



Flexible Pavement Preservation Industry Perspective

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PRDOT PP Conference— 11.15.2011



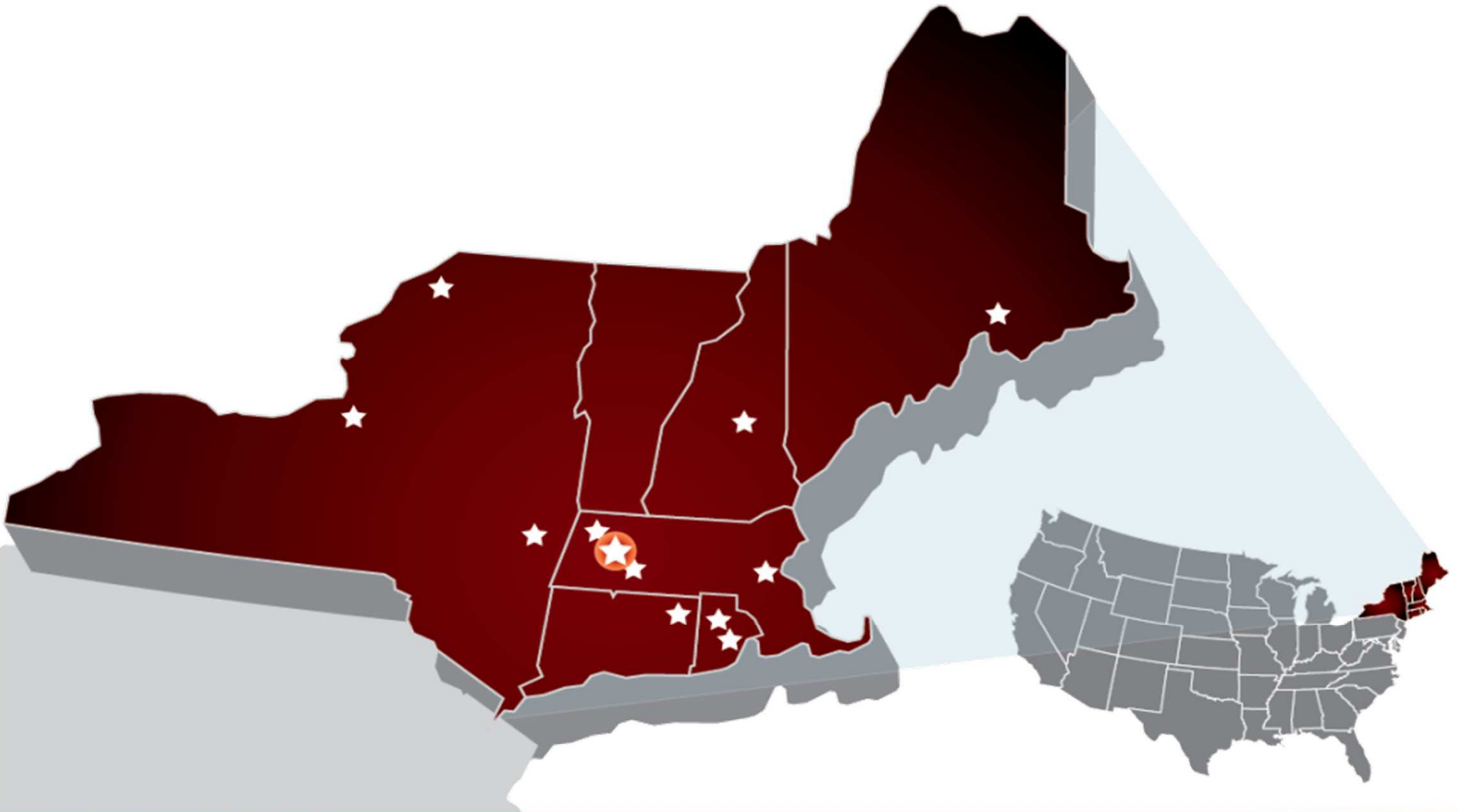
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Outline of Presentation

- What is Pavement Preservation
- Why Pavement Preservation
- Components of Successful Projects
- How do we do it
- How do we sell it
- What is in it for the Agency
- What is in it for the Contractor
- Summary

What is Pavement Preservation

- A Planned Network Strategy of Treating Pavements in Good Condition to Maximize their Useful Life as Cost Effective as Possible

Planned Network Strategy of Treating Pavements

- Network Level
- Proactive not Reactive
- Pavement Management System is Critical
 - Can be simple or detailed
- Long Term Thinking/Planning
- Remaining Service Life of Pavement

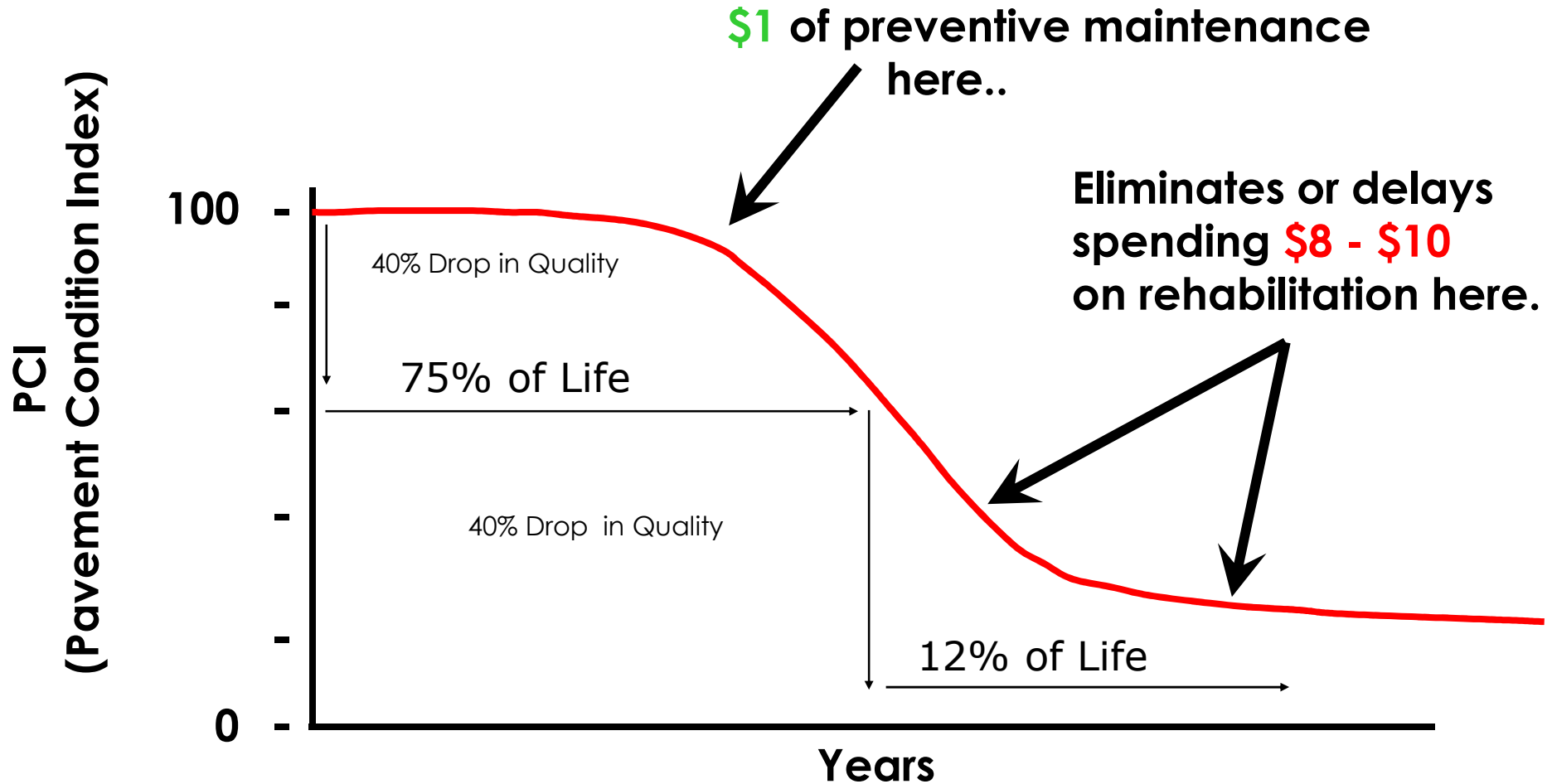
In Good Condition to Maximize Life

- Keep Good Roads in Good Condition
- Preventative Maintenance rather than Corrective Maintenance
- Planned early Strategies
- Timing of Treatment is Critical
- **GOAL** - Improve Condition Rating of Network

Cost Effective

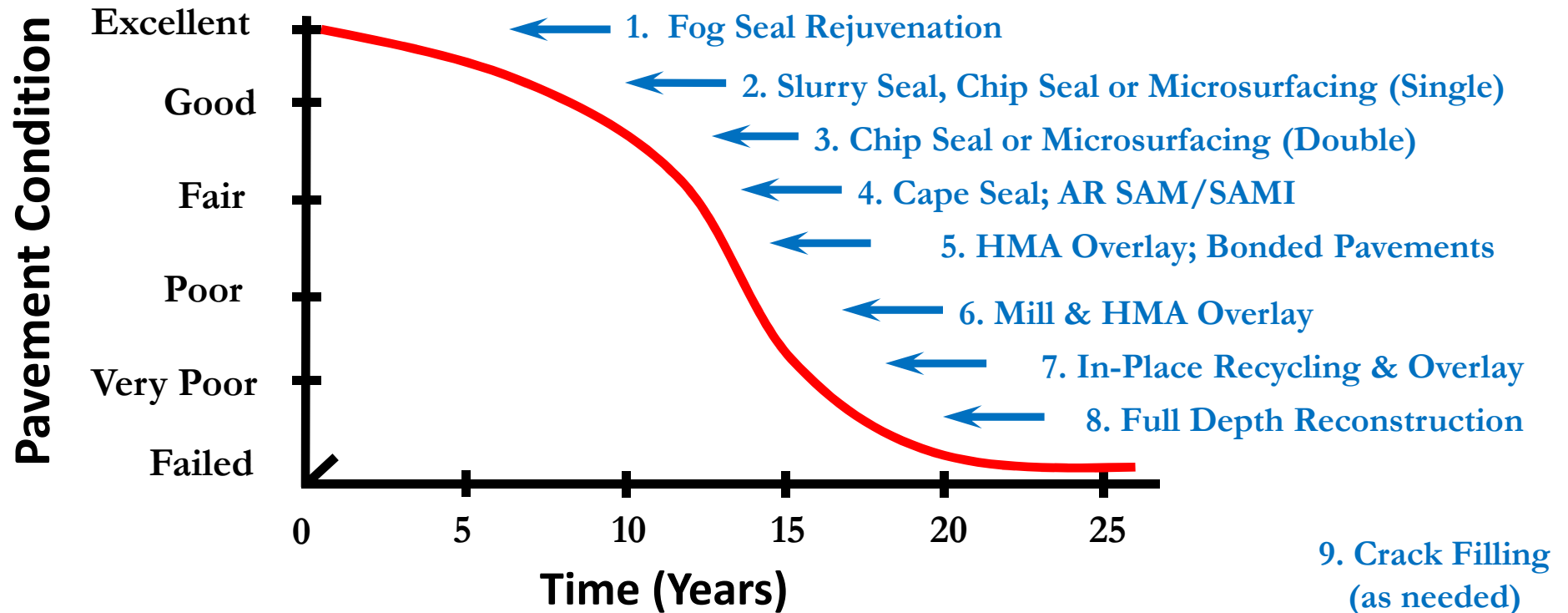
- Annualized Cost not Initial Cost
- Must evaluate all alternative Treatments
- Must determine service life of Treatment
- Service Life is a function of project selection and Treatment applied
- Annualized Cost = Initial Cost/ Service Life
- Optimize Budget Dollars

Life of a Pavement



Asphalt Deterioration Curve

Applying the Right Treatment, to the Right Road, at the Right Time...



NHDOT 2011 Equivalent Annual Pavement Management Costs

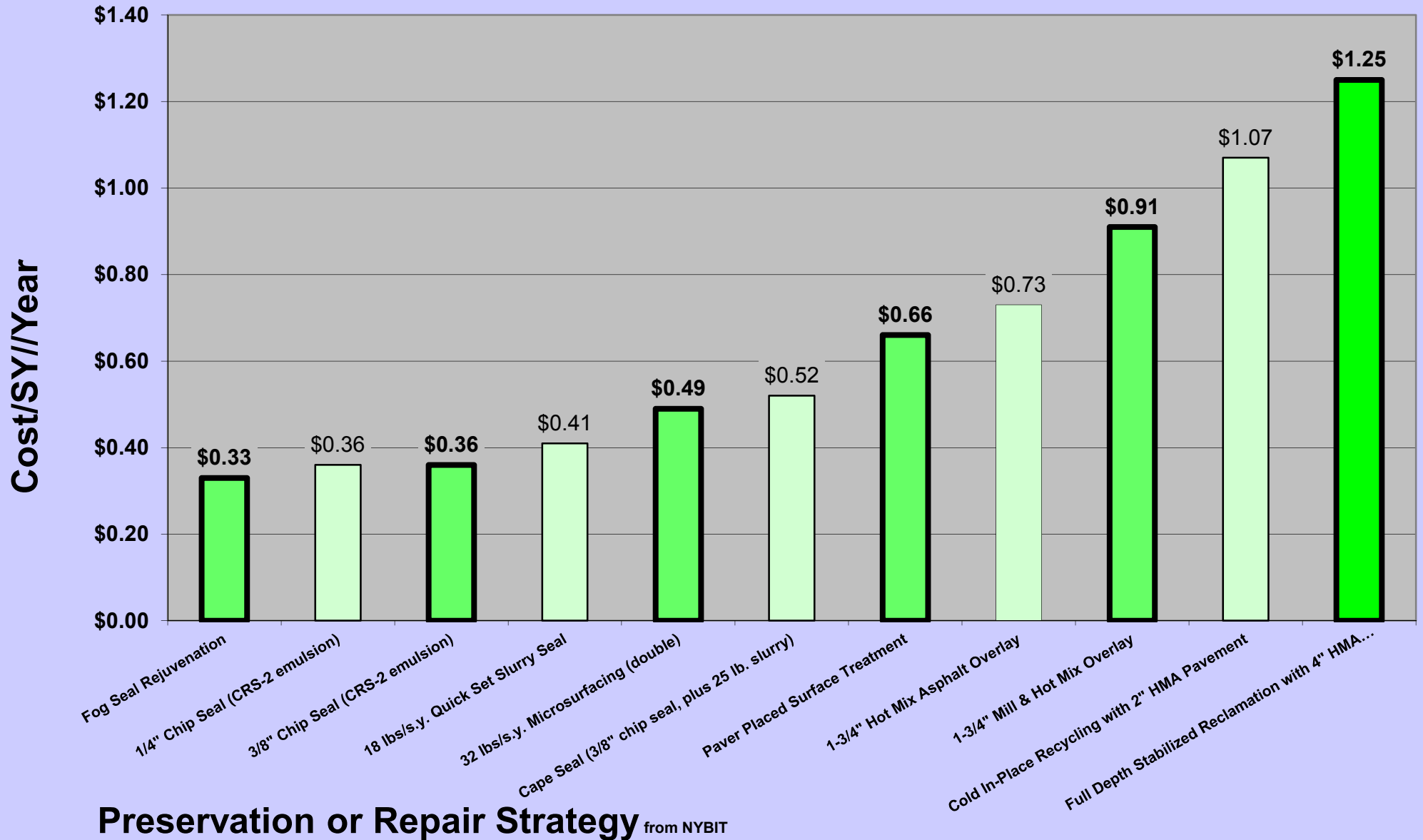
Treatment Alternative	2011 Approx. Costs		Estimated Service Life (years)	Equivalent Annual Cost (\$/SY/year)
	(\$/lane-mile)	(\$/SY)		
Micro or 4.75mm HMA	\$ 22,810	\$ 3.24	6	\$ 0.54
Double Chip Seal	\$ 28,301	\$ 4.02	7	\$ 0.57
3/4" Paver Shim	\$ 25,281	\$ 3.59	6	\$ 0.60
1" HBP Overlay	\$ 33,708	\$ 4.79	8	\$ 0.60
Chip Seal	\$ 21,120	\$ 3.00	5	\$ 0.60
15% AR Chip Seal	\$ 35,482	\$ 5.04	8	\$ 0.63
1-1/2" HBP Overlay	\$ 50,561	\$ 7.18	10	\$ 0.72
1-1/2" HBP Inlay	\$ 67,457	\$ 9.58	10	\$ 0.96
FDR with 4" HBP	\$ 147,502	\$ 20.95	15	\$ 1.40
2" TW Inlay with 1-1/2" FW Overlay	\$ 134,872	\$ 19.16	13	\$ 1.47
4" CIP with 3" HBP Overlay	\$ 156,035	\$ 22.16	15	\$ 1.48

Notes:

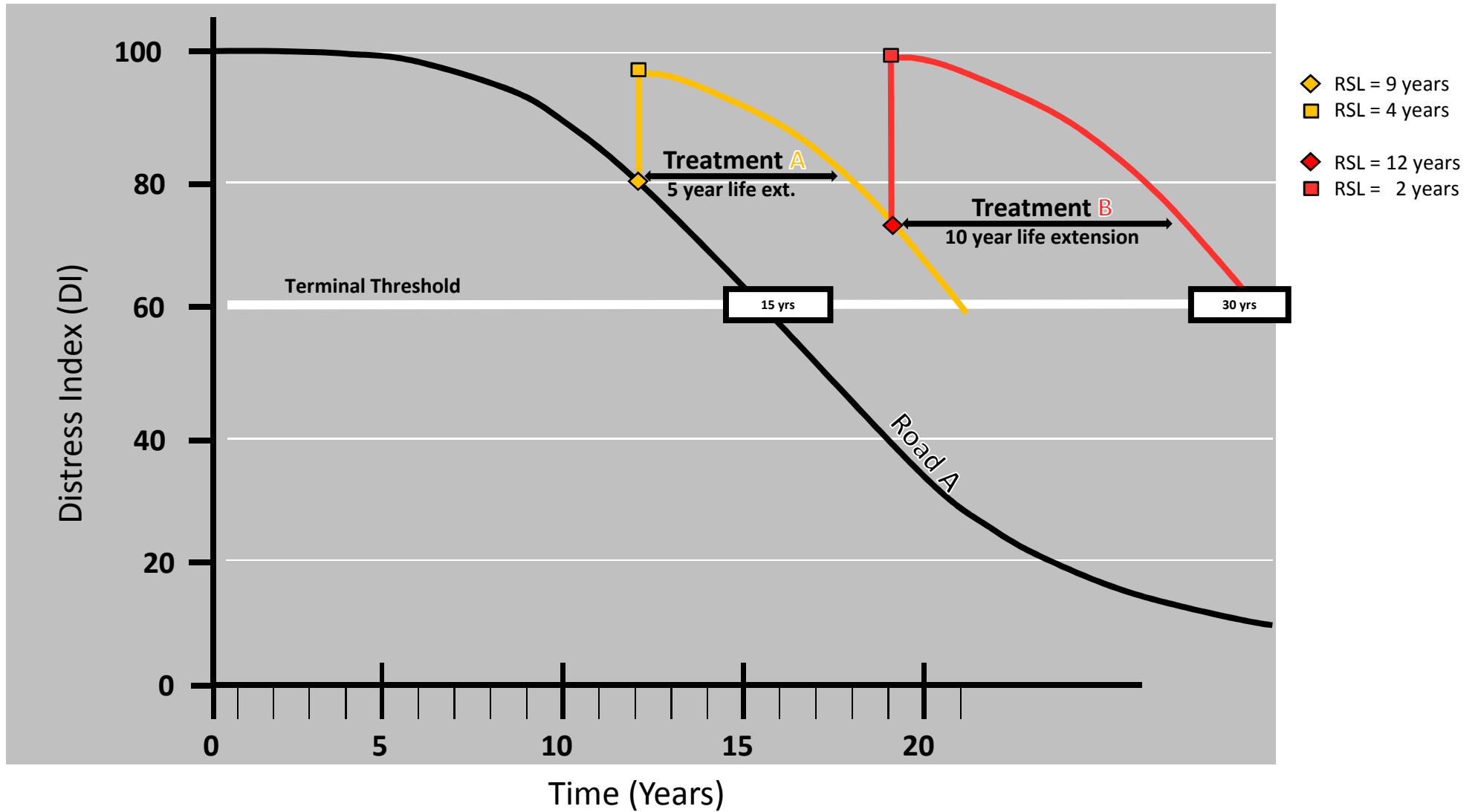
1. Costs per lane lane mile based on 12-foot lane width.
2. Costs shown here include a 20% multiplier to account for fixed costs.



Equivalent Annual Cost by Strategy



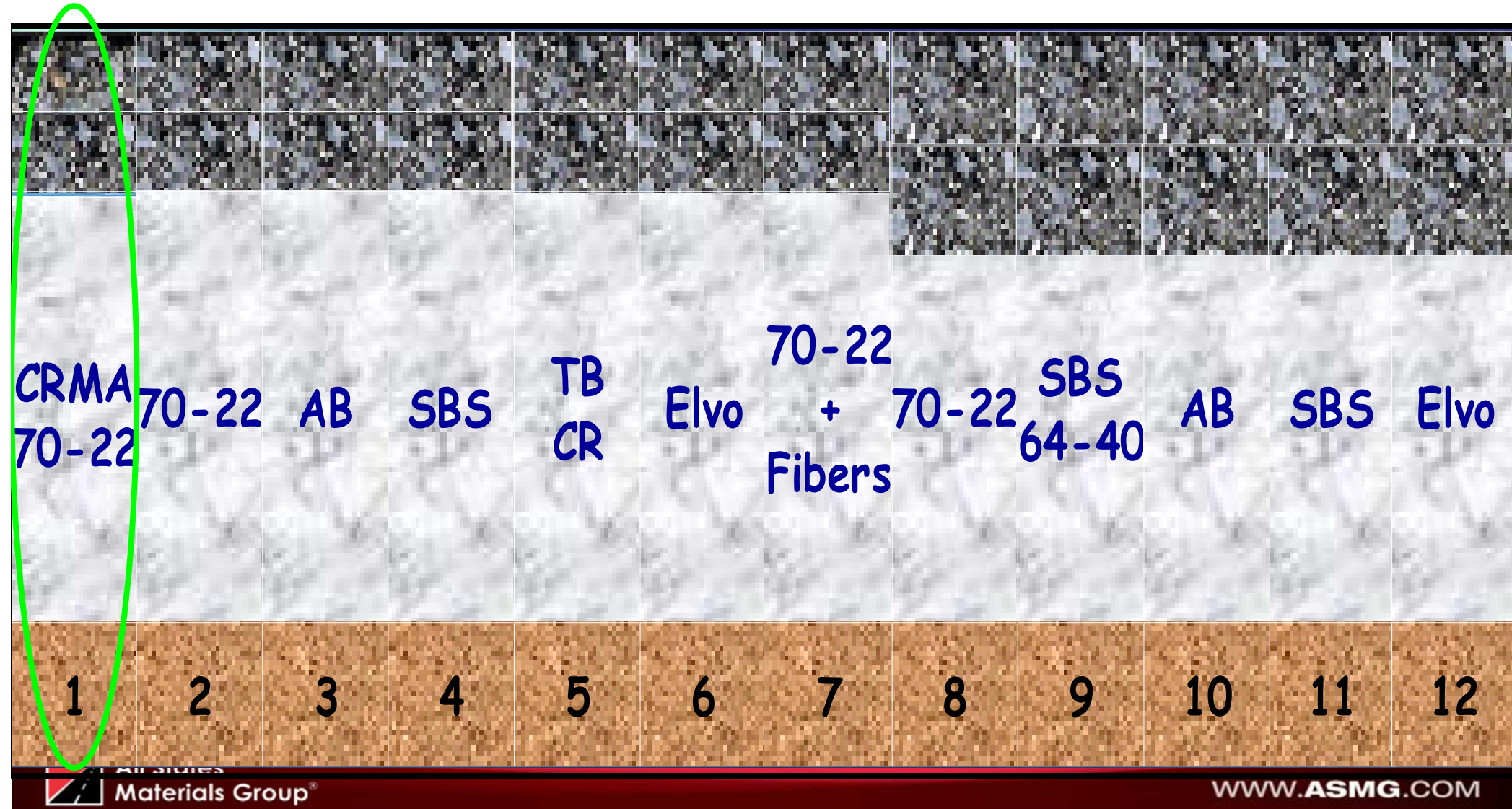
Remaining Service Life

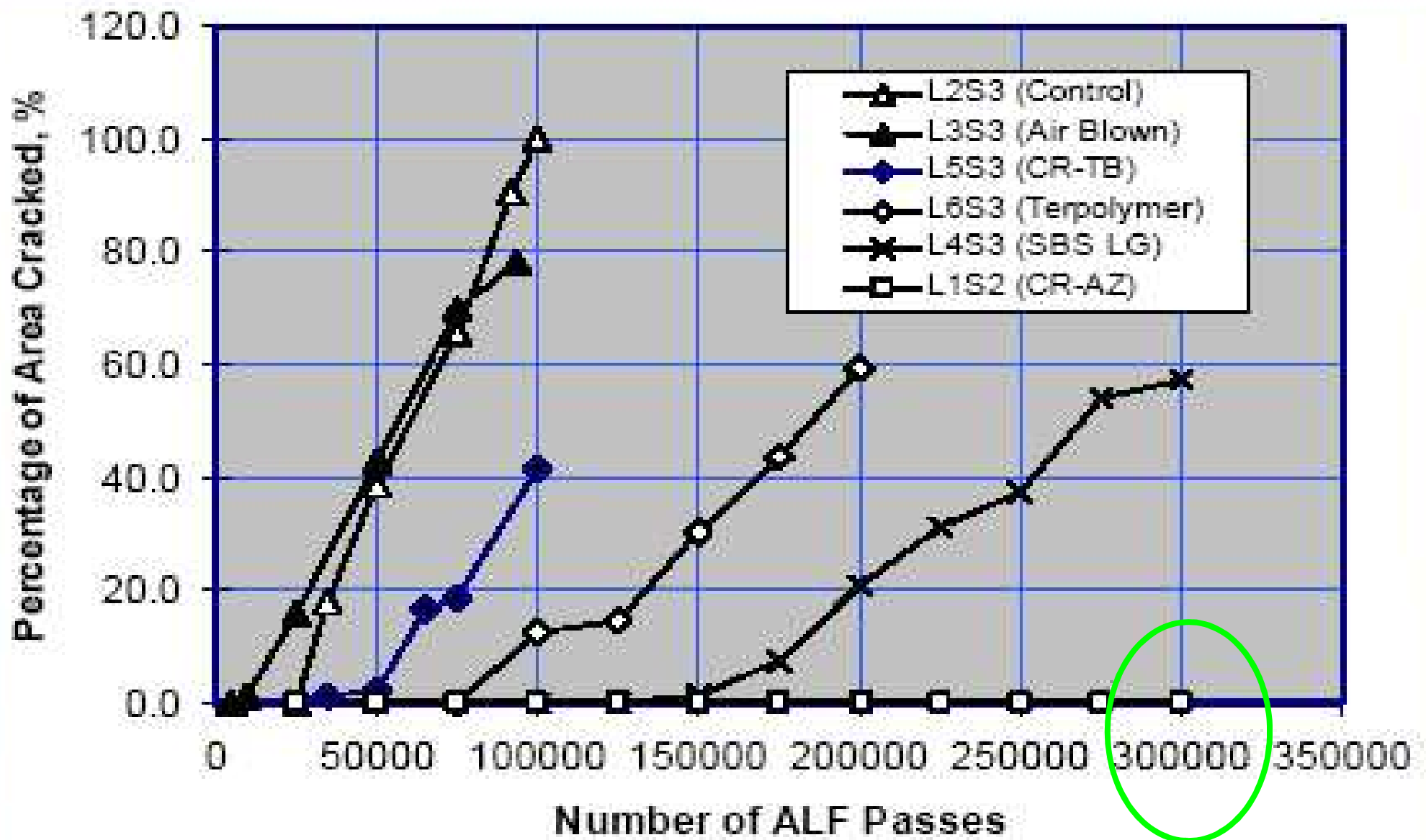


Two ALF's with
12 Pavement Lanes Constructed in
the Summer and Fall of 2002

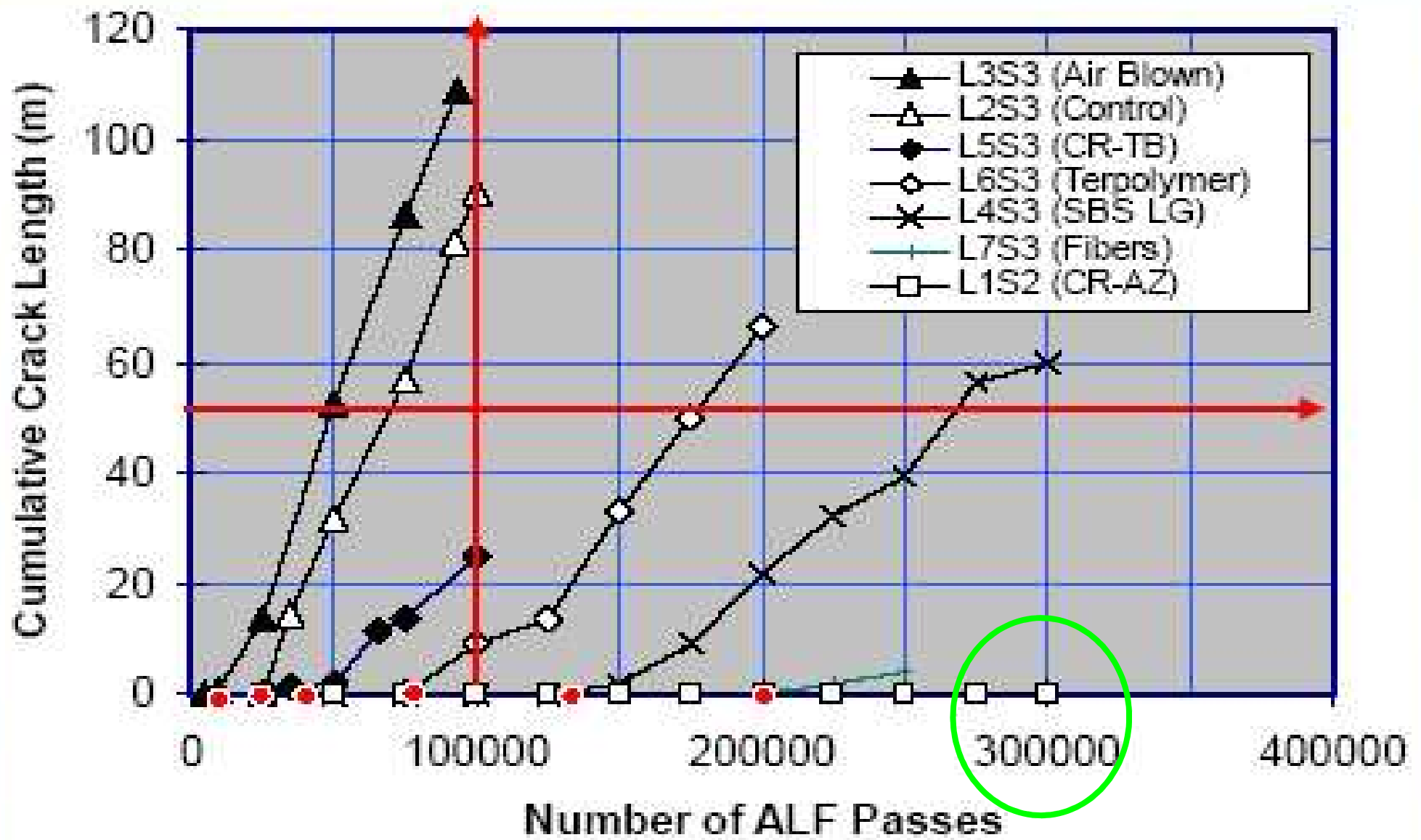


ALF Project Test Sections





Percentage of Area Cracked vs. ALF Wheel Load Passes



Fatigue Cracking Length vs. ALF Wheel Load Passes



Lane 1

Lane 2

Lane 3

Lane 4

Lane 5

Lane 6

CR-AZ

Control

Air Blown

SBS LG

CR-TB

TP

300,000

100,000

100,000

300,000

100,000

200,000

Integrating Preservation into Design:

A Beginning with Top Down Cracking

Idaho Office of Infrastructure RMD

Nelson Gibson

nelson.gibson@dot.gov

202.493.3073



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Objectives

- Illustrate well-documented cases of top-down fatigue cracking
 - Reflect on the mechanisms
 - Compare and contrast with classical bottom-up cracking
- Illustrate delay of top-down fatigue cracking with thin overlay



Objectives

- Stimulate a discussion on research needs
 - Transportation System Preservation Research, Development, and Implementation Roadmap
 - Positive direction of NCHRP 1-42 and 1-42(A)
 - Initiation more key than propagation??
- Goal: Apply 1-42(A) and future techniques to preservation selection and timing

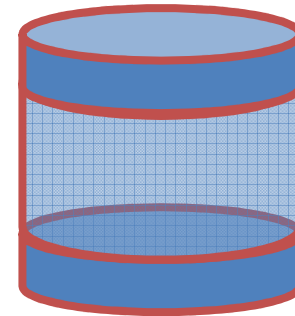
Objectives

- All of the activity is at the surface where preservation is applied
 - Aging is key – can not address top-down cracking without considering aging



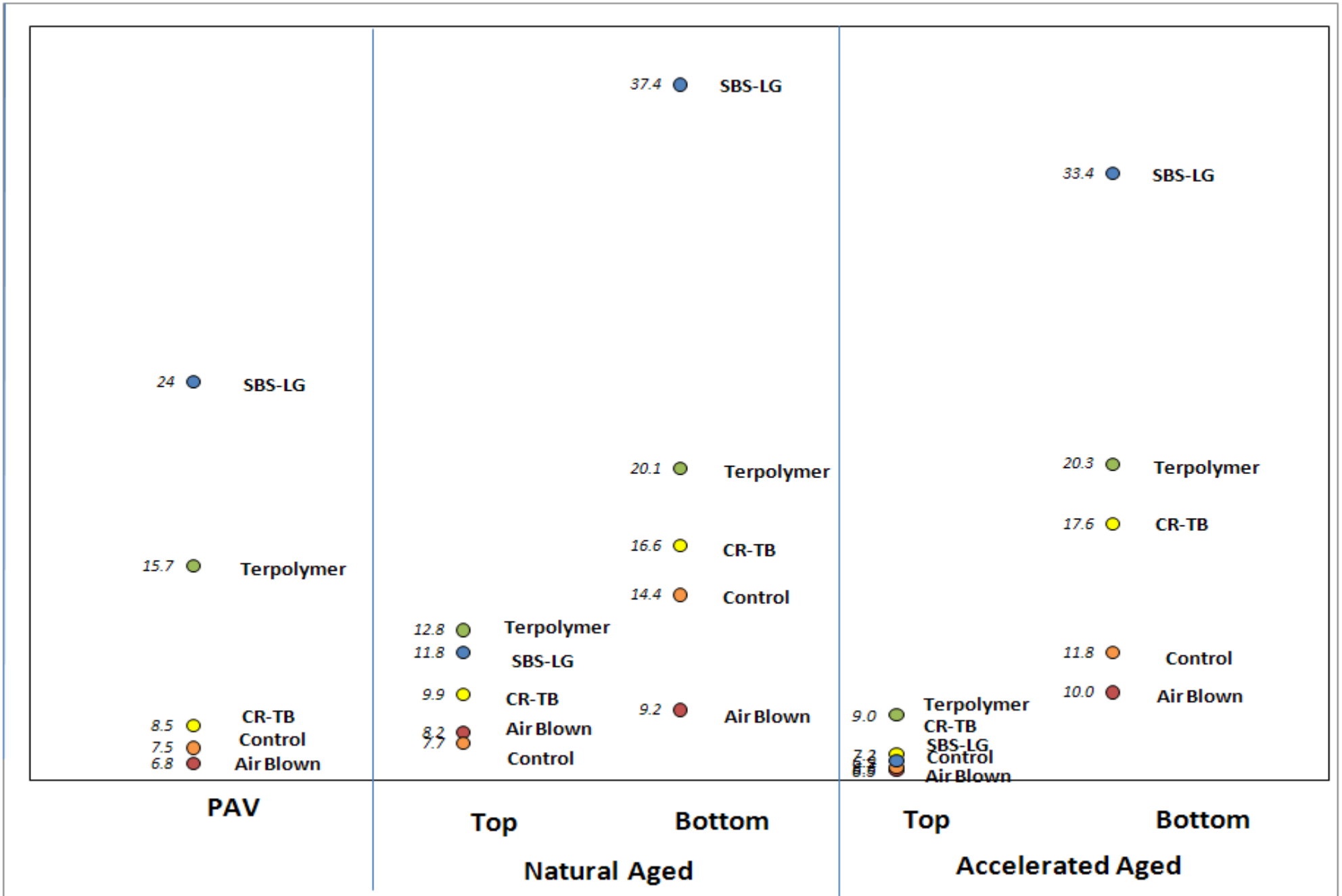
Extracted Binder Rheology

- Use of Toluene solvent rather than TCE
- Top 1-inch and bottom 1-inch



- More cores to obtain sufficient binder for CTOD characterization as well as DSR $|G^*|$ and phase angle

- Top-Down Cracking Contributing Factors from NCHRP 1-42, Phase I
 - **Mix Properties**: high stiffness, low fracture resistance, poor low temperature properties, moisture susceptible, compactability/permeability
 - **Load Related**: distortional tensile and shear stresses at surface and near surface
 - **Environmental**: age hardening, oxidation, moisture damage, thermal stresses, thermal/stiffness gradients
 - **Structural**: pavement thickness(?)
 - **Construction**: segregation, compaction



Why Pavement Preservation?

- Keep **'GOOD'** pavements in **"Good"** Condition
- Corrects minor surface deficiencies
- Preserves the pavement system
- Retards water intrusion and future deterioration
- Maintains or improves the functional condition of the pavement system
- **\$\$\$ Saves Budget Dollars.**



Benefits of Pavement Preservation

- Financial
- Environmental
- User Satisfaction



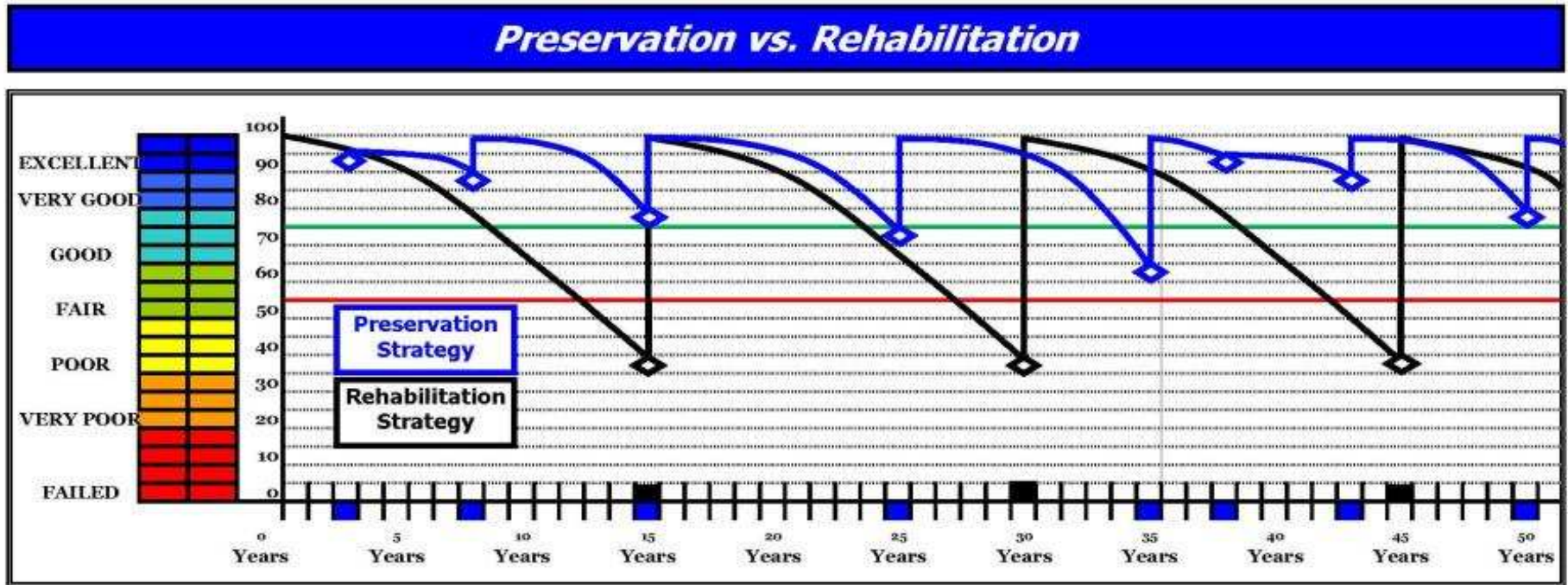
Benefits of Pavement Preservation

Financial

- Extending pavement life to preserve investment in pavement
- More predictable system maintenance costs
- Lower long term lifecycle costs
- Better use of Budget Funds



Progressive Pavement Management



PRESERVATION STRATEGY:

Years 3 & 38: Rejuvenation

Years 8 & 43: Microsurfacing (Single)

Years 15 & 50: Microsurfacing (Double)

Year 25: Cape Seal

Year 35: 1-3/4" Hot Mix Overlay

TOTAL COST/SY OVER 50 YEARS = \$28.65

REHABILITATION STRATEGY:

Year 15: CIPR with 2" HMA Overlay

Year 30: CIPR with 2" HMA Overlay

Year 45: CIPR with 2" HMA Overlay

TOTAL COST/SY OVER 50 YEARS = \$48.00

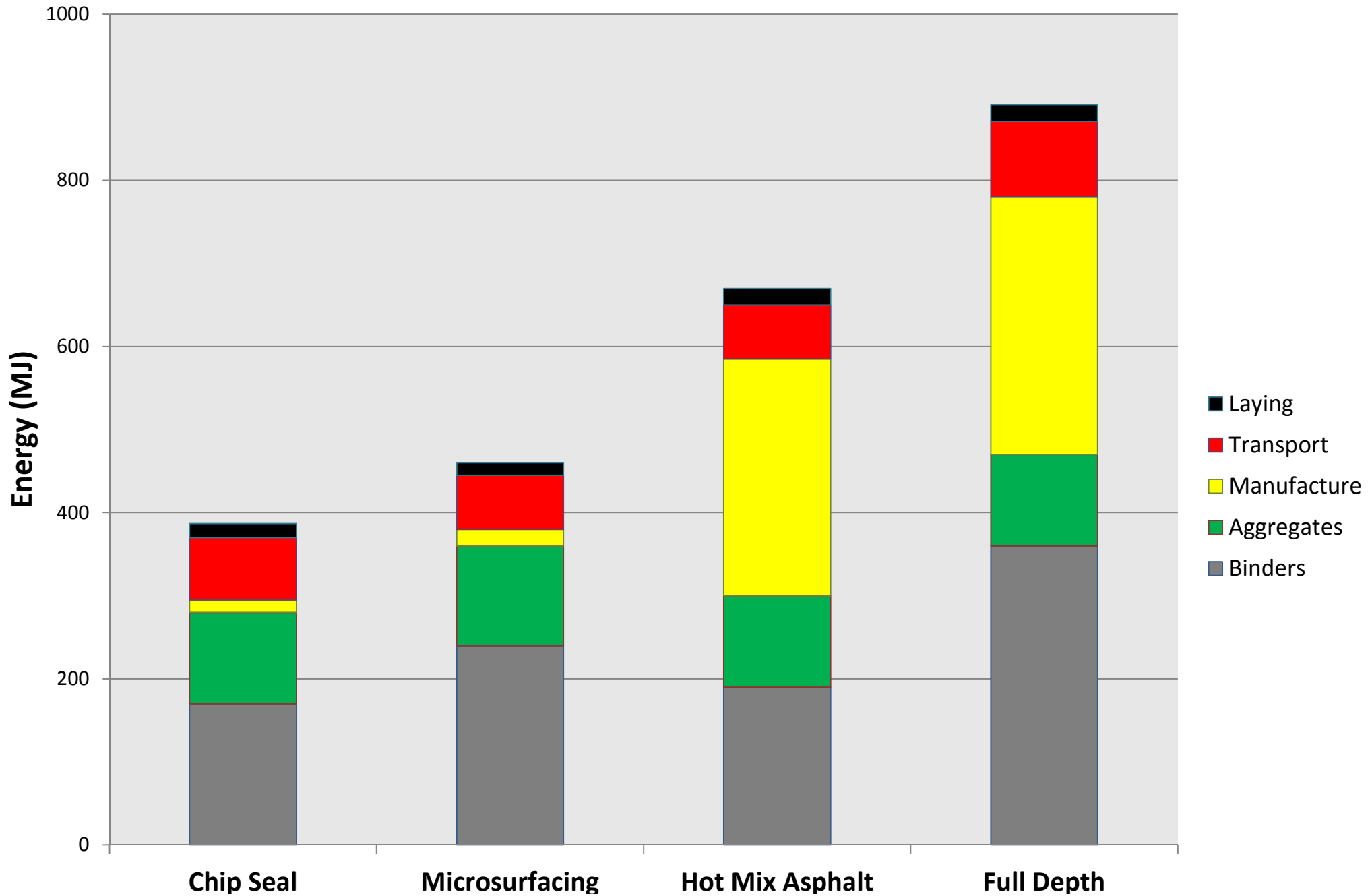
Benefits of Pavement Preservation

Environmental

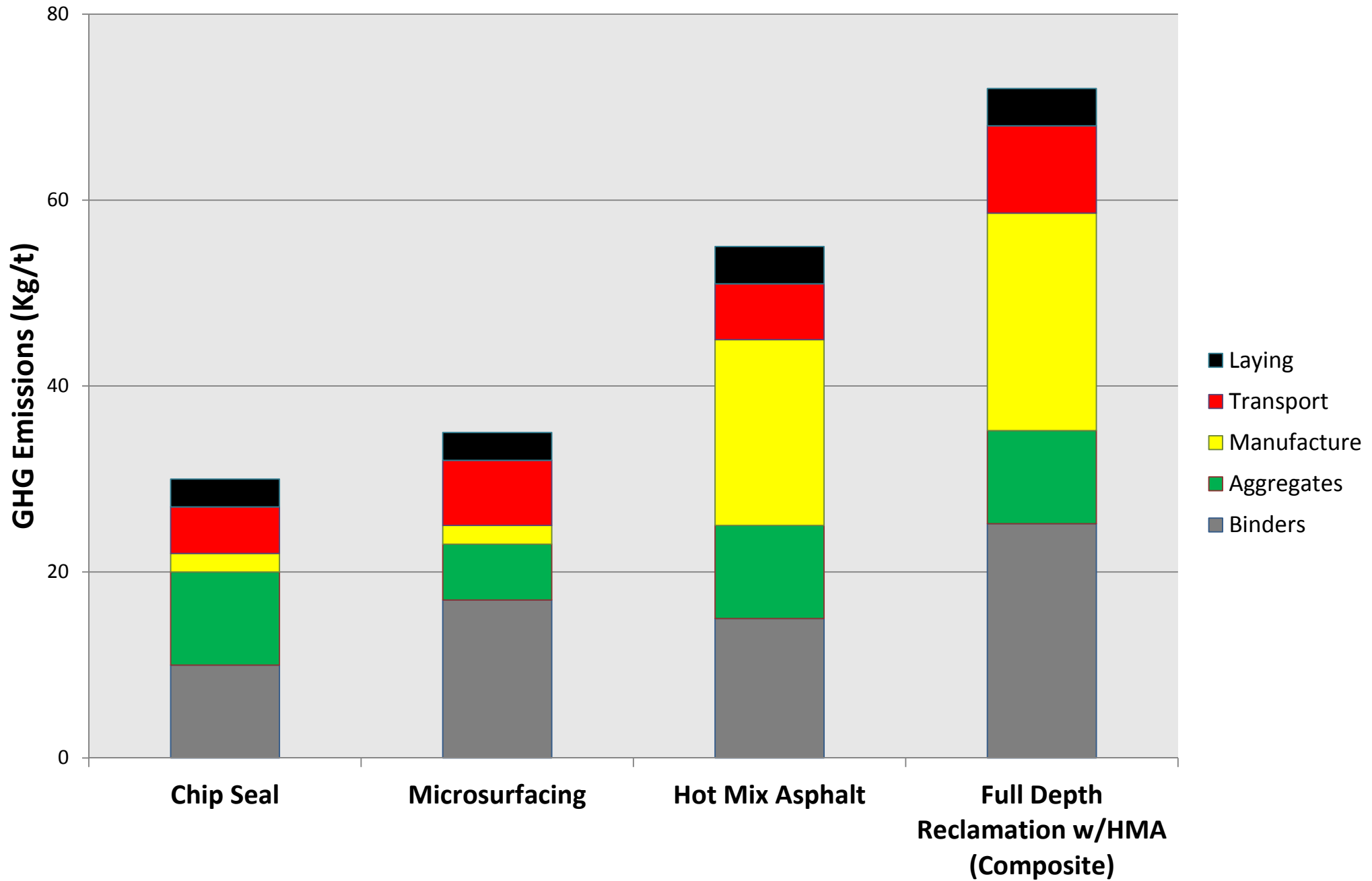
- Requires fewer natural resources – aggregates, petroleum products
- Less energy usage
- Less greenhouse gas emissions
- Less worker fatigue and exposure



Energy Consumption per Ton of Laid Material



GHG Emissions per Ton of Laid Material



Energy Consumption

Microsurfacing vs. HMA

For 1 Mile of Highway (2 Lanes) - 1 application each

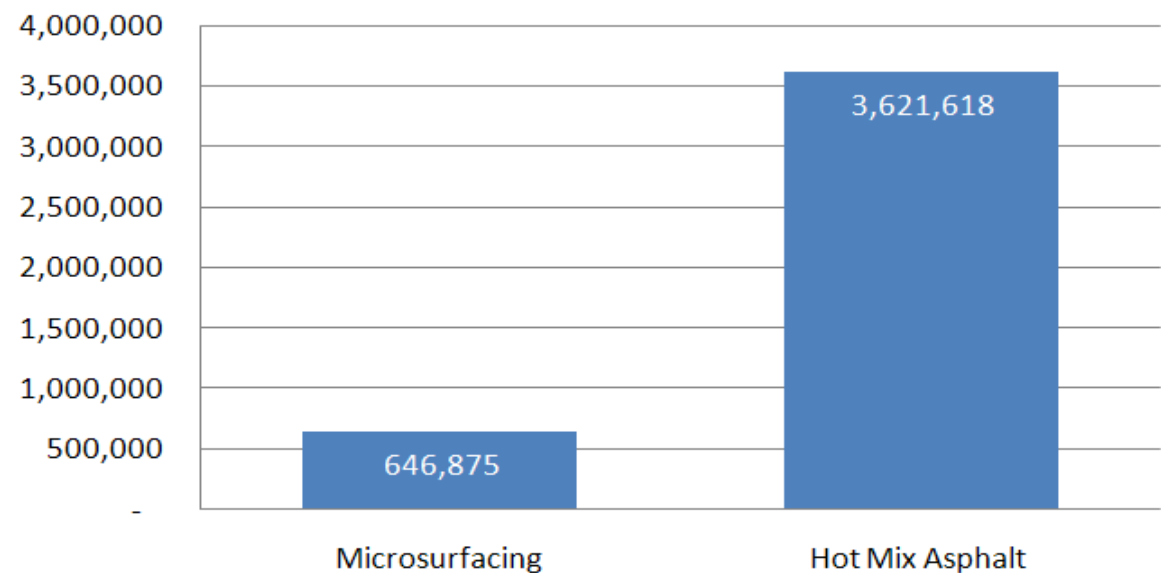
Method	Tons	Energy	Total*
Microsurfacing	225	460/tn	103,500
Hot Mix Asphalt	1188	670/tn	795,960
<i>Advantage of Preservation</i>			692,460
<i>a reduction of</i>			87.00%
<i>(per application)</i>			

For 50 Years of Maintenance

Method	Times Needed	Total*
Microsurfacing	6.25	646,875
Hot Mix Asphalt	4.55	3,621,618
<i>Advantage of Preservation</i>		2,974,743
<i>a reduction of</i>		82.14%
<i>(over 50 years)</i>		

**Energy is Measured in Megajoules*

Energy Consumption over 50 Years



Greenhouse Gas Emissions

Microsurfacing vs. HMA

For 1 Mile of Highway (2 Lanes) - 1 application each

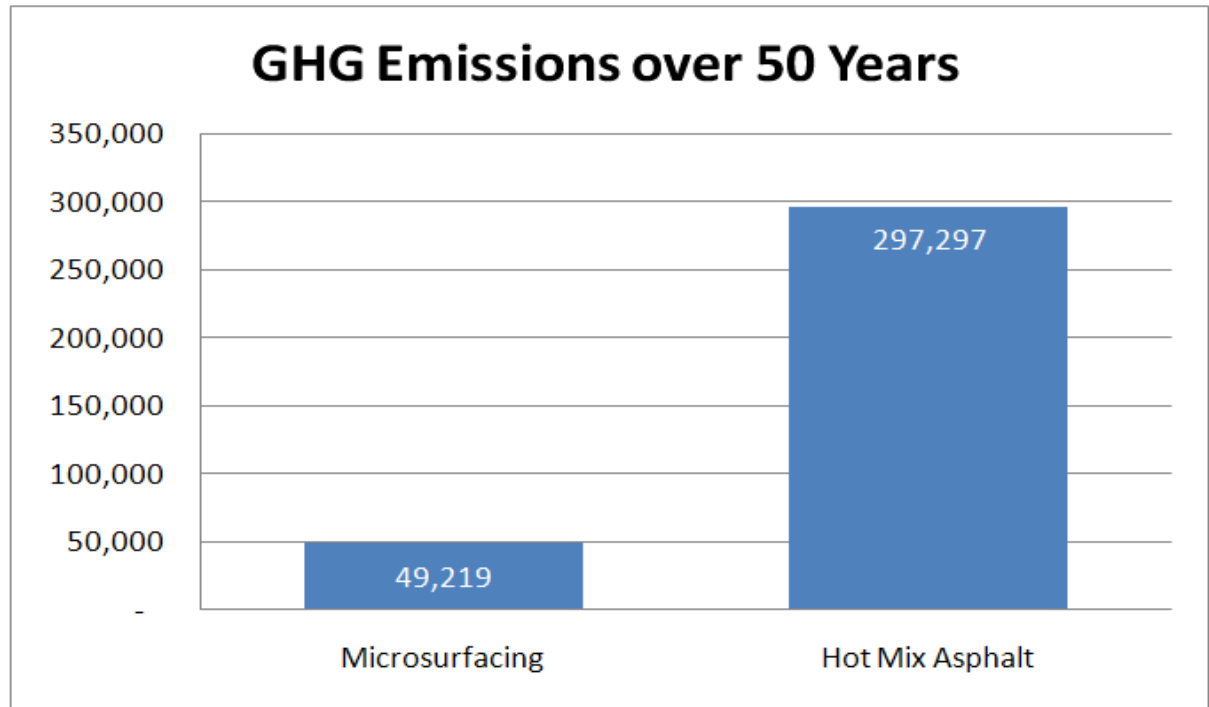
Method	Tons	GHG(kg/tn)	Total*
Microsurfacing	225	35/tn	7,875
Hot Mix Asphalt	1188	55/tn	65,340
<i>Advantage of Preservation</i>			57,465
<i>a reduction of</i>			87.95%
<i>(per application)</i>			

For 50 Years of Maintenance

Method	Times Needed	Total*
Microsurfacing	6.25	49,219
Hot Mix Asphalt	4.55	297,297
<i>Advantage of Preservation</i>		248,078
<i>a reduction of</i>		83.44%
<i>(over 50 years)</i>		

*GHG Emissions are Measured in Kilograms and include CO2 and other miscellaneous greenhouse gases.

GHG Emissions over 50 Years



Benefits of Pavement Preservation

User Satisfaction

- Better overall system condition
- Reduced vehicle damage and construction delays
- Some techniques improve ride and reduce noise
- Improved aesthetics
- Projects are quicker to complete than reconstruction

How do you Implement a Pavement Preservation Program?

- Fill up your Toolbox
- Look at alternatives
- Be receptive to new ideas and applications
- Commit to a Pavement Preservation Management System
- Partner with your Suppliers/Contractors

Pavement Preservation Tools

- Crack Sealing
- Fog Seal/Rejuvenation
- Chip Seal
- Quick Set Slurry
- Microsurfacing
- FiberMat®
- AR SAM/SAMI
- Thin Bonded Wearing
- Single Course HMA/WMA
- Single Course PM/AR HMA
- Mill and Fill
- Hot In-Place Recycling
- Cold In-Place Recycling



Pavement Management Systems

- Helps manage the networks condition
- Determine Remaining Service Life
- Looks at alternate treatments
- Manages alternatives based on cost and service life
- Maximizes budget allocation
- Consultants/ Software/ Visual
- FHWA Distress Identification Manual

Selling Pavement Preservation

- Believe in the Concept - Make the Commitment
- Educate and Train your Staff
- Work with Administration and Finance
- Communicate to the Users What you are doing and Why – PP is not Worst First
- Get Media Involved
- Notify Homeowners and Businesses that will be affected of your Plan of Work

Implementing Pavement Preservation

Simple (but effective) planning, education
and communication tool:

A Quick Check of Your Highway Network Health

By Larry Galehouse, Director,
National Center for Pavement Preservation
and

Jim Sorenson, Team Leader,
FHWA Office of Asset Management

Available at: www.fhwa.dot.gov/preservation/library.cfm

Implementation of Pavement Preservation

- based on the **Remaining Service Life** (RSL) concept

- every roadway segment in a network has a **Remaining Service Life**

- if you have 500 lane–miles of pavements in your network and do no repairs or maintenance in a given year, the network will lose 500 lane–mile–years of **Remaining Service Life**

- Develop** an annual work plan to achieve the agency's pavement condition goals (outcome-based budgeting)

Limit Costly Rehabilitation or Structural Overlays

Pavement Preservation can...

- Extend the life of structurally sound pavement.
- Prevent future deterioration.



Key Components to Successful PP

- Selecting the Right Candidate
- Using the Right Treatment at the Right Time
- Defined Specifications
- Proper Materials
- Calibrated Equipment
- Trained Workers
- Quality Workmanship
- QA/QC Plan
- Inspection/ Compliance
- What are your Expectations ?????



I-78 – Good Candidate for PP

- Longitudinal Joint - Microsurfacing

2009/06/17



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Good Candidate for Pavement Preservation



Good Candidate for Pavement Preservation



Not a Candidate for PP



Typical Life Extensions

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Crack Fill	1 - 3	0 - 2	0
Crack Seal	1 - 5	0 - 3	0
Fog Seal	1 - 3	0 - 1	0
Chip Seal	4 - 10	3 - 5	0 - 3
Micro-Surfacing	4 - 8	3 - 5	1 - 4
Thin HMA	4 - 10	3 - 7	2 - 4

Specifications

- Association/ Agency Specs to Reference
- Precise
- Define Expectations and Outcomes
- Hold Contractor Accountable
- May Include Incentives/Disincentives



Quality Materials

- Asphalt binders
 - Asphalt emulsions
 - Asphalt and Asphalt Rubber (AR)
- Aggregate
 - High Quality – Agency approved, durable
 - Required Gradation, Shape, Cleanliness
- Mix Design
 - Asphalt Content, Gradation, Air Voids

Well Maintained Equipment

- Sweeper
- Asphalt Distributor/Paver/Micro Paver/ Milling Machine
- Aggregate haul vehicles w/ clean bodies
- Rollers
- Note – All Equipment should be calibrated before using



Calibrations

- Asphalt Distributor
 - Bar Height
 - Nozzle size
 - Nozzle Angle
 - Pump pressure
 - Speed measurement
- Chip Spreader
 - Uniform application across box
 - Rate per square yard

Calibrations- Continued

- Asphalt Pavers
 - Screed
 - Automation
- Micropaver/Slurry Paver
 - Proportioning Capabilities
 - Rate per square yard
 - Auger Box
- Roller
 - Tire pressure on rubber tire roller
 - Weight

Training/Workmanship

- Require Trained/ Experienced Work Crew
- Train Inspection Staff for Process
- Do not Accept Shoddy work



QA/QC and Inspection

- Make Contractor Responsible
- Require Detailed QA/QC Plan
- Develop Inspection Check List
- Insure Contractor Meets Specifications
- Sample and Test Materials

Pavement Preservation Techniques

- Crack Seal
- Conventional Chip Seals
- Asphalt Rubber SAM & SAMI
- FiberMat®
- Slurry Seal
- Micro-Surfacing
- Bonded Pavements
- Modified HMA Thin Overlays
- Cold In-Place Recycle
- Hot In-Place Recycle
- Thin HMA Overlays w/ or w/out milling

Crack Seal



Conventional Chip Seals



Crumb Rubber Modified Binder – Blending

Auger Crumb Rubber into Mixer



Heat Exchanger for PG Binder



Asphalt Rubber SAM/SAMI



FiberMat[®] Machine



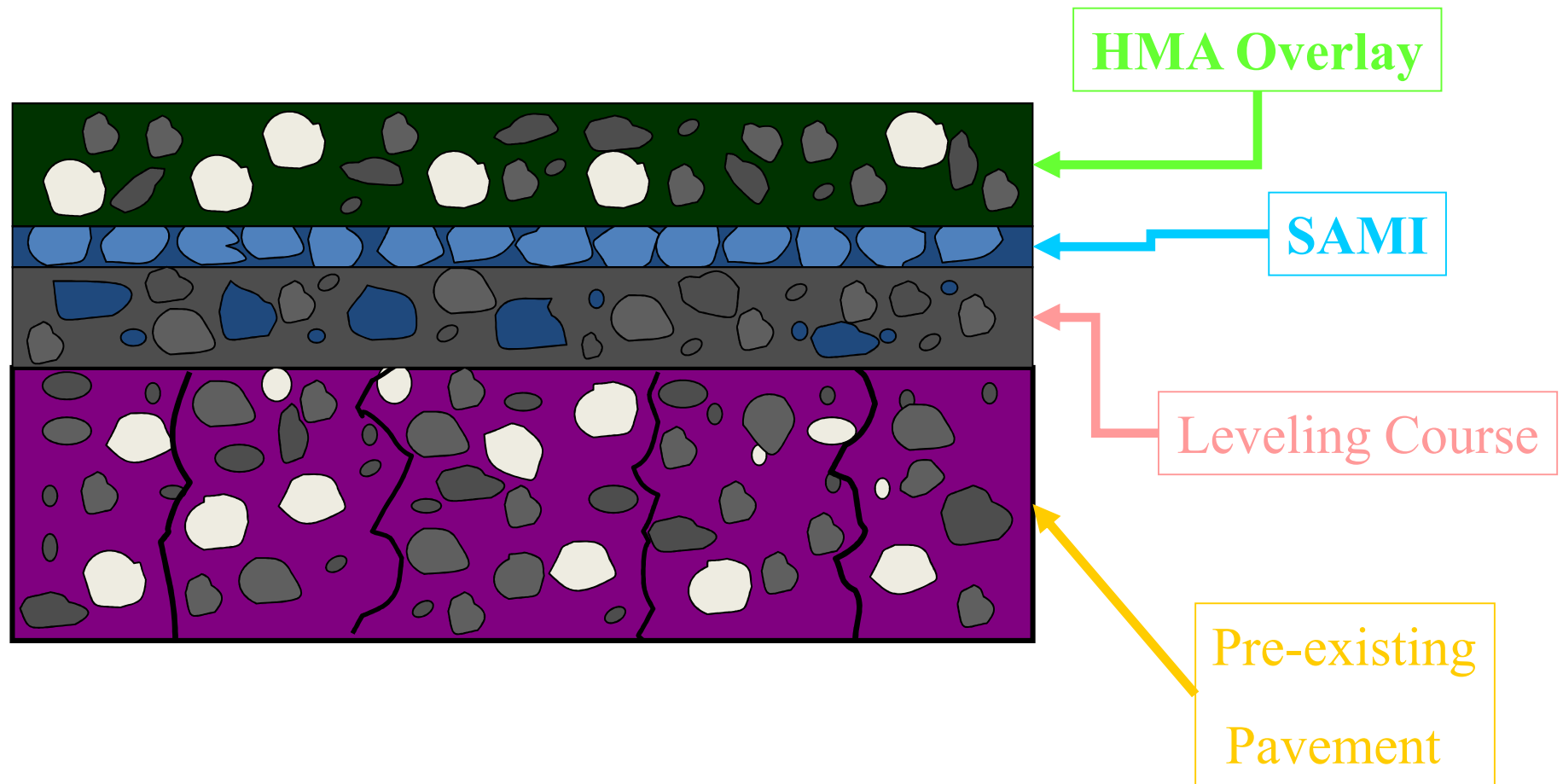
FiberMat® Application



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SAMI in a three layer system



Crumb Rubber SAMI



Bonded Pavements



Microsurfacing/ Slurry



HMA Paving



AR Gap Graded WMA



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Cold Milling



Hot In-Place Recycling



Cold In-Place Recycling



What is in it for the Agency

- Better Pavements
- Improved System Rating
- Better utilization of Budget Dollars
- Satisfied Customers – Driving Public
- Reduced Environmental Impact

What is in it for the Contractor

- More opportunities for work
- Opportunity to develop new techniques and Processes
- Opportunity to Grow Business and Employ more people

Summary

- Pavement Preservation is a Proactive, Planned, Economical Means of Keeping a Pavement Network in “GOOD” Condition
- Long term performance of Pavement Preservation Treatments are a function of prior pavement condition, type application and the above construction criteria
- A Network Pavement Management System is essential for the Success of Pavement Preservation
- There are many techniques to Preserve Flexible Pavements

Summary- Continued

- Successful projects require Planning, Training, Proper Specifications, Materials, Equipment and QC/QA
- Remaining Service life is a Key Concept
- Annualized Cost of Treatments must be Considered in Application Selection
- Pavement Preservation has Many Benefits –Financial, Environmental, User Satisfaction
- Great Potential for both the Agency and Contractor

Additional Resources

- The National Center for Pavement Preservation
(www.pavementpreservation.org)
- The Foundation for Pavement Preservation
(www.fp2.org)
- Federal Highway Administration
(www.fhwa.dot.gov/pavement/pres.cfm)
- All States Materials Group
(www.asmg.com)

THANK YOU



Products & Services

- **ECOBIT** WMA Binder
with SonneWarmix™
- CRMB for HMA
- Asphalt Rubber SAM & SAMI
- FiberMat® SAM & SAMI
- Bonded Wearing Courses
- Chip Seals
- Liquid Calcium/Magnesium Chloride
- Full Depth Reclamation
- Hot & Cold Mix Asphalt
- Asphalt Emulsions
- Aggregates

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