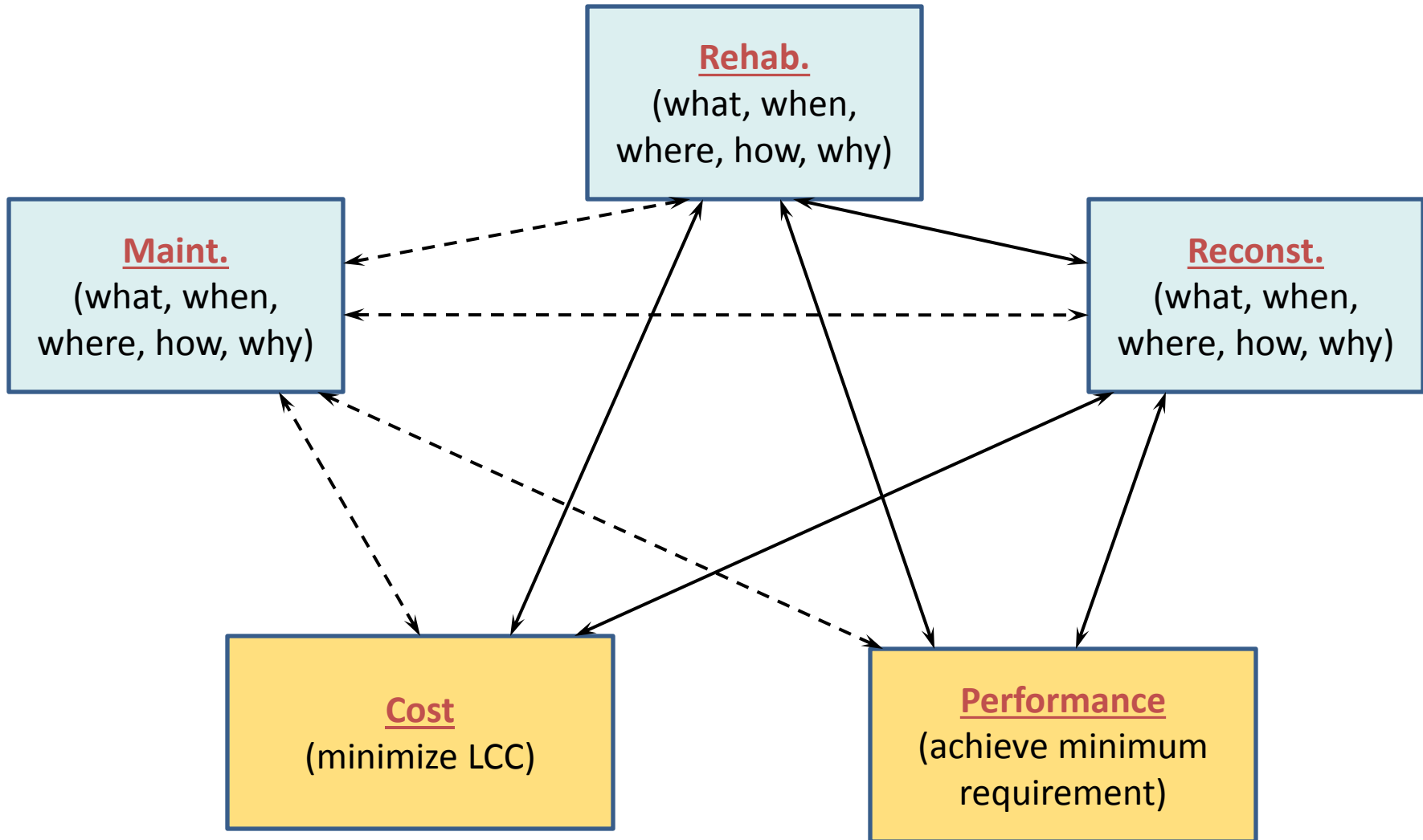
Uses for Economic Performance Methodologies

- Evaluation of Pavement Management
 - How efficiently are pavements performing?
 - Are the most cost-effective decisions being implemented?
- Evaluation of Pavement Design
 - Is pavement structure over designed or under designed?
- Evaluation of Freight Corridors
 - Are freight corridors designed with the most efficient pavements?

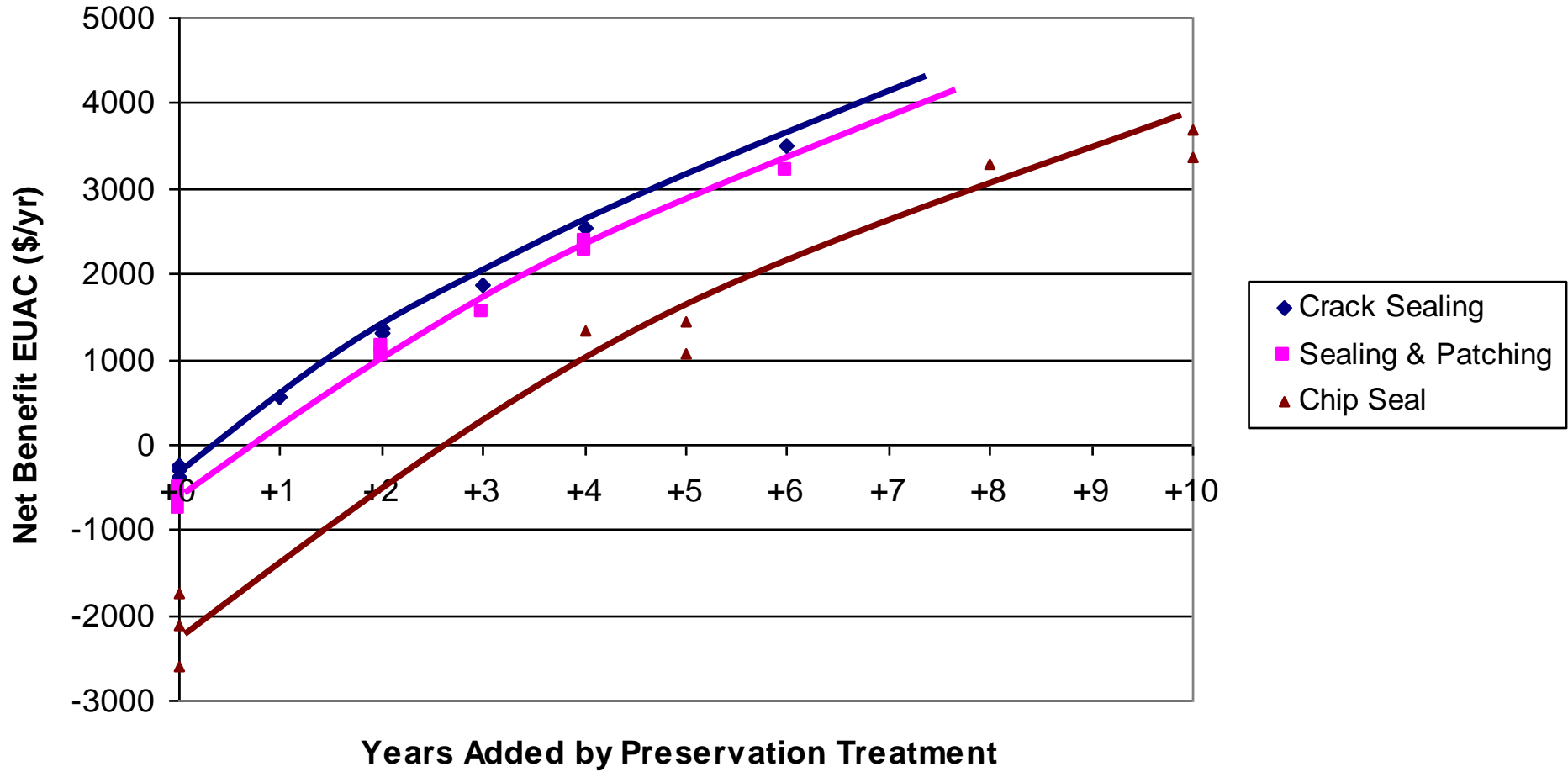
Economic Performance Measures

- Historical Cost of Pavement Service
 - EUAC (\$ / lane-mile year spent)
 - Equivalent Uniform Annualized Cost
- Expected Cost of Future Pavement Rehab
 - LCCA (\$ / lane-mile year gained)
 - Life Cycle Cost Analysis
- ESAL Efficiency
 - Divide EUAC by average ESALs per lane per year
 - \$ / ESAL
 - Equivalent Single Axle Loadings

Decisions and Outcomes

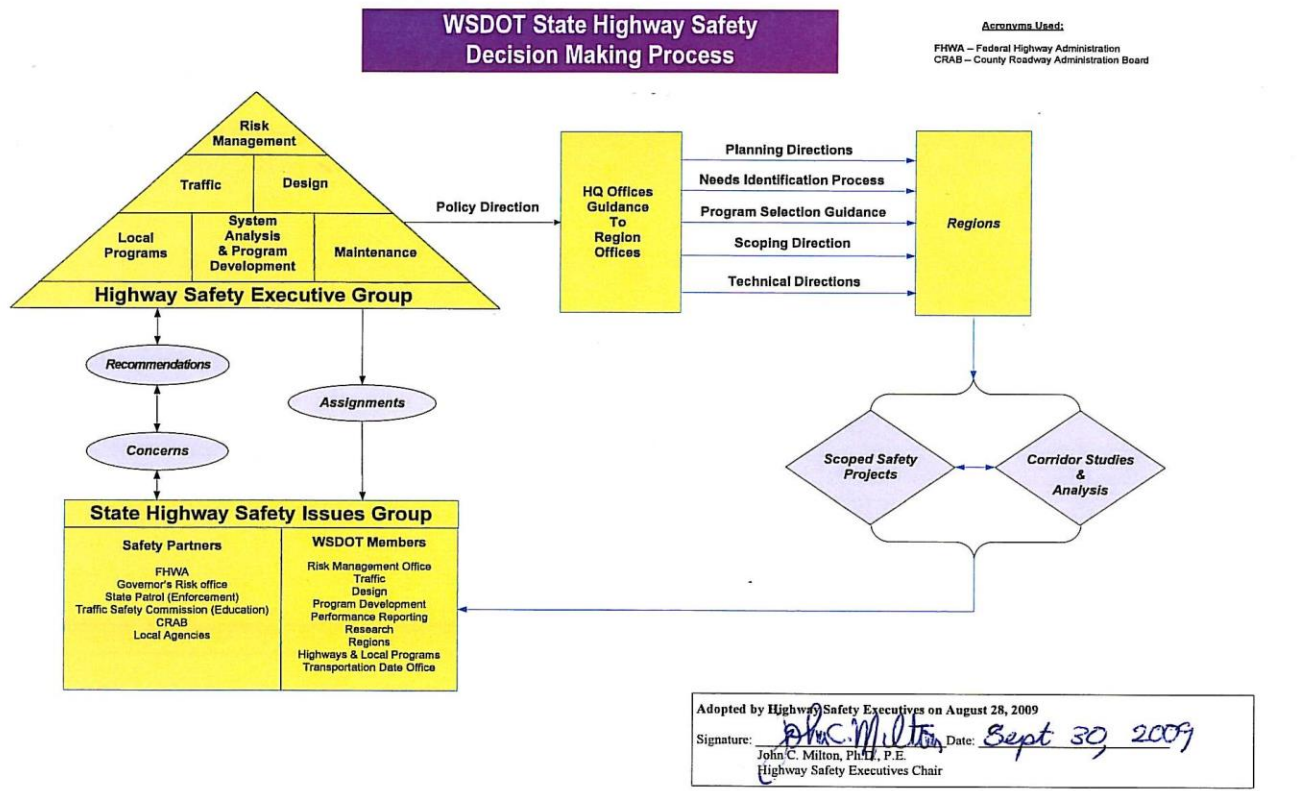


Net Benefit (EUAC)



Executive Decision Making

WSDOT will establish an executive level policy making group for asset management similar to safety



Pavement Prioritization

Flexible Pavements

- Minimum Performance Standard
 - Rutting – ½ inch
 - Cracking Index – score of 45 out of 100
 - Ride – 220 inches per mile (lagging indicator)
- Alternative Analysis based on Lowest Life-cycle cost
 - Preventative Maintenance (strategic Crack Sealing)
 - Chip Seals on lower volume and lower truck loadings
- Prioritization
 - 70% of the analysis units within a paving job should be below the minimum performance standard to be included in program proposal

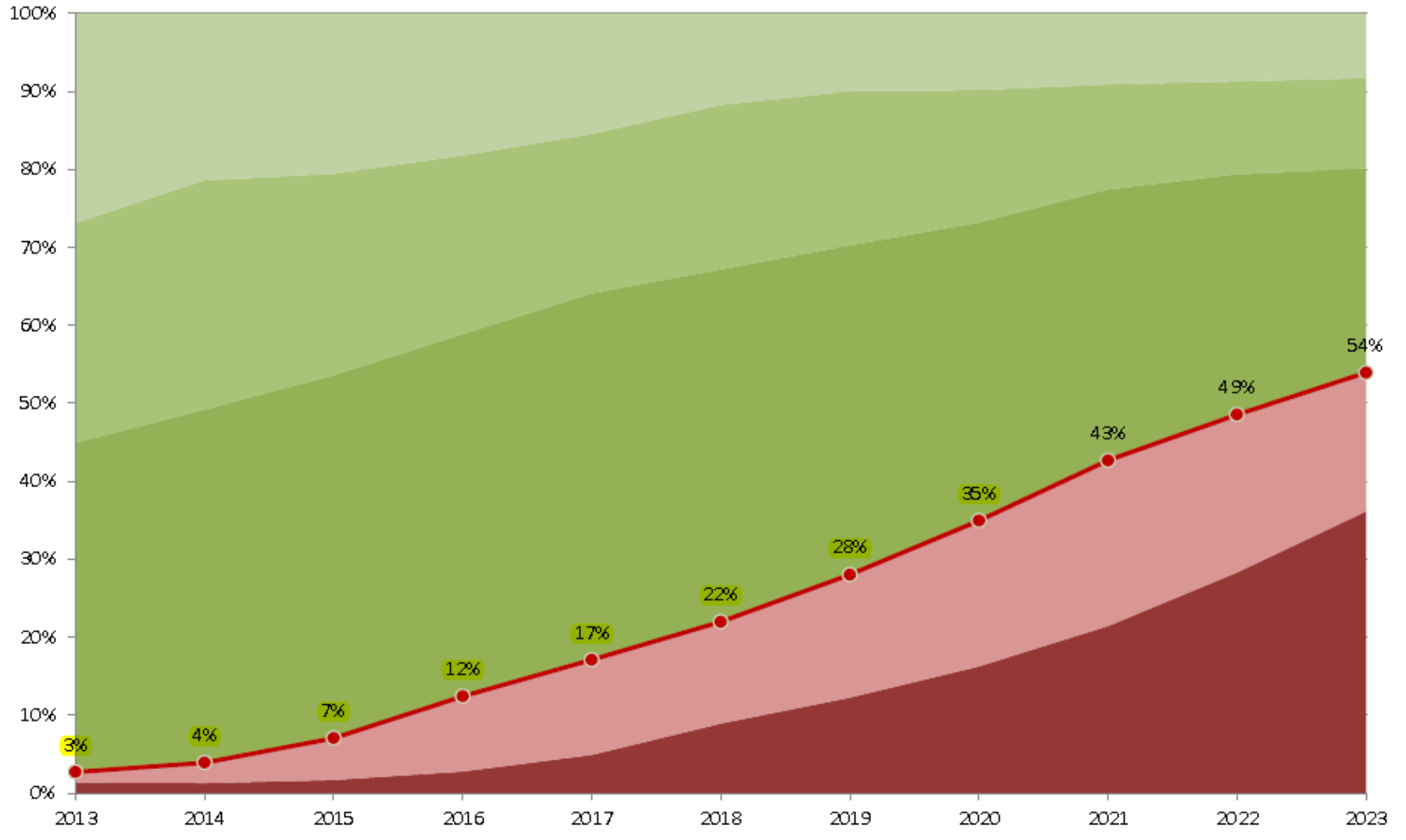
Rigid Pavements

- Minimum Performance Standard
 - Rutting – ½ inch
 - Faulting
 - Cracking
 - Ride – 220 inches per mile
- Alternative Analysis based on Lowest Life-cycle cost
 - Preventative Maintenance to replace isolated panels with significant cracking
 - Grind rutted panels with minimal faulting and rutting
 - Dowel-bar rehab faulted panels & grind
 - Replace concrete roadway that is beyond rehabilitation

Good Fair Poor - All Surface Types

Current Funding Analysis: \$275 M per Biennium

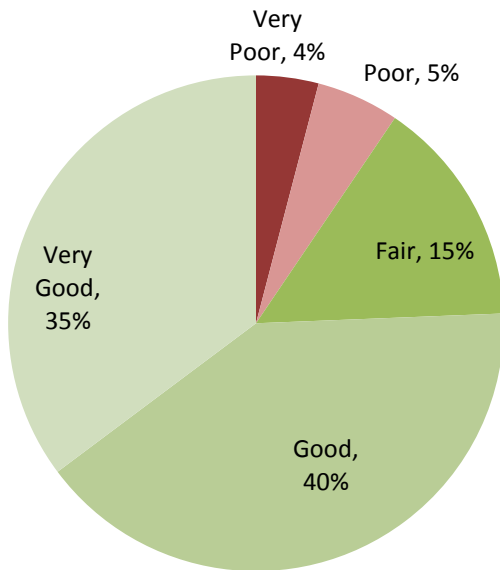
Very Poor Poor Fair Good Very Good Poor and Very Poor



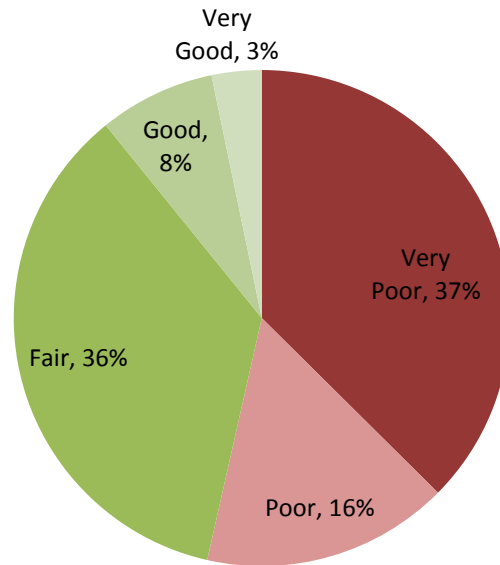
Combined Pavement Condition

2023 Pavement Condition

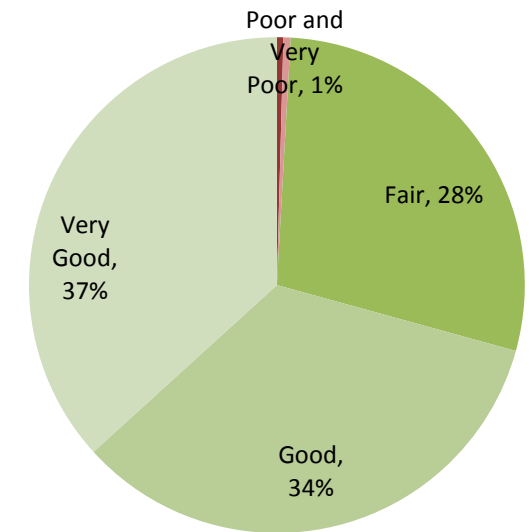
2011 Pavement¹ Condition



Planned Funding

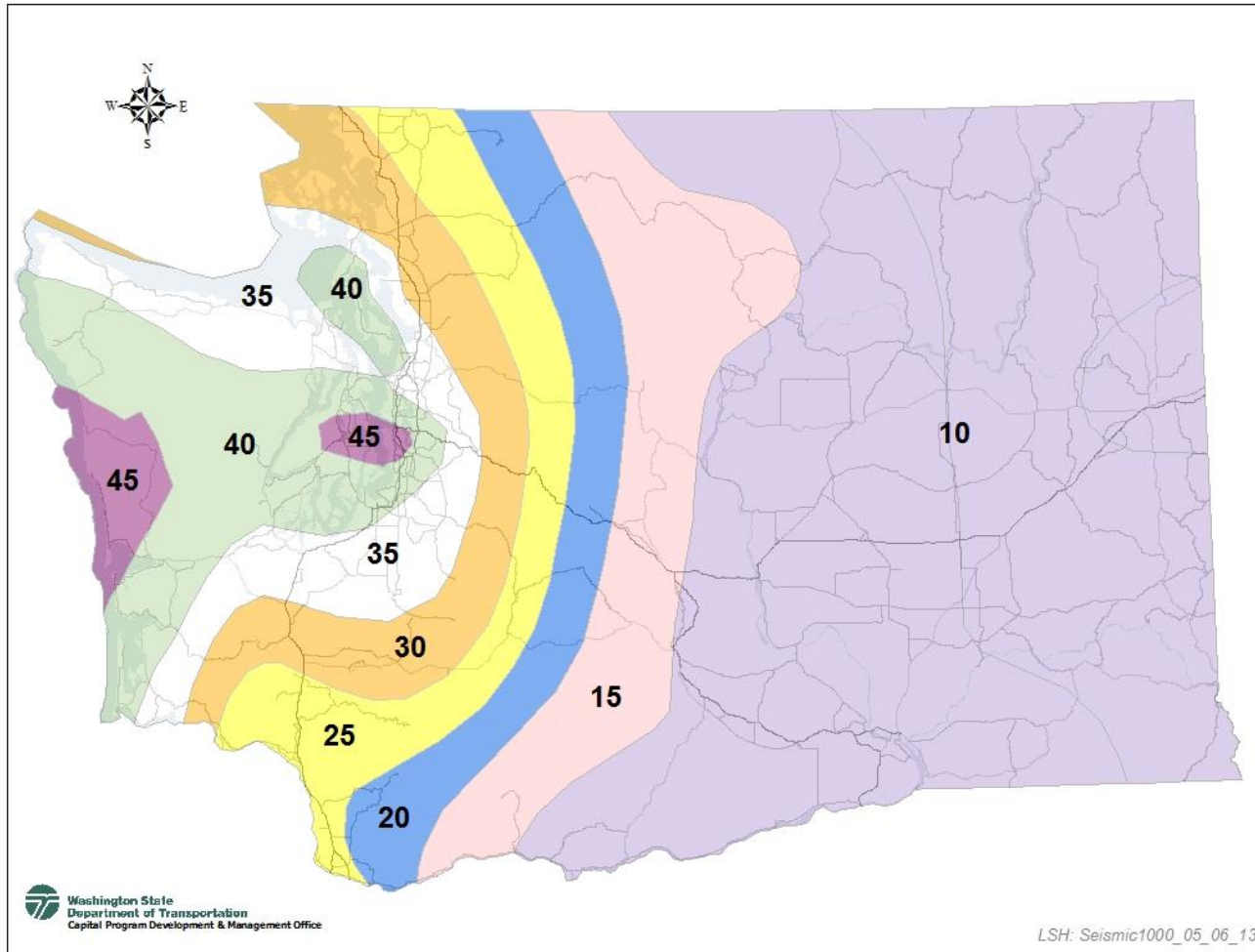


O&M Funding



¹ Due to reduced budget, Chip Seal roadways were not rated in 2011 and are excluded from the 2011 combined chart

Seismic Ground Acceleration Zones



Bridge Pier Damage due to Vertical Acceleration

6.6 Magnitude, San Fernando 1971



6.8 Magnitude, Nisqually 2001



I-5 Beacon-Holgate Bridge in Seattle

Status of Seismic Rehab Bridges

1000-Year Zone	Complete	Partially Retrofitted	Retrofit Required	Under Contract	Grand Total
45	44	24	38	7	113
40	95	58	113	1	267
35	67	28	102	2	199
30	24	17	86		127
25	9	4	86		99
20	4	1	27		32
15	18	2	22		42
10	10		10		20
0	1		1		2
Grand Total	272	134	485	10	901

WSDOT's Three-Phase Seismic Plan

- Objective: Strengthen structural elements that are vulnerable to damage from ground motion (generally west of Moses Lake)
- Phase 1 – Secure superstructure to columns (potentially catastrophic)
- Phase 2 – Rehab single columns (has no redundant support)
- Phase 3 – Rehab multi-columns

Seismic Lifeline Route

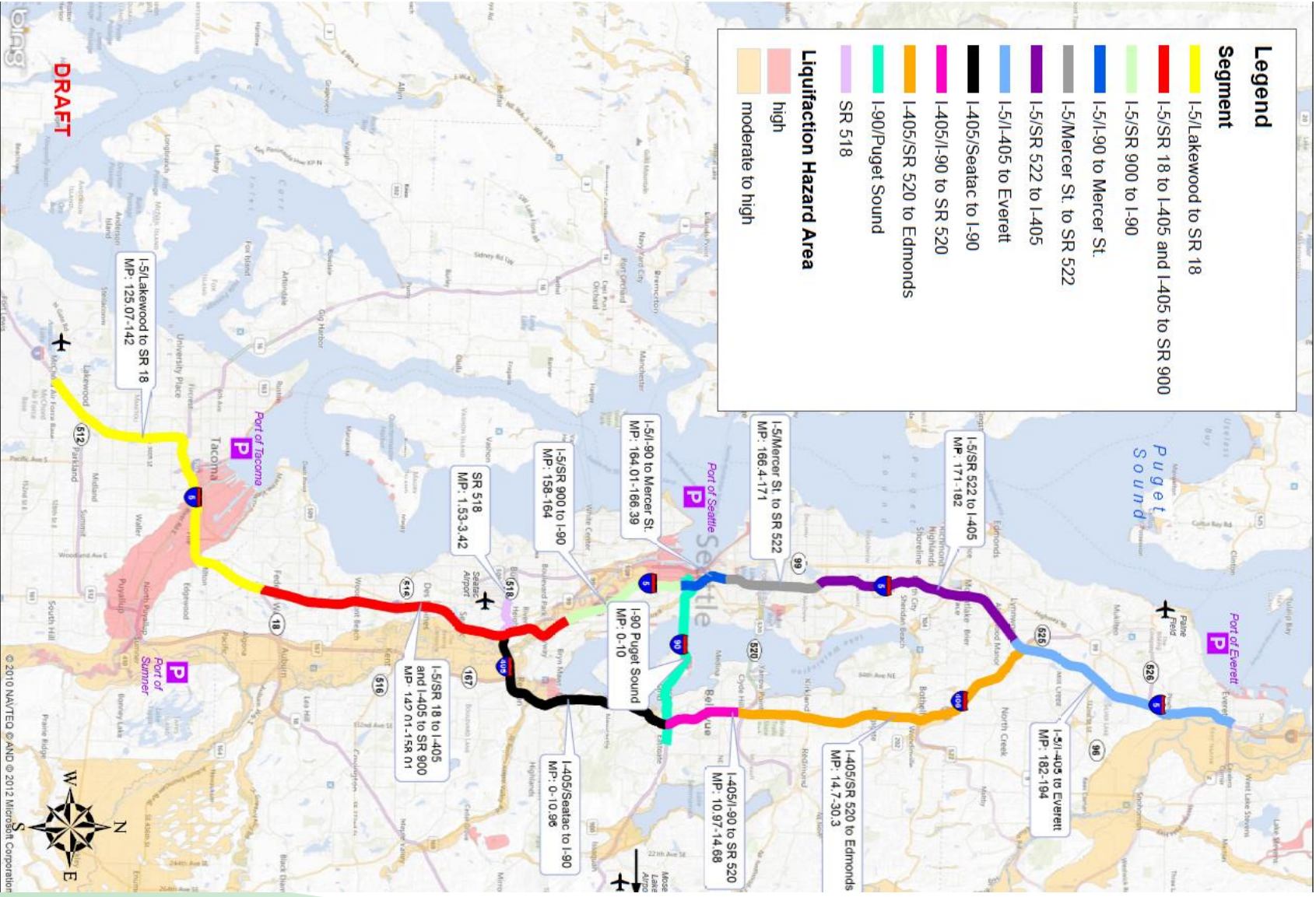
Legend

Segment

- █ I-5/Lakewood to SR 18
- █ I-5/SR 18 to I-405 and I-405 to SR 900
- █ I-5/SR 900 to I-90
- █ I-5/I-90 to Mercer St.
- █ I-5/Mercer St. to SR 522
- █ I-5/SR 522 to I-405
- █ I-5/I-405 to Everett
- █ I-405/Seattleac to I-90
- █ I-405/I-90 to SR 520
- █ I-405/SR 520 to Edmonds
- █ I-90/Puget Sound
- █ SR 518

Liquefaction Hazard Area

- █ high
- █ moderate to high



Washington State
 Department of Transportation
 Capital Program Development & Management Office

✈ Airport **P** Ports

Bridge Seismic Retrofit Segments
 December 2012

Bridge data obtained 12/11/2012
 File: SeismicSegments_27Dec2012

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Total Cost of Key Seismic Rehab in Puget Sound

\$678M of needs in Puget Sound with \$10M per biennium identified in 10-Year Financial Plan would take until the end of this century

Row Labels	Collector Distributor	Eastbound	Northbound	Northbound & Southbound	Overcrossing & Ramp	Reversible Lane	Southbound	Westbound	Grand Total
I-5/Lakewood to SR 18			\$ 4,969,853		\$ 13,421,259		\$ 8,793,814		\$ 27,184,926
I-5/SR 18 to I-405 and I-405 to SR 900			\$ 17,065,026		\$ 7,777,693		\$ 12,632,455		\$ 37,475,174
I-405/Seatac to I-90			\$ 941,875	\$ 4,324,661	\$ 18,444,217		\$ 1,263,867		\$ 24,974,620
I-405/I-90 to SR 520			\$ 6,411,977		\$ 732,743		\$ 5,361,521		\$ 12,506,241
I-405/SR 520 to Edmonds	\$ 1,651,155		\$ 4,783,537		\$ 2,085,710		\$ 4,356,330		\$ 12,876,732
I-5/I-90 to Mercer Street	\$ 18,329,036		\$ 23,421,134		\$ 15,227,861		\$ 5,539,479		\$ 62,517,510
I-5/Mercer Street to SR 522			\$ 46,222,033		\$ 33,464,915	\$ 25,044,206	\$ 86,427,539		\$ 191,158,693
I-5/SR 522 to I-405	\$ 728,002		\$ 1,818,124		\$ 3,964,873		\$ 1,698,466		\$ 8,209,465
I-5/SR 900 to I-90			\$ 74,810,307		\$ 29,033,763		\$ 77,597,179		\$ 181,441,249
I-90/Puget Sound	\$ 20,017,459	\$ 45,345,828						\$ 48,437,708	\$ 113,800,995
SR 518		\$ 800,734						\$ 1,134,133	\$ 1,934,867
SR 526					\$ 4,611,365				\$ 4,611,365
Grand Total	\$ 40,725,652	\$ 46,146,562	\$180,443,866	\$ 4,324,661	\$ 128,764,399	\$ 25,044,206	\$ 203,670,650	\$ 49,571,841	\$ 678,691,837

Telling the story

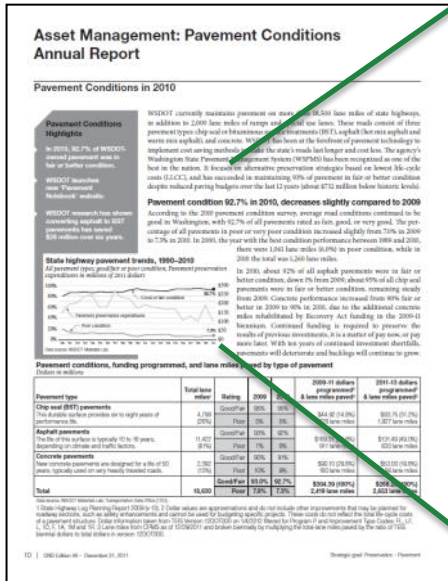
Pavement:

Innovations to lower costs, preserve life

WSDOT's pavement technology innovations help offset declining investments

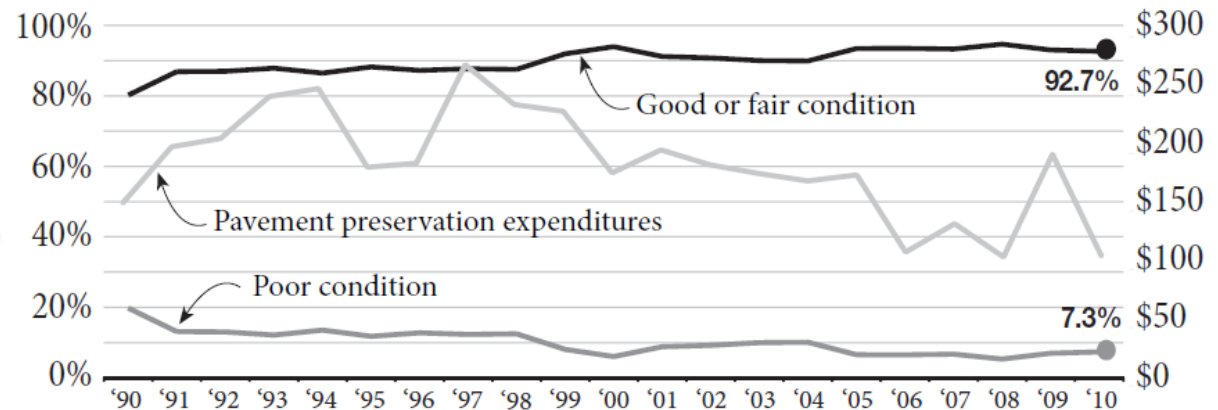
WSDOT uses pavement technology to make the state's roads last longer and cost less. Efficiencies include:

- Dowel bar retrofits on concrete pavements
- Selective panel replacement and diamond grinding on concrete pavements
- Converting higher cost asphalt pavements to lower cost chip seal pavements (\$151 million saved as of December 2011)



State highway pavement trends, 1990-2010

All pavement types; good/fair or poor condition; Pavement preservation expenditures in millions of 2011 dollars



Data source: WSDOT Materials Lab.

1990-2010: Changes in Pavement Asset Management

Then (1990)

Worst first
Allocation funding
WSPMS as sideline
Hveem mix design protocol
Volumetrics in the lab
Concrete Total Replacement
Dowel bar retrofit
Thick overlays (>2"+)
No westside BST
BST only if ADT <2000 ADT

No RAP
No RAS
No clear pavement selection
No dowel bar selection

Now (2010)

Lowest life cycle cost
Need based funding
WSPMS as key decision making tool
Superpave mix design
Volumetrics in the field
Dowel bar retrofit
Triage protocol
P-1 protocol (2" overlays for all HMA)
All west side regions doing BST
BST on all routes under 5,000 ADT and
consideration for rtes between 5,000-10,000
Consuming all the RAP produced in the state
Test project with RAS
Pavement Type Selection Protocol
Dowel Bar Selection Protocol

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