

Pavement Management: - Learning Lessons

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Learning Lessons

If you hold a cat
by the tail you
learn things you
cannot learn any
other way.

Mark Twain

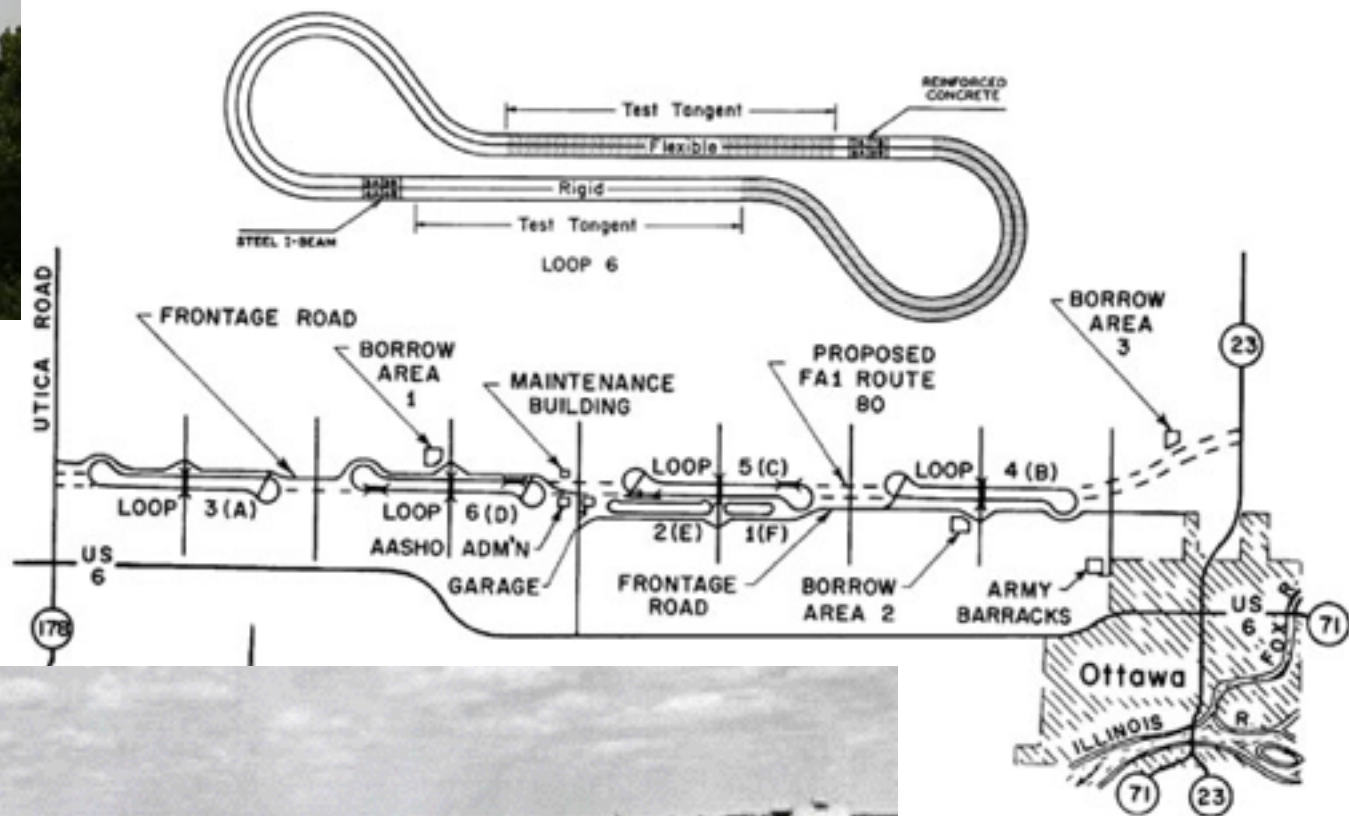
There are no mistakes in life ... only lessons to be learned.

Mark Twain

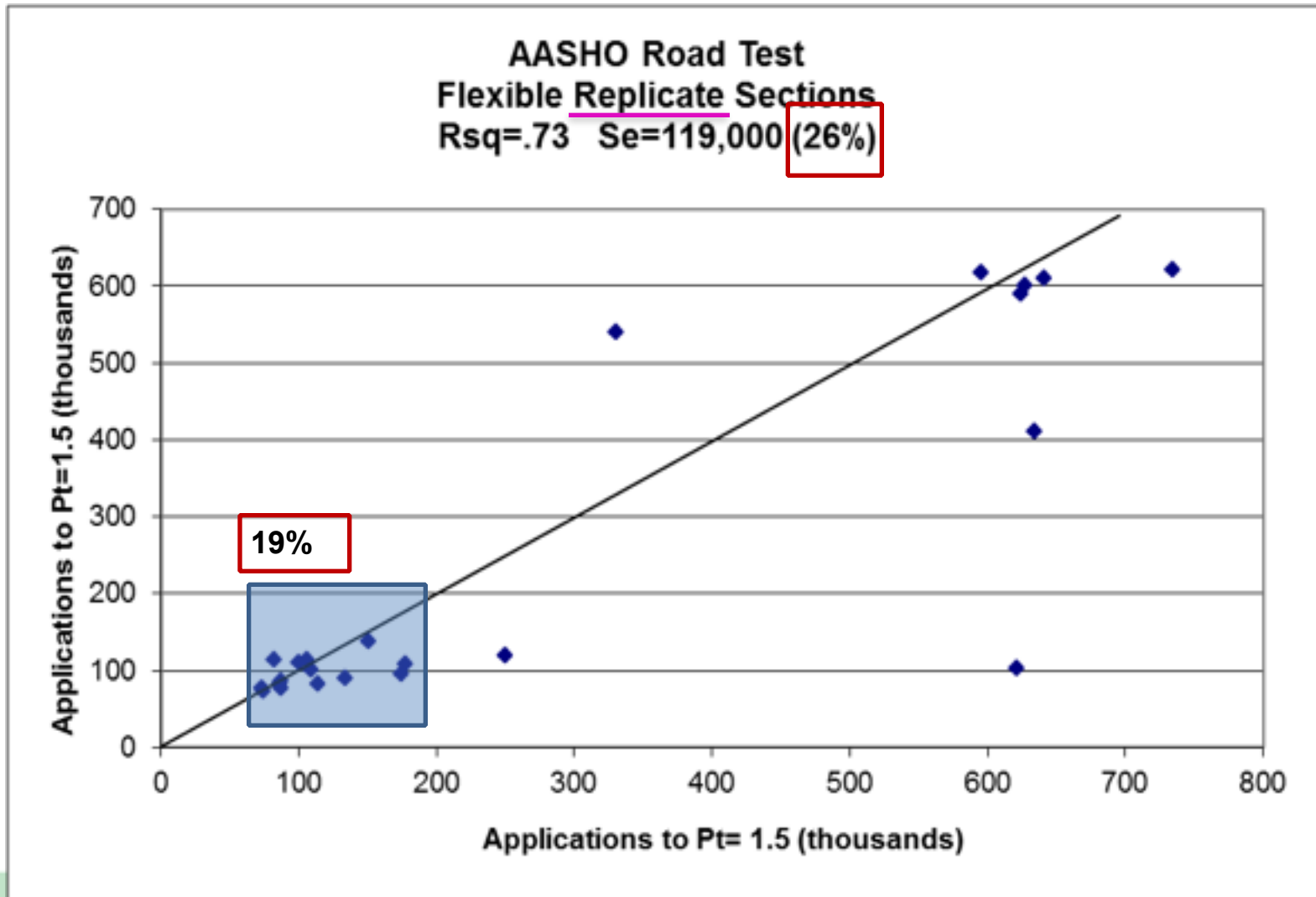


Pavement Management - Learning Lessons

- Some basic facts
- System Development
- Examples of system details
- “Clinical Trials”
- Cost Effectiveness
- Communication

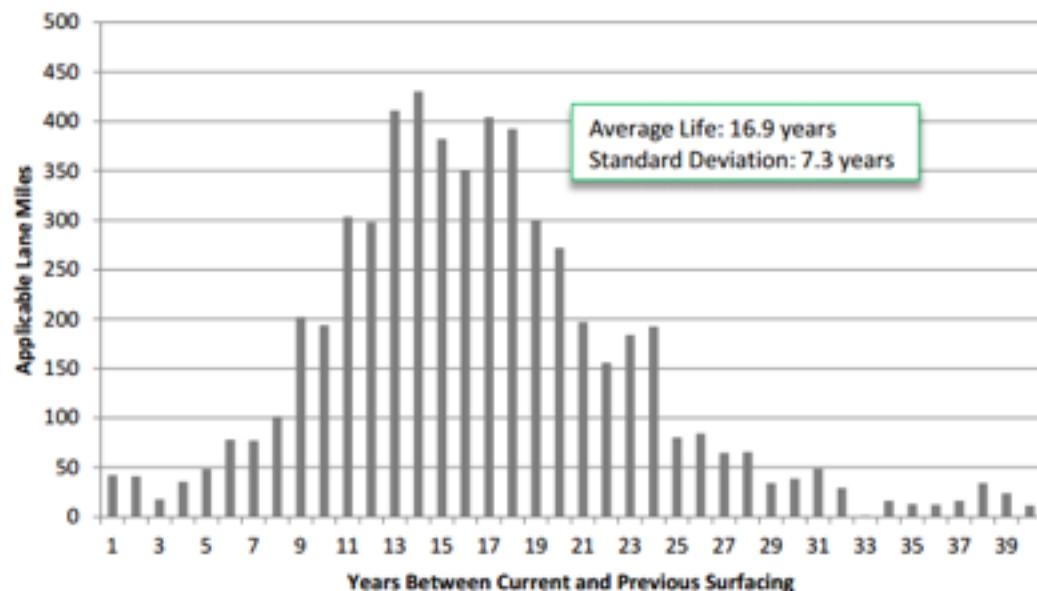


Pavement Variability

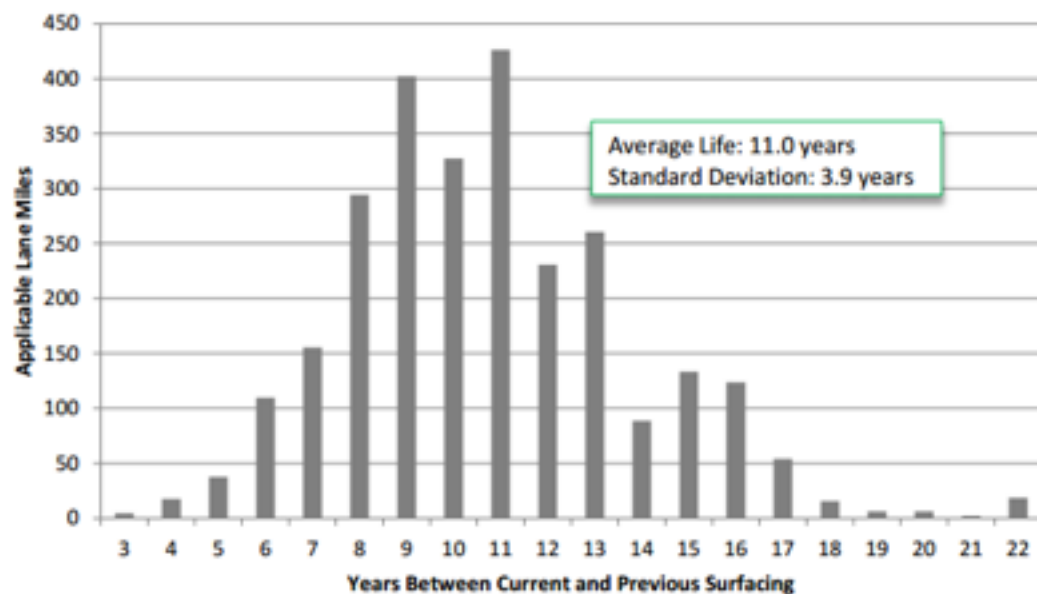


Pavement Variability (cont.)

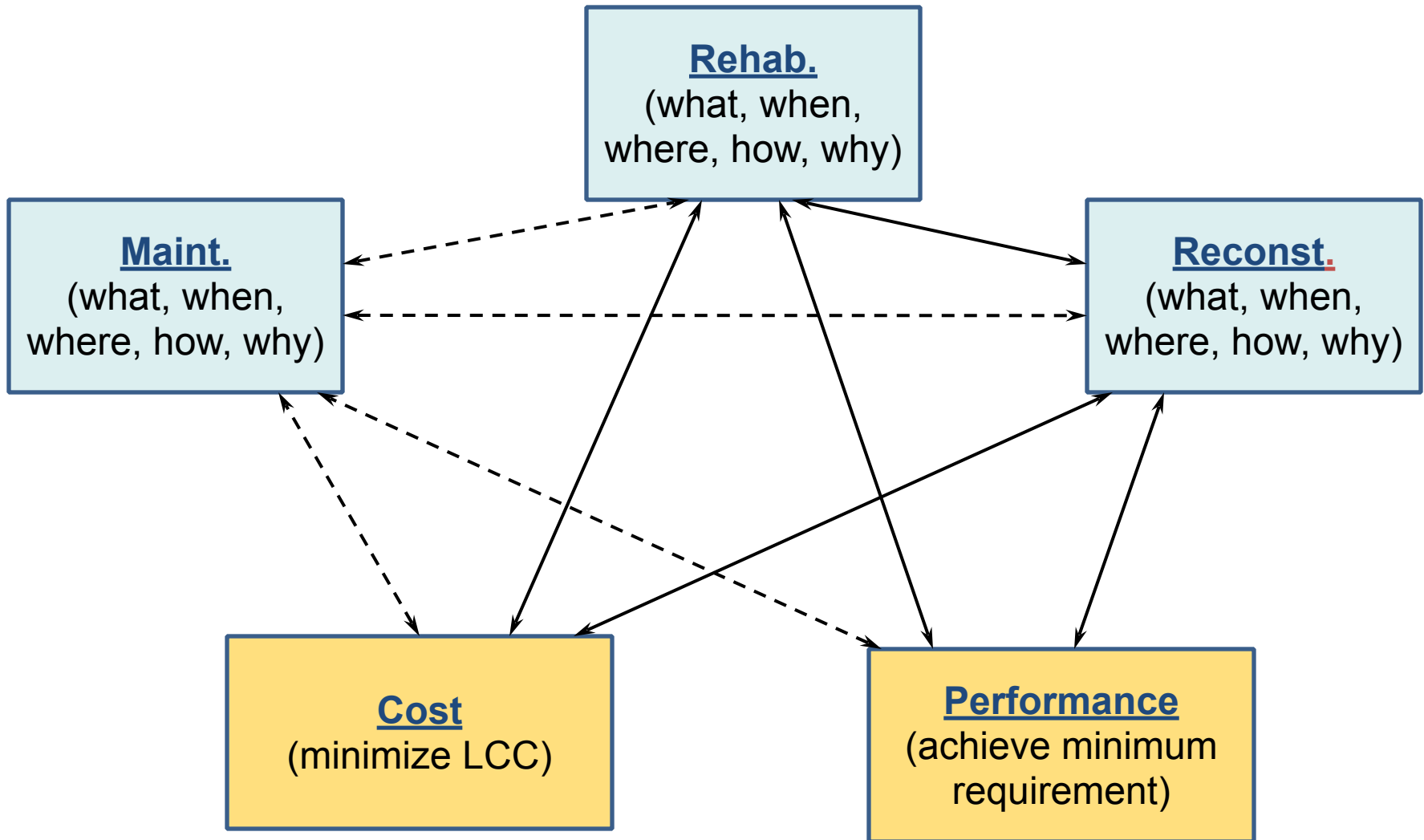
ACP Pavement Life
Western Regions (Olympic, Northwest, Southwest)



ACP Pavement Life
Eastern Regions (North Central, South Central, Eastern)



Decisions and Outcomes



Decision Support System

“Good decisions come from experience.
Experience comes from making bad
decisions”.

Mark Twain

System Development

- Develop requirements carefully, then specifications

“If you don’t know where you are going, any
“If you don’t know where you are going, you
might wind up someplace else”.

Yogi Berra

- Remember, it’s a **Decision Support** tool !

System Development (cont.)

“Information is a source of learning. But unless it is organized, processed, and available to the right people in a format for decision making, it is a burden, not a benefit”.

William G. Pollard (1911 – 1989) American Physicist

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Lessons Learned

Data Visualization

- There are many ways to display data in a pavement management system, but visualization helps to communicate and overlay various types of information.

Data Visualization

Web WSPMS Segment Viewer

Home | External Links | WebWSPMS Site | Account

Search | Route: 002 | Direction: I | D | B | SRMPs: 95.00 - 180.09 | ARMs: 95.08 - 172.06 | Length: 76.98

Select Location | Manage Data Components | Hide Slider

0.00B 32.56 65.13 97.83 137.38 170.12 203.90 236.51 269.15 301.80 334.51

0.00 32.64 65.27 97.91 130.54 163.18 195.82 228.45 261.09 293.72 326.36

<< 1 mi >> Auto Refresh SRMP: 95.00 - 180.09 | ARM: 95.08 - 172.06 | Go

Lane Configuration | Hide | Export to Excel | Close

Visual | Hide Visual

Axis Type | Fit/Fixed

102.70 110.40 118.09 132.71 140.51 148.21 155.91 163.60 172.39

Data | Show Data | Filter:

Location | Hide | Export to Excel | Close

Visual | Hide Visual

Fields | Show Labels

City Name	No City	No City	No City	No City
County Name	LeNo City	ChDouglas	ChDouglas	WaNo City
Maintenance Section	01	01	01	03
Region Name	North Central	North Central	North Central	North Central

Data | Show Data | Filter:

SR: 041 RRT RRQ I SRMP 0.110 ARM 0.110 Slider Image Segments <->

0.00 0.04 0.08 0.12 0.16 0.20 0.25 0.29 0.33 0.37 0.41

0.00 0.04 0.08 0.12 0.16 0.20 0.25 0.29 0.33 0.37 0.41

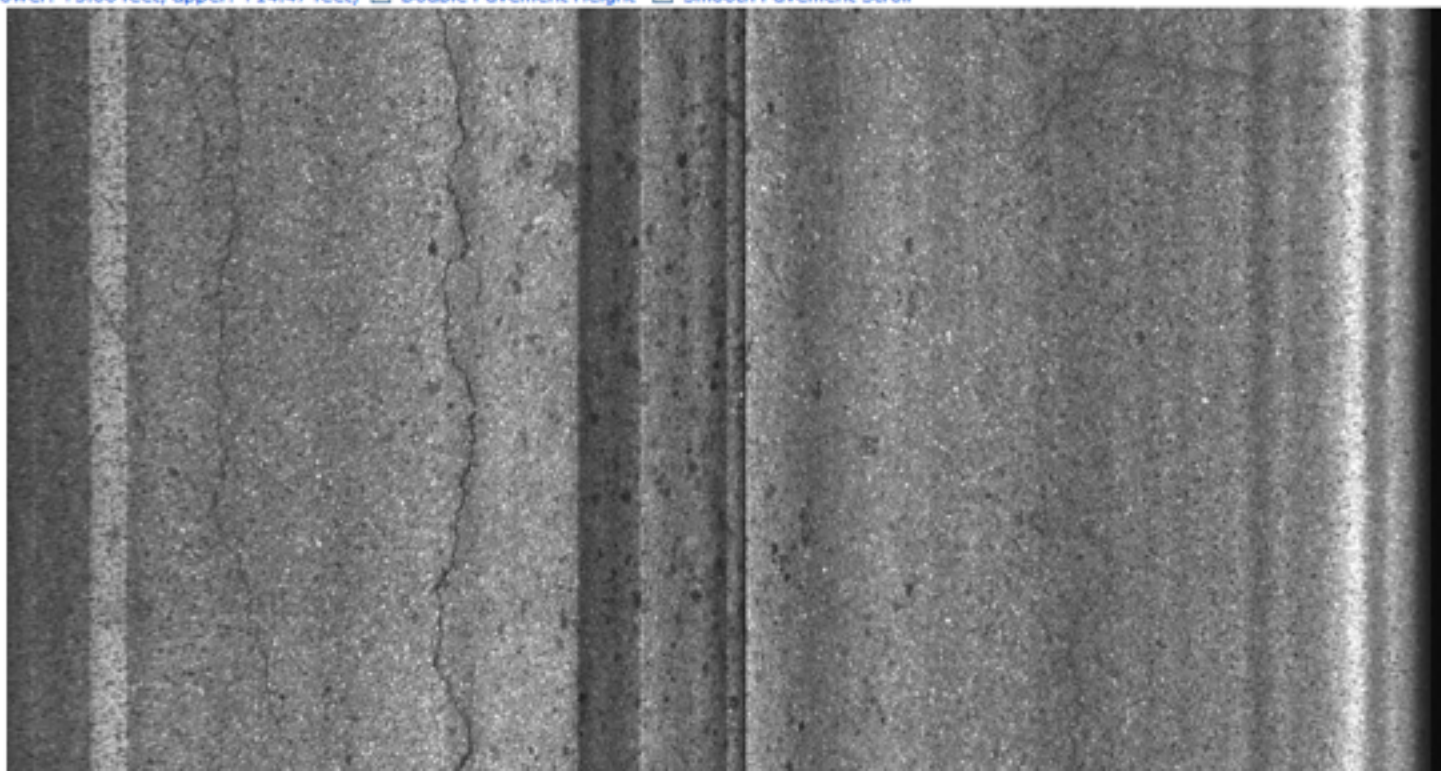
Decreasing Images

Increasing Images

Windshield Images SRMP: 0.110 ARM: 0.110 Windshield Image Only



Pavement Image (lower: +5.66 feet, upper: +14.47 feet) Double Pavement Height Smooth Pavement Scroll



Lessons Learned

Inventory and Construction History

- The system inventory is the backbone of the pavement management database.
- No matter when you start, it is important to keep accurate construction records.

Route: 002 | Direction: I D B
SRMPs: 95.00 - 180.09 | ARMs: 95.08 - 172.06 | Length: 76.98

Select Location Manage Data Components Hide Slider

SRMP: 95.00 - 180.09 | ARM: 95.08 - 172.06 |

Lane Configuration

Visual

Filter:

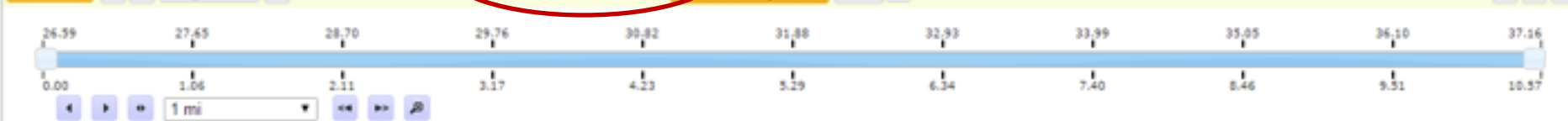
Cross Section

Visual

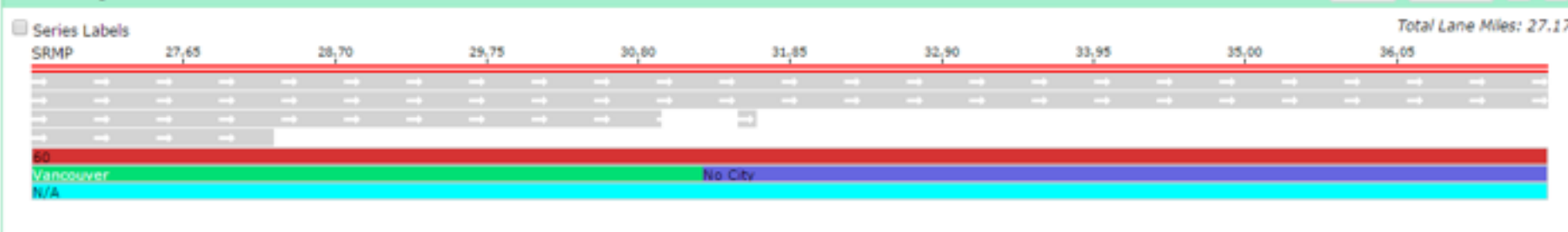
SRMP: 137.08 - 139.35
ARM: 130.24 - 132.51

Construction End Date	Contract	Thickness	Surface	Exception
12/5/2009	017718	0.15	ACP CLASS 1/2IN PG64-28	
12/5/2009	017718	0.15	GRINDING ACP OR BST	
9/11/2000	015787	0.15	ACP CLASS A PG58-34	
9/11/2000	015787	0.03	BST CLASS D CRS-2P	
9/11/2000	015787	0.02	BST CL D PRE SEAL CRS-2P	
11/5/1991	013861	0.15	ACP CLASS B AR4000W	
8/1/1984	012678	0.04	BST CLASS B CRS-2	
1/1/1978	010000	0.02	BST CLASS A CRS-2 TACK	
1/1/1978	010000	0.04	BST CLASS A CRS-2 PRIME	
1/1/1961	000000	0.21	ACP CLASS B AR4000W	
1/1/1961	000000	0.58	UTreat Base	

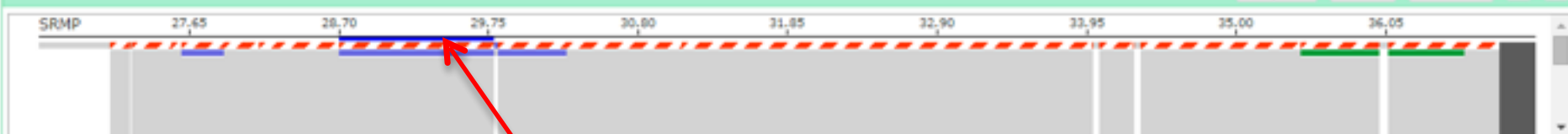
Search Route: 205 Direction: **I** **D** **B** SRMPs: 26.60 - 37.10 | ARMs: 0.01 - 10.51 | Length: 10.5



Lane Configuration Excel Show Data



Cross Section Options Excel Show Data



SRMP: 28.70 - 29.79 (ARM: 2.11 - 3.20)

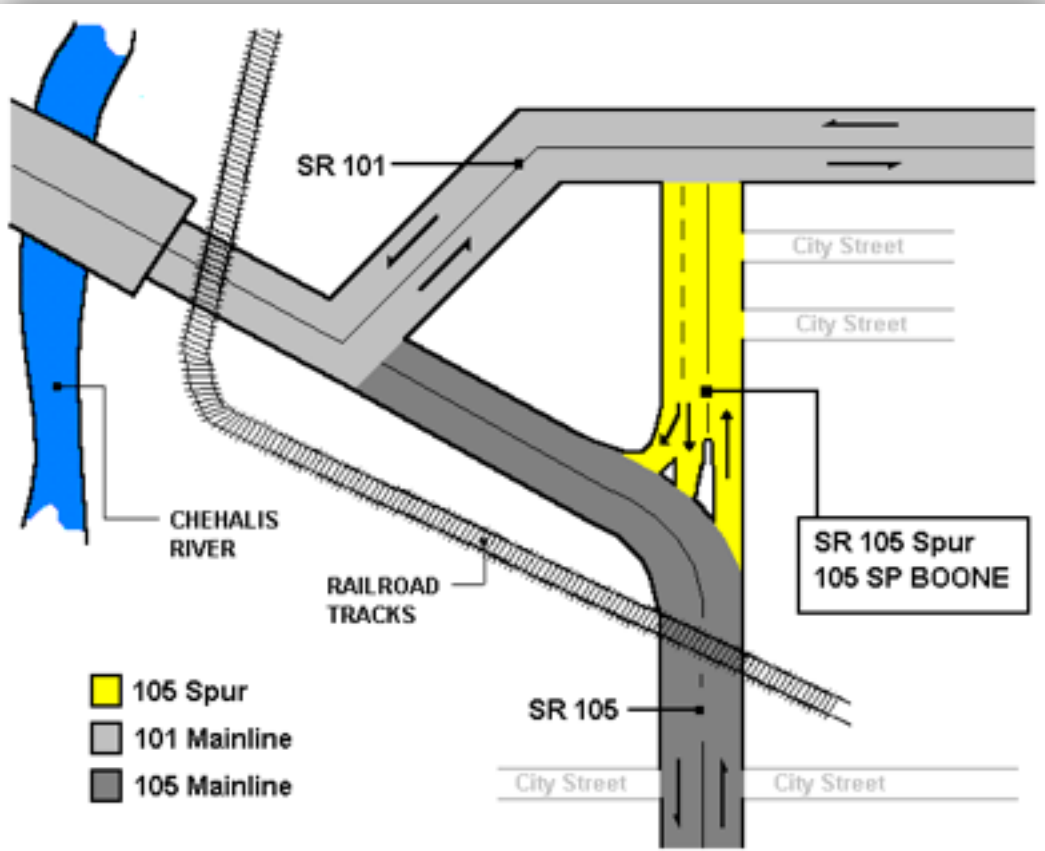
Construction End Date	Contract	Thickness	Surface	Exception
9/20/2013	018462	0.00	PCCP PANEL REPLACEMENT	SEE CONTRACT
9/20/2013	018462	0.03	GRINDING PCCP	LANE 1 ONLY
9/20/2013	018462	0.03	GRINDING PCCP	LANE 2 ONLY
9/1/1982	012239	0.00	PCCP	LANE ADDED LEFT
1/1/1977	010085	0.75	PCCP	
1/1/1977	010085	0.35	Asphalt Treated Base Or Bituminous Admix	
Total Thickness		1.07		

Lessons Learned

Data Flexibility

- Account for variations and exceptions in construction/maintenance in the database design. (For example, construction only in one direction, or for turning lane only).

Location Referencing



Select Location

Route

SR: RRT: RRQ:

I D B

Route Limits SRMP: 48.66 - 48.81 | ARM: 0 - 0.15

Set Segment Limits

	SRMP	ARM
Begin:	<input type="text" value="48.66"/>	<input type="text" value="0"/>
End:	<input type="text" value="48.81"/>	<input type="text" value="0.15"/>

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- **“Clinical Trials”**
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Modeling vs. Monitoring

- Modeling (for example - MEPDG) helps to guide us in areas where we don't have experience (new load limits, new materials, etc.); but, it's hard to do well!
- Monitoring is also hard to do, but it provides the most reliable information.



CLINICAL TRIALS

Experimental Treatment
May Be Right For You



Factors Affecting Performance of Preservation Treatments

- condition & age of existing pavement
- traffic
- climate
- construction methods
- construction materials
- treatment timing
- treatment location
- pavement structure
- drainage
- subgrade conditions
- selecting treatment type
- construction history of pavement section

Original Experimental Concept

Design

Table 2. Maintenance Experiment—Primary and Secondary Factors

Climate (Region)	Traffic (ESALs per year)	Maintenance Treatments							
		Crack Sealing (Pavement Condition)			Crack Filling	Fog Seal	Patching	Chip Seal	Full Depth Digouts
		Poor	Fair	Good					
Olympic	Medium	Poor	Fair	Good	...	...	...	...	...
		2	2	2	...	...	...	...	...
	High	Poor	Fair	Good	...	...	...	...	...
		2	2	2					
Eastern	Medium	Poor	Fair	Good	...	...	...	...	...
		2	2	2					
	High	Poor	Fair	Good	...	...	...	...	...
		2	2	2					

Notes

1. Total sections = 144 and 288 with control sections.
2. All primary and secondary “treatment” combinations have two replicate sections.
3. Reducing the pavement conditions from three to two will reduce the number of sections to 96.

Simplified Monitoring Approach

- Limited number of treatment types
- Modify treatments in segments (about $\frac{1}{4}$ mile) on same test section
- Repeat at different geographic areas
- Document and monitor
 - previous condition
 - treatment methods and materials
 - cost
 - performance

Monitoring of Treatment Segments



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Economic Performance Measures

- Cost of Pavement Service
 - Annual Cost (\$ per lane mile per year)
- Annual Cost is determined using Discount Rate (4%) to consider Time Value of Money:

Equivalent Uniform Annual Cost (EUAC)

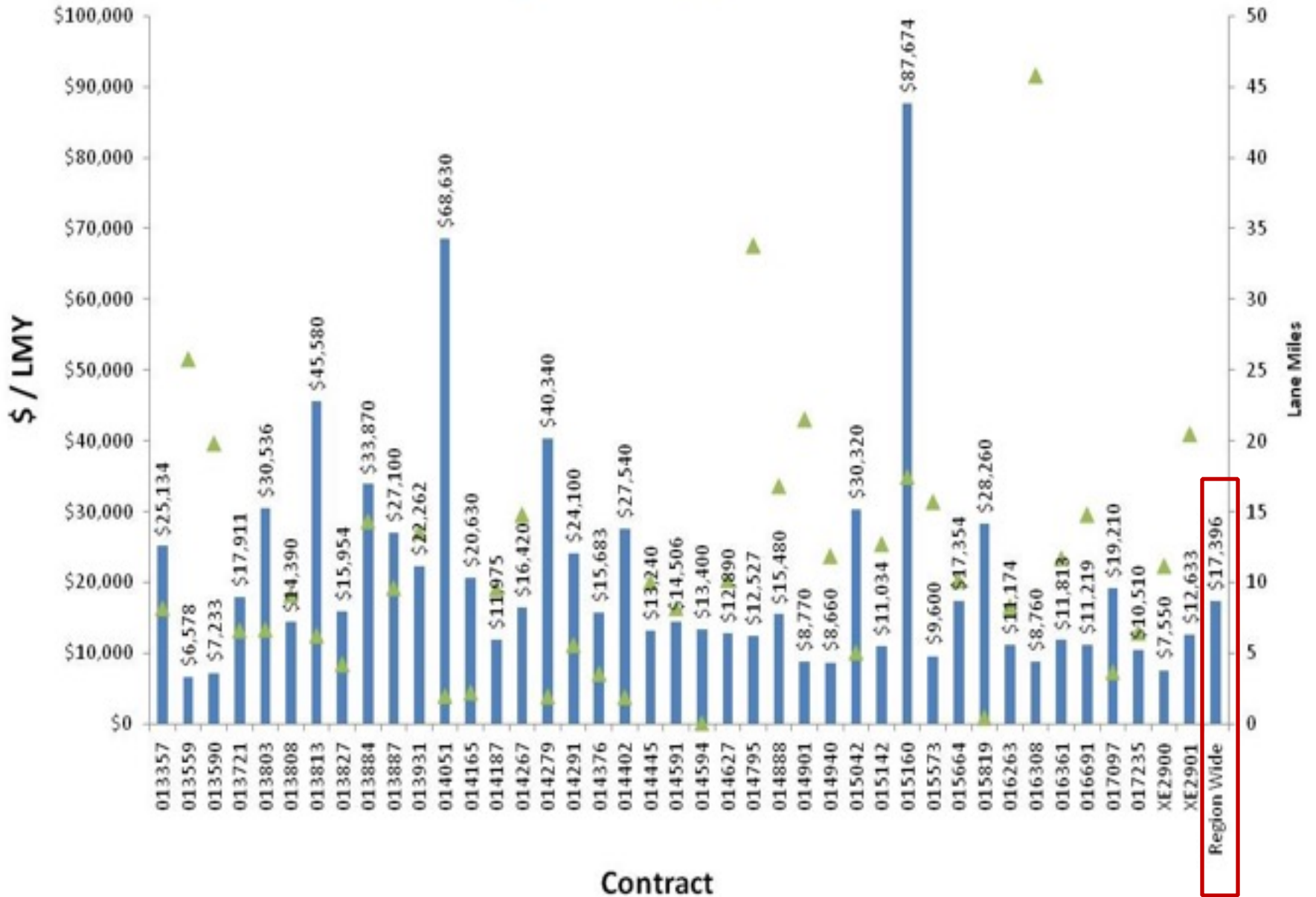
Cost Effectiveness Examples

<u>Project Type</u>	<u>Const. Cost(\$/LM)</u>	<u>LMY gained</u>
Reconst (ACP)	\$900,000	20
Rehab (ACP)	\$250,000	14
Chip Seal	\$45,000	7
Crack Seal	\$5,000	3
Reconst.(PCCP)	\$2,500,000	50
Grinding (PCCP)	\$150,000	15

* includes 4% Discount Rate

South Central Region ACP \$ / LMY by Contract

■ Weighted Average ▲ Lane Miles



Pavement Management - Learning Lessons

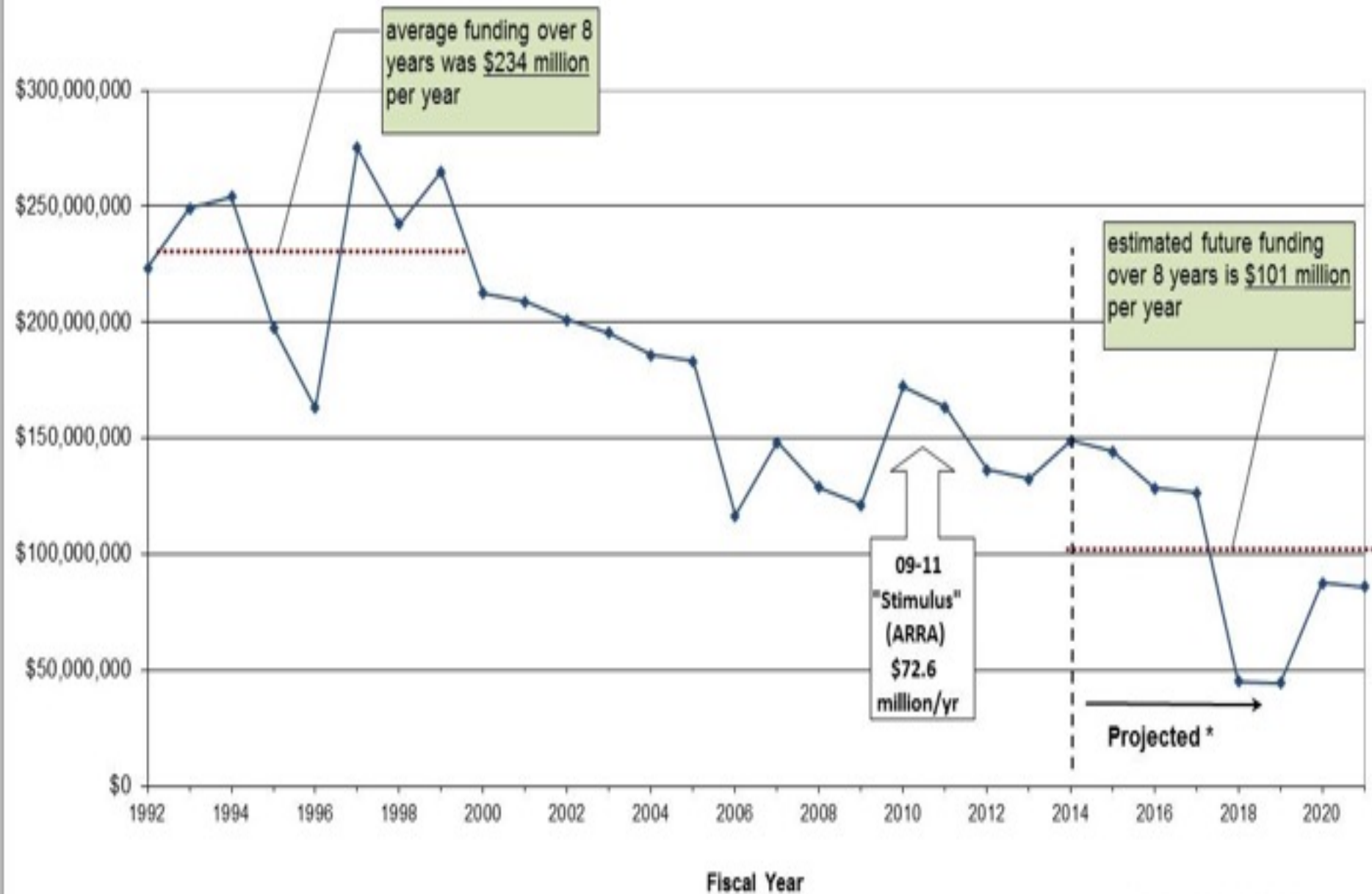
- Some basic facts
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- **Communication**

Communication

“The single biggest problem in communication is the illusion that it has taken place”.

George Bernard Shaw

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



* As of Feb. 2014



New Performance Measures Introduced in GNB 48

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Remaining Service Life (RSL)

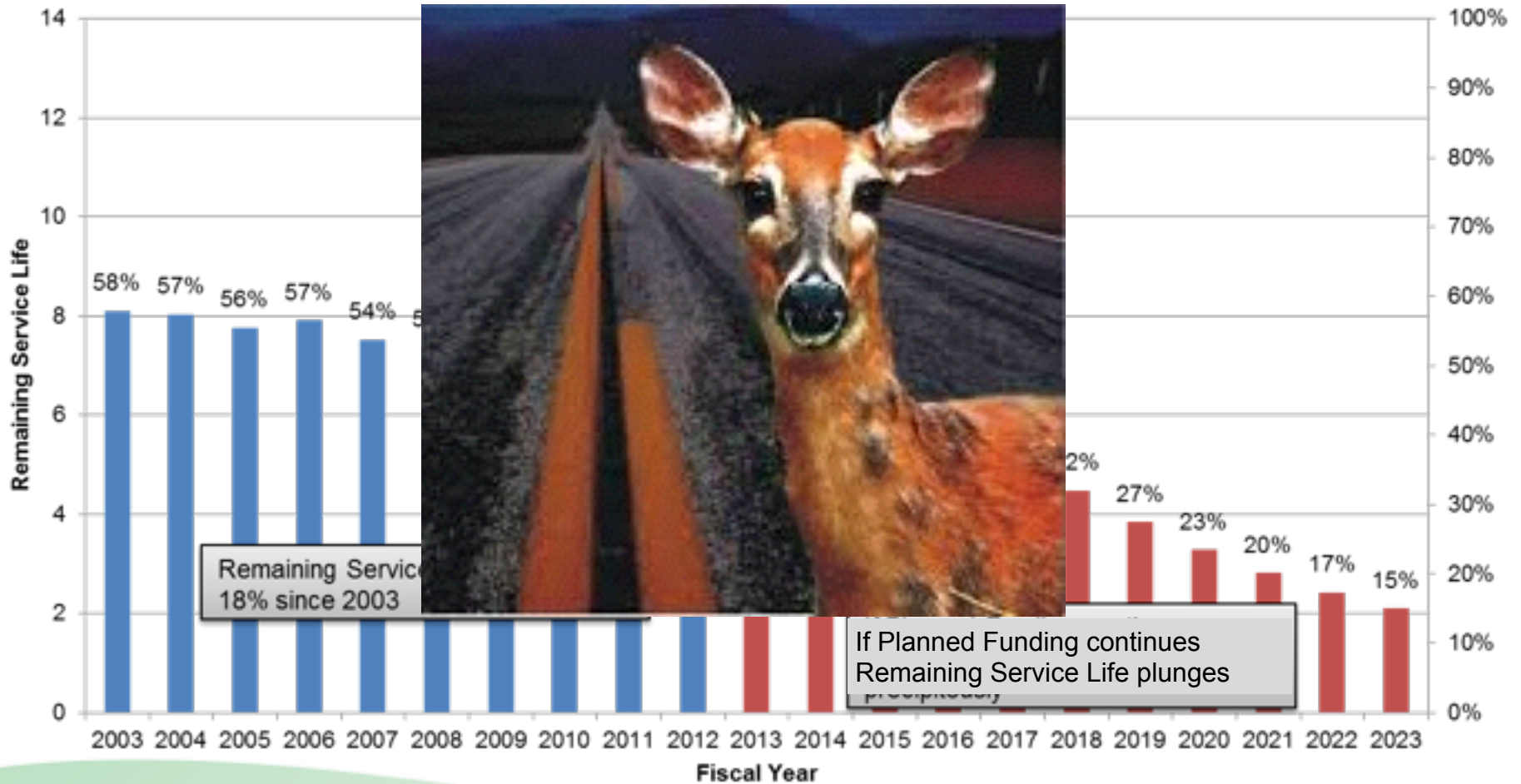
- Measures the average pavement life (years until due) of the entire network (expressed as % of typical pavement life)
- Healthy system has remaining service life of 40 – 60 percent
 - In an ideal system, the entire system would have an average remaining service life equal to 50% of the total average pavement life

Statewide Average Remaining Service Life

Asphalt Pavement

In Washington, Asphalt typically needs resurfacing in 12-16 years

■ Historical Funding ■ Planned Funding



Challenges

“You don’t drown by falling in the water; you drown by staying there”.

Edwin Lewis Cole

“The significant problems we face cannot be solved at the same level of thinking we were at when we created them”.

Albert Einstein

Summary of (a few) Lessons Learned

- Plan (and design) your system
- The objective is better decision making
- Develop a flexible database model
- Monitor, monitor, monitor; and record
- Know your cost effectiveness
- Communicate
- Continue Learning !

Questions?

