

# Pavement Faults and Fixes



Kim Willoughby, PE  
Research Manager  
WSDOT



# Overview

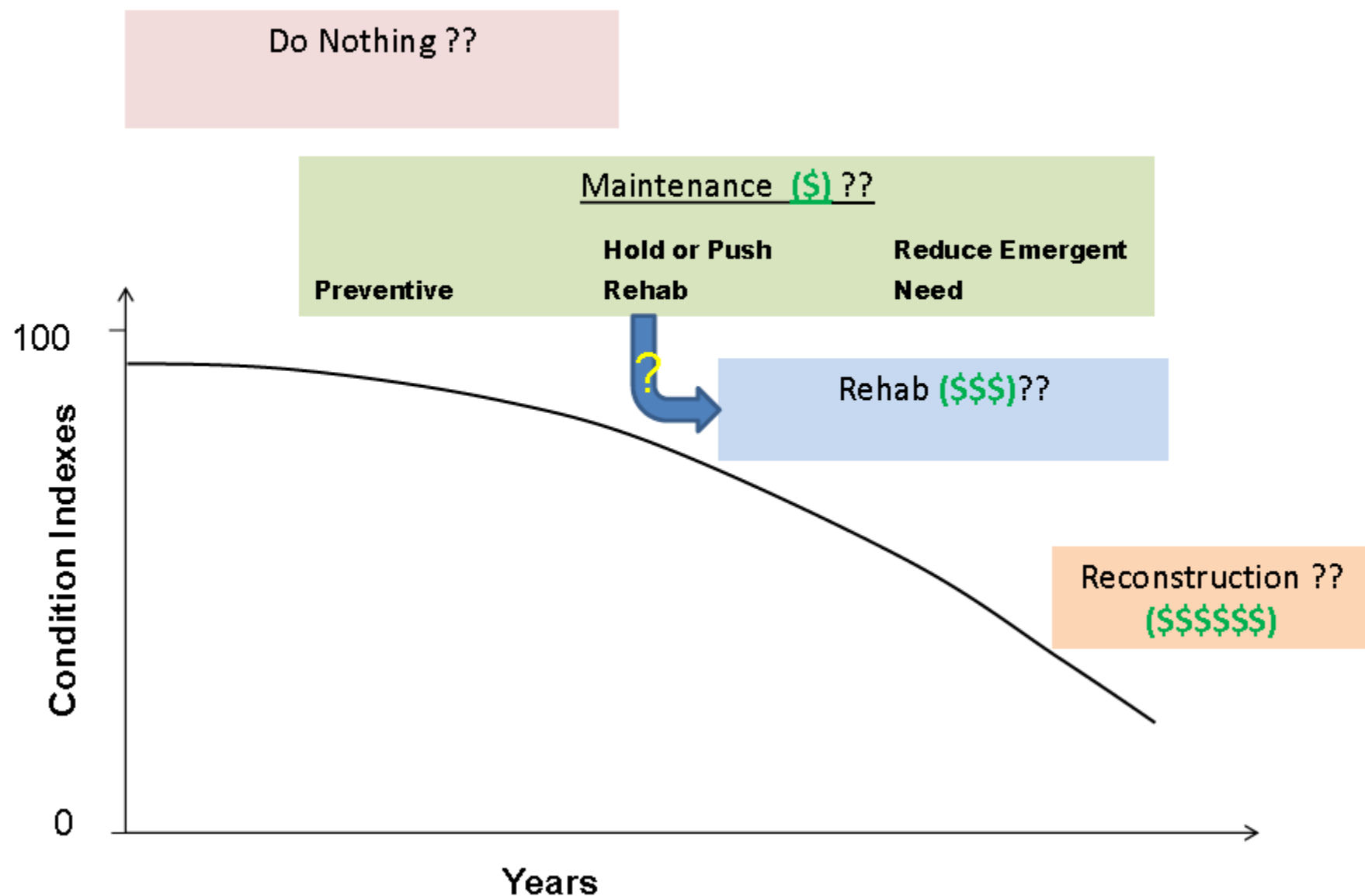
- Importance of pavement preservation
- Pavement distresses
  - Flexible
  - Rigid
- Fixes and options
  - Flexible
  - Rigid



# Pavement Preservation Emphasis

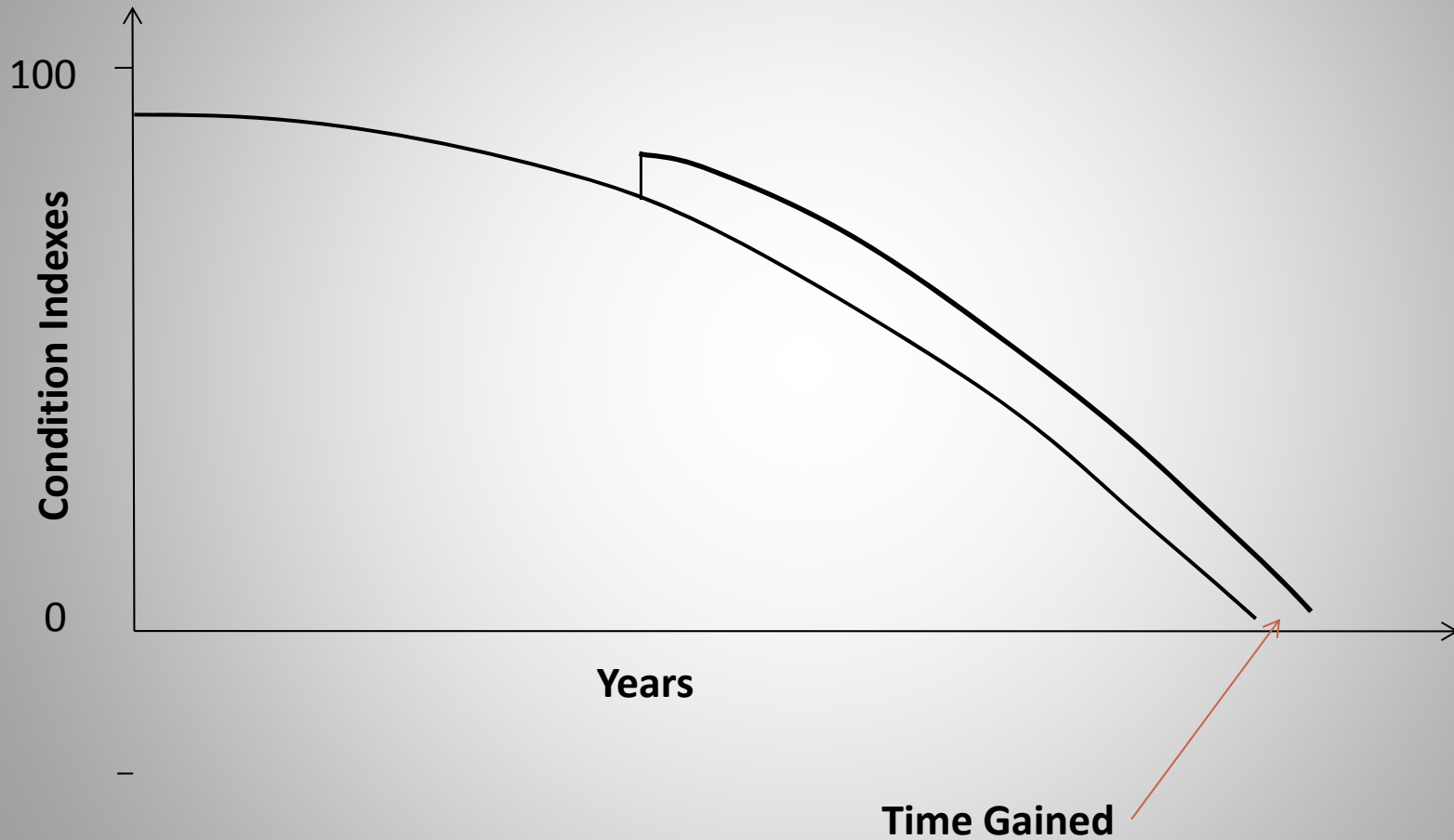
- Reducing pavement annual costs by using preservation treatments to extend pavement life
- Deferring rehabilitation projects improves cash flow by reducing need for immediate capital resource needs

# Asphalt Pavement Preservation Decisions





# Flexible Pavement Preservation Decisions

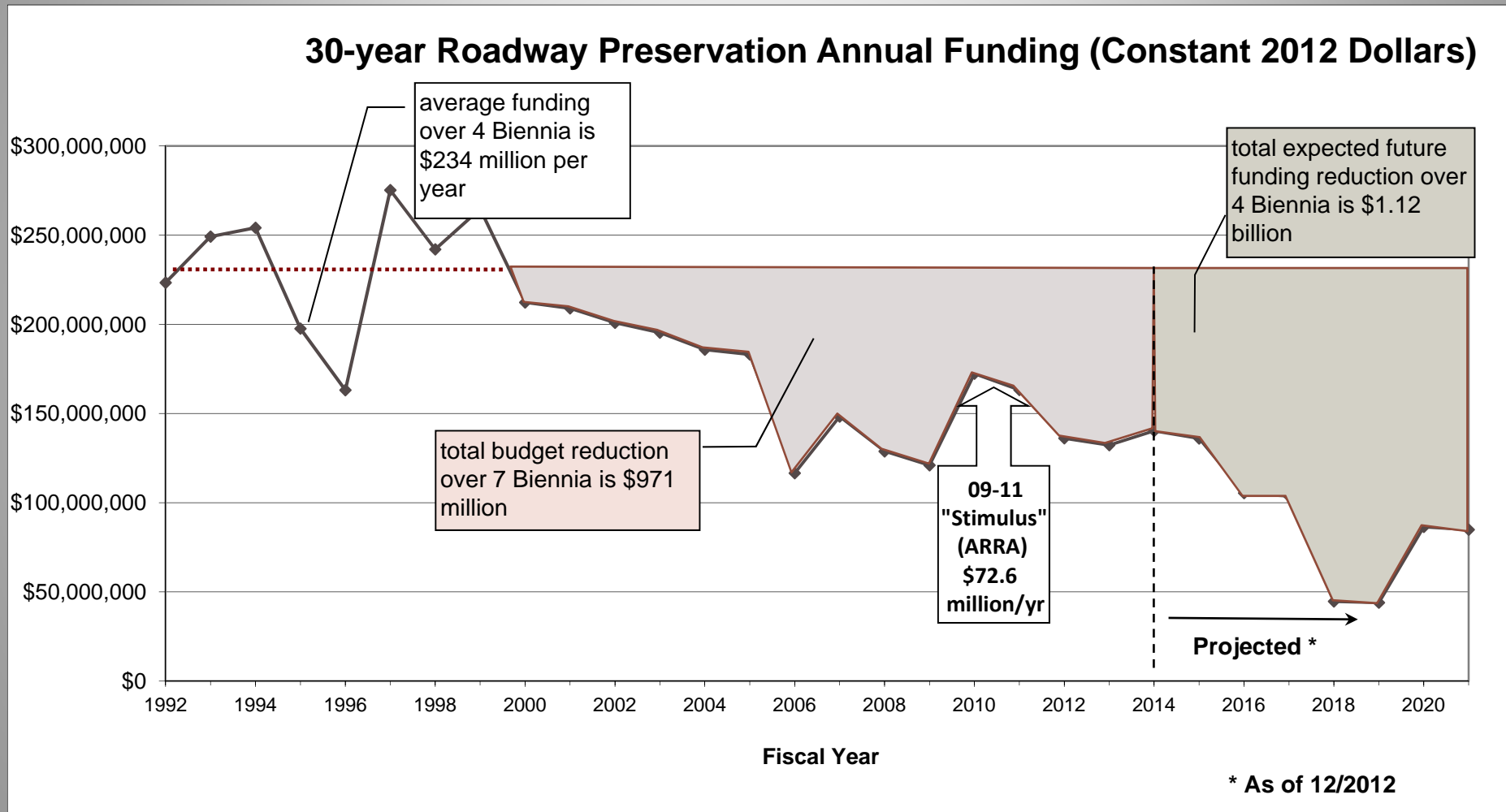


# Flexible Pavement Preservation

<u>treatment</u>	<u>added life(years)</u>	<u>annual cost</u>
Maintenance	2-4	\$1,000 / LMY
BST Rehab	6-7	\$6,000 / LMY
ACP Rehab	10-17	\$18,000 / LMY

*[LMY = lane mile year]*

# WSDOT Preservation Funding



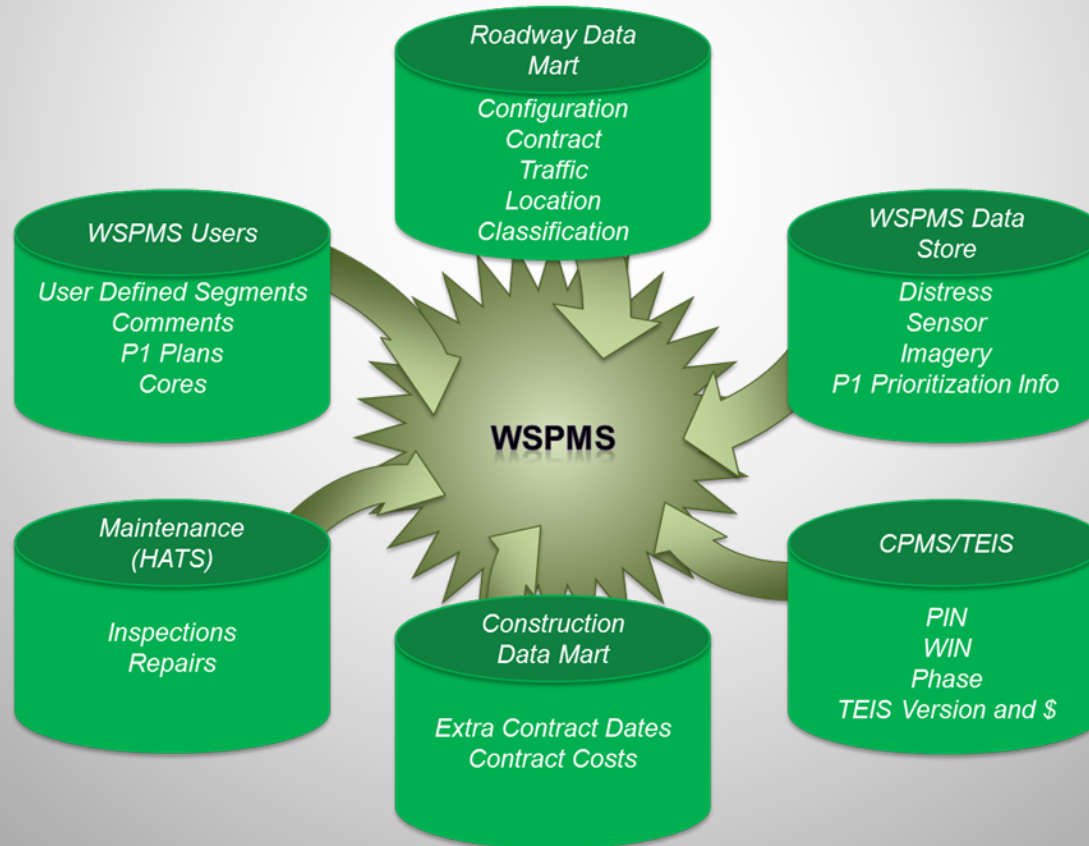


# How do we plan projects?

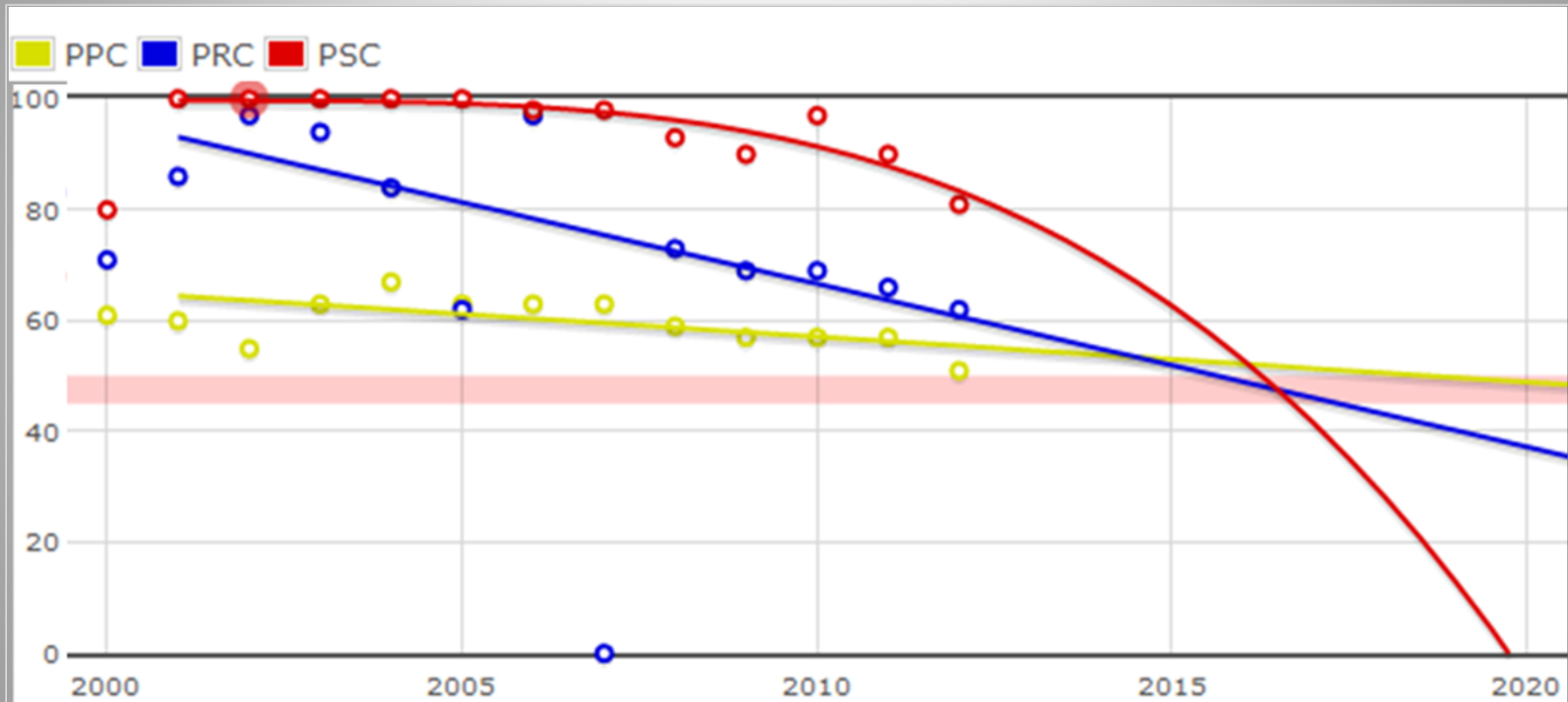
- Expected life-cycle
- Annual condition surveys
- Field reviews

# WSPMS

- **Why?** Because engineers love data – we use it to prioritize work
- **What?** Road configuration, intersections, bridges, maintenance (once HATS is fully utilized), contract history, traffic data, condition survey data, coring, and future project info and much, much more!



# Data from Van





# WSPMS Data



# Pavement Distress Types

Flexible pavements  
HMA and BST routes

## Cracking

# Longitudinal Cracking





# Top Down Cracking





# Top Down Cracking



# Top Layer Debonding







# Top Down Cracking from Debonded Layer





# Full Depth Cracking





# Fatigue Cracking





# Transverse Cracking





# Reflection Cracking





# Block Cracking



# Edge Cracking



# Pavement Distress Types

Patches and potholes









# Potholes



# Pavement Distress Types

## Surface Deformation



# Rutting







# Rutting (or wear)



# Pavement Distress Types

Surface Defects, Misc.



# Shoving



# Bleeding (flushing)







# Flushing





# Polished Aggregate





# Raveling





# Water Pumping







# Asphalt Stripping







# Asphalt Stripping





# Pavement Distress Types

## Construction-Related Defects



# Temperature Differentials





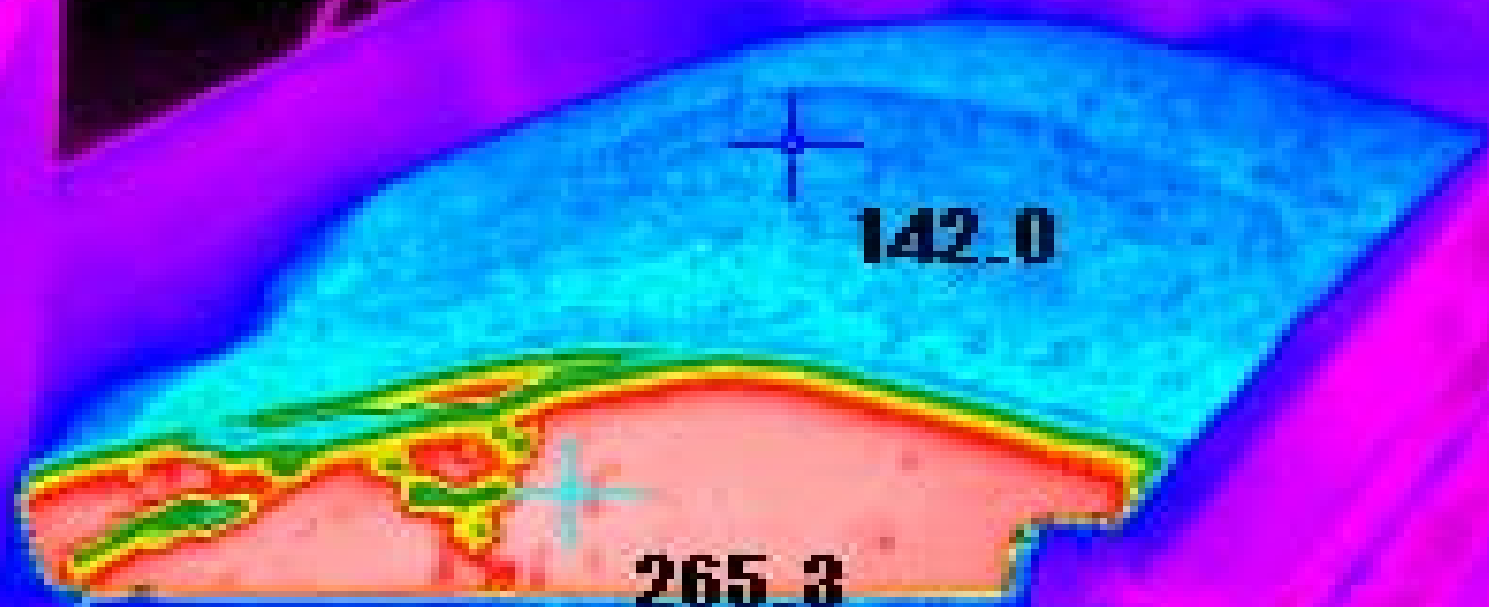
- Temperature Differentials
  - Reduced performance
  - Premature replacement

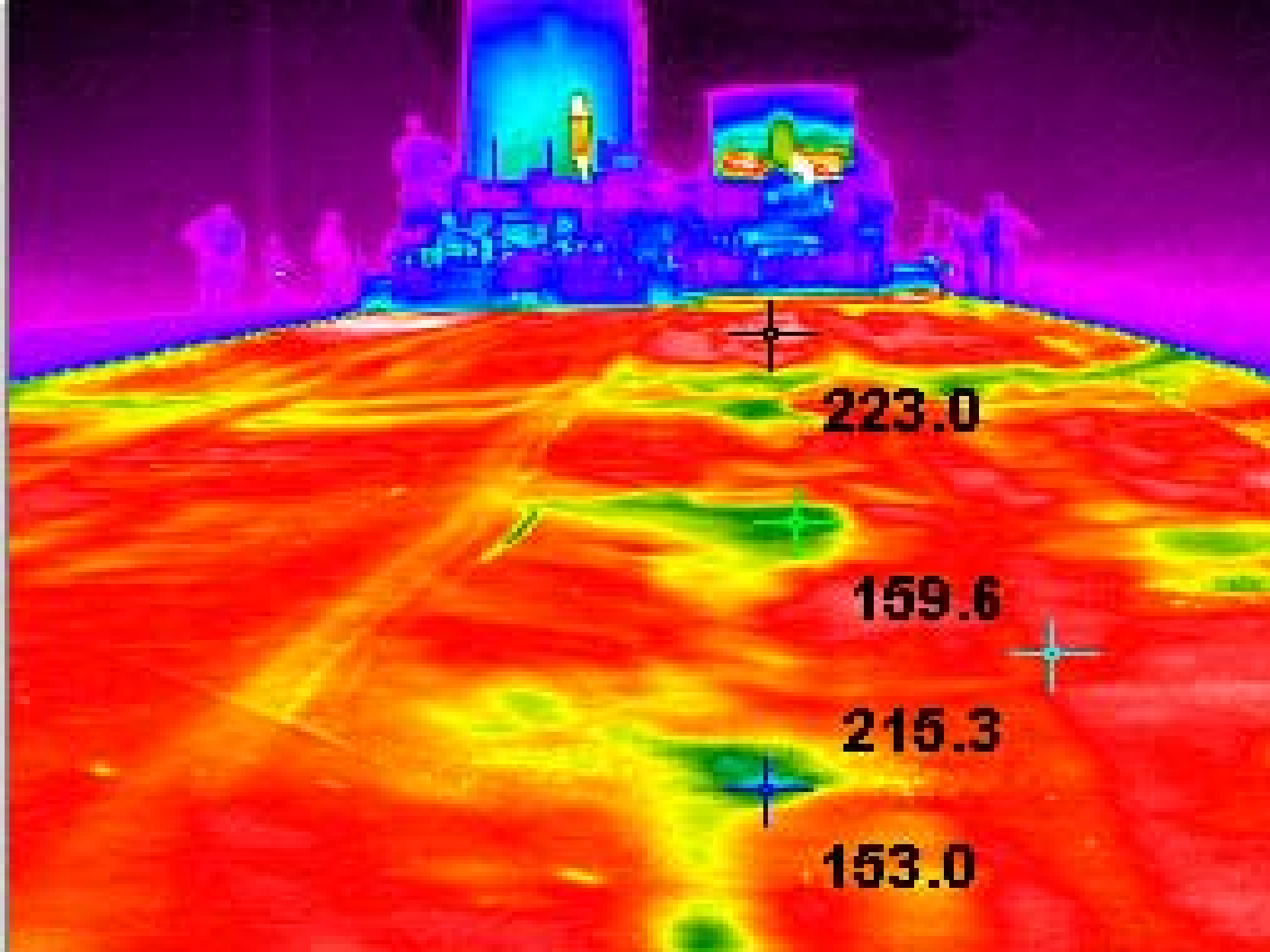
















# Longitudinal Joint Deterioration





# Streaks





# Late Season Paving



# Late Season Paving

- Increased risk of reduced compaction
- Likelihood of premature pavement distress
- Ultimate reduction in pavement life

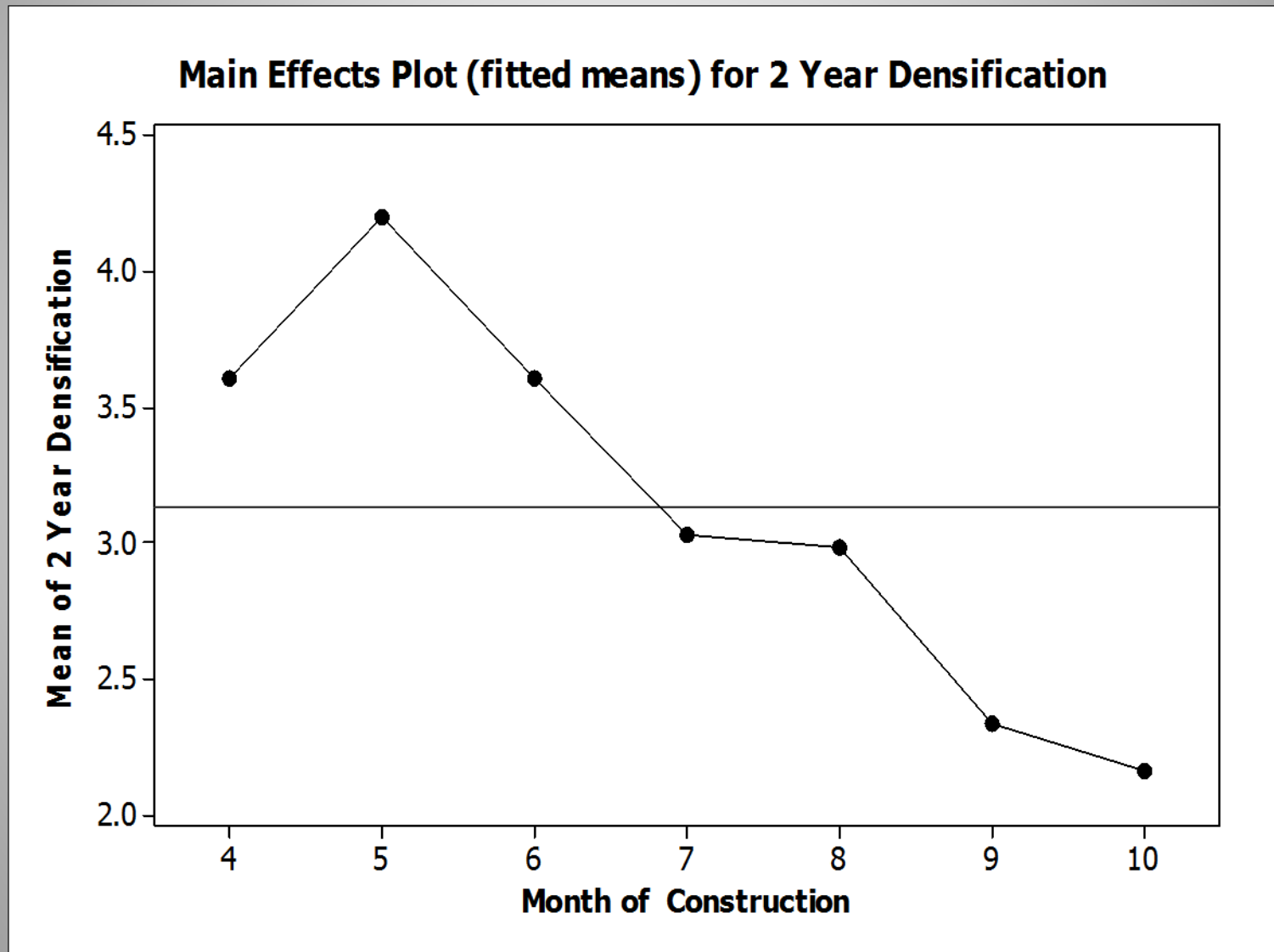
15 percent of WSDOT paving failures can be attributed to Late Season paving

**University of Washington Research Finding:** Minimum 10 percent loss of pavement life for every 1 percent loss of compaction below 93 percent of MTD

Some studies say 10 to 30 percent!



# NCHRP Report 573



# Maintenance Fixes/Options

Flexible Pavement



# Crack sealing - Good

Years 2009-2011

A photograph of a two-lane asphalt road stretching into the distance under a clear blue sky. The road has white dashed center lines and solid white edge lines. Several dark, irregular patches of sealant are visible along the center line and edge lines, indicating crack sealing work. The road is flanked by green grassy fields and some distant trees and utility poles.

A bit of crack sealing  
Rural Interstate Highway

# Crack sealing – too much?

A bit more...  
Rural Interstate Highway



Years 2011-2013



# Crack sealing - wow



A lot more...  
Rural Interstate  
Highway

# Fog seal



Before



After



# Chip Seal





# Chip Seal – with Prelevel



This lane received prelevel HMA (3/8") prior to the BST.



# Chip Seal





# Chip Seal Patch





# Wheel Path Chip Seal (rutting)



# DuraPatch





# DuraPatch









# Preservation Repairs





# Grind and Inlay Patches





# Partial Depth Repair





# Full Depth Repair





# Overlay patches

Spreader box or grader patch

- Good for depressions – slow moving slides or unsuitable base material
- Creates new surface where BST is not appropriate

# Blade Patch





# Blade Patch – after time



# Lift Thickness

Maximum lift thickness:

HMA Class 1"	0.35' (4")
HMA Class $\frac{3}{4}$ "	0.30' (3 $\frac{1}{2}$ ")
HMA Class $\frac{1}{2}$ "	0.30' (3 $\frac{1}{2}$ ")
HMA Class $\frac{3}{8}$ " (G mix)	0.10' (1 $\frac{1}{4}$ ")



# Flexible Distresses Summary

- Cracking
- Potholes
- Rutting
- Wear
- Shoving
- Flushing
- Polished Aggregate
- Raveling
- Water Pumping
- Stripping
- Temperature Differentials
- Longitudinal Joints
- Construction Defects
- Late Season Paving

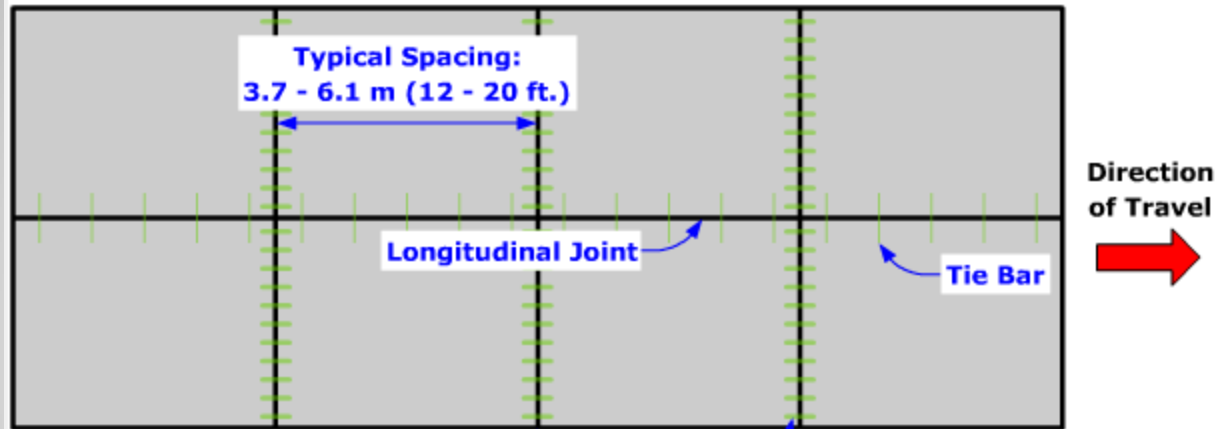
# Pavement Distress Types

Rigid pavements

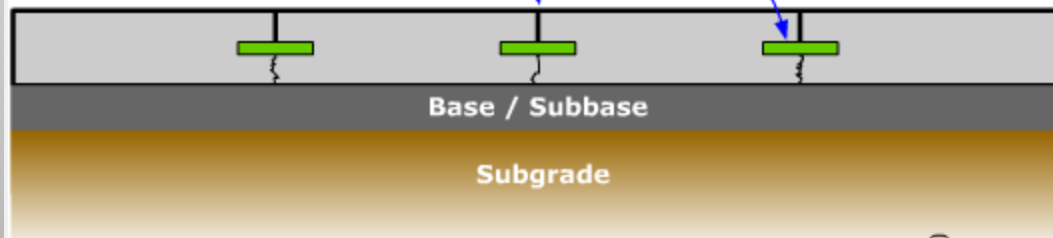


# PCCP

**Top View**



**Side View**



# Pavement Distress Types

Rigid pavements

Cracking

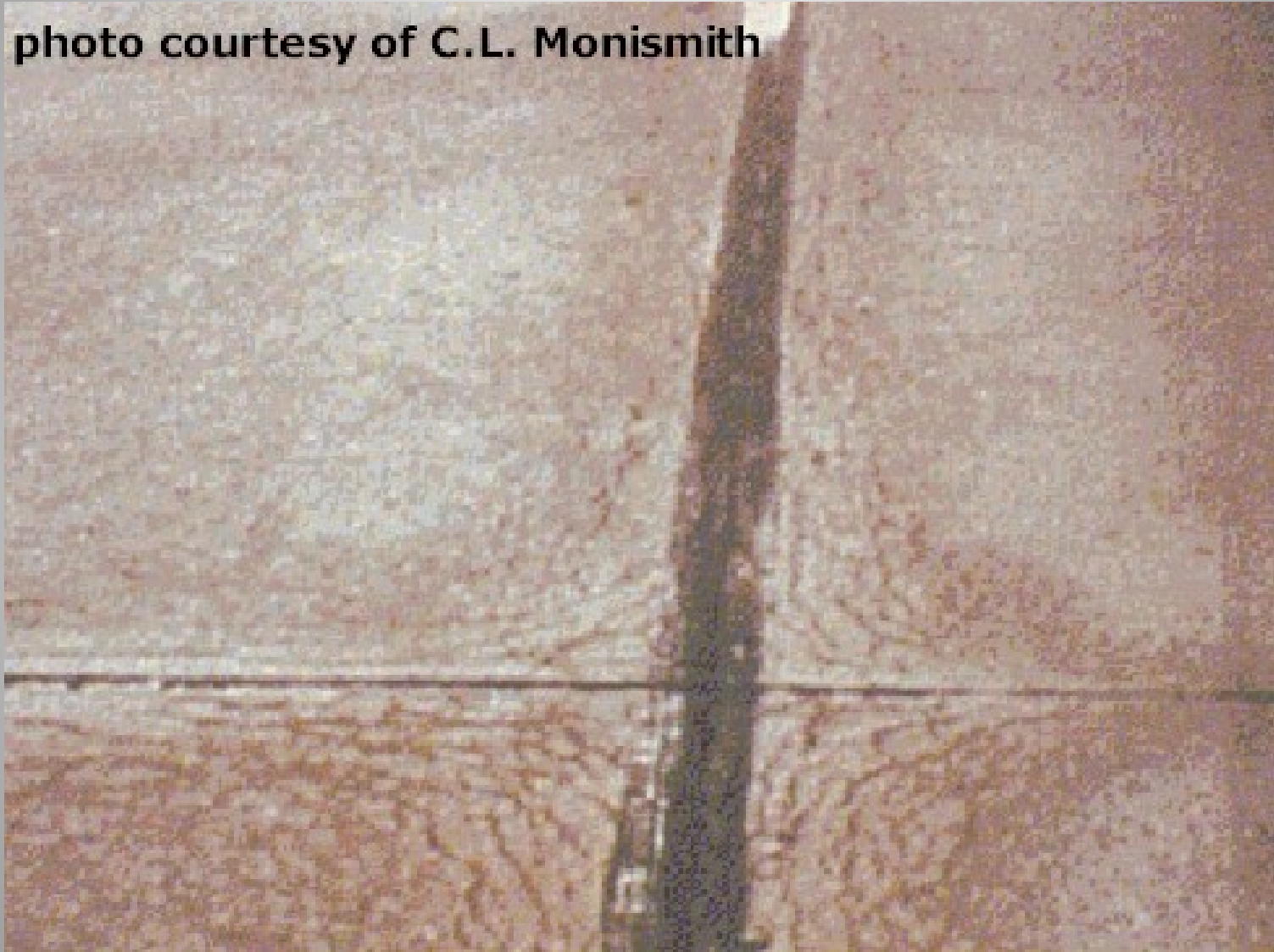


# Corner Cracking



# Durability Cracks

photo courtesy of C.L. Monismith





# Longitudinal/Transverse Cracks



# Pavement Distress Types

Rigid pavements

Joint Deficiencies



# Joint seal damage





# Spalling of Joint





# Faulting



# Pavement Distress Types

Rigid pavements

Surface Defects



# Studded Tire Wear





# Polished Aggregate





# Map Cracking



# Scaling





# Popouts



# Pavement Distress Types

Rigid pavements

Miscellaneous Distress



# Severe Blowup





# Rocking and Pumping





# Voids Beneath Slab





# Lane-to-Shoulder Separation





# Construction Related – Late Sawing





# Construction Related – No Boxouts







# Rigid Distresses Summary

- Cracking
- Joints
  - Seal
  - Spalling
  - Faulting
- Wear
- Polished Aggregate
- Lane/shoulder separation
- Map/durability cracking
- Scaling
- Popouts
- Blow up
- Rocking
- Pumping
- Voids under slab
- Late sawing
- No boxouts



# Maintenance Fixes/Options

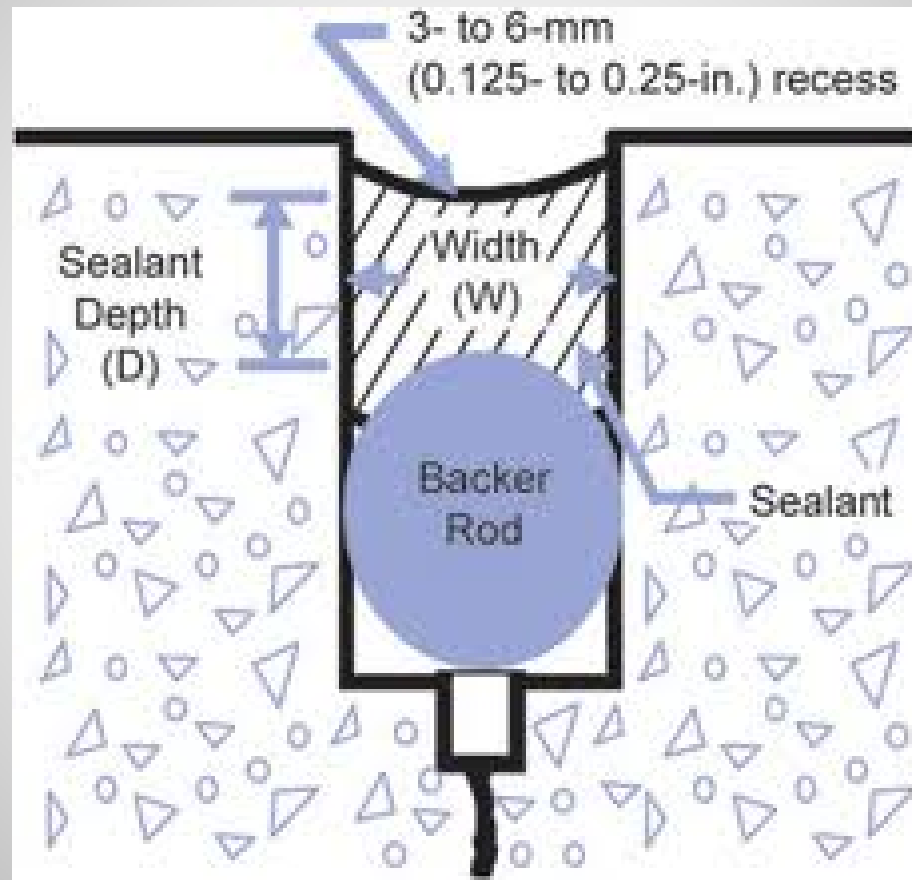
Rigid Pavement

# Crack Sealing





# Joint Seal Repair



# Diamond Grinding





# Dowel Bar Retrofit



# Panel Replacement

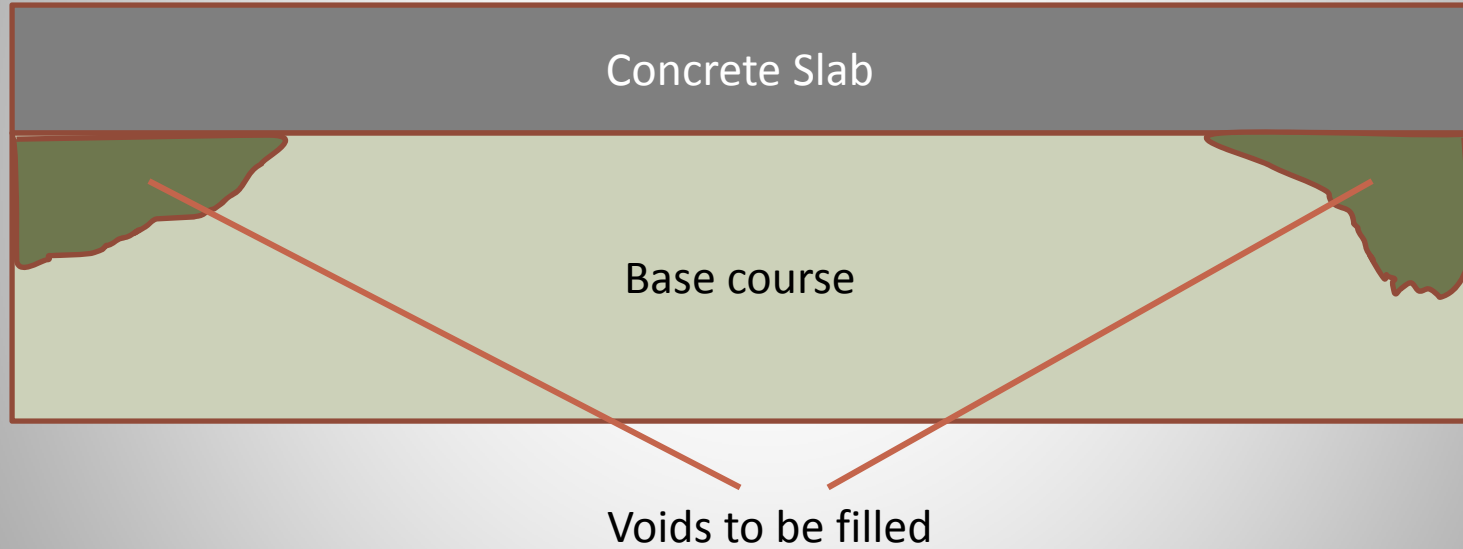




# Utility Boxouts



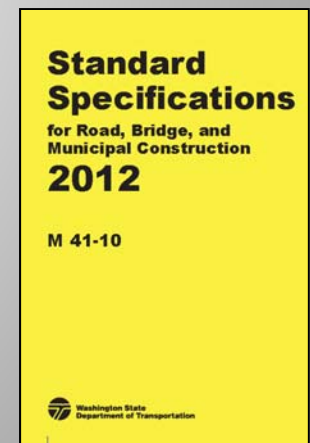
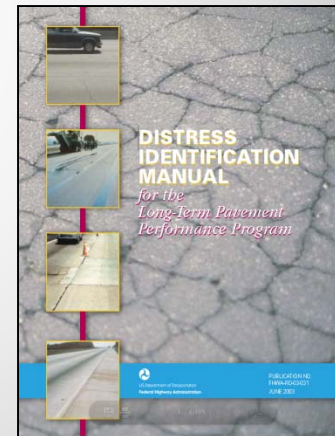
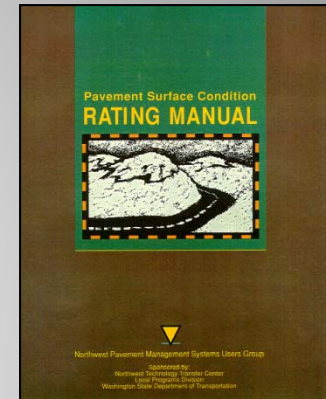
# Slab Stabilization





# Resources

- WSDOT Maintenance Manual
- WSDOT Standard Specifications
- FHWA Distress Identification Manual FHWA-RD-03-031
- WSDOT Pavement Surface Condition Rating Manual
- WSPMS
- [www.pavementinteractive.org](http://www.pavementinteractive.org)



# Questions?

Kim Willoughby

[willouk@wsdot.wa.gov](mailto:willouk@wsdot.wa.gov)

360.705.7978