A Look into the Future Considering the "Tuff Economic Times"

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The Future

- **The Problem**
  - Too many roads
  - Not enough funds
- **The Opportunity**
  - A sound pavement preservation program to optimize paving funds
  - Securing dedicated funding

Can your agency continue to do more with less?

The Future

- Funding situation
  - Need for change
  - Existing system seems to be broken
- Challenges
  - Competing needs
    - Managing our assets
    - Capacity issues
    - Safety
  - How to prioritize
- Alternative:Turning paved roads into gravel

Possible Solutions

- Using Pavement Preservation Concepts
  - Surface Seals
  - Thin bonded wearing courses
  - In- place surface recycling
- Using warm mix asphalt
  - Rubber chip seals
  - Thin lift rubberized asphalt mixes

Pavement Preservation Concept

- Overview
  - When, where, what
  - Choosing the right treatment
- Better use of existing and improved technologies

Pavement Preservation

“Strategy including all activities to provide & maintain serviceable roadways”

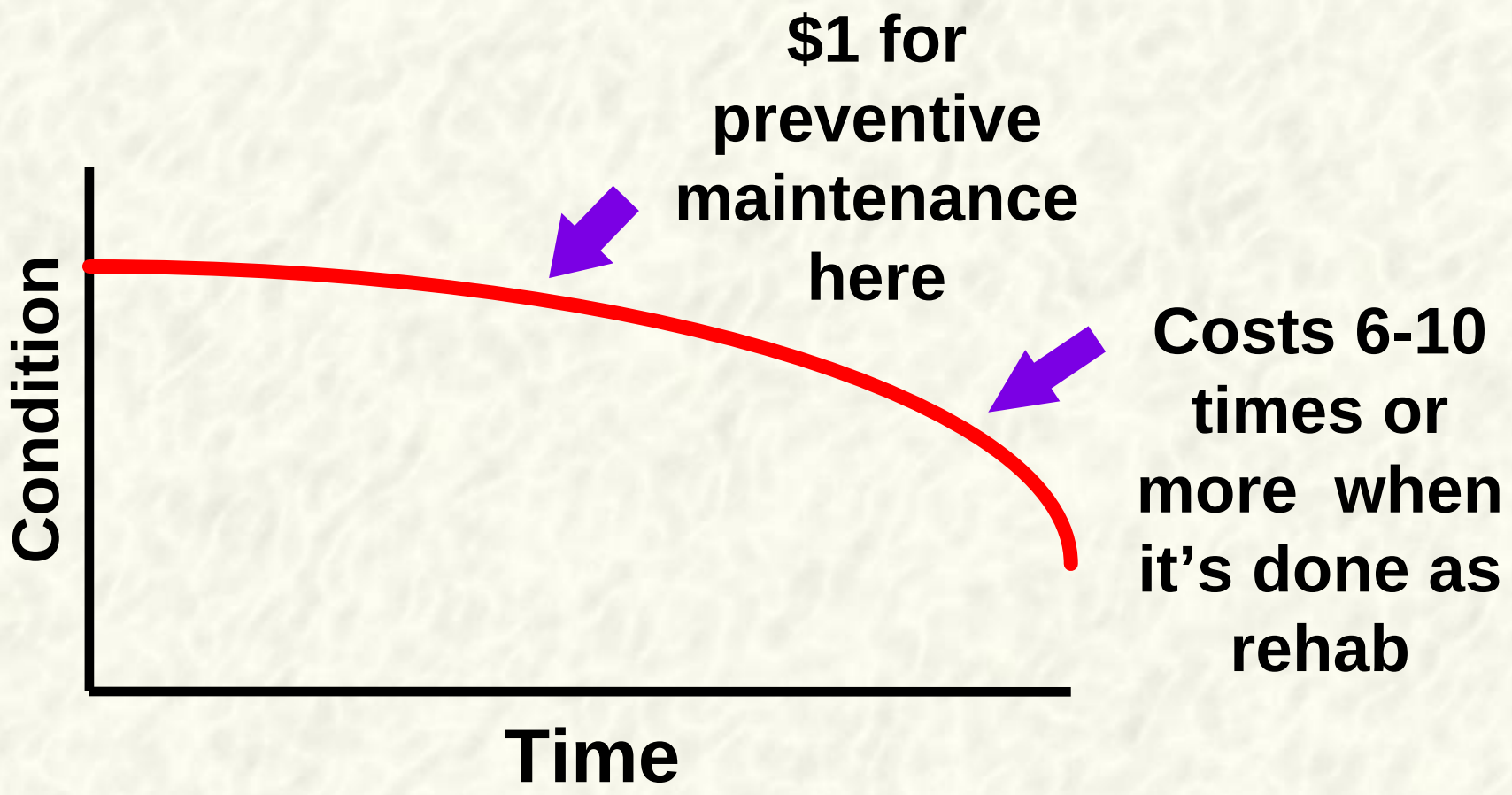
- **Lower life cycle costs**
- **Higher quality pavements**
- **Keeping good pavements good**
- **Greener solutions**

The right treatment on the right pavement at the right time

Types of Pavement Maintenance

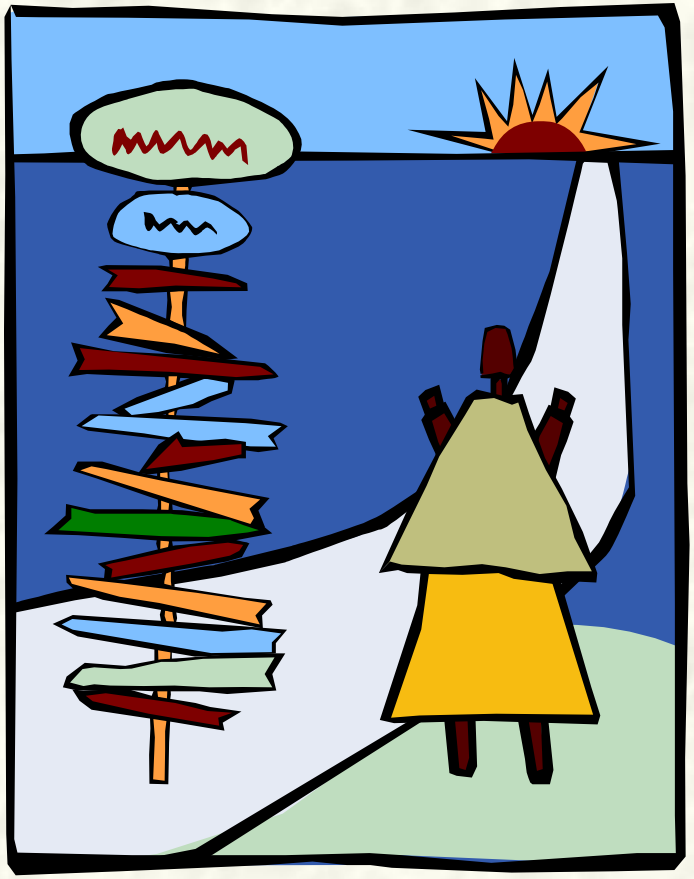
- **Pavement Preservation (Proactive)**
  - Extend the pavement life
  - Protect investment
  - Lower life cycle costs
- **Corrective (Reactive)**
  - After deficiency occurs
  - More expensive

Effective Pavement Preservation



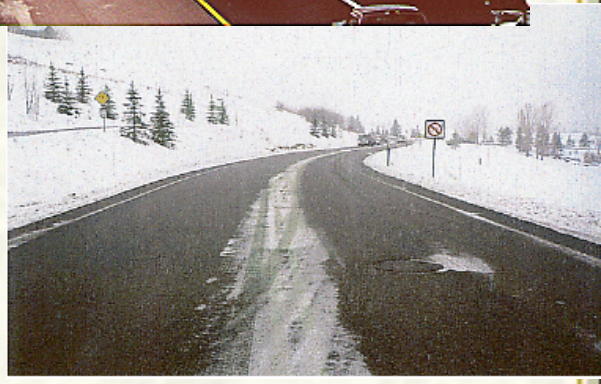
What's the "Right" Road?

- Start by looking at overall road network
- Keep pavement condition such that rehabitation is deferred as long as possible



“Right” Treatment Depends Upon

- Existing pavement
  - Distresses
  - Structure and drainage
- Environment
  - Climate, traffic, etc.
- Life cycle costs
  - Initial, maintenance, rehab & downtime costs, service life, etc.
- Locally available treatments
  - Materials, contractors, quality, performance, costs, etc.



Pavement Preservation Techniques for Flexible (Bituminous) Pavements

Crack Seal

Fog Seal

Slurry Seal

Chip Seal

Thin HMA Overlay

Pavement Preservation Techniques for Flexible (Bituminous) Pavements

High Performance Chip Seal

Scrub Seal

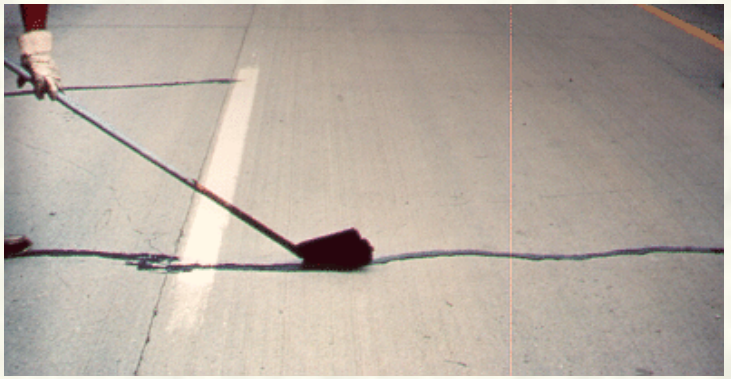
Recycling

Micro-Surfacing

Ultrathin Bonded Wearing Course

Crack Sealing

- Routine maintenance
- Cleaning & sealing
- Prevents intrusion of water and incompressible materials from entering cracks
  - Retards deterioration
  - Retards cupping deformation



Fog Seal

- **Light application of diluted, slow-setting asphalt emulsion without aggregate cover**
  - **Seals pavement**
  - **Inhibits raveling**
  - **Enriches oxidized asphalt**
  - **Provides delineation**

Surface Treatments

- **Typically used to:**
  - **Seal cracks**
  - **Waterproof surface**
  - **Improve friction**
  - **Improve rideability**
  - **Rejuvenate surface**

Chip Seal

- Application of asphalt and aggregate chips rolled onto the pavement
  - Seals pavement
  - Enriches hardened/oxidized asphalt
  - Retards reflection cracking on HMA overlays
  - Improves skid resistance

Scrub Seals

- Application of sand or small sized aggregate on broomed layer of polymer modified asphalt
  - Fill and seal small cracks and voids
  - Enriches oxidized asphalt

Slurry Seal

- **Mixture of well-graded aggregate & slow setting asphalt emulsion**
  - **Type I: Seal surface cracks**
  - **Type II: Correct raveling/oxidation**
  - **Type III: Fill minor surface irregularities and restore surface macro-texture & skid**

Micro-Surfacing

- **Mixture of high quality aggregates and polymer modified emulsion binder**
  - **Inhibit raveling and surface oxidation**
  - **Improve skid resistance**
  - **Fill ruts/minor surface irregularities**
  - **Seal pavement surface**

Thin Bonded Wearing Courses

- **Gap or open graded, polymer-modified HMA placed on a heavy, polymer-modified emulsified asphalt tack coat**
  - **Increase surface texture**
  - **Address surface distress**
  - **Reduce back-spray**
  - **Reduce noise**

Recycling Treatments

- **Typically used to rework AC to a depth of 25 to 100 mm (1 to 4 inches)**
  - **Cold in-place (CIR)**
  - **Hot in-place (HIR)**

Cold In-Place Recycling

- Milling, rejuvenating, and replacement of the top portion of the bituminous surface (without heat)
- Rework HMA to depth of 50 to 100 mm (2-4”) to
  - Correct surface distresses
  - Improve profile and cross-slope

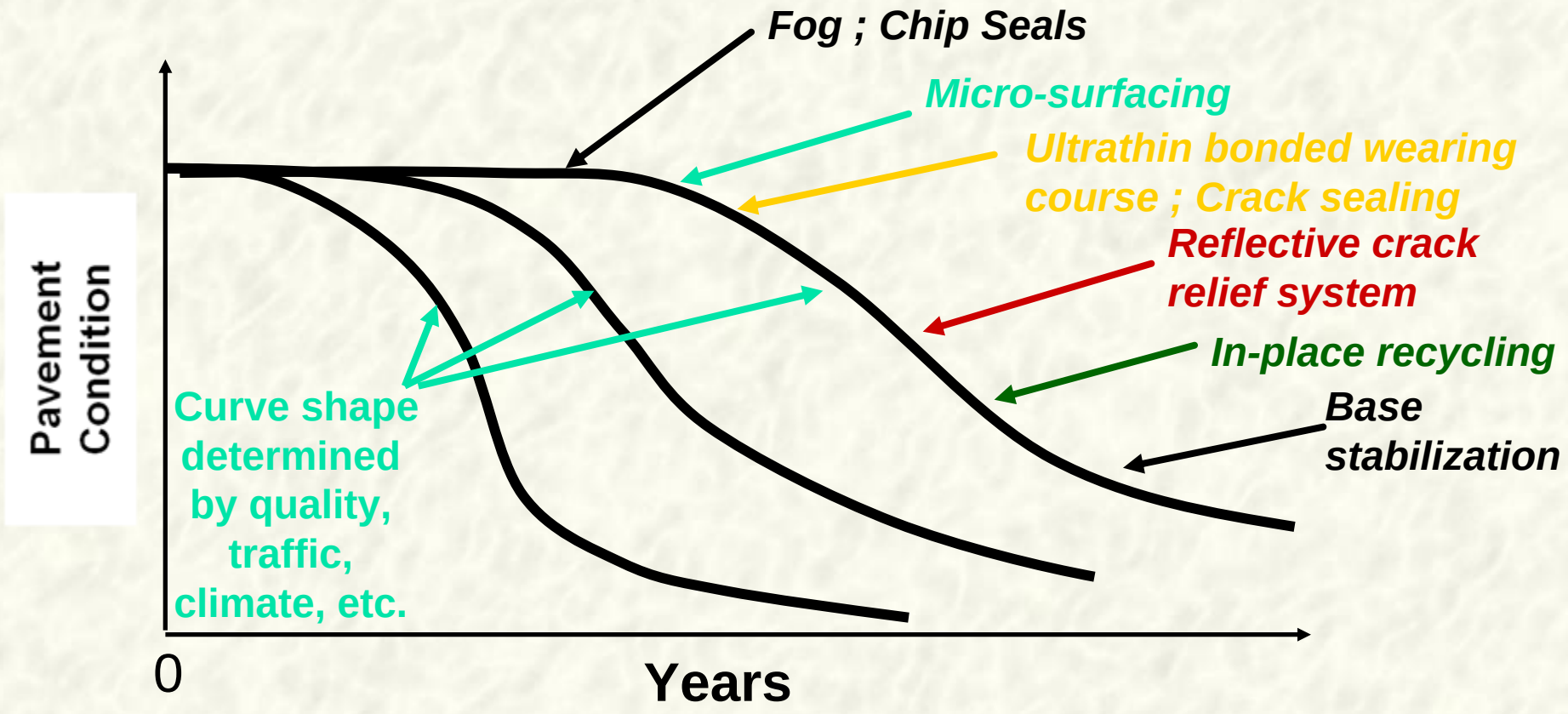
Hot In-Place Recycling

- Heating, scarifying, milling, rejuvenating the existing surface
- Rework HMA to depth up to 100mm (1-3”)
  - Correct surface distresses
  - Improve profile and cross slope

Thin HMA overlays: Mill and Fill

- **Application of a new HMA wearing course**
  - **After milling existing surface**
  - **Reduces hydroplaning and tire splash**
  - **Improve profiles, crown and cross-slope**

When Should The Treatments be Applied?



Estimated Life Extension (years)

Surface Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Fog Seal	3 - 5	1 - 3	1 - 2
Chip Seal	7 - 10	3 - 5	1 - 3
Slurry Seal	7 – 10	3 - 5	1 - 3
Micro-surfacing	8 – 12	5 - 7	2 - 4
Ultrathin Bonded Wearing Course	10+	5 - 10+	2 - 6
Thin HMA	10 - 12	5 - 7	2 - 4

Timing for Preventive Maintenance Treatments

Treatment	Years
Crack Sealing	2 – 4
Fog Sealing	2 – 4
Chip Seals	4 – 8
Slurry Seals	4 – 10
Micro-Surfacing	6 – 12
Thin & Ultrathin HMA	8 – 15

Improved Pavement Preservation Technologies

- Polymer modified asphalt binders
- New asphalt emulsion chemistries
- Improved aggregate tests & specs
- Improved construction equipment
- New performance-related tests & specs.
- Warm mix technology for binders

Engineered Emulsion Technology

- **Formulated for**
  - Chemical break/solvent free
  - Timed cures for early strength, quick construction & traffic release
  - Improved adhesion, workability, coating, durability, moisture resistance
  - Higher asphalt content
    - Good dispersion with higher film thickness
    - Durable flexibility
  - Climate-specific binder

Conventional vs. Engineered Emulsion

for Cold In-Place Recycling

3% Conventional Emulsion

3% Engineered Emulsion

New chemistry coats both fines
& coarse materials allowing higher asphalt content

Aggregate Performance-Related Specification Tests

Property	Performance	Specification Test
Hardness	Degradation resistance	-LA Abrasion -Micro-Deval
Shape	Macrotexture Matrix Strength	-Flat & Elongated -% Crushed Faces -Flakiness
Water Sensitivity Adhesion	Stripping	-Sand Equivalent -Methylene Blue -Deleterious Materials
Soundness	Durability	-Sulfate Soundness
Film Thickness	Raveling	-Water Absorption
Shape	Microtexture Structural integrity	-Uncompacted Void Content

Performance-Related Specs & Pavement Preservation

- Increase performance
- Decrease risks
- Better roads at lower life cycle costs

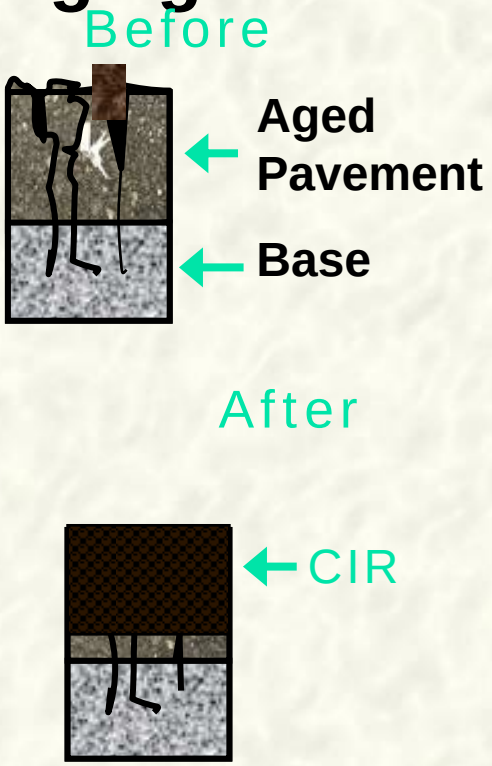
Corrective Maintenance Treatments

In-Place Recycling

Base Stabilization /
Full Depth Reclamation

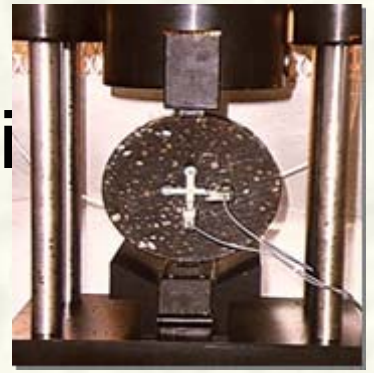
Engineered CIR

- Sampling & design with special chemistry emulsion for faster set times
- Milling, rejuvenating & replacing aged road surface with equipment train
  - Corrects surface distresses
  - Improves profile, crown & cross-slope
  - Engineered for reliability
  - Low user delays
  - Cost-effective rehabilitation



Cold In-Place Recycling

- **Performance Needs**
  - **Resistance to raveling**
  - **Resistance to thermal cracki**
- **Performance related tests**
  - **Raveling**
  - **Indirect Tensile**



Less Raveling – Lab & Field

Samples & field photos from CSAH No. 20, Blue Earth County, MN

Conventional CIR
25.7% mass loss

Raveling in the field

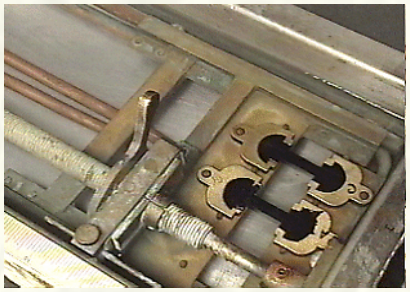
Engineered CIR
1.6% loss

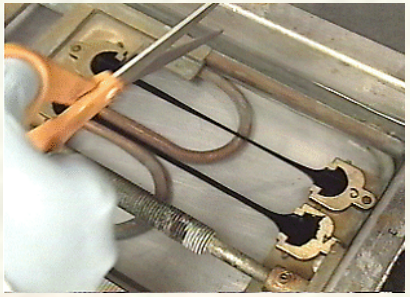
Engineered CIR Project

Cathedral City CA

Engineered HIR Emulsion

- Formulated with
  - Rejuvenator and Elastomeric polymer modified asphalt
  - Grade selected for project
- Rejuvenates aged, oxidized asphalt
- Excellent aggregate/RAP coating
- Polymer improves
  - flexibility & durability
  - adhesion
  - temperature susceptibility
  - strength & rutting resistance
  - cracking resistance





Asphalt Rubber Products

- Chip seals
- HMA-gap and open
- With or without warm mix

Asphalt Rubber History

- Rubber modification of asphalt has a long history.
- In the 1950's Goodyear, Firestone, U.S Rubber among others promoted the use of various rubber modifiers in asphalt.
- In the mid 1960's Charlie McDonald, an engineer with the City of Phoenix, developed a process for blending rubber from waste tires with asphalt

AR History -Continued

- His formula produced a binder that used about 18-20% tire rubber
- Based on positive performance experiences over the ensuing years, ADOT adopted the use of these materials.
- These products have been used in over 40 states in the US and over 25 countries worldwide.

Rubber Facts

- As concerns with tire waste escalated, various techniques for incorporating emerged.
- Three basic methods for modifying asphalt include:
  - Wet process.
  - Dry process.
  - Terminal blend process.

Asphalt Rubber—Wet Process

- Base asphalt is typically PG 64-16
- Materials are heated up to 425 F with reaction times at a minimum of 45 minutes.
- Rubber swells to increase the compatibility with the asphalt.
- Extender oils are used sometimes.
- After reaction times ends, materials are transferred to spreader unit.

Advantages of Asphalt Rubber Chip Seals

- **Higher applications rates with improved long term performance.**

  § **Typical Application Rates (based on ½ inch cover aggregate):**

§ **CRS-2P**	**0.38 to 0.45 Shot Rate** **0.27 to 0.32 Residual**
§ **Terminal Blend**	**0.38 to 0.45 Shot Rate / Residual**
§**Asphalt Rubber**	**0.62 to 0.70 Shot Rate / Residual**

Typical Asphalt Rubber Blending Plant

What is Warm Mix?

- **WMA technology**
  - **Foaming process which is water based to promote foaming**
  - **Chemical modifiers that use chemical modifies or surfactants**
  - **Additives that use wax based products**

Why Use Warm Mix Additives?

- Warm mix allows one to retain the binder viscosity while using lower temperatures
- Allow us to reduce the spray apply temperature from 385F to 335F.
- Reduces emissions.
- Improves worker safety.

AR Warm Mix Without Emission Controls

Hot Pre-coated Chips

Rolling

Chip Seal Train

Post Sweep & Traffic Times

Finished Surface-Coarser Chip

Finished Surface-Finer chip

Los Angeles County-Cape Seal Pre-condition

Asphalt Rubber Warm Mix

Finished AR chip seal

Application of Micro

Finished Surface

Asphalt Rubber Chip Seals

Advantages

- Flexible Treatment
- Provides Impermeable Membrane
- Wards off Reflective Cracking
- High binder application rates
- Cost Effective

AR Warm Mix Chip Seals: Summary

- Asphalt Rubber Chip Seals using warm mix technology and Micro Surfacing are proven, viable and economic tools for your “Toolbox” for preventative maintenance or asphalt repair
- Systems Can Be Selected To Tackle a Large Array of Conditions

Benefits of Thin Overlays Using RWHA

- Allows paving in cooler temperatures extending the paving season
- Allows for longer haul distances
- Longer time to roll for improved compaction
- Lowers emissions
- Safer work environment
- Lower energy costs = Cost Savings
  - Mixing 280 – 300 F
  - Compaction 250 – 275 F

SELECTED AR WITH WARM MIX TECHNOLOGIES CONSTRUCTED IN CALIFORNIA

Road Name	Location (PM: n/n)	Date Constructed	Warm Mix Additive
Santa Clara Rte. 152	Santa Clara	March 2006	Sasobit
Interstate 5	Santa Nella (105.9/106.4)	September 2008	Astec DBG &Evotherm
Interstate 5	Orland	May 2009	Evotherm
Interstate 5	Near Firebaugh, Fresno Co. (PM 37.2 to PM 45.0)	September 2010	Astech PER & Engineered Additives WMA
CA-94	San Diego	June 2009	Advera, Evotherm, Sasobit
SH 70	Marysville	July 2009	Evotherm
SR-101	Fortuna (54.2/56.3)	September 2009	Evotherm
SH 99	Sutter County	November 2009	Evotherm
Various	City of Roseville	September-October 2010	Engineered Additives WMA

More than 20 products currently available

Completed RWMA Projects

Manthey Rd.
Stockton, CA

I-5,Near Orland, CA

SR 94, San Diego,
County, CA

Completed Warm Mix Projects

AR Chip Seal on Shoulder, I-5, Fresno County, CA (2010-2011)

RWMA-G, I-5

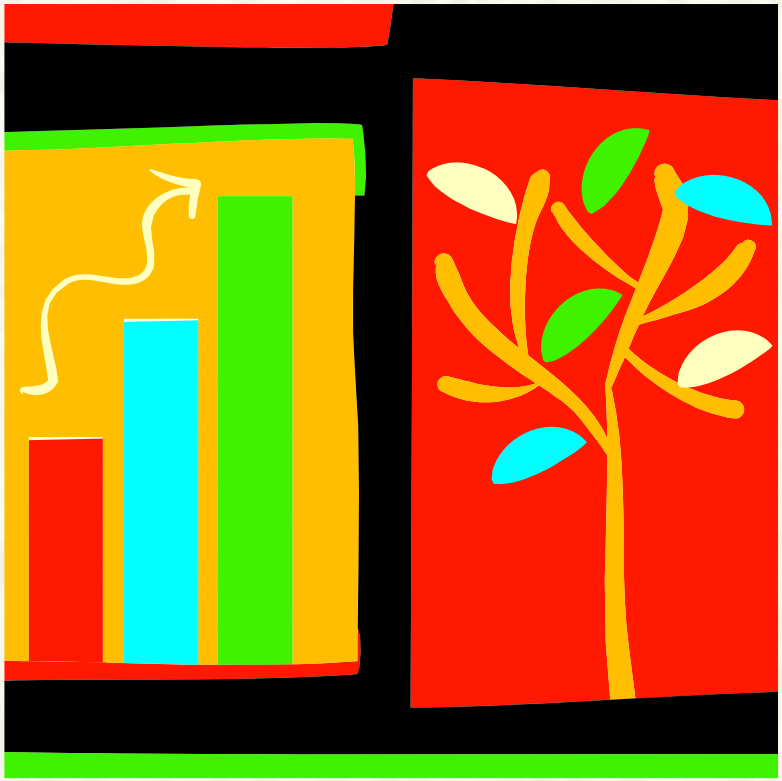
Near Dunnigan, CA (2011)

Completed Projects in 2011

- Over 1,000,000 tons
  - D-3
    - I-5- Several projects
    - US-99
    - US-70
    - I-80 at Truckee
  - D-1- numerous projects

Future of Warm Mix Applications

- Use is growing in California and elsewhere
- Applications are good for night work and late season work



Summary: Benefits of Pavement Preservation

- Extended life or serviceability
- Lower life-cycle costs (cost effectiveness)
- Lower user costs
- Improved safety
- Gaining considerable public support

Overall Summary

- What does the future hold?
- Pavement Preservation
  - Preventive
  - Corrective
- Warm mixes
  - Chip seals
  - Hot mixes

Questions

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