Why Preservation: Definitions, Treatment Types, Benefits and Challenges

Prepared for the Alaska Summit
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Background

- Preservation is becoming more a part of this summit
- In the past the primary focus was on
  - Binders
  - Mixes
  - Materials characterization
  - Structural design
  - Performance

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

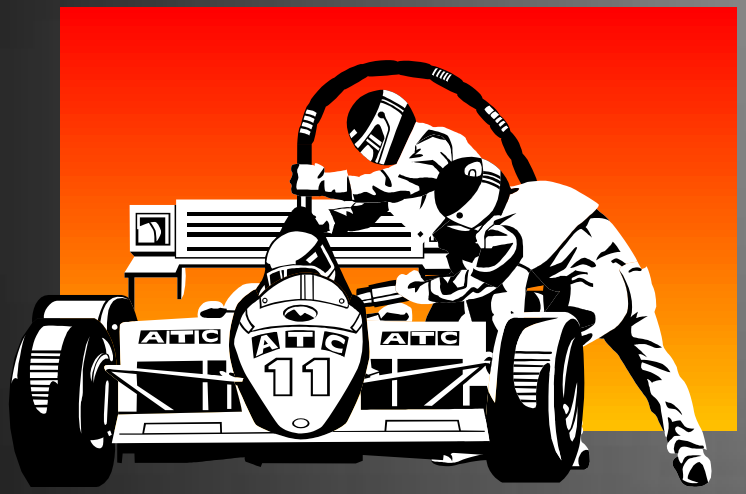
Current Efforts

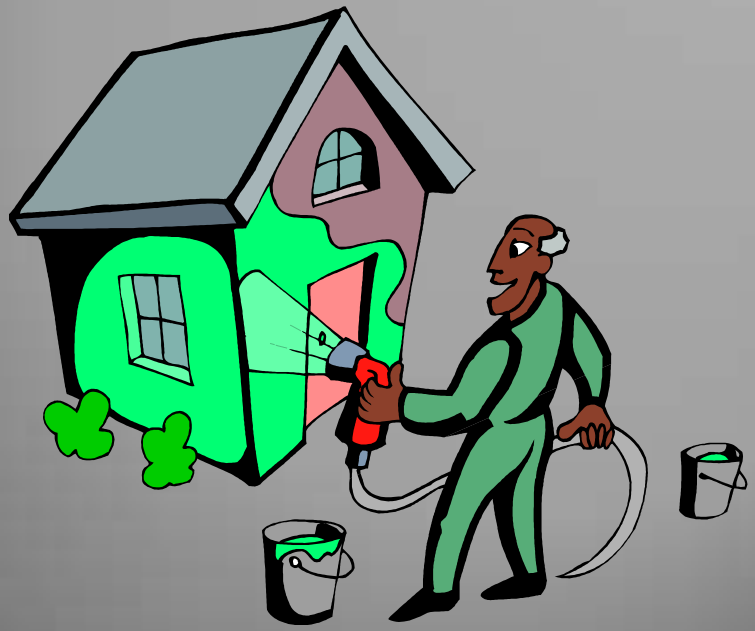
- Lobbying to raise the bar for pavement preservation
- Support for the National Center
- Carrying the message to the states through the AASHTO TSP-2 program and national conferences

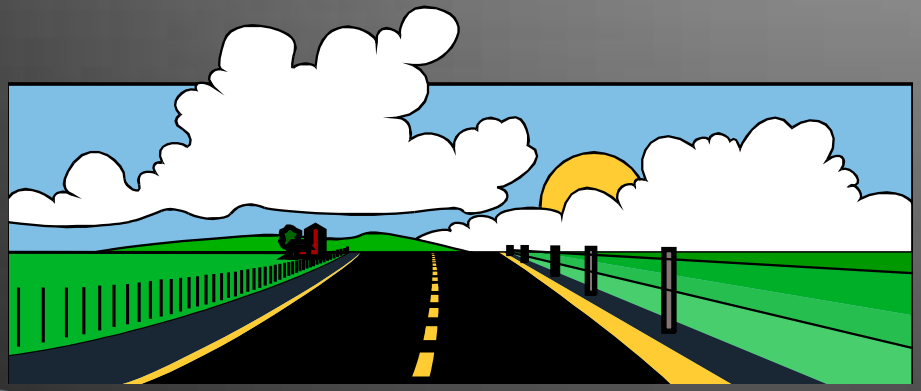
Moulthrop

Hicks, Mueller, and Galehouse

Concept for Pavement Preservation





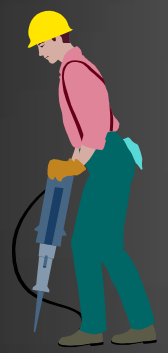


Pavement Preservation– What is it?

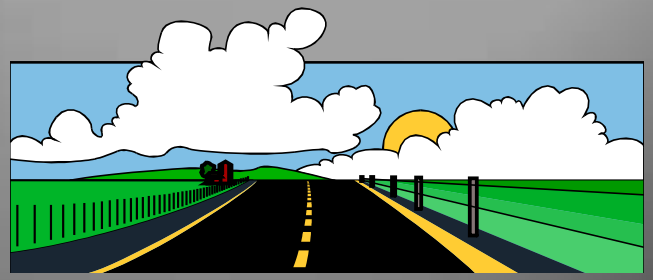
- Sum of all activities to provide and maintain serviceable roadways
- Includes
  - Corrective & Preventive Maintenance
  - Minor rehabilitation
- Does not include
  - Reactive maintenance
  - Major rehabilitation or reconstruction

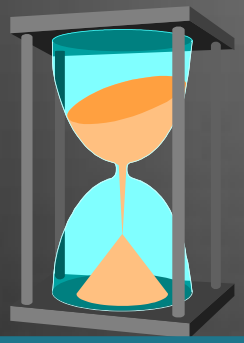
Philosophy

Right Treatment



Right Pavement

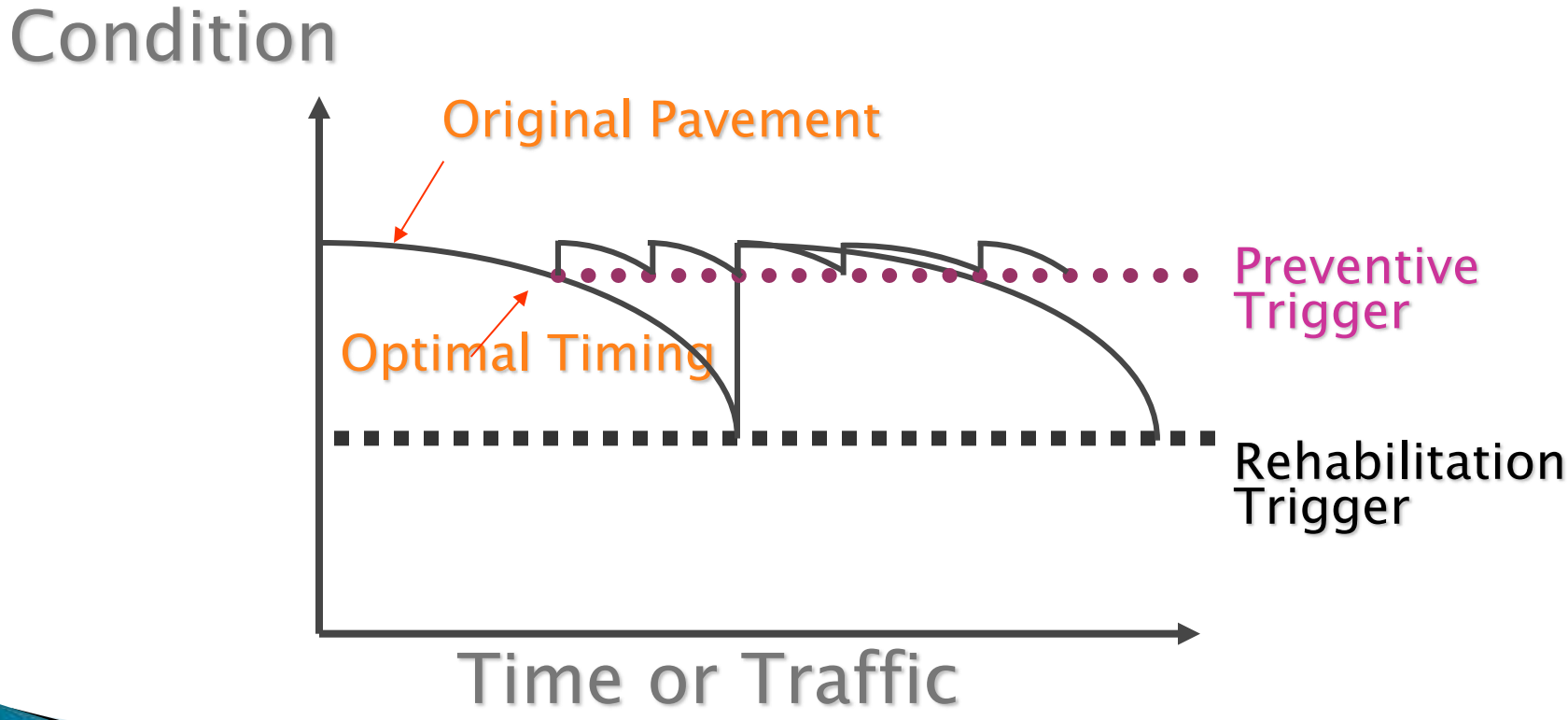




Right Time

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)

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)

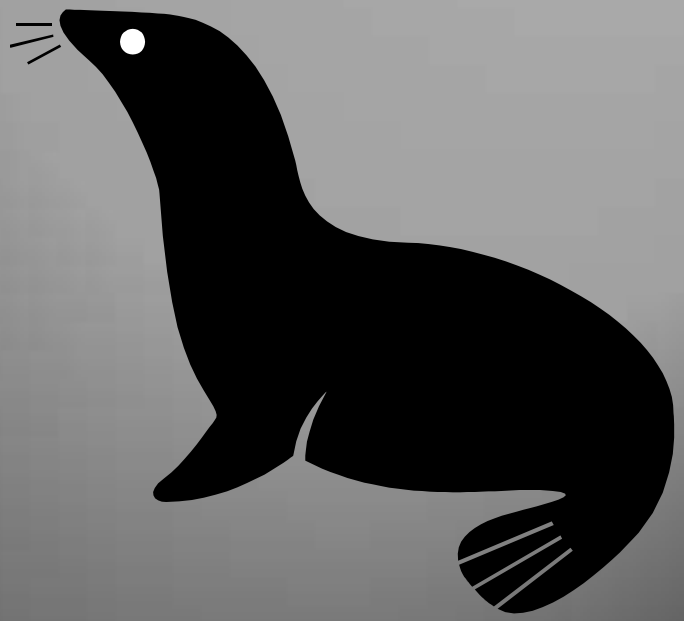
Binder Application

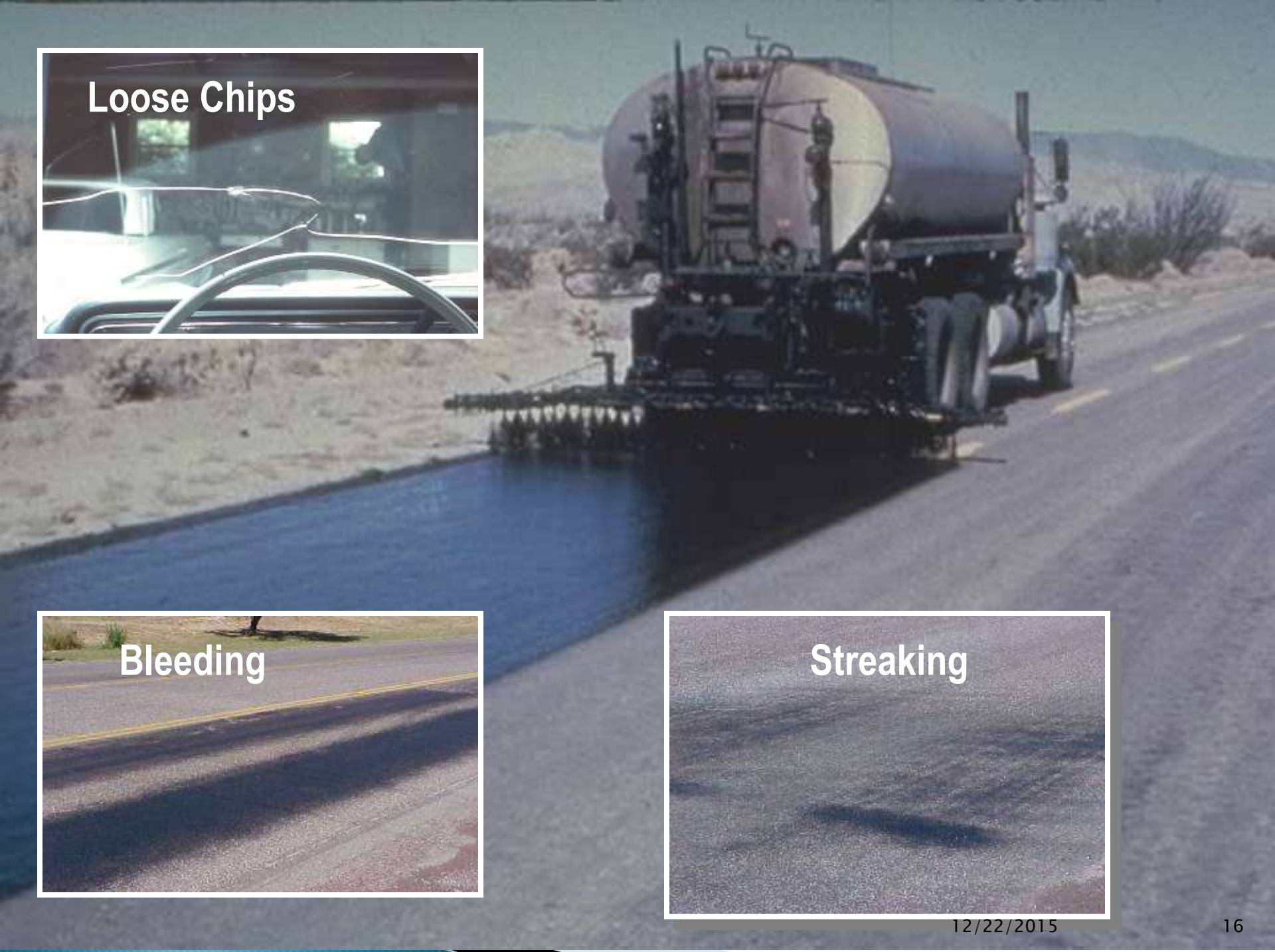
Aggregate Application

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

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

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- seals the surface, fill minor wheel ruts and surface irregularities 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.
- Expected life-lasts 8-12 years depending on the surface it is applied too
- May not hold up under studded tires unless polymer content is increased

Continuous Mix Paving Machine

Recommended for long straight sections

Micro Surfacing - Where is it used?

Arterials

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

Thin Bonded Overlays

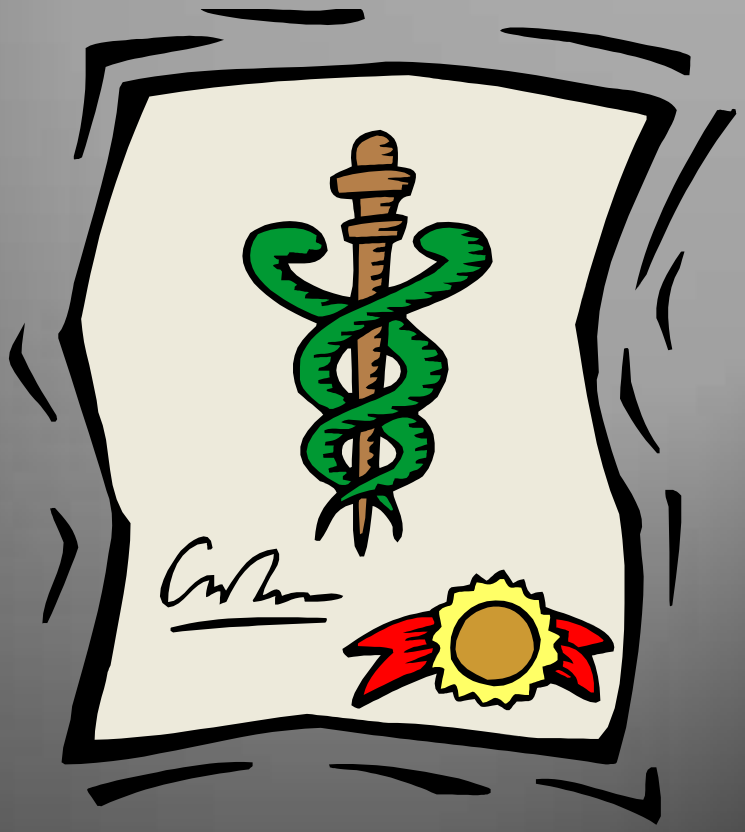
- Application of polymer modified binder immediately followed by a thin HMA overlay
- Total thickness has been about 25 mm
- Applied with a spray paver
- Expected life;8-12 years

Thin HMA Overlays

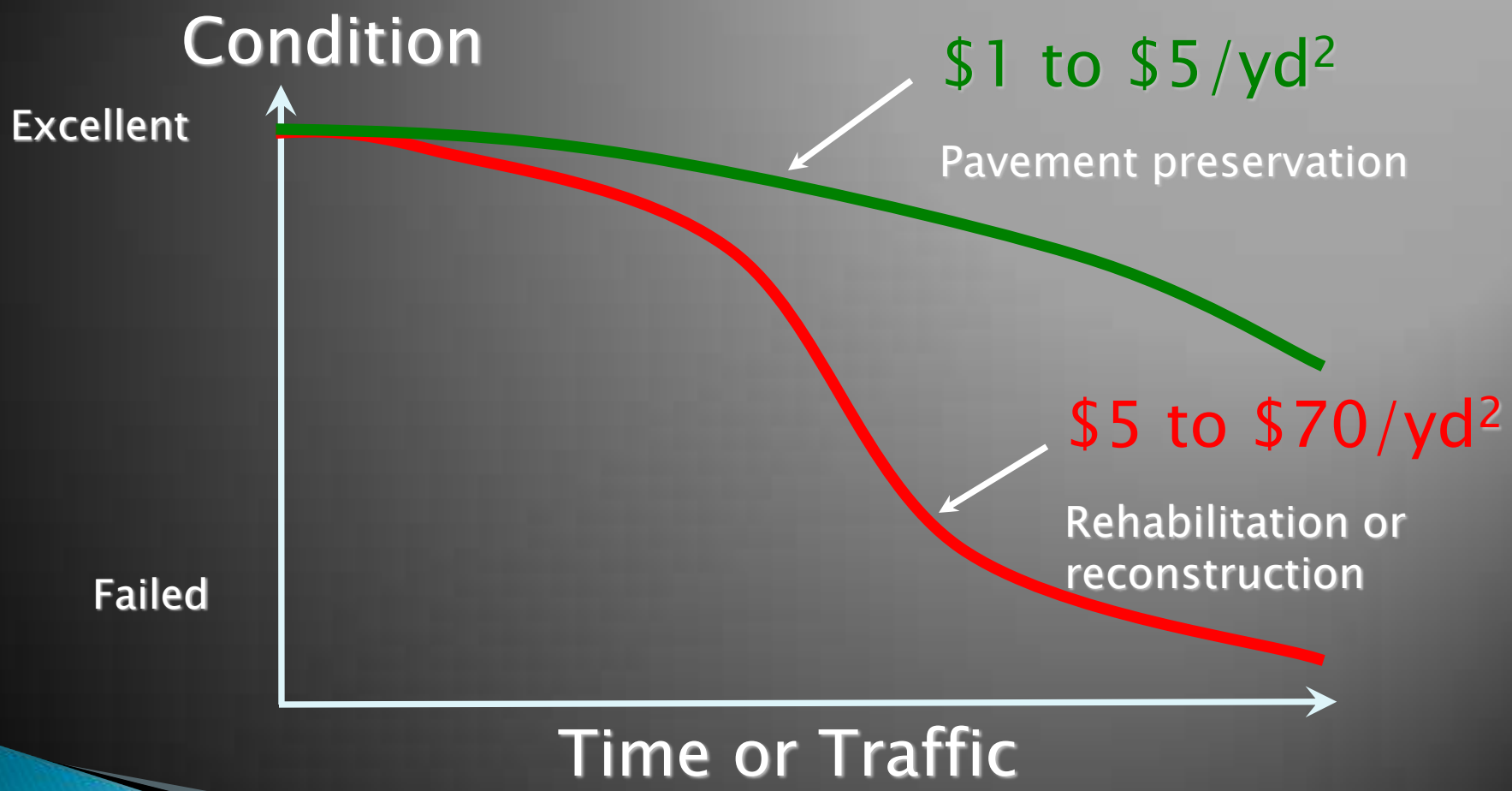
- Types
  - Conventional
  - Polymer modified asphalt
  - Asphalt Rubber
  - Terminal Blends
- Thickness of 25-37.5 mm
- May be used with warm mix additives in cold weather construction

Reported Benefits of Pavement Preservation

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



Costs


Condition
Excellent
Failed
$1 to $5/yd²
Pavement preservation
$5 to $70/yd²
Rehabilitation or reconstruction
Time or Traffic

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.

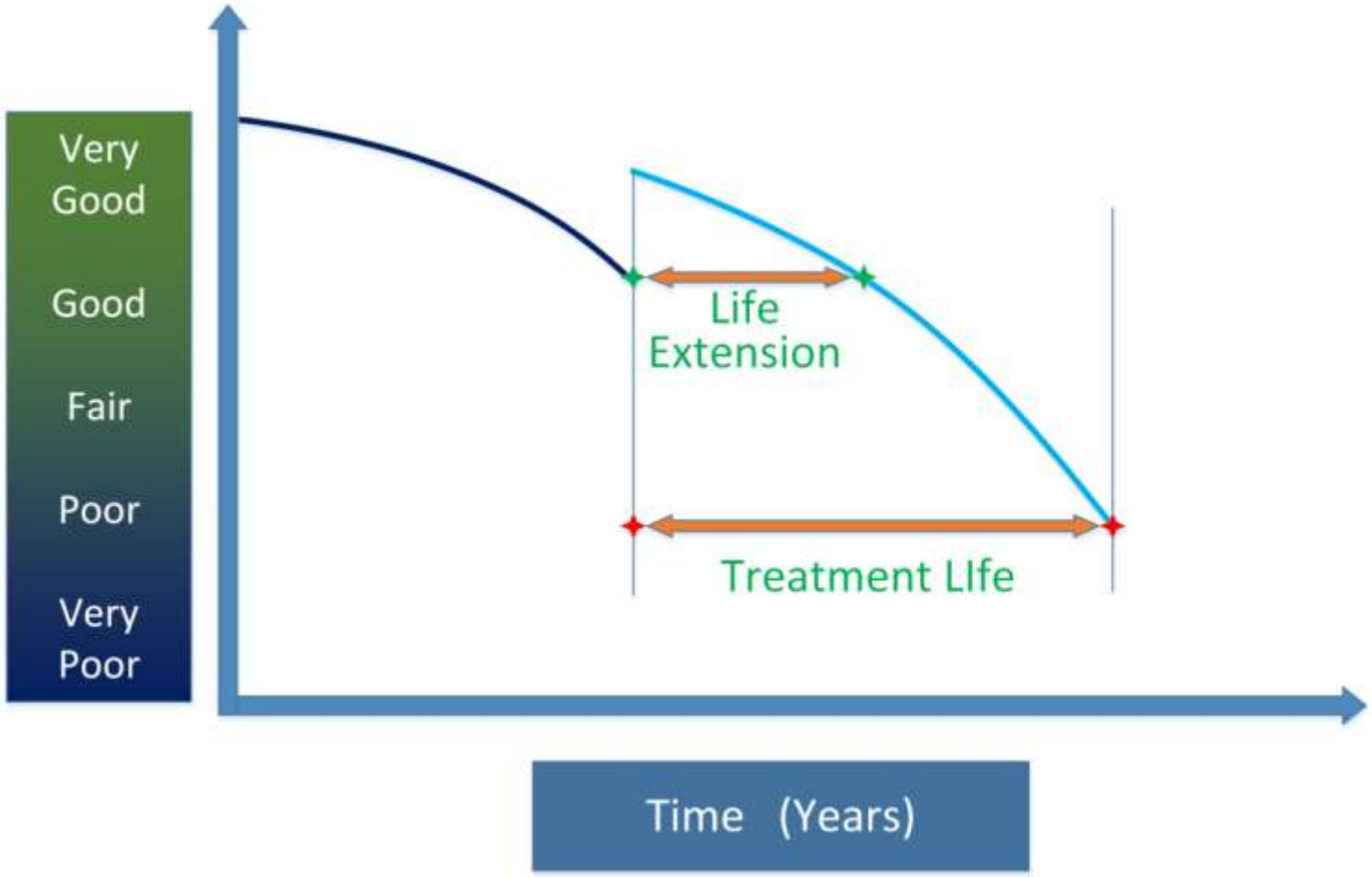
Reduced Emissions

- Emulsions have fewer emissions that 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

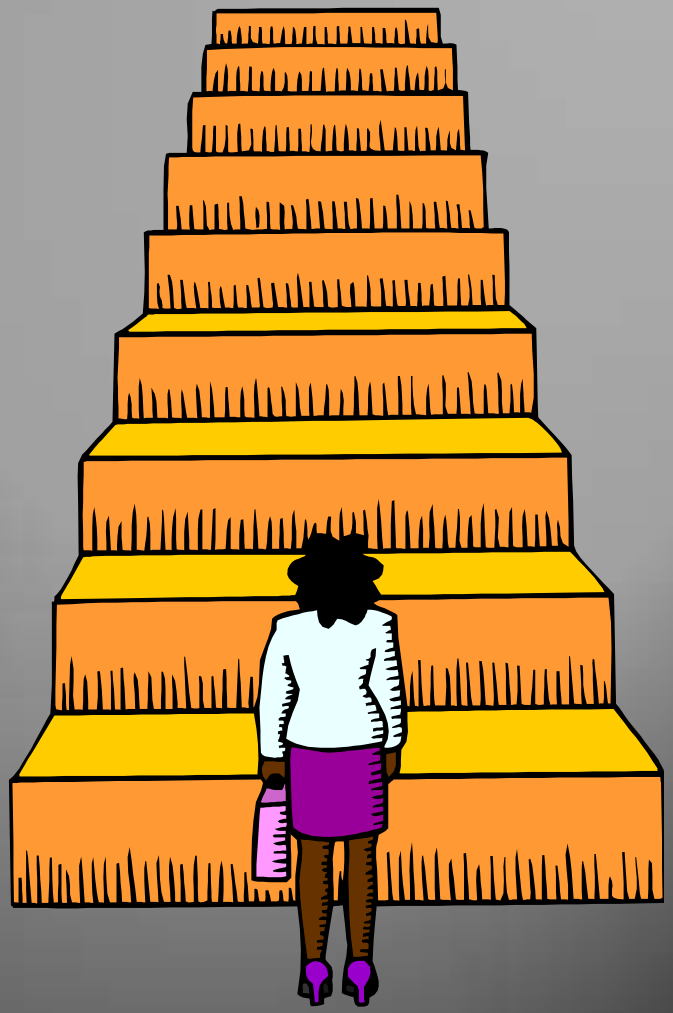
- Clearly documenting the benefits
- Shift from worst first to preserving good pavements
- Getting agencies to perform proper strategy selection
- Maintaining quality construction and acceptance testing
- Lack of performance related specifications for most products
- Keeping a preservation champion

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

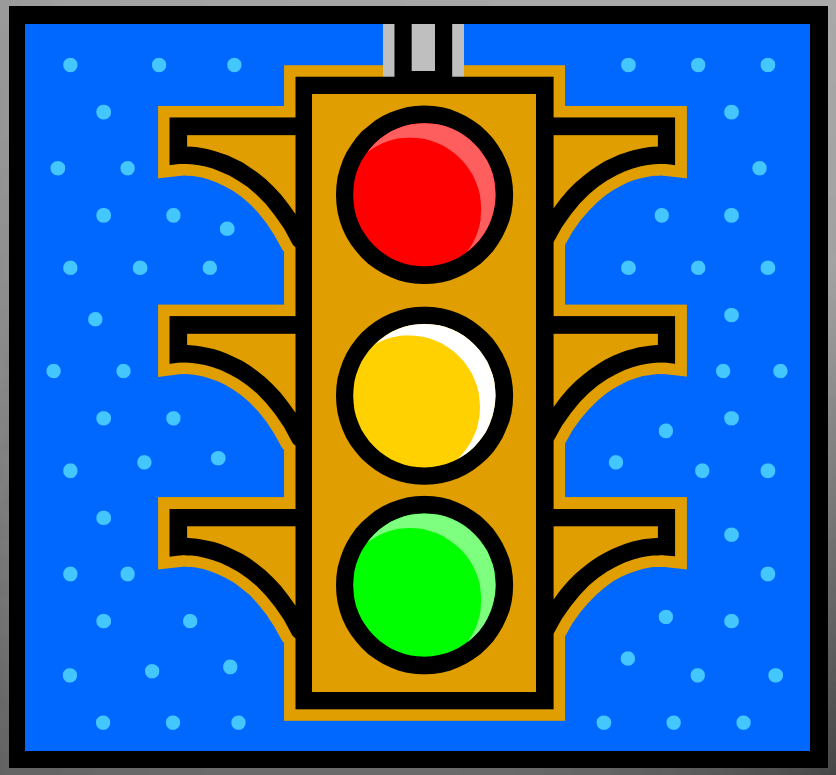
More Challenges

- 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*

ADA Maintenance	ADA Alterations
Crack Filling and Sealing	Addition of a new layer of asphalt
Surface Sealing	Reconstruction
Chip Seals	Rehabilitation
Slurry Seals	Resurfacing**
Fog Seals	Widening
Scrub Sealing	Open-graded Surface Course
Joint Crack Seals	Micro surfacing
Joint Repairs	Thin Lift Overlay
Dowel Bar Retrofit	Cape Seals
Spot High-Friction Treatments	In-Place Recycling
Diamond Grinding	
Pavement Patching	

* 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%

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

Where is Alaska with regard to Preservation?

- Recent project with the CP2 Center completed in 2012
- What has been the results of this study?
- Does Alaska need to do more in the future?

Alaska Research Project on Pavement Preservation

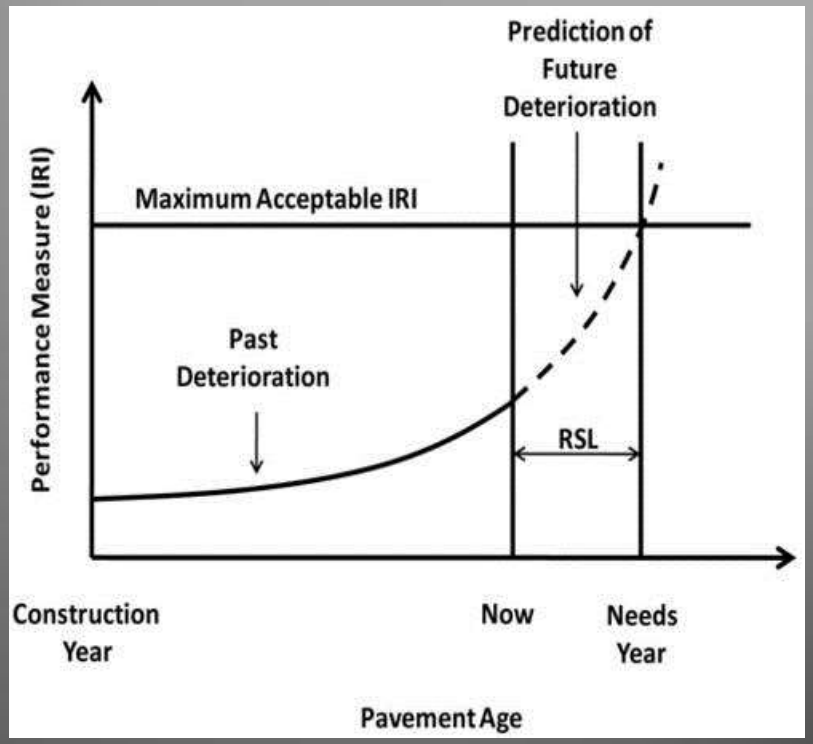
- Develop the framework for a pavement preservation program for Alaska
- Develop guides and tools for the implementation of the pavement preservation program

Deliverables

- Developed a Roadmap for establishing a pavement preservation program and indicate how it fits into the Asset Management program
- Developed a state of the practice on pavement preservation treatments used in cold regions.
- Developed a pavement preservation database for the State of Alaska which can be found at: https://sites.google.com/site/alaskap2/
- Reports can be found at the following http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_12_14.pdf

Pavement Preservation Database

- Used to track the performance of pavement preservation treatments used in Alaska
- Alaska Pavement PMS did not track the performance of these treatments
- Database can be used to develop performance curves



Major Functions of the Database

- Promote technology transfer and share project experience among AK DOT&PF, local agencies and others
- Capable of storing multiple year surveys and show the long term performance and benefits of pavement preservation treatments
- Google Mapping function to display project locations and environment
- Life Cycle Cost Analysis to support cost effective strategy selection including preservation

Pavement Preservation Database

UAF INE AUTC **Pavement Preservation Treatment Database**

testing, testing

Advance User

[Logout] [Edit Profile]

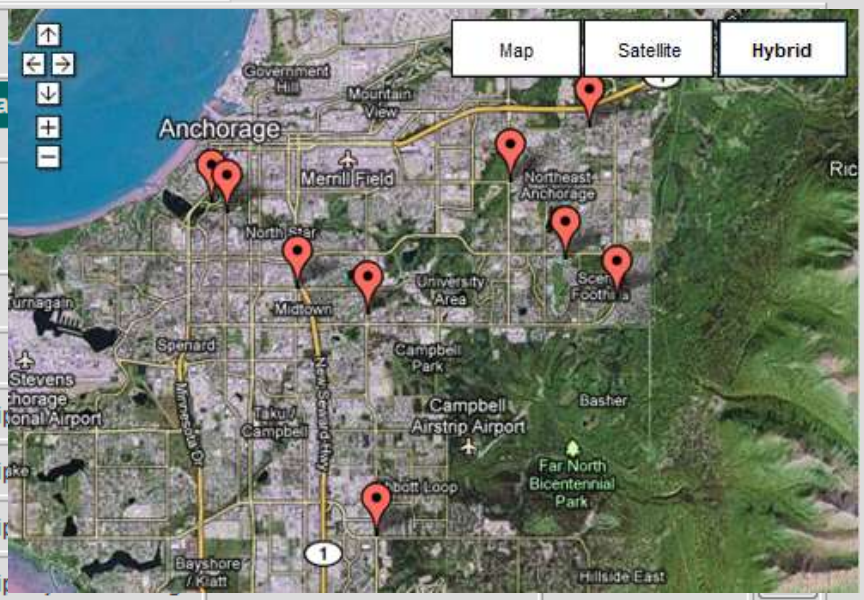
Search Treatments | Flexible Pavement Treatment | Preventive Treatment | View My Flexible Pavement Treatment

Add New Flexible Pavement Treatment

[Prev]--[First] Record (1 - 10) of 45

List of Flexible Pa

ID	Section ID	Preventive Treatment	District	
158	2	Chip Seals: Single Layer, AR	2 Anchorage	
160	650	Thin Overlay: Conventional	2 Anchorage	
161	1174	Chip Seals: Double Layer (non-PME)	14 Tazlina	
162	1828-1830	Chip Seals: Single Layer (non-PME)	2 Anchorage	Munici
163	1868-1873	Chip Seals: Single Layer (non-PME)	2 Anchorage	Munici
164		Microsurfacing: Type II	2 Anchorage	Munici
165		Chip Seals: Single Layer (non-PME)	2 Anchorage	Munici



Other Uses of the Database

- Includes a Strategy Selection process for pavement preservation treatments.
- Makes use of the expected lives and costs of the various treatments used in Alaska.
- Can be used to develop performance models for cold region pavement preservation treatments.

Strategy Selection Program

- Integrated with pavement preservation Database
- Uses a Life Cycle Cost Analysis
- Based on Alaska treatment selection matrices

Alaska Treatment Strategy Selection

CLOSE[X]

Edit	Delete	TreatmentID	TreatmentName	ExpectedLife	TreatmentCost	TreatmentInterest	Anual Life Cycle Cost	Notes	MAXRepeat
		8	Chip Seals: Double Layer (PME)	8	14	4	2.08		
		11	Thin Overlay: RHMA	10	23.4	4	2.89		
		14	Thin Overlay: Conventional	9	21.24	4	2.86		
		19	Rehab Overlay (more than 2 inch)	15	30	4	2.7		
		20	Full Depth Reclaimation (FDR) and 2-4 inch HMA	16	60	4	5.15		
		21	Reconstruction	20					

PREV RESET SAVE & CLOSE CA

Crack/Joint Seal: Modified (Rubber)
Crack/Joint Route and Seal: Modified (Rubber)
Crack Banding (Transverse)
High Float Chip Seals
Chip Seals: Single Layer (PME)
Chip Seals: Double Layer (PME)
Chip Seals: Single Layer (non-PME)
Chip Seals: Double Layer (non-PME)
Thin Overlay: RHMA
Thin Overlay: RHMA after Mill
Thin Overlay: RHMA after prelevel
Thin Overlay: Conventional
Thin Overlay: Conventional after Mill
Thin Overlay: Conventional with prelevel
High Severity Pothole Repair
Reclaim-Reshape-Resurface
Rehab Overlay (more than 2 inch)
Full Depth Reclaimation (FDR) and 2-4 inch HMA
Reconstruction

Preservation Treatments Used in Alaska as of 2012

- Thin Hot mix overlays (mill and fill)
- Chip seals for asphalt pavements
- Bituminous surface treatments for aggregate roads
- Crack sealing

Overall 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 Center at Chico State
- 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

Overall 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

Other 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

Questions

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