

Why Preservation: Definitions, Treatment Types, Benefits and Challenges

Prepared for the 12th ISAP Conference
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ISAP 2014

2014 Conference

- ▶ Preservation is becoming more a part of this conference
- ▶ In the past the primary focus was on
 - Binders
 - Mixes
 - Materials characterization
 - Structural design
 - Performance
- ▶ Two sessions dealt with preservation issues at this conference along with this plenary lecture

Presentation Outline

- ▶ History
- ▶ Definitions
- ▶ Treatments
- ▶ Benefits
- ▶ Challenges
- ▶ The road ahead
- ▶ Conclusions and recommendations



History Prior to 1992

- ▶ Most current preservation treatments were used prior to 1992—called maintenance. Since then:
 - Materials have changed
 - Equipment has changed
 - Design practices have not changed as much
- ▶ Maintenance treatments perceived primarily as reactive, not preventive
 - Often considered for low volume roads
 - Designed by art not science
- ▶ Used worldwide by federal, state and local agencies

Preservation History Since 1992

- ▶ Formation of current Foundation for Pavement Preservation (FP2) occurred in 1992
- ▶ Cooperative agreement between FHWA and Industry in 1997
- ▶ Lead for FHWA was Jim Sorenson
- ▶ Leads for industry were Mike Buckingham (ISSA) and Bill Ballou, Michael O'Leary, and Jim Moulthrop (Koch Materials)
- ▶ Academic lead was Gary Hicks (OSU)
- ▶ Current FP2 Inc reorganized in 2006

Leadership in the FP2 Inc.

- ▶ Bill Ballou, Koch Materials, 1st President
- ▶ Mike Buckingham, former President
- ▶ Gerry Eller, former FHWA and FP2 Executive Director
- ▶ Jim Moulthrop, Current Executive Director



Sorenson and Buckingham



Eller

Early Challenges

- ▶ Preservation did not fit the highway bill as it was more than maintenance
- ▶ Many HMA contractors did not support it because it took market share from them
- ▶ Persistence paid off



Current Efforts

- ▶ Lobbying to raise the bar for pavement preservation
- ▶ Support for the National Center
- ▶ Carrying the message to the states through the AASHTO TSP-2 program and national conferences

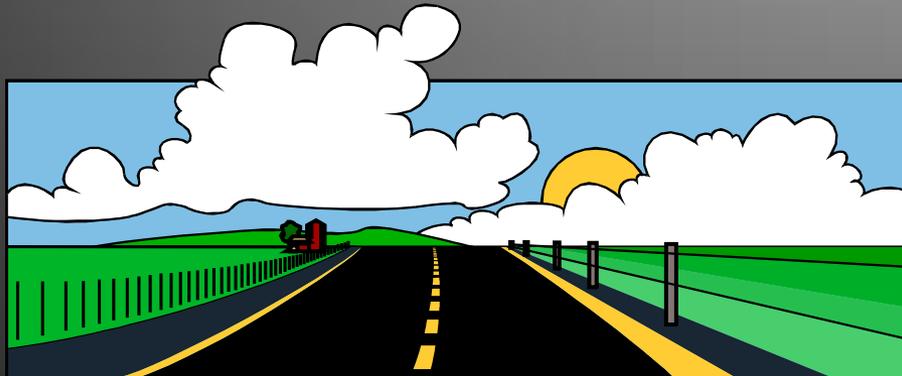
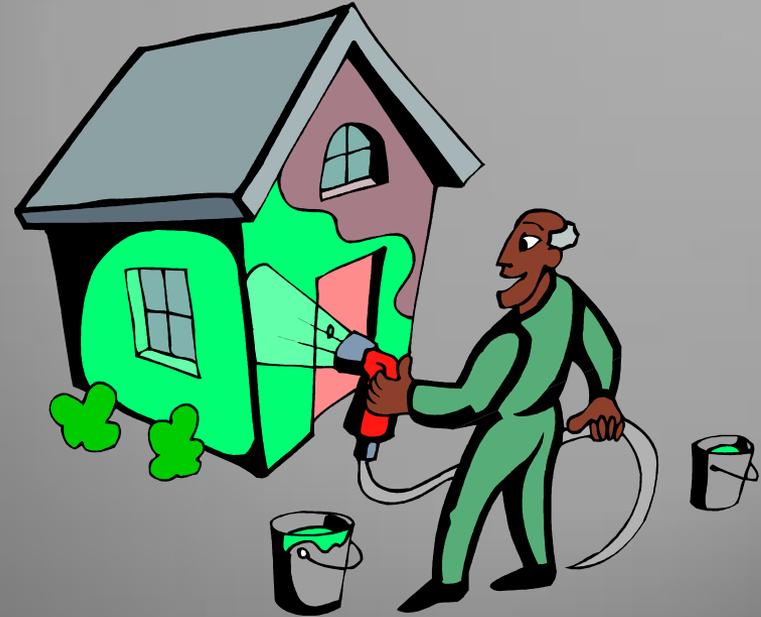
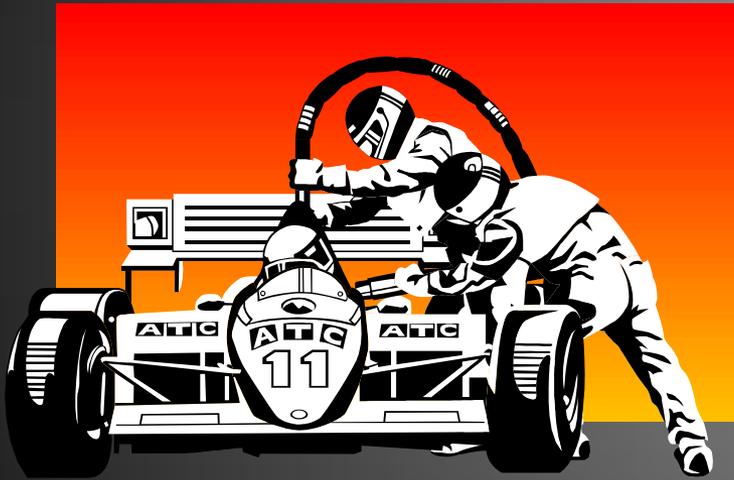


Moulthrop



Hicks, Mueller, and Galehouse

Concept for Pavement Preservation



Pavement Preservation– What is it?

- ▶ Sum of all activities to provide and maintain serviceable roadways
- ▶ Includes
 - Corrective & Preventive Maintenance
 - Minor rehabilitation
- ▶ Does not include
 - Reactive maintenance
 - Major rehabilitation or reconstruction



Defining Pavement Preservation

- ▶ Planned strategy of cost effective treatments
- ▶ Maintains or improves functional condition
- ▶ Does not increase structural capacity!!

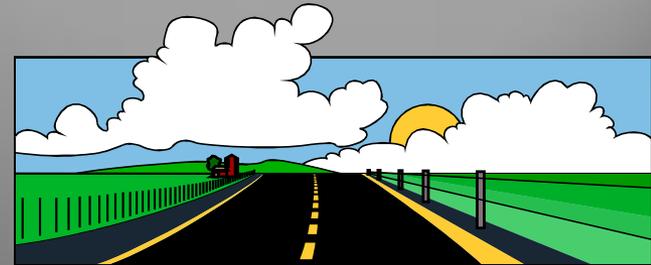
Keeping Good Roads Good

Philosophy

Right Treatment



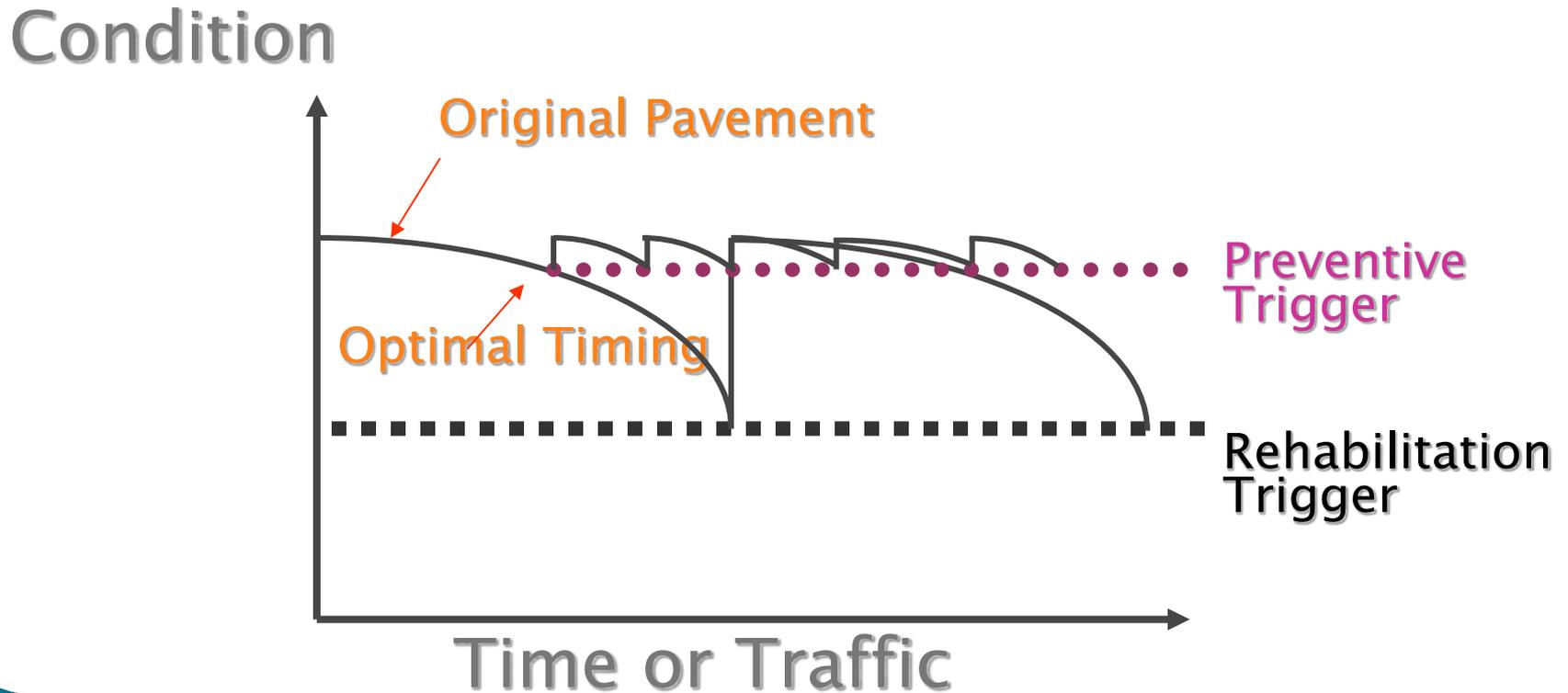
Right Pavement



Right Time

Also needs to be designed and constructed in the right way

Pavement Preservation – Concept



FHWA Definition: Memo Dated September 12, 2005

- ▶ Proactive approach to maintain our existing highways
- ▶ Consists of
 - Minor rehabilitation
 - Preventive maintenance
 - Routine maintenance
- ▶ Does not include
 - Corrective maintenance
 - Catastrophic maintenance
 - Pavement rehabilitation



Preservation Treatments Commonly Used for Asphalt Pavements

- ▶ Crack Sealing
- ▶ Fog seals
- ▶ Chip seals
- ▶ Scrub seals
- ▶ Slurry surfacings
- ▶ Cape seals (also 3 layer systems)
- ▶ Thin bonded wearing courses
- ▶ Thin HMA overlays
- ▶ In-place recycling (CIR and HIR)



Fog and Rejuvenating Seals



- ▶ Purpose– enriches dry pavement surfaces, reduces raveling, and locks in chips on chip seals (flush coat)
- ▶ Materials– generally diluted asphalt emulsions or a specialty product
- ▶ Design considerations– application rate a function of surface condition
- ▶ Construction– applied using a distributor truck in diluted form
- ▶ Expected life – 1 to 3 years or more

Potential Problems

- ▶ Using excess emulsion for the existing pavement surface
- ▶ Placing in wet and/or cool weather
- ▶ Over or under dilution
- ▶ Incompatible water for dilution
- ▶ Skid issues



Chip Seals

- ▶ Purpose– waterproof the existing surface and improve texture
- ▶ Materials– application of emulsions or hot binders followed by crushed aggregate
- ▶ Design– application rates need to be determined
- ▶ Construction–asphalt is applied followed by an application of aggregate
- ▶ Expected life– 5–7 years or more



Sweeping (before and after)



Binder Application



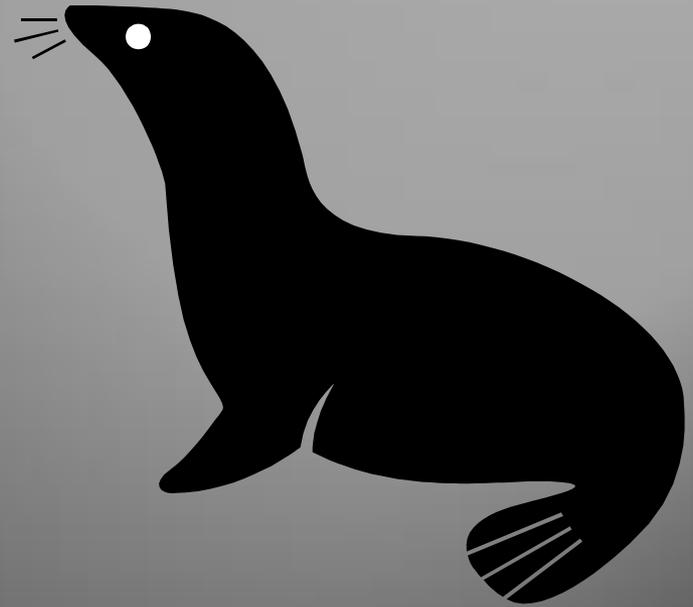
Aggregate Application



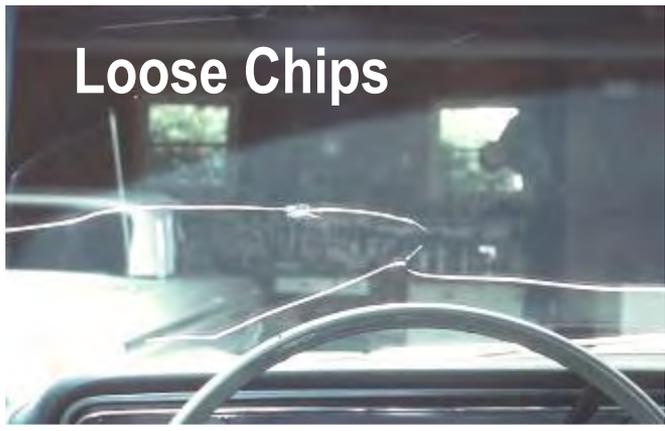
Rolling

Causes of Problems

- ▶ Improper surface preparation
- ▶ Applying in cool and/or wet weather
- ▶ Using dirty rock
- ▶ Not accounting for new patches or flushed surfaces
- ▶ Not taking traffic into account
- ▶ Over spreading or under spreading binder or aggregate



Loose Chips



Bleeding



Streaking



Scrub Seals

- ▶ Chip seal with a polymer modified rejuvenating emulsion (PMRE)
- ▶ A scrub broom is used to push the emulsion into the cracks
- ▶ Rejuvenates aged binder as it seals the pavement surface







The size of wave is a function of the number and severity of cracks.



Existing pavement

**After emulsion
applied with the
scrub broom**



Slurry Seals

- ▶ Purpose– seals minor cracks, restores surface texture, mitigates raveling
- ▶ Materials– a mixture of graded aggregate, emulsion (generally polymer modified), and setting agents
- ▶ Design– special mix design is needed
- ▶ Construction–applied using a special paver mounted on a truck
- ▶ Expected life– 5 to 7 years or more if placed on sound pavements



Sweeping



Manhole Covering



Application



Handwork

6/9/2014

Slurry Seals



Type		
I	II	III
Crack Filling Fine Seal	General Seal Medium- Textured Surface	Rough - Textured Surface
Parking Lots Residential Streets Airfield Runway	Urban Streets	Primary Highways

Causes of Problems

- ▶ Improper surface preparation or placing on unsound pavements
- ▶ Placing in cool and/or wet weather
- ▶ Not following the a mix design or calibrating the equipment
- ▶ Too much or too little additive
- ▶ Improper maintenance of spreader box and drag
- ▶ Adding too much water
- ▶ Not allowing enough cure time prior to traffic
- ▶ Inadequate QC or inspection testing

Micro Surfacing

- ▶ Purpose– seal the surface, fill minor wheel ruts and surface irregularities, and can be placed at night
- ▶ Materials– a mixture of graded aggregates, polymer modified emulsion, and set additives
- ▶ Design– requires a mix design to determine the proportion of components
- ▶ Construction– applied using a special truck mounted mixing/paving machine. For long straight jobs a continuous machine is recommended
- ▶ Expected life–lasts 8–12 years depending on the surface it is applied to

Continuous Mix Paving Machine





Interstates



Placed at Night

Micro Surfacing - Where is it used?



Quick Traffic

Arterials



Cool Climates

6/9/2014

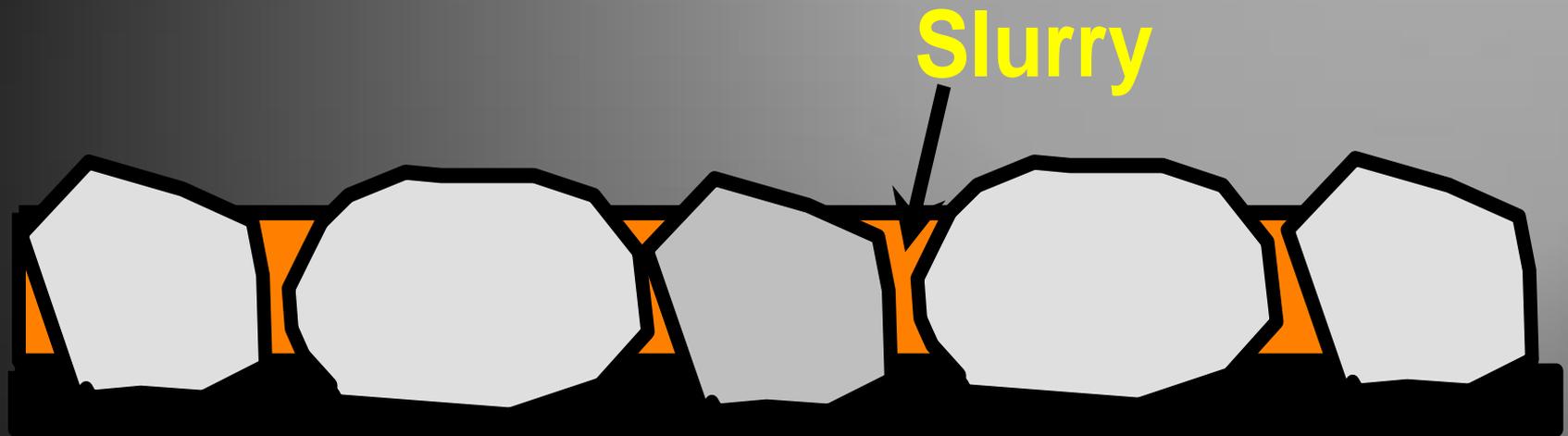
Causes of Problems

- ▶ Improper surface preparation or placing on badly cracked pavements
- ▶ Not following the mix design
- ▶ Construction in wet weather
- ▶ Equipment not calibrated
- ▶ Poor workmanship, including too much water in the mix
- ▶ Insufficient applications rate
- ▶ Inadequate QC and acceptance testing

Cape Seals

- ▶ Purpose– seal the surface and provide a smooth hard wearing surface
- ▶ Materials– a chip seal followed by a slurry seal
- ▶ Design considerations– mix designs for both products
- ▶ Construction– application of a chip seal followed by a slurry seal
- ▶ Expected life– 8–12 years or more

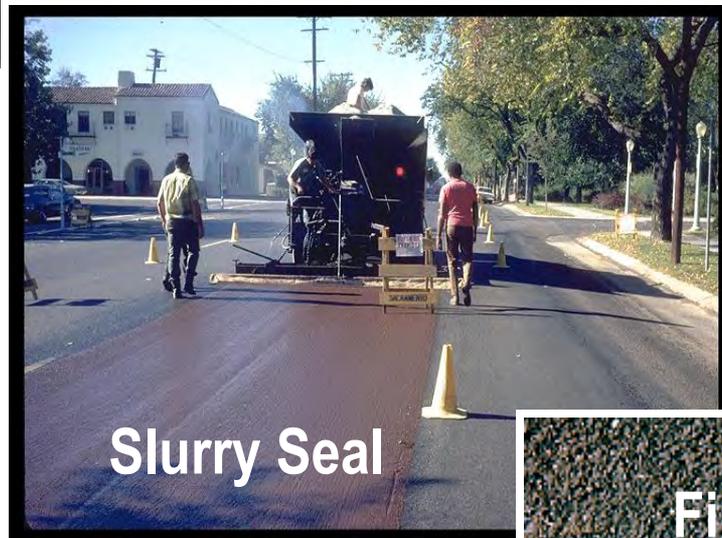
What is a Cape Seal?



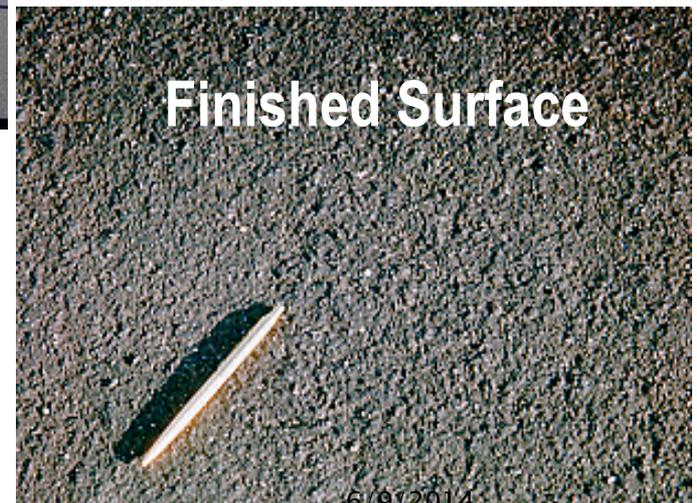
Chip Seal Followed by a Slurry



Chip Seal



Slurry Seal



Finished Surface

Causes of Problems

- ▶ Improper surface preparation
- ▶ Not following the mix designs
- ▶ Applying in cool and/or wet weather
- ▶ Over application of binder in either course
- ▶ Using conventional or polymer modified chip seals over cracked surfaces.



Thin Bonded Overlays

- ▶ Application of polymer modified binder immediately followed by a thin HMA overlay
- ▶ Total thickness has been about 25 mm
- ▶ Applied with a spray paver
- ▶ Expected life; 8–12 years



Thin HMA Overlays



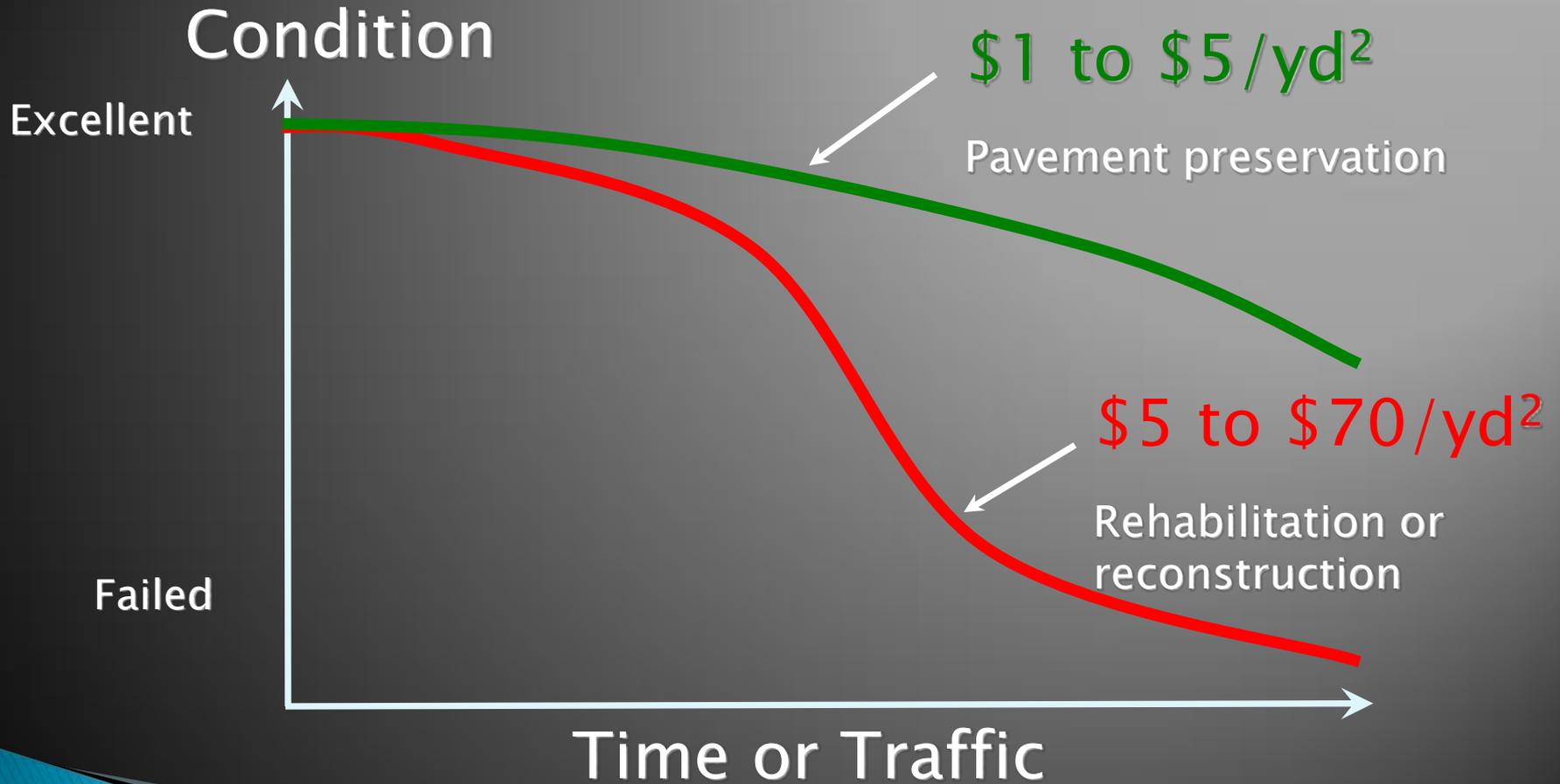
- ▶ Types
 - Conventional
 - Polymer modified asphalt
 - Asphalt Rubber
 - Terminal Blends
- ▶ Thickness of 25–37.5 mm
- ▶ May be used with warm mix additives in cold weather construction

Reported Benefits of Pavement Preservation

- ▶ Cost effectiveness
- ▶ Energy savings
- ▶ Reduced emissions
- ▶ Reduced user costs
- ▶ Life extension
- ▶ User satisfaction
- ▶ Safety



Costs



Energy Savings

- ▶ Use of emulsions can provide energy savings because there are smaller amounts of materials placed at lower temperatures
- ▶ Use of warm mix technology can produce savings by placing hot asphalt materials at lower temperatures
- ▶ Faster construction times can save equipment operating costs and user costs.

Reduced Emissions

- ▶ Emulsions have fewer emissions than hot applied binders
- ▶ Warm mix additives allow for cooler temperatures and fewer emissions
- ▶ Quicker construction cuts emissions from both users and contract activities.

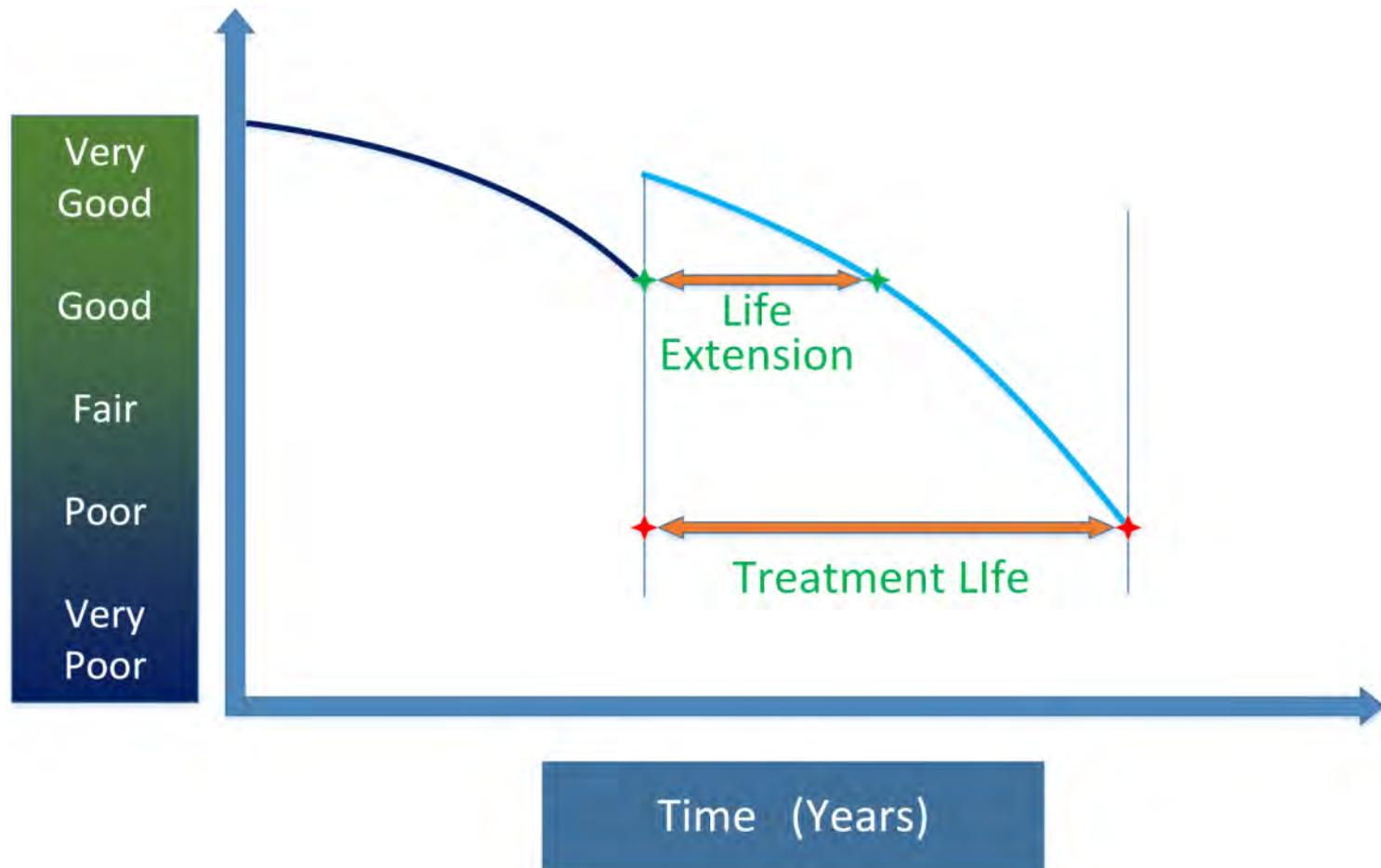


Reduced User Costs--Maintenance vs. rehabilitations

- ▶ Maintenance projects generally have shorter traffic queues
- ▶ Any detours are of shorter duration
- ▶ Shorter construction times reduce user delays and user costs



Life Extension



Life Extension

- ▶ Pavement preservation treatments can extend pavement life by 2 to 7 years or more
- ▶ Minimum costs compared to rehabilitations
- ▶ In many cases, maintenance can be repeated multiple times for added pavement life
 - Fog seals every 2–3 years
 - Chip seals every 3–7 years
 - Thin blankets every 5–10 years
- ▶ Major rehabilitation at 20 years of service instead of 12 years of service

Challenges

- ▶ Clearly documenting the benefits
- ▶ Shift from worst first to preserving good pavements
- ▶ Getting agencies to perform proper strategy selection
- ▶ Maintaining quality construction and acceptance testing
- ▶ Lack of performance related specifications for most products
- ▶ Keeping a preservation champion

Updating Pavement Preservation Design and Construction Practices

- ▶ Structural design
 - Not required
 - But is it needed?
- ▶ Mix design
 - Based on art not science
 - Lack of precision and bias statements
 - Need improved performance tests
- ▶ QC and acceptance testing
 - Does not follow practices like for HMA
 - Tests are not always performed on the mix
 - Agency's get what they inspect and test

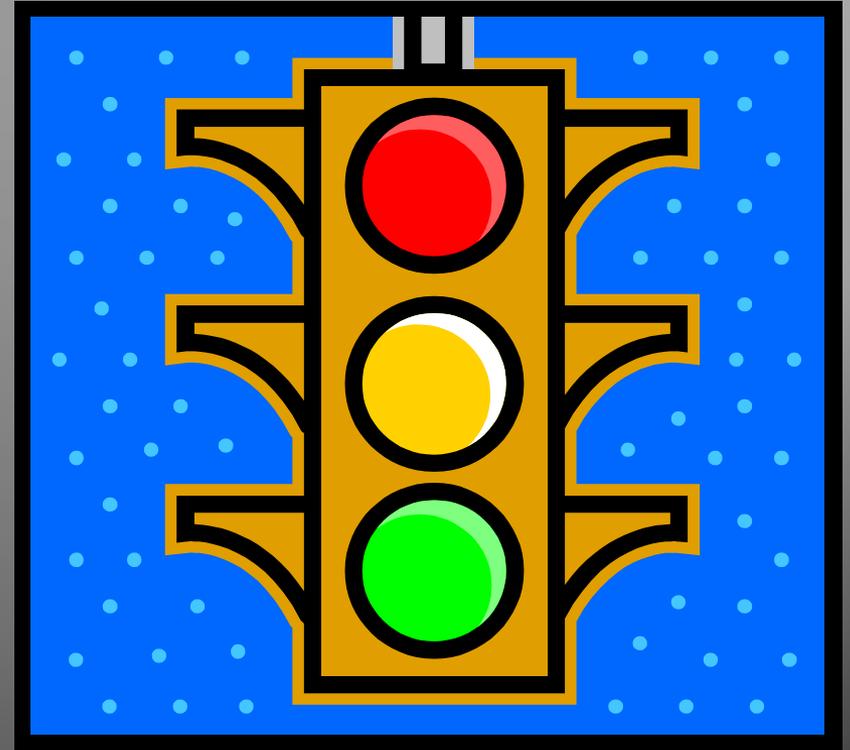
More Challenges

- ▶ Convincing the public that preservation is a good thing
- ▶ Getting agency's management to buy into spending maintenance \$ on good roads
- ▶ Understanding the effects that various maintenance strategies have on user costs
- ▶ Understanding the safety benefits of maintenance treatments



DOJ Regulatory Challenge

- ▶ In 2013, the DOJ and FHWA developed a joint technical assistance document which defines the difference between an alteration and maintenance
- ▶ This could have a substantial impact on how agencies do business in U.S.



Maintenance vs. Alterations*

Crack Filling and Sealing
Surface Sealing
Chip Seals
Slurry Seals
Fog Seals
Scrub Sealing
Joint Crack Seals
Joint Repairs
Dowel Bar Retrofit
Spot High-Friction Treatments
Diamond Grinding
Pavement Patching

Addition of a new layer of asphalt
Reconstruction
Rehabilitation
Resurfacing**
Widening
Open-graded Surface Course
Micro surfacing
Thin Lift Overlay
Cape Seals
In-Place Recycling

ADA Maintenance

ADA Alterations



* Alterations trigger wheelchair ramps in most circumstances;
** from one intersection to another, includes overlay of additional material, with or without milling

What are the Impacts to Agencies?

- ▶ FP2 Inc., CCSA, and the CP2 Center have conducted a survey on the potential impacts (cost and availability of treatments)
- ▶ The results should be available soon
- ▶ HMA contractors should be concerned as well



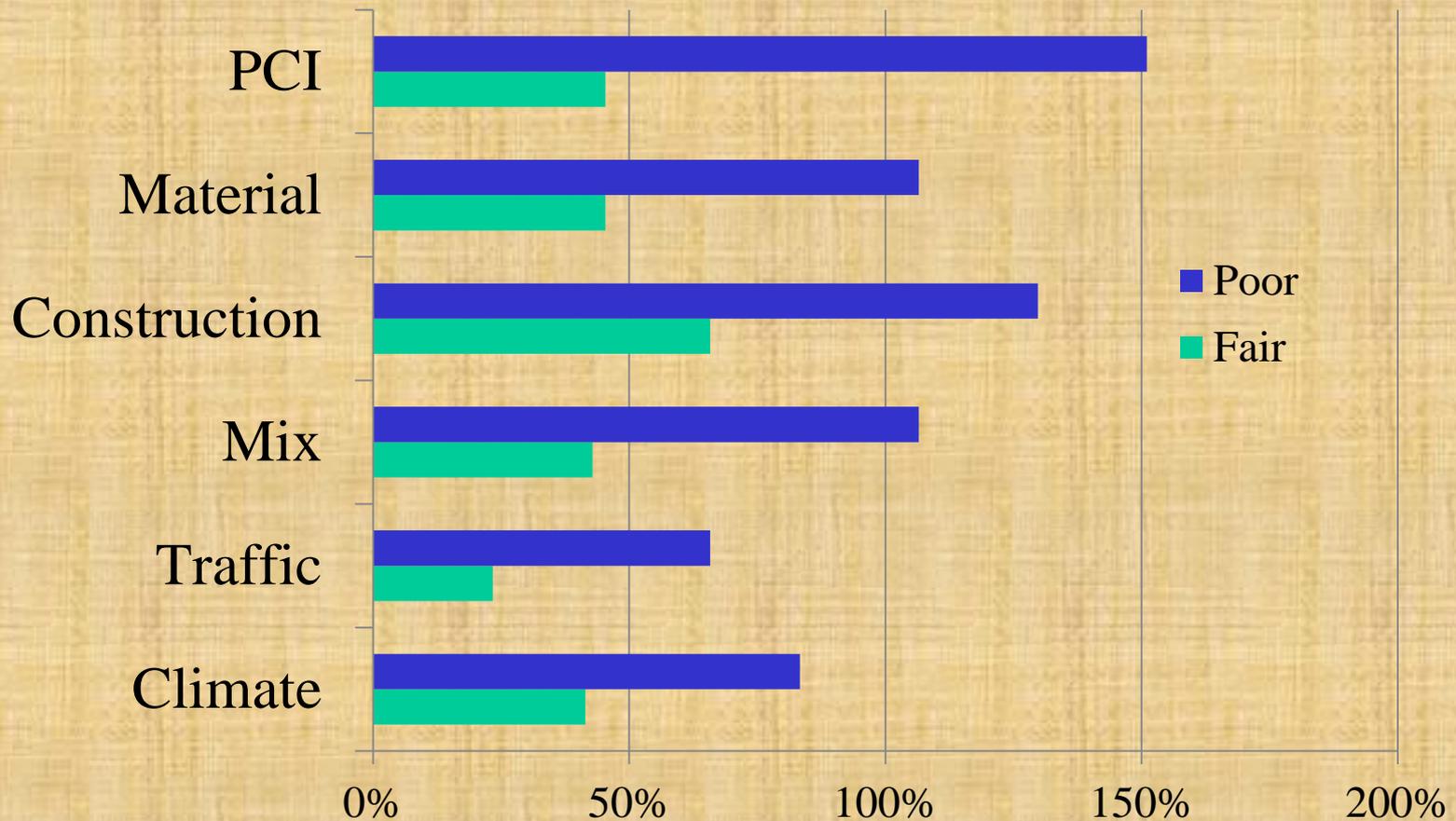
Factors Affecting the Performance of Pavement Preservation Treatments

- ▶ Existing pavement condition
- ▶ Construction process and workmanship
- ▶ Materials quality and selection
- ▶ Climate and Traffic



Percent Reduction in Life for a Thin HMA Overlay

Treatment Life Reduction Percentage, %		Average	Standard Deviation
Pretreatment Pavement Condition	Fair	36%	18%
	Poor	64%	18%
Materials Selection and Quality	Marginal	36%	22%
	Poor	57%	20%
Construction and Workmanship	Marginal	45%	21%
	Poor	61%	21%
Mix and Structural Design	Marginal	35%	19%
	Poor	57%	20%
Traffic Level	Medium	22%	22%
	Poor	45%	25%
Climate during and immediately after construction	Marginal	33%	24%
	Poor	50%	24%



Percent Cost Increase from Good Conditions

Road Ahead– Bumpy or not

- ▶ The preservation community has to do better. There are still too many failures with some of the treatments
- ▶ We need to control the factors affecting the field performance
- ▶ We need to document the performance of the treatments using
 - Test tracks like NCAT and MnRoad
 - FHWA plans to develop a LTPP program for preservation treatments
- ▶ Lets hope this information will help answer some of the major issues related to pavement preservation

Conclusions

- ▶ We have come a long way in the past 20+ years. However, we still have much to do
- ▶ Preservation is now a common practice in the USA largely in part due to FHWA, FP2 Inc , AASHTO, the National Center at Michigan State University, and the regional Centers at Chico State and University of Texas at Austin
- ▶ Many agencies throughout the world have established pavement preservation programs for both asphalt and concrete pavements
- ▶ However, it will be difficult to do more with less funding. The fiscal cliff we are in needs to be resolved soon

Best Recommend Concrete Preservation Treatment



Recommendations

- ▶ Documenting the performance of preservation treatments
- ▶ Improving the technology for mix design and performance testing for many of the treatments
- ▶ Developing performance based specification for these treatments that include Superpave binder testing
- ▶ Improving the QC and acceptance testing practices for preservation treatments
- ▶ Providing continuous education on how to place successful treatments

Resources for Asphalt Pavement Preservation

- ▶ FP2 Inc. – www.fp2.org
- ▶ FHWA– www.fhwa.dot.gov/pavement/pres.cfm
- ▶ PPRA– www.ppralliance.org
- ▶ NAPA– www.asphaltpavement.org
- ▶ NCPP– www.pavementpreservation.org
- ▶ AASHTO– www.tsp2.org
- ▶ CP2 Center– www.cp2info.org/center

Recent Conferences on Pavement Preservation

- ▶ 2010. 1st International conference in Newport Beach, CA
 - Over 600 attendees
 - Deliverable–Proceedings of the papers
 - Included exhibitors and some field demonstrations
- ▶ 2012. 1st National conference in Nashville, TN
 - Over 600 attendees
 - Deliverables–Copies of presentations
 - Included exhibitors and field demonstrations
- ▶ 2015. 2nd International conference in Paris France, Feb 22–25



Questions

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