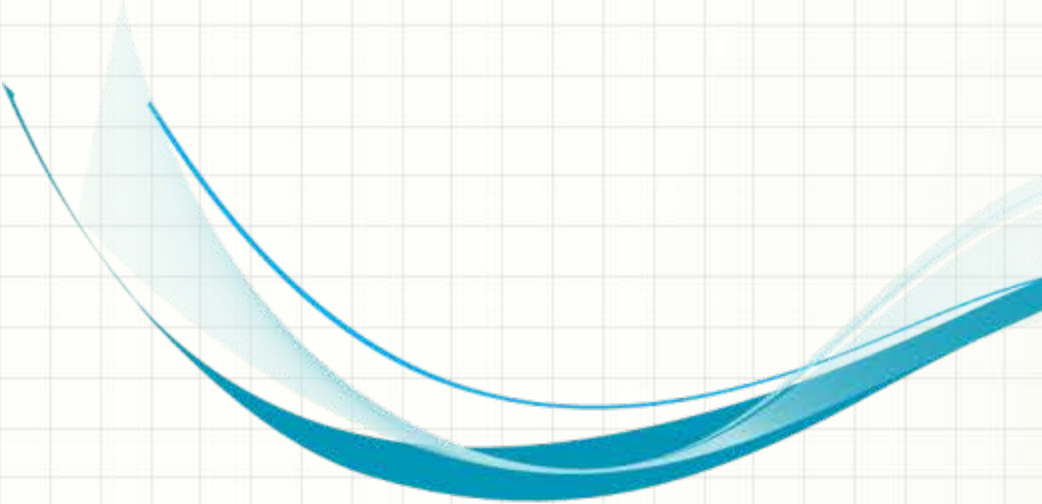# PMS: PUTTING THE DATA TO WORK

Judith Corley-Lay

May 16, 2016

Outline of Presentation

- Use of Open graded friction course in NC
- Data available in PMS
- Individual performance curves
- Overall performance of OGFC and FC-2
- How we will use the results
- Broader application

Use of friction course in NC

Uses

- Reduction of splash and spray on roadways with high truck traffic and significant passenger car traffic.

- Reduction of wet weather accidents, especially where land is naturally flat (eastern coastal plain).

- Two gradations have been used: OGFC and FC-2.
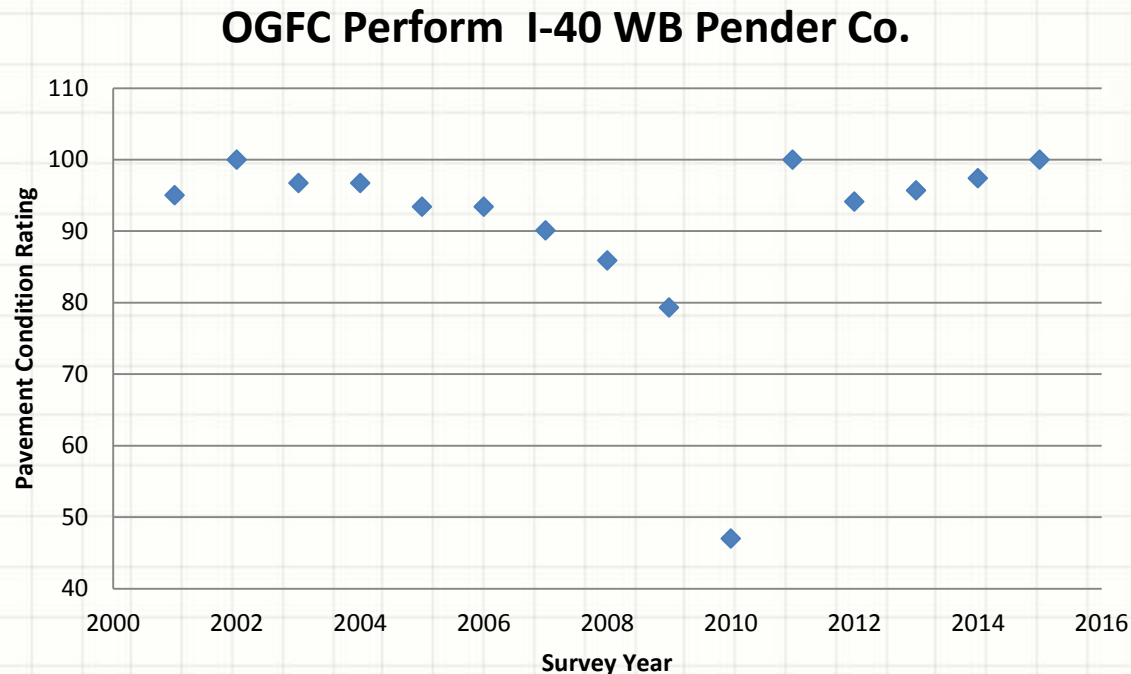
Data in PMS

PMS data

- Inventory data

- Construction history indicates when OGFC or FC-2 is the wearing surface, date of construction.

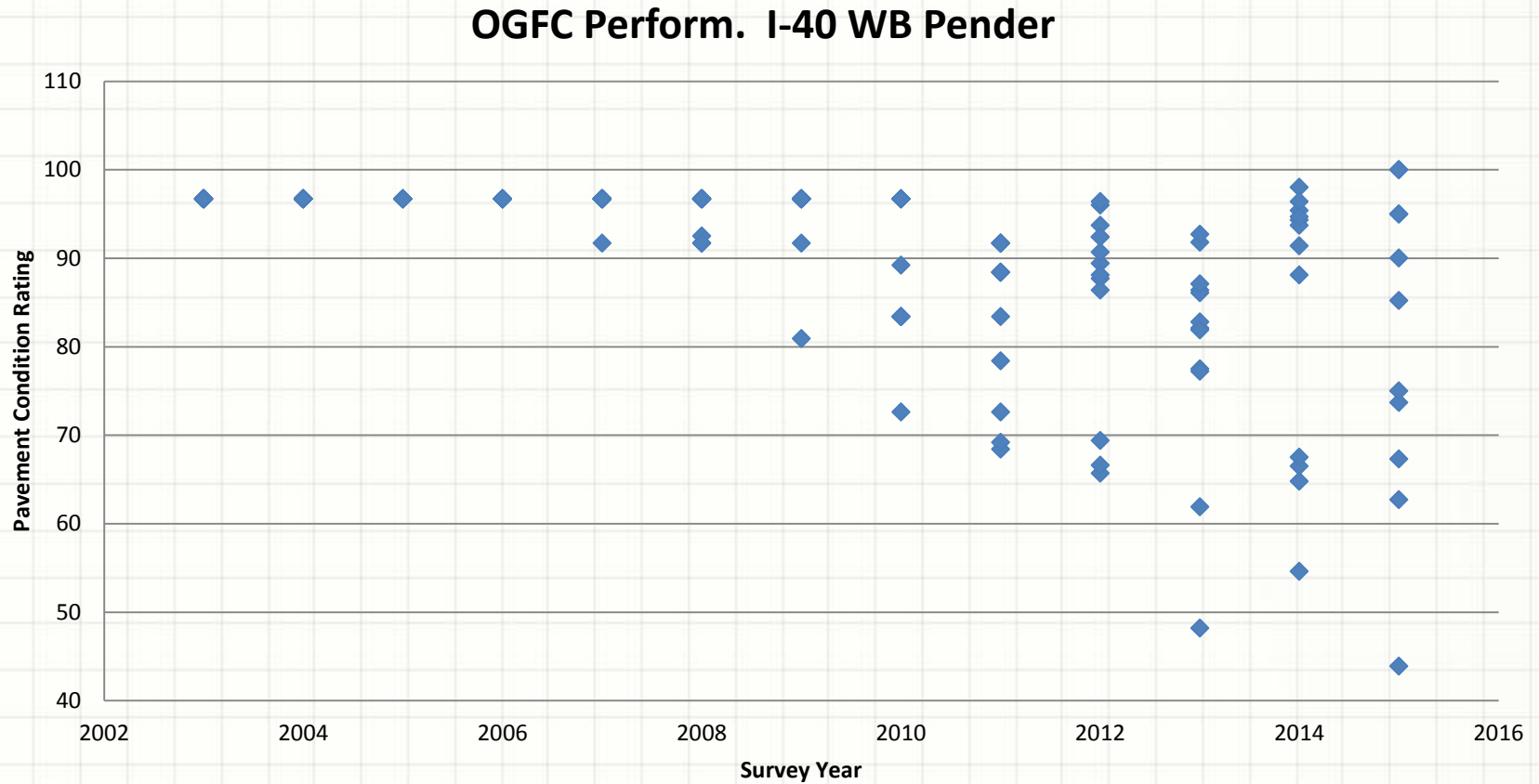- Pavement Condition over 25 years. Only 15 years maximum for OGFC, 13 years maximum for FC-2.

Individual performance curves

Each project length evaluated.

- Plotted pavement condition rating versus survey year.

OGFC Perform I-40 WB Pender Co.

Not all data is "easy"

OGFC Perform. I-40 WB Pender
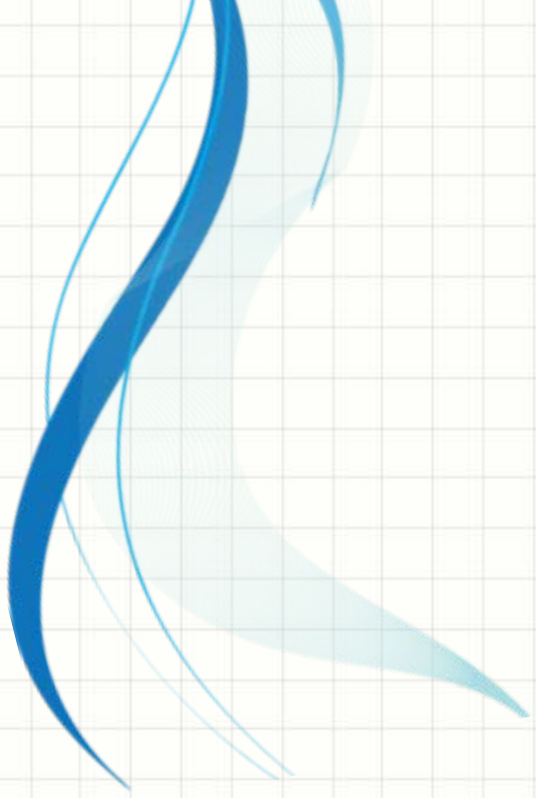
Overall performance

OGFC- All sections combined
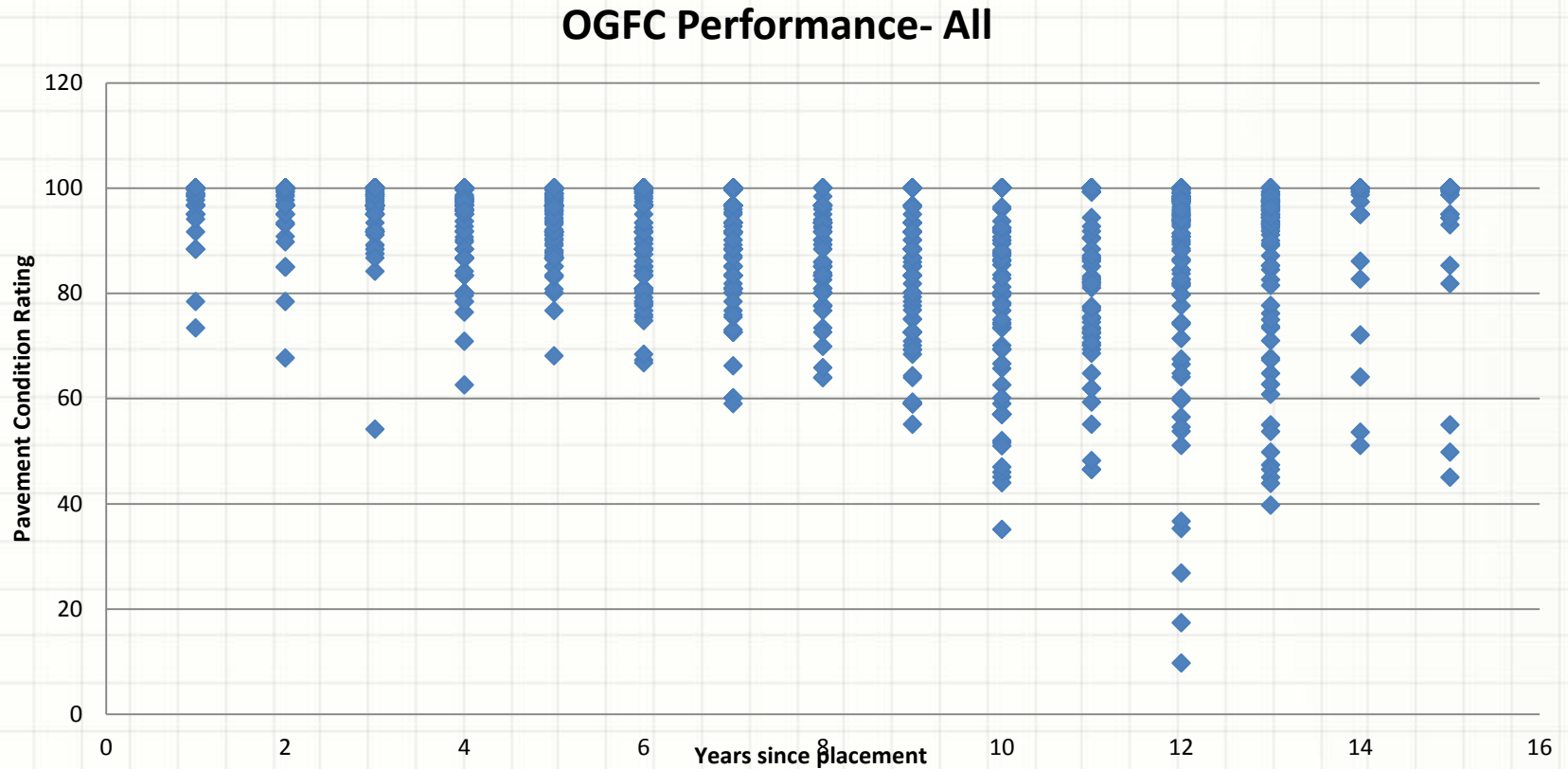
OGFC Performance- All
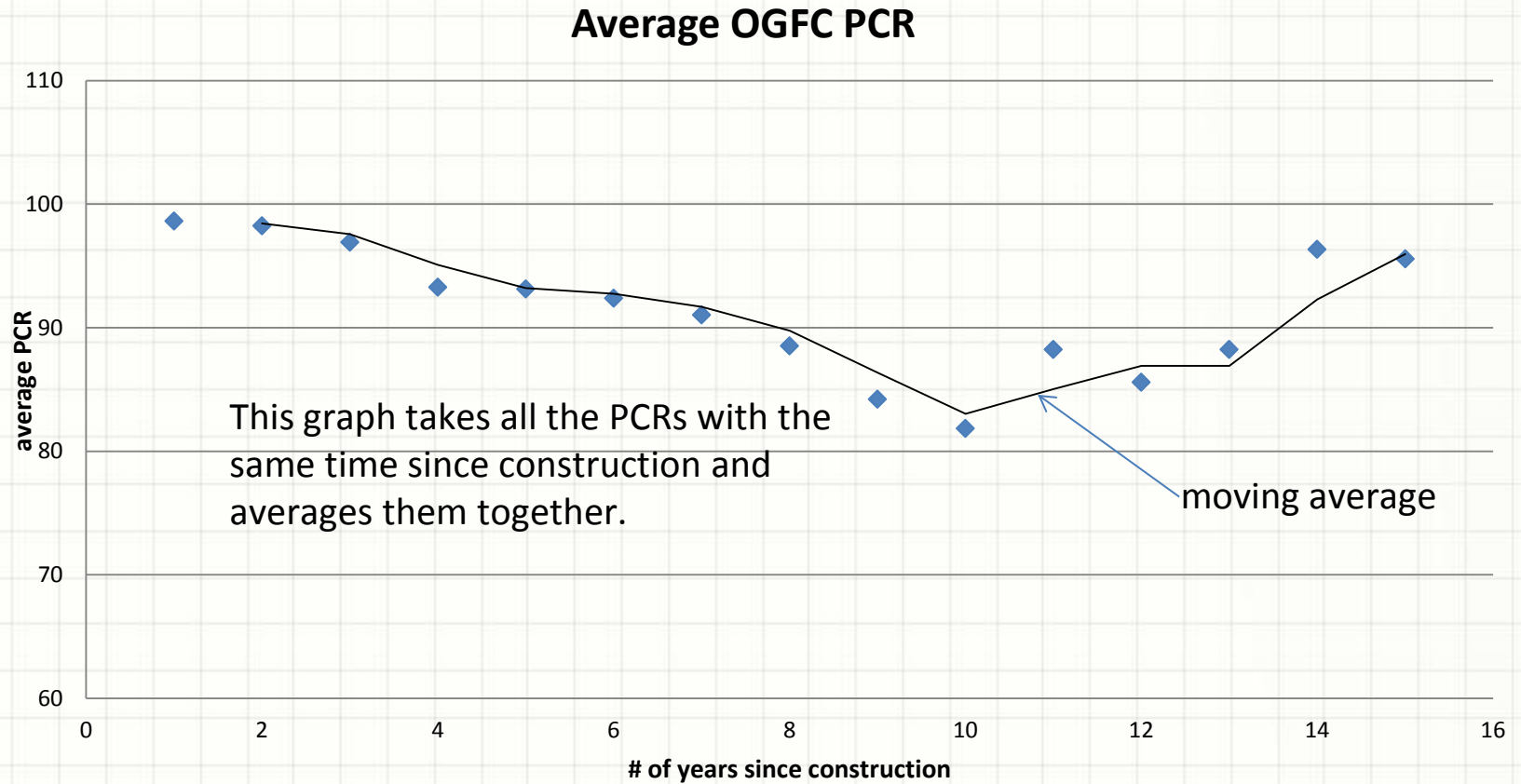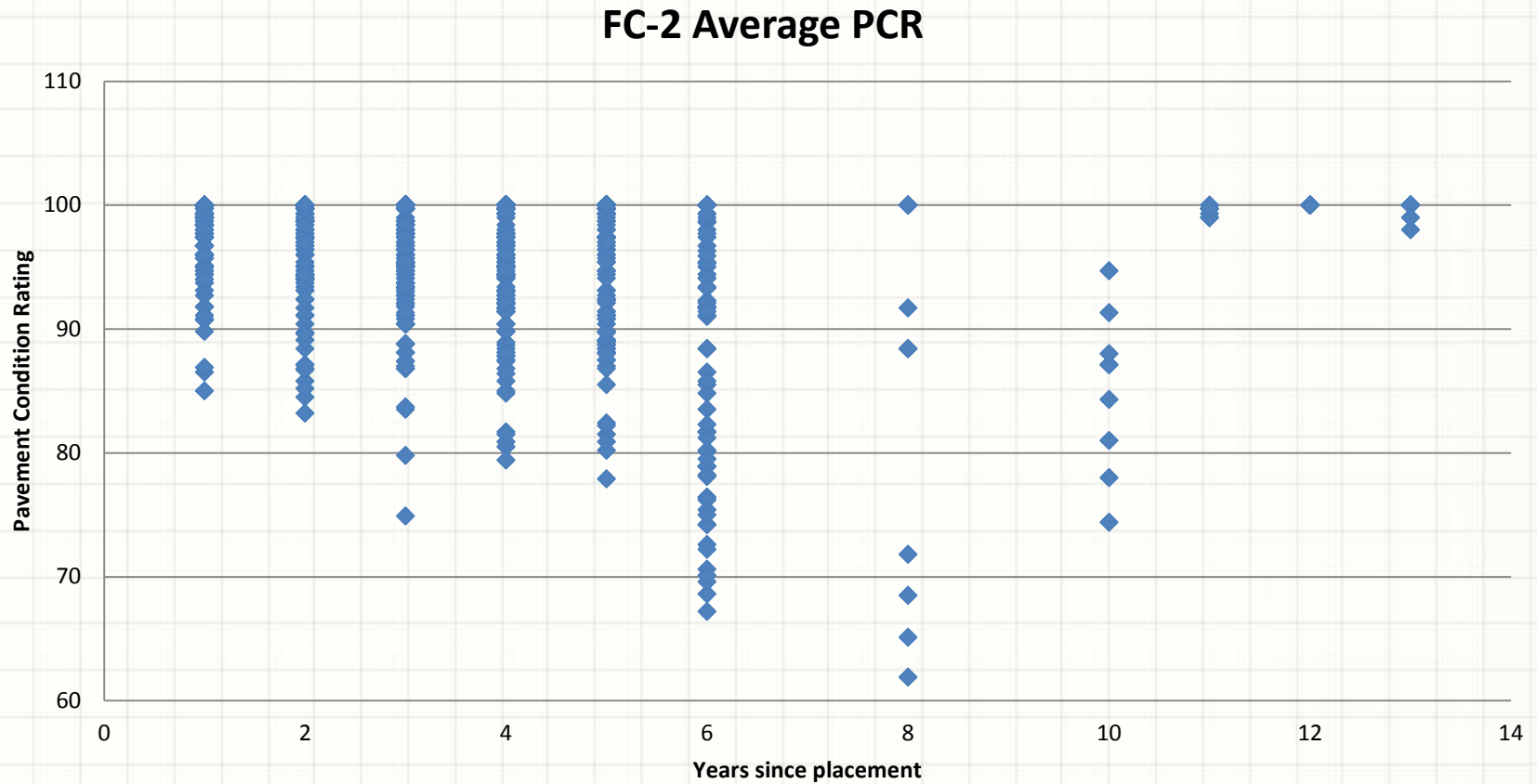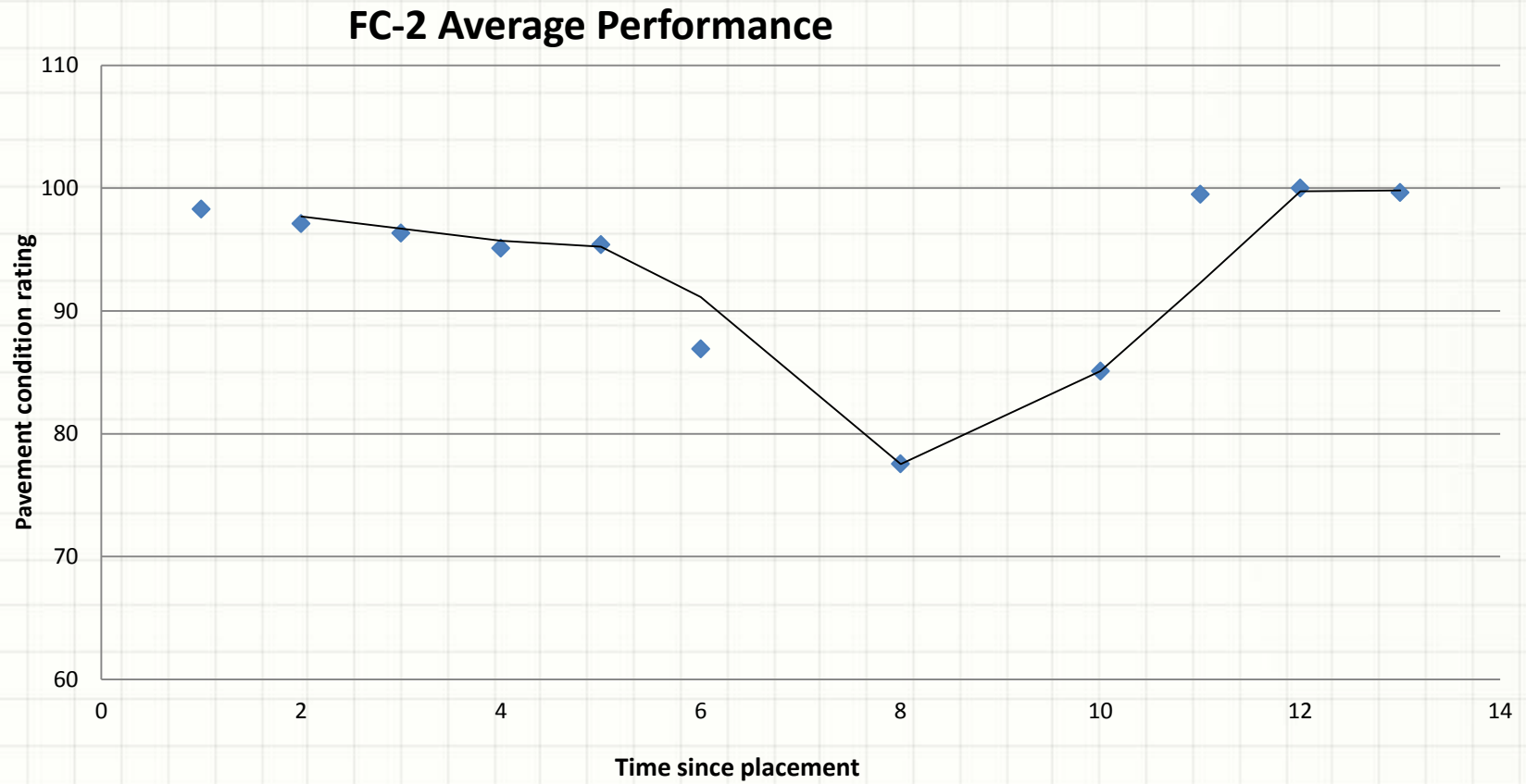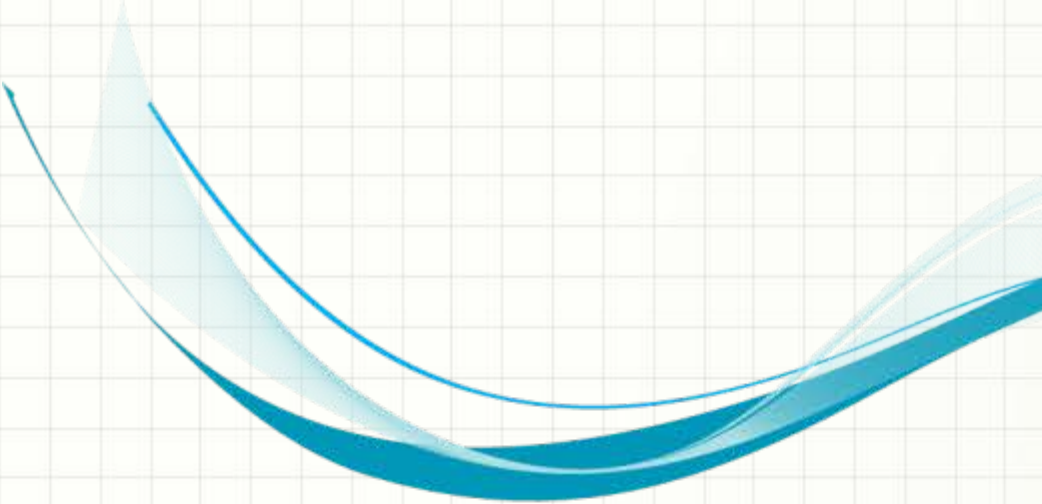
OGFC Performance

Average OGFC PCR

This graph takes all the PCRs with the same time since construction and averages them together.

moving average

average PCR

# of years since construction

FC-2 Performance

FC-2 Average PCR

FC-2 Performance

FC-2 Average Performance

Using the results

Uses

- Life cycle cost analysis for pavement design
- Life cycle cost analysis for system (would need similar work for multiple treatments)
- Informing choices made by field divisions.

Broader Application

Transportation Asset Management

- Must be data based. Must use PMS or other data source to identify life of treatments.

- NCDOT has used our data to look at performance, or time to treatment for flexible pavements based on climate region, use of UTBWC on jointed pavements and other treatments. This will be included in our TAMP calculations.

My contact information: JLAY@NCDOT.GOV

Thank you for your attention.

QUESTIONS?
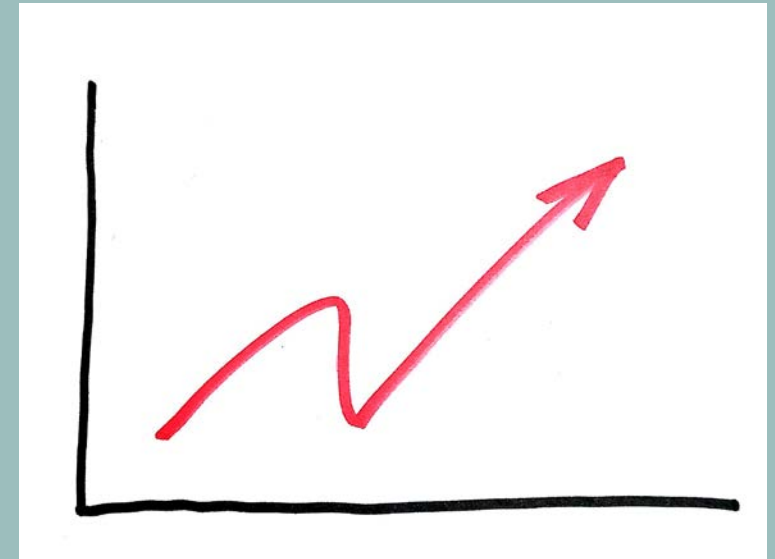
USING PMS DATA FOR PERFORMANCE MANAGEMENT IN AN MPO

Sui Tan, PE
Metropolitan Transportation Commission

TRB Webinar: Using PMS Data to Meet Agency Needs , May 16, 2016

SAN FRANCISCO METROPOLITAN REGION

POPULATION = **7.4** MILLION

9 COUNTIES

100 CITIES

43,000 LANE-MILES OF LOCAL STREETS & ROADS

6,850 LANE-MILES OF STATE HIGHWAY (CALTRANS)

23 TRANSIT AGENCIES

7 TOLL BRIDGES

One MPO -
Metropolitan Transportation Commission

REGIONAL TRANSPORTATION PLAN (RTP)

LOCAL STREETS & ROADS NEEDS ASSESSMENT:

▪ Answer how much we need to invest as a region for

- ✓ Pavement
- ✓ Non-Pavement
- ✓ Local Bridges

▪ Facilitate Regional Transportation Plan (RTP) discussion and funding policies

▪ Are easy due to exclusive use of a common PMS by Bay Area jurisdictions

28-YEAR NEEDS ASSESSMENT

($ in millions)

County	Avail. Revenues	Pavement Needs	Non-Pavement Needs	Total Capital Needs	Total Remaining Capital Needs
Alameda	$ 2,148	$ 3,715	$ 4,082	$ 7,798	$ 5,650
Contra Costa	$ 2,915	$ 3,111	$ 2,674	$ 5,786	$ 2,871
Marin	$ 655	$ 865	$ 641	$ 1,506	$ 852
Napa	$ 219	$ 1,087	$ 429	$ 1,516	$ 1,297
San Francisco	$ 2,299	$ 2,416	$ 2,363	$ 4,778	$ 2,480
San Mateo	$ 1,440	$ 1,929	$ 1,984	$ 3,913	$ 2,473
Santa Clara	$ 3,374	$ 5,776	$ 5,118	$ 10,894	$ 7,520
Solano	$ 488	$ 1,906	$ 1,289	$ 3,195	$ 2,707
Sonoma	$ 994	$ 3,699	$ 1,319	$ 5,018	$ 4,023
REGION	$14,500	$24,500	$20,000	$44,500	$30,000

REGIONAL INVESTMENT POLICY

Performance-based planning approach

Keep Our System in a State of Good Repair

Our transit and roadway systems are an integral part of the Bay Area's transportation network and represent a huge investment of public resources. This plan not only reaffirms the region's long-standing "fix it first" maintenance policy but also expands our commitment to maintaining and operating our existing local roadway and transit systems. The Transportation 2035 Plan directs $7 billion in discretionary funds to maintain local roadways at current pavement conditions, and $6.4 billion to close funding shortfalls for the highest-rated transit assets.

" …long-standing "fix it first" maintenance policy… "

Transportation 2035 Performance Objectives

Three Es

Economy

Reduce per-capita delay by 20 percent from today by 2035

Improve Maintenance

- Maintain pavement condition index (PCI) of 75 or greater for local streets and roads

- Distressed pavement condition lane-miles not to exceed 10 percent of total state highway system

- Achieve an average age for all transit asset types that is no more than 50 percent of their useful life

- Increase the average number of miles between service calls for transit service in the region to 8,000 miles

Reduce Collisions/Fatalities

- Reduce fatalities from motor vehicle collisions by 15 percent from today by 2035

- Reduce bicycle and pedestrian *fatalities* attributed to motor vehicle collisions by 25 percent (each) from 2000 by 2035

- Reduce bicycle and pedestrian *injuries* attributed to motor vehicle collisions by 25 percent (each) from 2000 by 2035

Improve Regional Transportation Emergency Preparedness

- Conduct regional transportation exercise that tests emergency response and coordination capabilities for special needs populations

- Improve the seismic safety of high-priority transportation facilities

- Increase the number of transportation agency employees trained in security/emergency awareness protocols

Reduce Vulnerability to Transportation Security Threats

- Increase the number of transportation agency employees trained in security/emergency awareness protocols

- Enhance or install critical infrastructure detection equipment on high-priority transportation facilities

Environment

Reduce daily per-capita vehicle miles traveled (VMT) by 10 percent from today by 2035

Reduce Emissions

- Reduce emissions of fine particulates ($PM_{2.5}$) by 10 percent from today by 2035

- Reduce emissions of coarse particulates (PM_{10}) by 45 percent from today by 2035

- Reduce carbon dioxide (CO_2) emissions to 40 percent below 1990 levels by 2035

Equity

Decrease by 10 percent the combined share of low-income and lower-middle-income residents' household income consumed by transportation and housing

Long Range Regional Transportation Plan 2035

For Local Streets & Roads:

Performance Target:
   PCI =75

BAY AREA LOCAL STREET AND ROAD CONDITIONS

San Francisco Bay Area Pavement Conditions
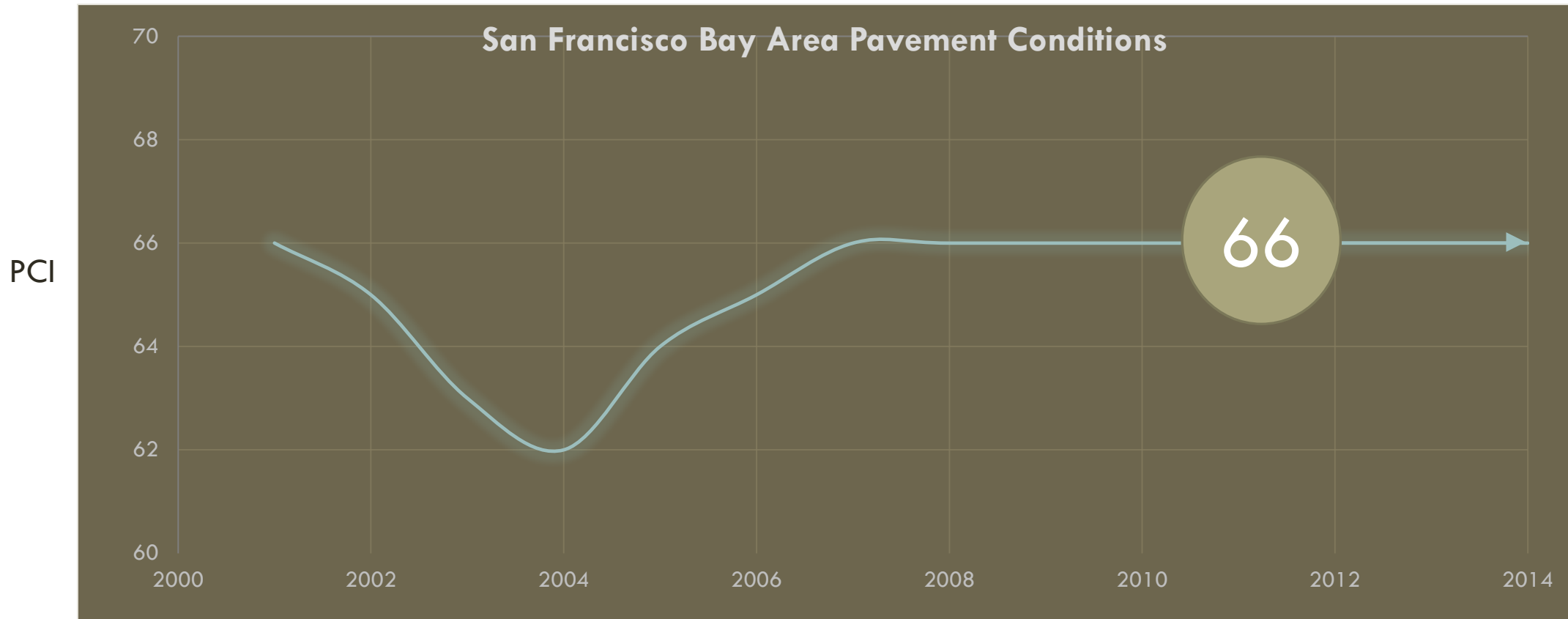
OUTCOME-DRIVEN PERFORMANCE MEASURE

- Easy to compute formula

- No advantage or disadvantage due to age of network, current PCI or annual budget size

- Data extracted from StreetSaver databases

- Promotes pavement preservation principles

- Replaces "Maintenance of Effort"

Shifts from "worst first" to preventive maintenance

PERFORMANCE-BASED FUNDING ALLOCATION
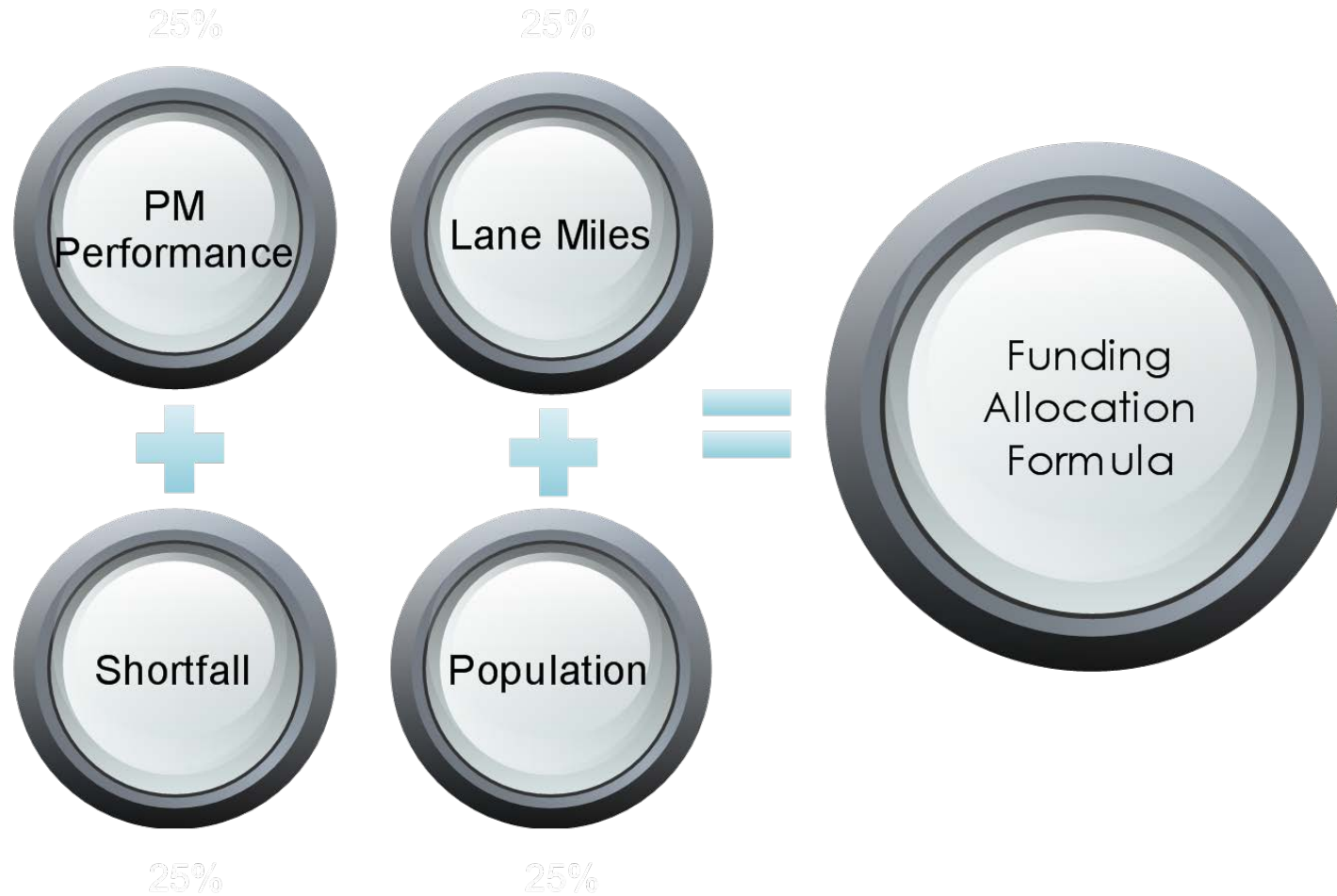
KPI: PAVEMENT PRESERVATION INDEX

What is the effort toward pavement preservation?

County	Jurisdiction	Network PCI	$PM/ Lane Mile	% Actual PM	% PM Needs	Pavement Preservation Index
	Regional Benchmarks	**66**	**$ 1,336**	**17%**	**16%**	**1.06**
Alameda	ALAMEDA	66	$ 1,271	13%	15%	0.88
	ALAMEDA CO.	71	$ 671	18%	28%	0.67
	ALBANY	58	$ 1,247	10%	13%	0.78
	BERKELEY	58	$ 263	2%	11%	0.20
	DUBLIN	87	$ 3,124	50%	79%	0.62
	EMERYVILLE	75	$ 48	100%	35%	2.87
	FREMONT	63	$ 5,140	43%	16%	2.76

DATA QUALITY MANAGEMENT PLAN

- Consultant prequalification
- Quality control plan - before, during, and, after production
- Quality acceptance
- Rater Certification Program
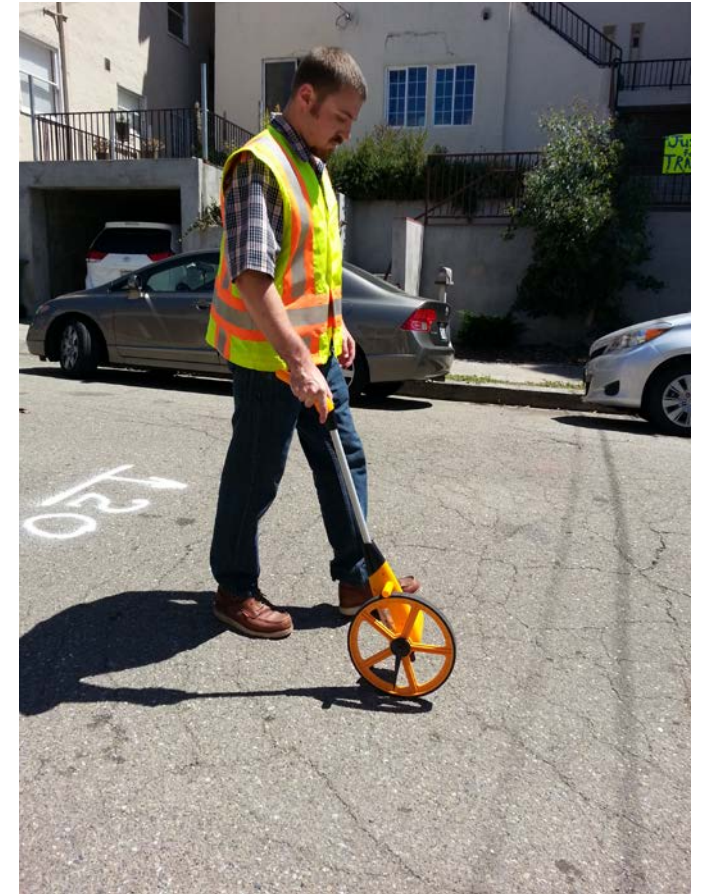
QUALITY ACCEPTANCE

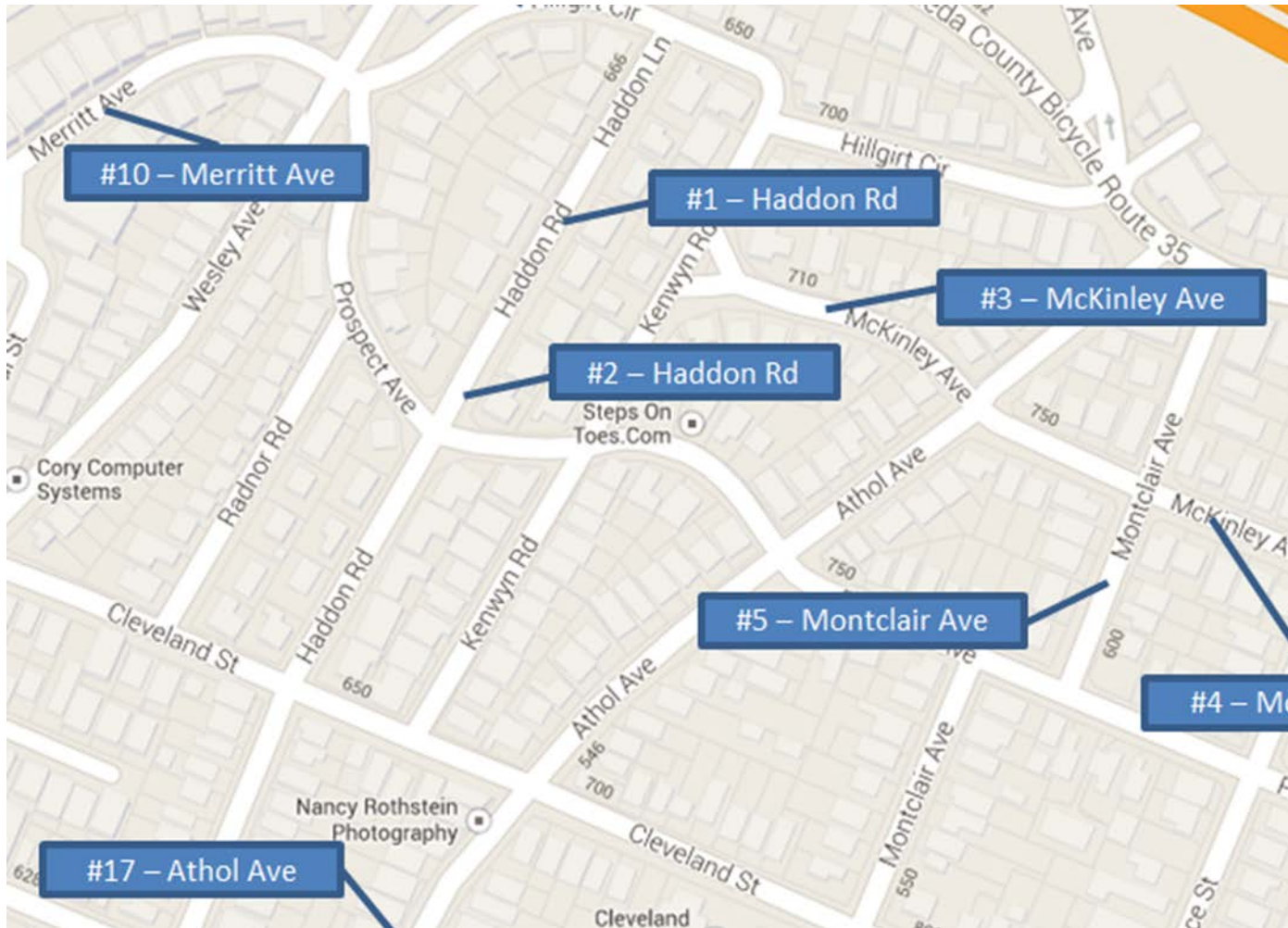3rd Neutral Party – California Pavement Preservation Center:

- Verifies quality control plans (QCP) adopted by contractors

- Audits QCP results to ensure contractors are meeting the requirements

- Conducts on-project site audits
  - ✓ Survey sample sections previously rated by contractor

PRE-QUALIFICATION TEST SITES

GARBAGE IN – GARBAGE OUT

JUST REMEMBER…

If it wasn't documented, it didn't happen!

CALIFORNIA STATEWIDE LOCAL STREETS & ROADS NEEDS ASSESSMENT

Pavement Condition Index PCI
- 71 - 100 (Good)
- 50 - 70 (At Risk)
- 0 - 49 (Poor)

54 counties have average PCI that is "at risk" or "poor"

2008

2014

WHAT ARE FUNDING SHORTFALLS?

Transportation Asset	10 Year Needs (2014 $B)	Funding	Shortfall
Pavements	$72.7	$16.6	$ (56.1)
Essential Components	$31.0	$10.1	$ (20.9)
Bridges	$4.3	$3.0	$ (1.3)
Totals	$108.0	$29.7	$ (78.3)

Measure T—Fix Our Local Roads

How did we get here?

Federal and State revenues over the last 10 years have been declining in both real and nominal terms. The 18.4 ¢ per gallon tax deposited in the National Highway Trust Fund for surface transportation projects has not been increased since 1993. Reductions in federal funds has been compounded by the diversion of millions in State Highway and local streets and roads funds for highway needs or to backfill shortfalls in the State's general fund.

What's the Problem?

The Cities, Town, and County of Napa have almost $300 million in deferred road maintenance. Without a near term infusion of new revenues, this figure is projected to grow to almost $2 billion over the next 25 years. Measure T will not solve all of the county's problems but will help get a handle on exponential growth of Streets & Roads Deferred Maintenance needs.

NAPA'S ROADS ARE THE WORST IN THE REGION - ON A SCORE FROM 25 (LOW) TO 89 (HIGH) - 90% OF NAPA'S ROADS ARE CONSIDERED VERY POOR OR AT RISK ON THE REGION'S PAVEMENT CONDITION INDEX (PCI).

Napa County & Jurisdictions Pavement Condition & Deferred Maintenance
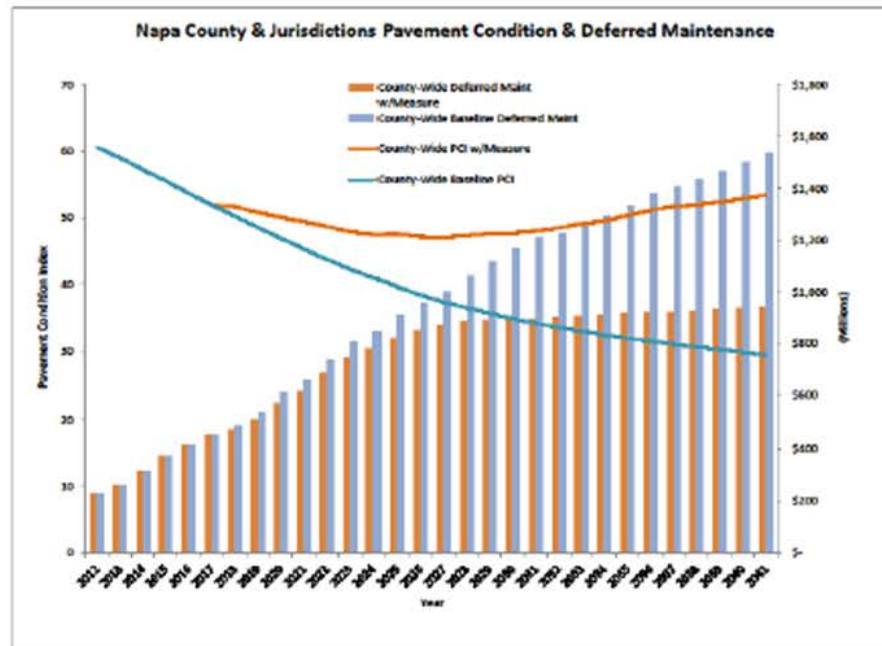
Source: MTC—Pavement Management System

19

DELAY RESULTS IN EXPONENTIAL GROWTH OF DEFERRED MAINTENANCE

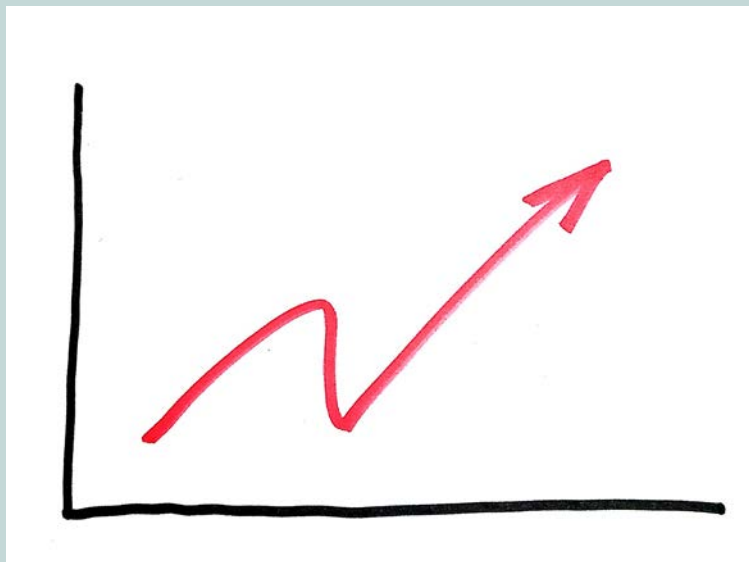**Napa County & Jurisdictions Pavement Condition & Deferred Maintenance**
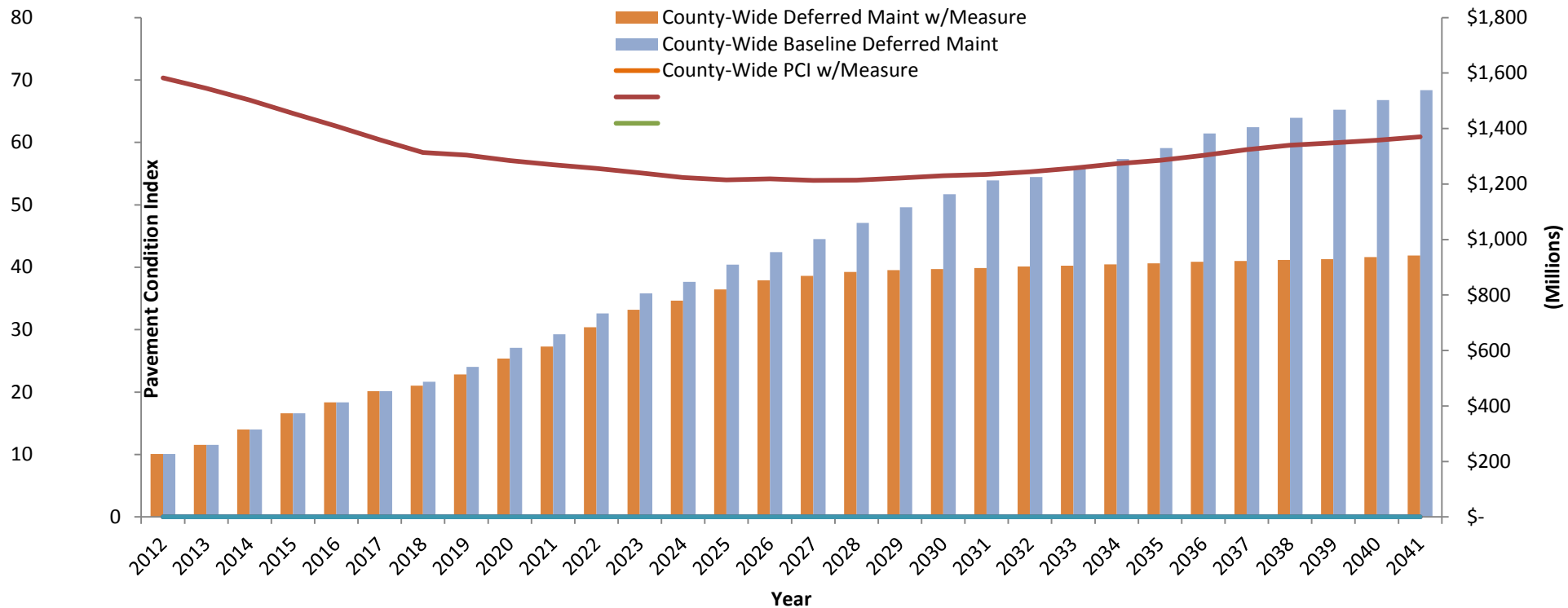
NAPA COUNTYWIDE ROAD MAINTENANCE ACT

~$300 million over 25 years

- Dedicated funding:
  - ✓ 99% Local Streets Maintenance
  - ✓ 1% Administration
- 75% YES votes

SUI TAN, PE

StreetSaver Program Manager
MTC
stan@mtc.ca.gov
510-400-8428

Performance Measures for Pavement Management

David Luhr
Pavement Management Engineer

Washington State DOT

Performance Management in MAP-21

Title 23, U.S.C.

§150. National goals and performance management measures

(a) DECLARATION OF POLICY.—Performance management will transform the Federal-aid highway program and provide a means to the most efficient investment of Federal transportation funds by refocusing on national transportation goals, increasing the accountability and transparency of the Federal-aid highway program, and improving project decisionmaking through performance-based planning and programming.

1958: The concept of pavement performance was developed

HIGHWAY RESEARCH BOARD
Special Report 61E

The AASHO Road Test
Report 5
Pavement Research

National Academy of Sciences—
National Research Council
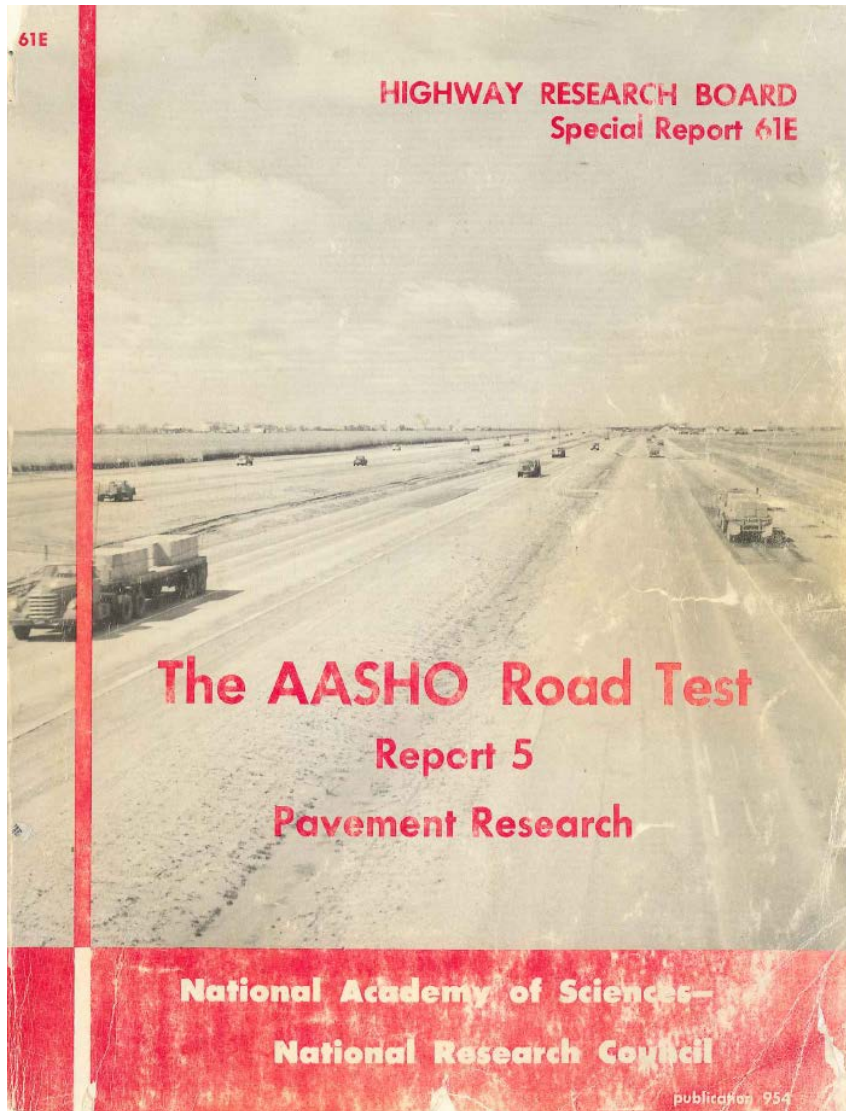
How does the public perceive the quality of a road?

Figure 1–F. Individual present serviceability rating form.

Highway Research Board 1962

3
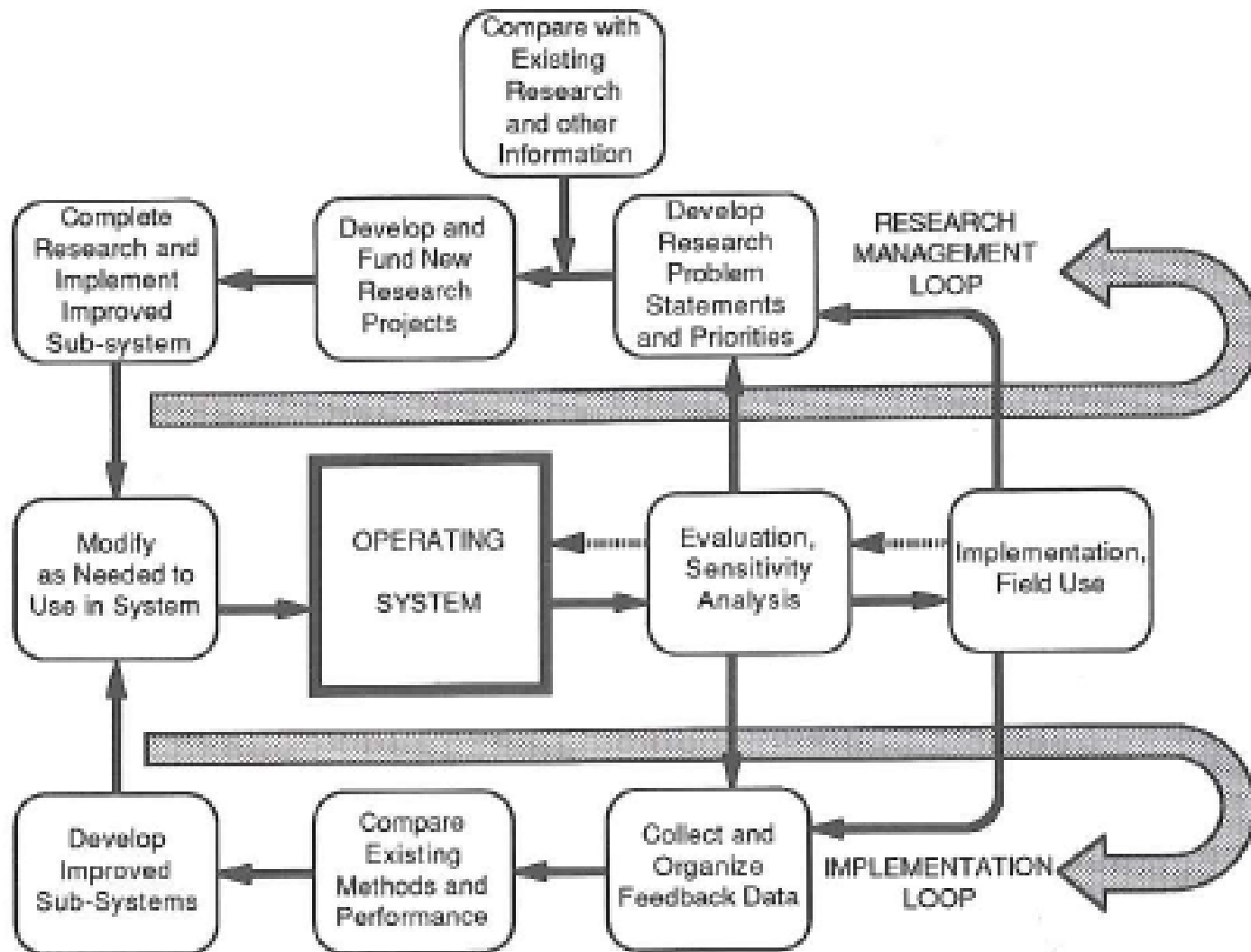
Figure 5.1 Cyclic improvements of pavement design and management system.

Haas, et al, 1994

4

Performance Measures within what Context?

- Historical?
- Future Projection?

- Project Level?
- Network Level?

- Agency Perspective?
- User Perspective?

Performance Measures as Tools in Pavement Management

- ## Decision Support
  - What, When, and How for pavement decisions
- ## Accountability & Communication
  - achieving standards, reports to legislature & public
  - stewardship, protecting infrastructure investment
- ## Forecasting Needs & Risks
  - funding needs, evaluation of risk
- ## Learning
  - continual improvement of methods & procedures

Cost-Effectiveness

"…the most efficient investment…"

– Annual Cost ($ / lane-mile / year of life)

- Historical Cost of <u>Acceptable</u> Pavement Performance

  – Actual historical cost ($/LMY)

- Expected Cost of Future Pavement Rehab

  – Projected LCCA ($ /LMY)

Cost Effectiveness Examples

Project Type	Typical Cost($/LM)	(Avg.) LMY gained	Annual Cost $/LMY * (no user $)
Reconst (ACP)	$900,000	20	$66,000
Rehab (ACP)	$250,000	14	$23,000
Chip Seal	$45,000	7	$ 7,500
Crack Seal	$5,000	3	$ 1,800
Reconst.(PCCP)	$2,500,000	50	$116,000
Grinding (PCCP)	$150,000	15	$13,500

* includes 4% Discount Rate

Historical ACP $ / LMY by Region — Performance Period

9
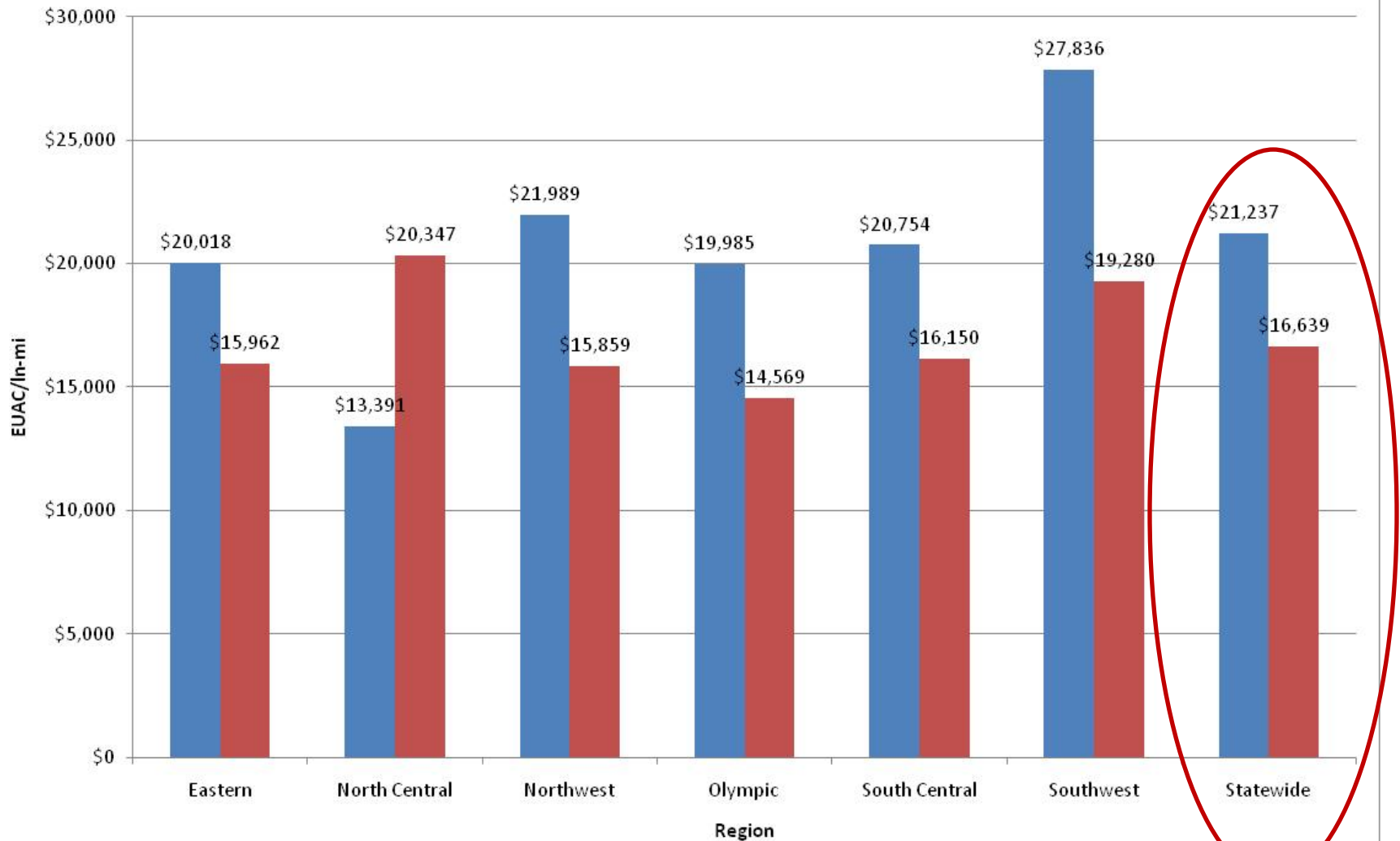
South Central Region ACP $ / LMY by Contract

10

Select Location 🖫 🔖 🕐 ★   ⊕ Manage Data Components ⌃ ⌄   ⇕ Hide Slider 📌

24.00 24.50 25.00 25.50 26.00 26.50 27.00 27.50 28.00 28.50 29.00

24.08 24.58 25.08 25.58 26.08 26.58 27.08 27.58 28.08 28.58 29.08
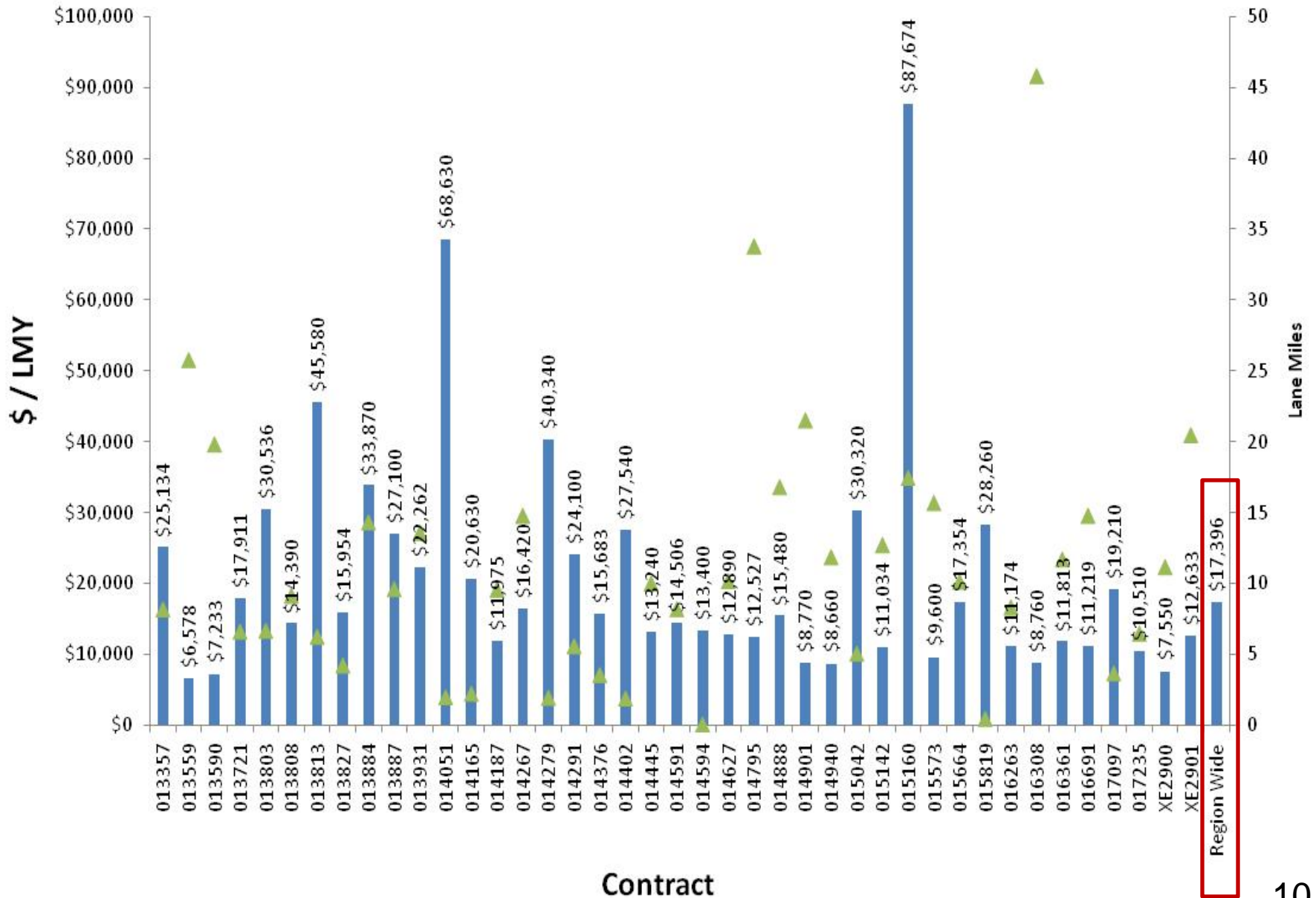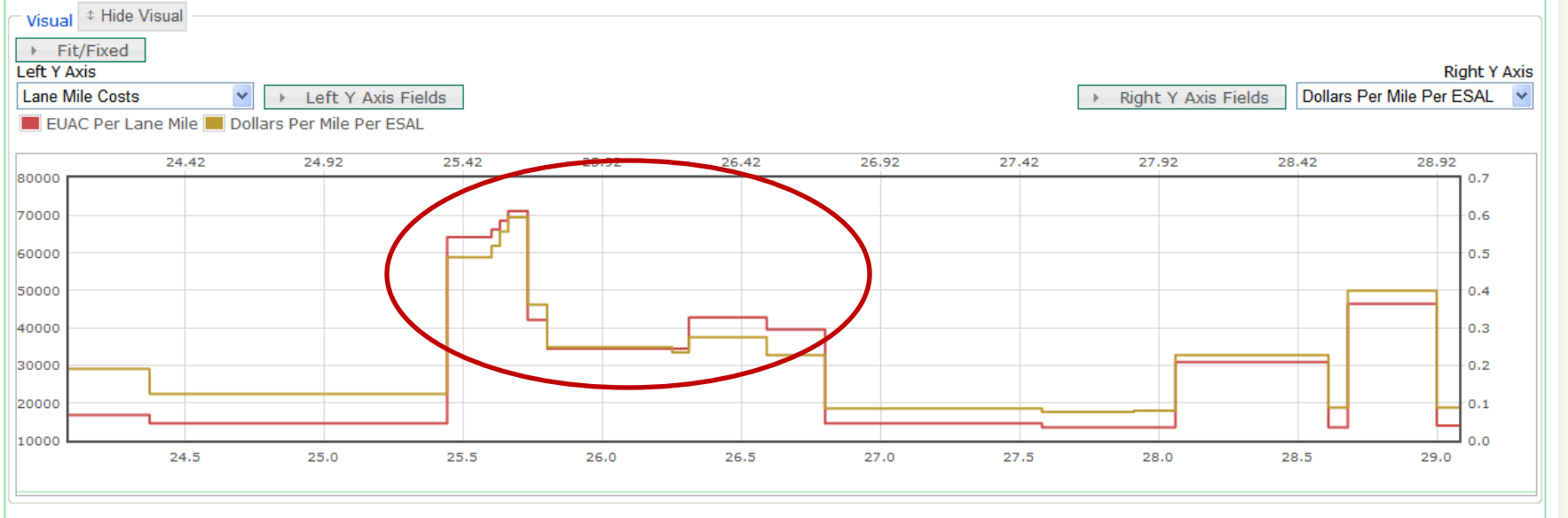
◄◄ | 1 mi ▼ | ►► | 🔍 | ☐ Auto Refresh

SRMP: 24.00 - 29.00 | ARM: 24.08 - 29.08 | ◀ ⧉ Go

Search Data Dictionary: [   ] 🔍

Economic Performance   ⇕ Hide   ⊗ Close

Visual ⇕ Hide Visual

▸ Fit/Fixed

Left Y Axis
[Lane Mile Costs ▼] ▸ Left Y Axis Fields

Right Y Axis
▸ Right Y Axis Fields [Dollars Per Mile Per ESAL ▼]

🟥 EUAC Per Lane Mile 🟨 Dollars Per Mile Per ESAL

Cross Section   ⇕ Hide   ⧉ Export to Excel   ⊗ Close

Visual ⇕ Hide Visual

▸ Axis Type   ▸ Fit/Fixed

Contract Detail | ⇕ Hide Contract Detail | ◄◄ Previous Contract Area | ►► Next Contract Area | Show All Contract Info | ⧉ Scroll Into View

SRMP: 26.23 - 26.51				
ARM: 26.31 - 26.59				
Construction End Date	Contract	Thickness	Surface	Exception
6/21/2002	016187	0.15	ACP CLASS B PG58-22	
8/29/2000	015668	0.15	ACP CLASS B PG58-22	
12/10/1996	014847	0.15	ACP CLASS B AR4000W	
9/30/1988	013313	0.08	ACP CLASS B AR4000W	

Done   💙 Local intranet   🔍 100% ▾

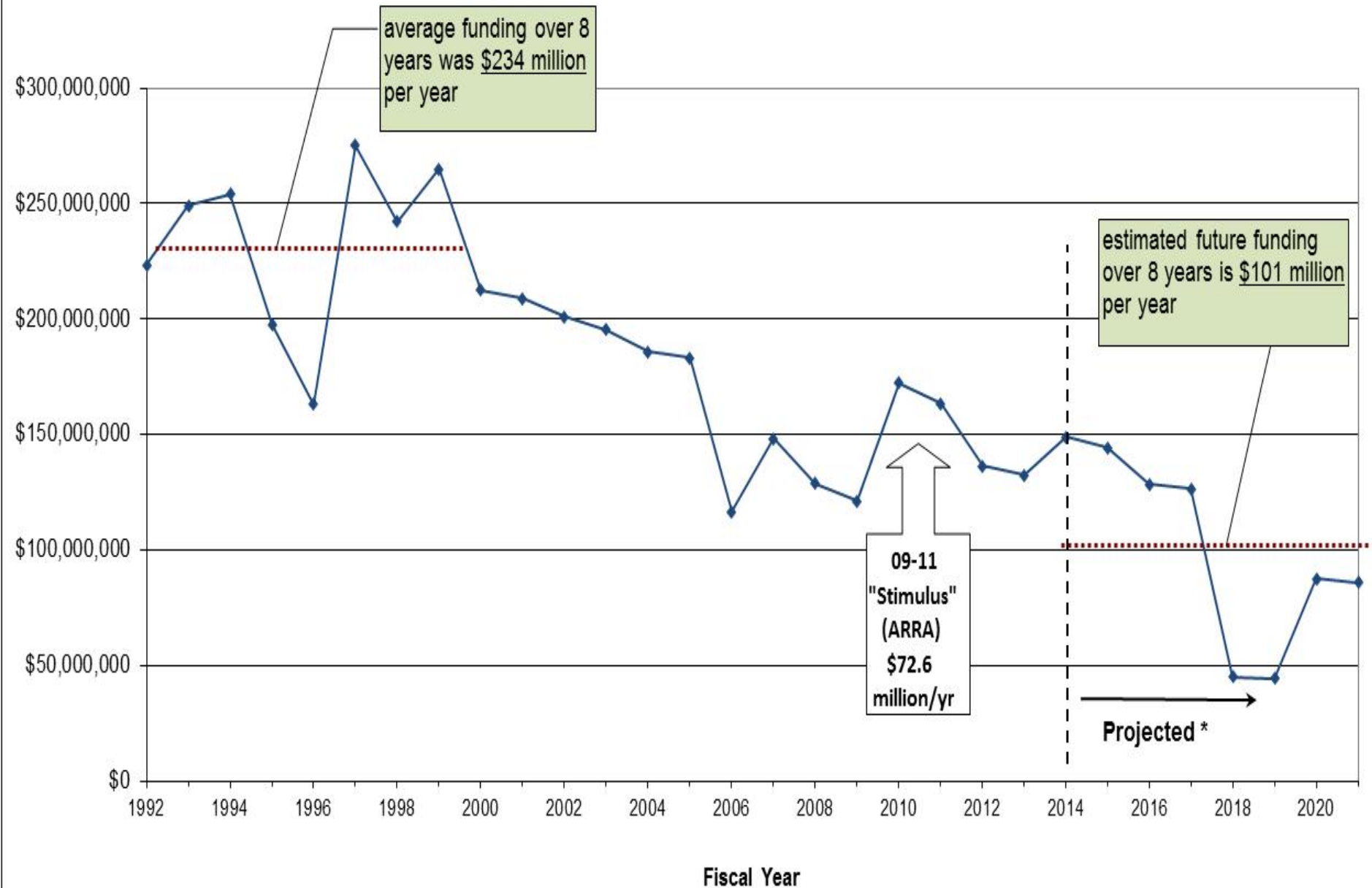# Performance Measures as tools in Pavement Management

- ## Decision Support

  - What, When, and How for pavement decisions

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  - achieving standards, reports to legislature & public

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- ## Forecasting Needs & Risks

  - funding needs, evaluation of risk

- ## Learning

  - continual improvement of methods & procedures

Pavement Performance Measures

How well is infrastructure being managed (past and future)?

- Remaining Service Life (RSL)
- Asset Sustainability Ratio
- Accrued cost of deferred maintenance/rehabilitation (Deferred Preservation Liability)

30-year Pavement Preservation (P1) Annual Funding (Constant 2012 Dollars)

average funding over 8 years was $234 million per year

estimated future funding over 8 years is $101 million per year

09-11 "Stimulus" (ARRA) $72.6 million/yr

Projected *

Fiscal Year

* As of Feb. 2014   14
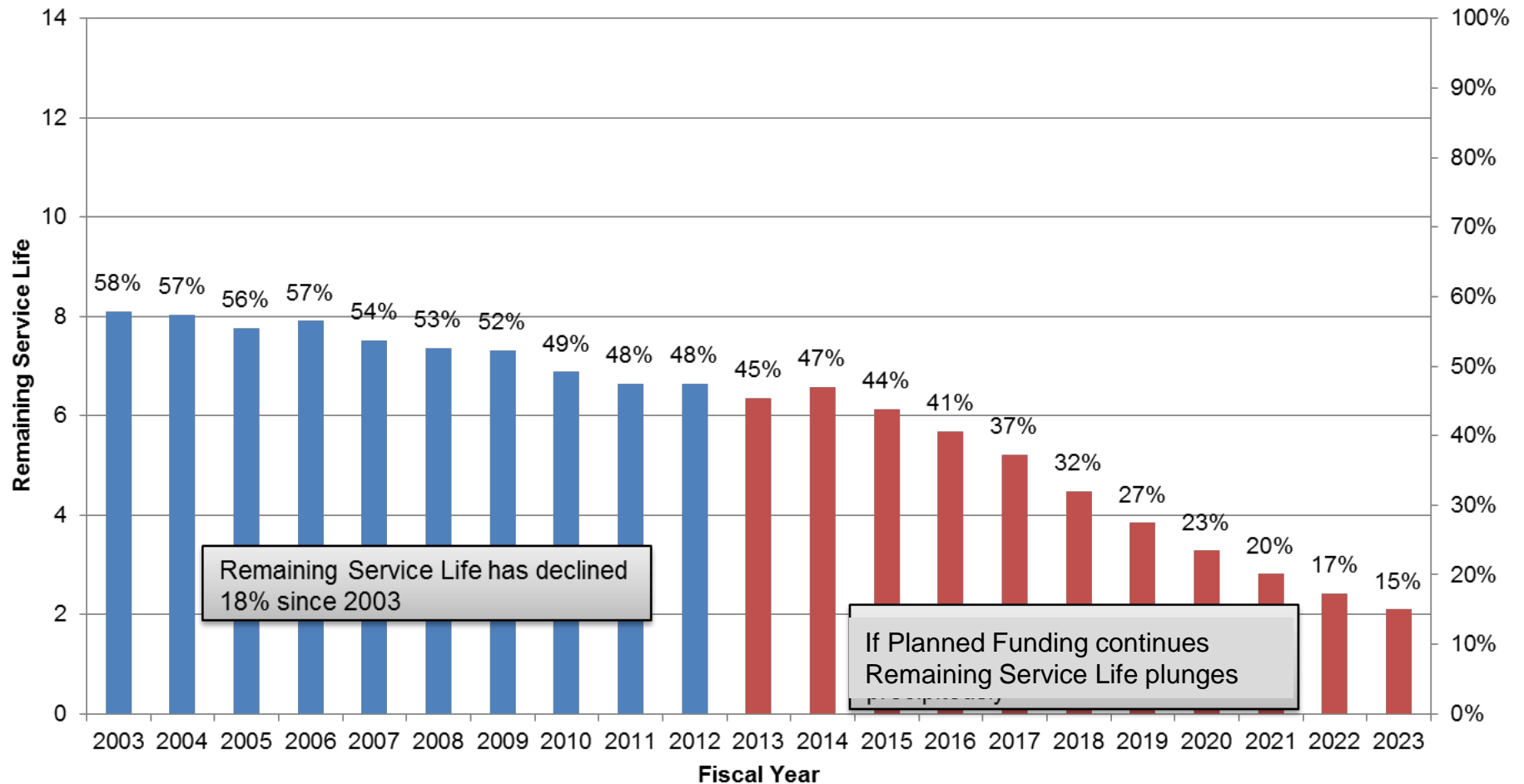
Remaining Service Life (RSL)

- Measures the pavement life (years until due for rehabilitation) of each section over the entire network (expressed as % of typical pavement life)

- Healthy system has remaining service life of   40 – 60 percent

  – In an ideal system, the entire system would have an average remaining service life equal to 50% of the total average pavement life

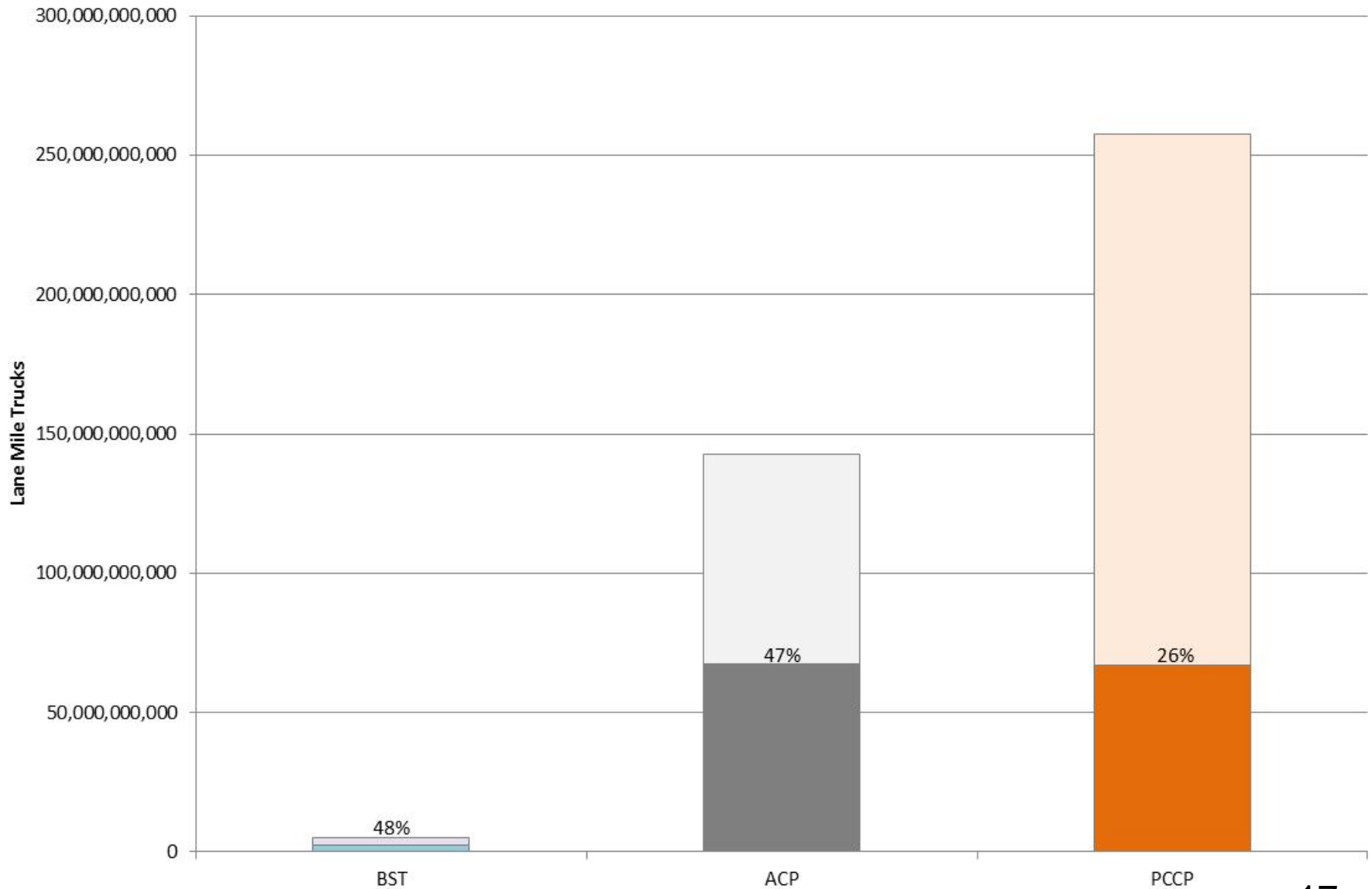**Statewide Average Remaining Service Life**
Asphalt Pavement
In Washington, Asphalt typically needs resurfacing in 12-16 years

Remaining Service Life has declined 18% since 2003

If Planned Funding continues Remaining Service Life plunges precipitously

16

**Statewide Remaining Service Life (Truck Miles)**

17

Asset Sustainability Ratio

- Measures how well WSDOT's pavement replenishment is keeping up with pavement wear.

- Illustrates how much life was put back into the pavement system verses how much was consumed in a given year (units of lane-mile years).

- Consumption (for WSDOT flexible pavements) is 16,000 lane-mile years (per year)
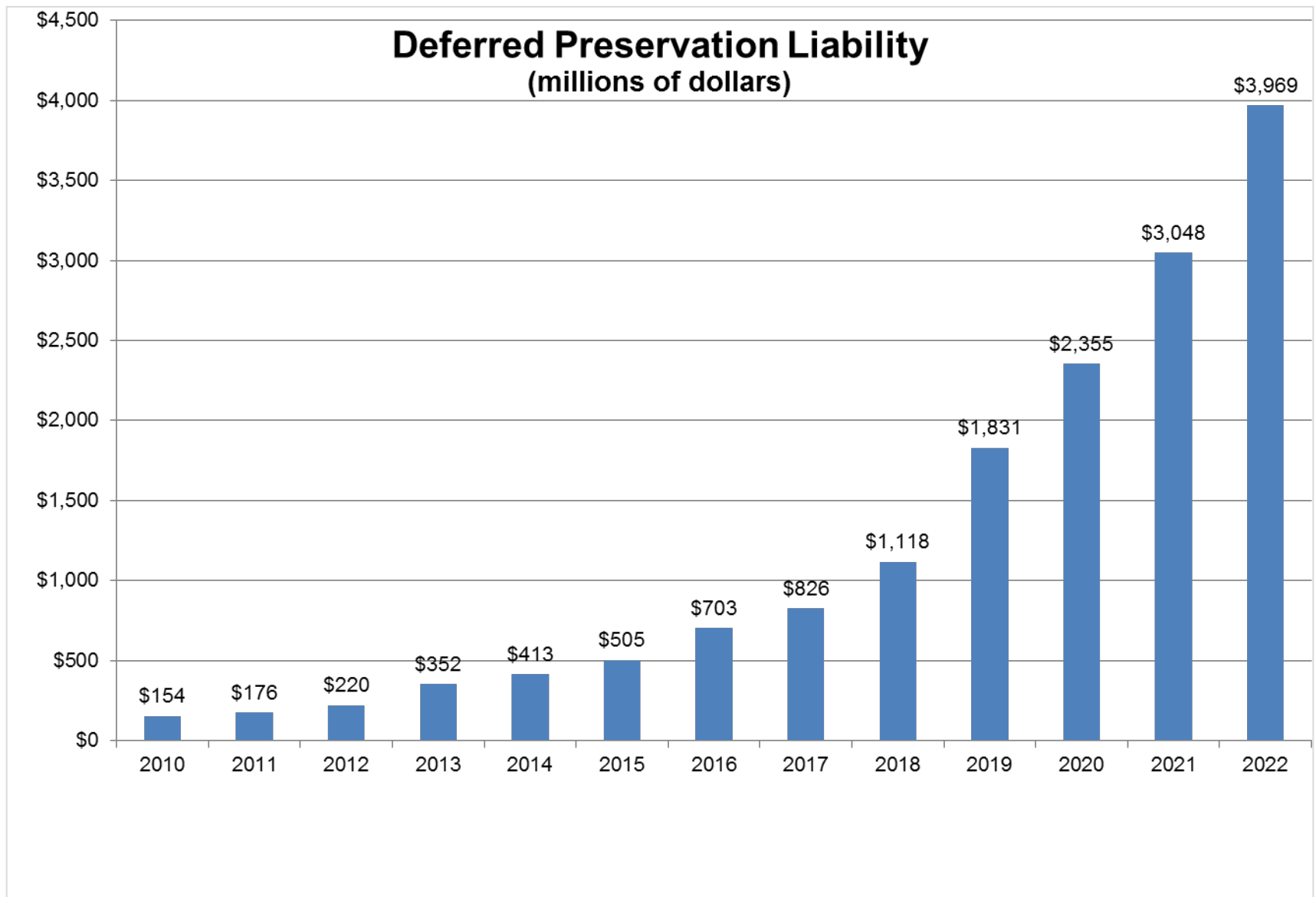
- Target is Ratio of 1.0

Asset Sustainability Ratio (Flexible Pavements)
1980 through 2022

19
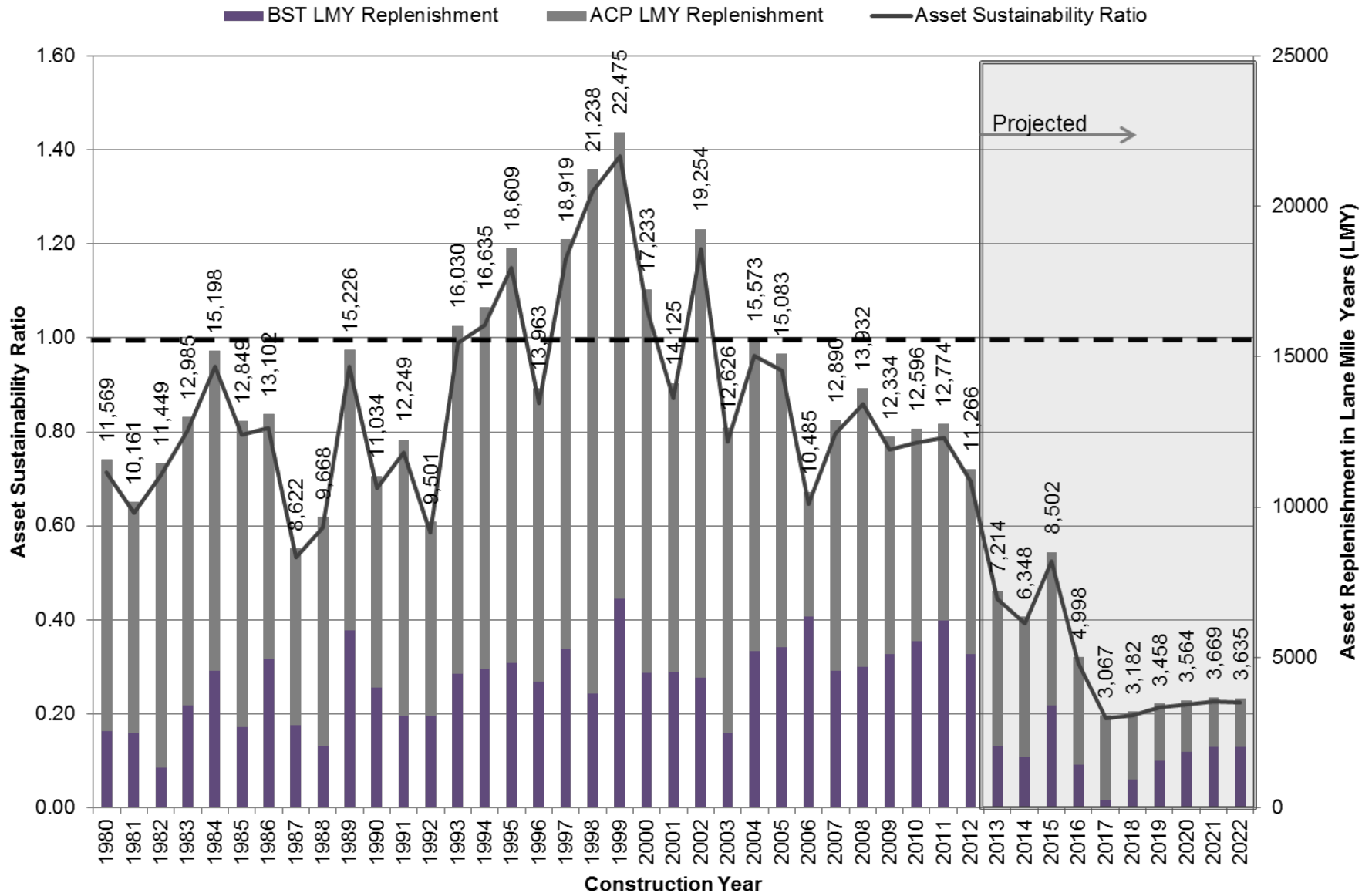
Deferred Preservation Liability

- Is an estimate of the funding necessary to address the backlog of deferred pavement rehabilitation

- Takes into consideration higher costs as pavement condition gets worse (and needs more extensive repair)

Deferred Preservation Liability
(millions of dollars)

Year	Amount
2010	$154
2011	$176
2012	$220
2013	$352
2014	$413
2015	$505
2016	$703
2017	$826
2018	$1,118
2019	$1,831
2020	$2,355
2021	$3,048
2022	$3,969

Performance Measures as Tools in Pavement Management

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  - What, When, and How for pavement decisions

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  - achieving standards, reports to legislature & public
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- ## Forecasting Needs & Risks
  - funding needs, evaluation of risk

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  - continual improvement of methods & procedures

Decision Support
- Pavement Condition
- Cost-Effectiveness
- Remaining Service Life

Forecast Needs & Risks
- Pavement Condition
- Remaining Service Life
- Deferred Preservation Liability

Accountability & Communication
- Pavement Condition
- Asset Sustainability Ratio
- Cost-Effectiveness

Learning
- Cost-Effectiveness
- Remaining Service Life
- Pavement Condition

	Future	Historic	Project Level	Network Level
	✓		✓	
	✓			✓
		✓	✓	✓
		✓	✓	✓

23

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