

# MTAG Overview (Flexible Pavements)



DRAFT  
MAINTENANCE TECHNICAL ADVISORY GUIDE  
Volume I – Flexible Pavement Preservation  
Second Edition



State of California Department of Transportation  
Office of Pavement Preservation  
Division of Maintenance  
1120 N Street, MS-5  
Sacramento, CA 95814

June 29, 2007

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is MTAG?

- A Maintenance Technical Advisory Guide developed for Caltrans and other pavement professionals
- Developed by Caltrans Division of Maintenance
- MTAG Vol. 1 for Flexible Pavements
  - First edition – 2003 (8 chapters)
  - Second edition – 2007 (13 chapters)
- MTAG Vol. 2 for Rigid Pavements
  - First edition – July 2006 (7 chapters)
  - Second edition – July 2007 (8 chapters)
- Both volumes focus on pavement preservation strategies

# Chapters Covered in MTAG for Flexible Pavements

Chapter	Topic
1	Introduction
2	Materials
3	Framework for Treatment Selection
4	Crack Sealing, Crack Filling, and Joint Sealing
5	Patching and Edge Repair
6	Fog and Rejuvenating Seals
7	Chip Seals
8	Slurry Seals
9	Microsurfacing
10	Thin Maintenance Overlays
11	Bonded Wearing Courses
12	Interlayers
13	In-Place Recycling

# Organization of Training Modules

- Modules on each treatment contain three sub-modules
  - Managers' overview
  - Design, materials, and specifications
  - Construction and inspection

# Chapter 1

## Introduction

From... Maintenance Technical  
Advisory Guide (MTAG)

# Purpose of Pavement Preservation

- To keep good pavements in good conditions by applying the right maintenance strategies at the right time to extend pavement life and preserve investments



# FHWA Definition of Pavement Preservation

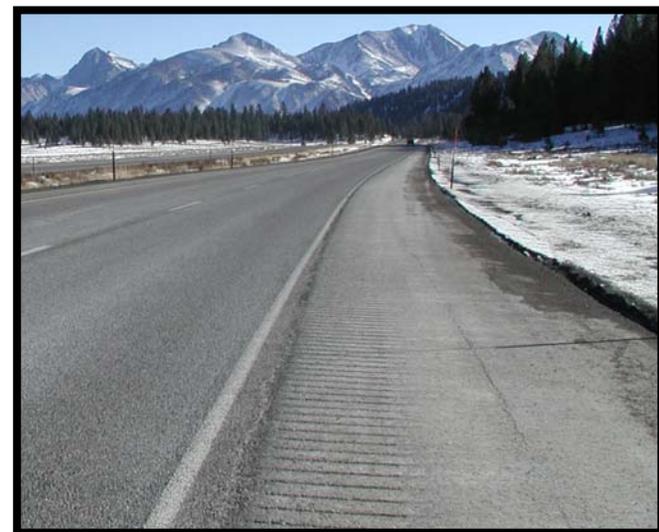
“A program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations”

# Components of Pavement Preservation Program

- Consists primarily of three components:
  - preventive maintenance
  - minor rehabilitation (restoration), and
  - some routine maintenance
- Does not include new pavements or pavements that require major rehabilitation or reconstruction



*Crack Seal*



*Chip Seal*

# Pavement Preservation Concept

- A proactive approach to maintaining the existing highways
- Addresses pavements while they are still in good condition and before the onset of serious damage
- Applying a cost-effective treatment at the right time to the right pavement to extend pavement life



NOT a Preservation Candidate

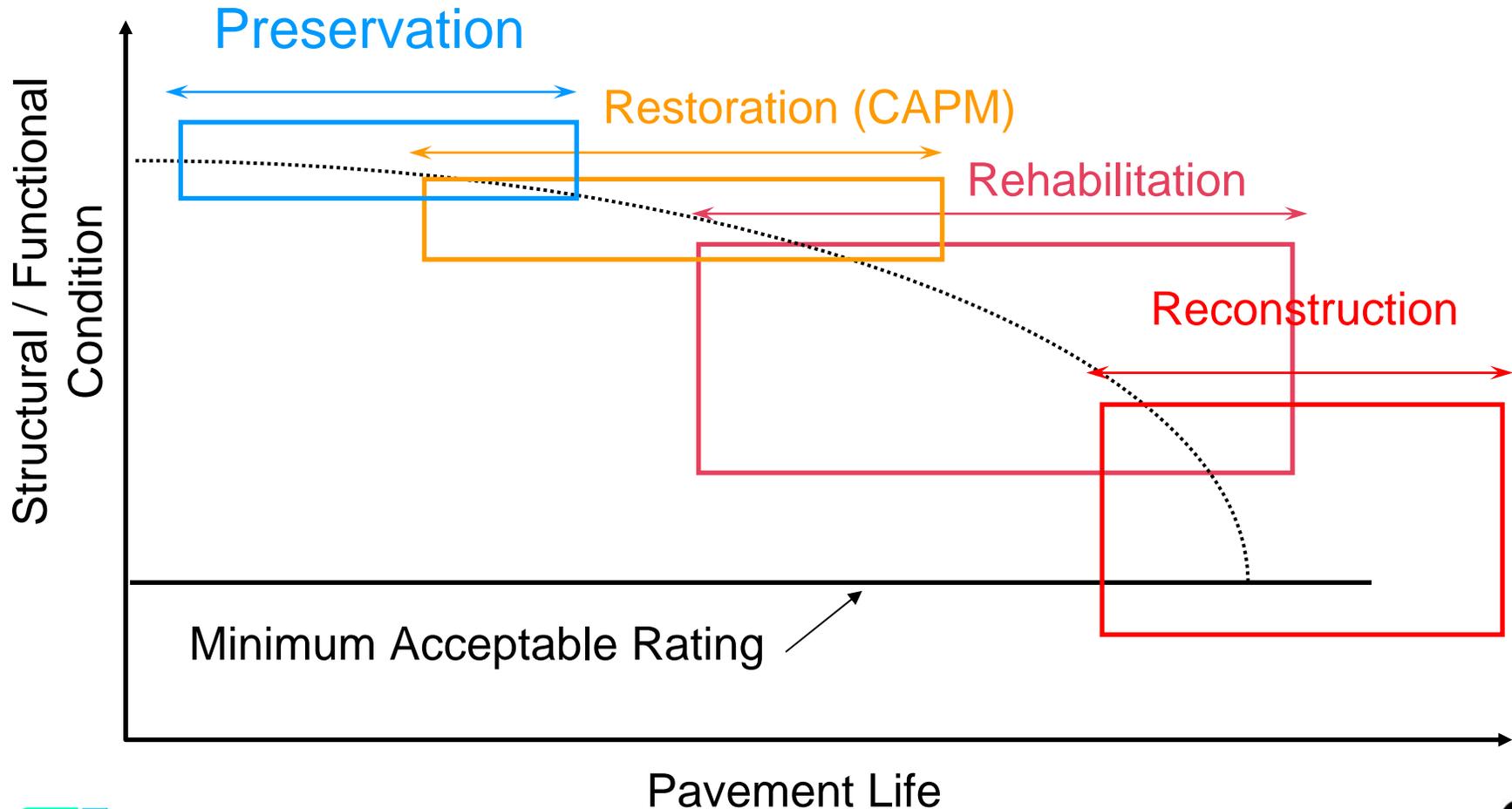
# Essentials of Pavement Preservation Program

- Pavement preservation is an agency program
- An effective pavement preservation program includes agency leadership and a dedicated annual budget
- It also includes support and input from staff in planning, finance, design, construction, materials, and maintenance

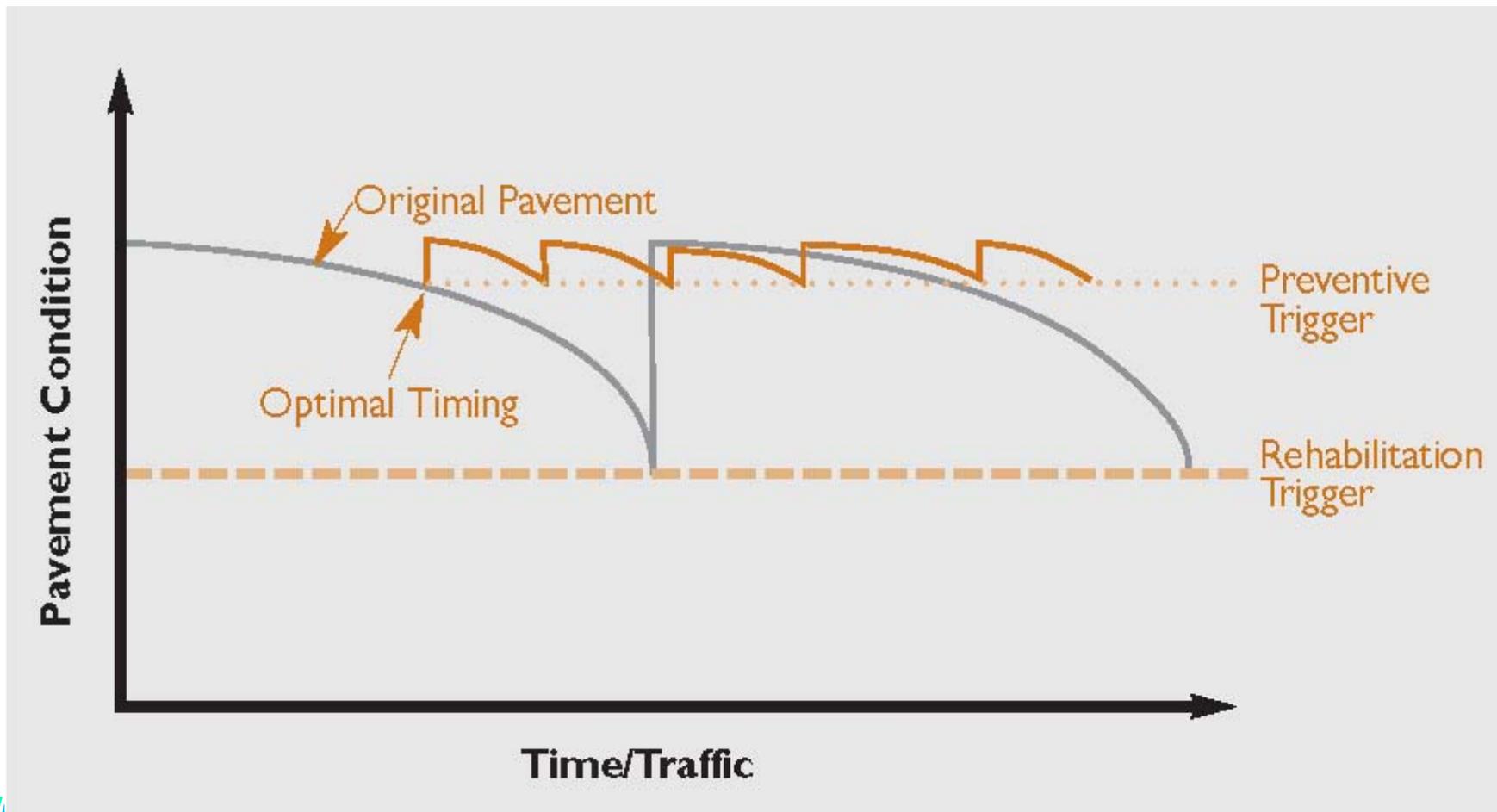
# Benefits of Pavement Preservation

- Benefits of pavement preservation program:
  - preserving the roadway network
  - enhancing pavement performance
  - ensuring cost-effectiveness by extending pavement life, and
  - reducing user delays by avoiding rehabilitation or reconstruction.
- Some of these benefits may be noticed immediately and some may be realized over time

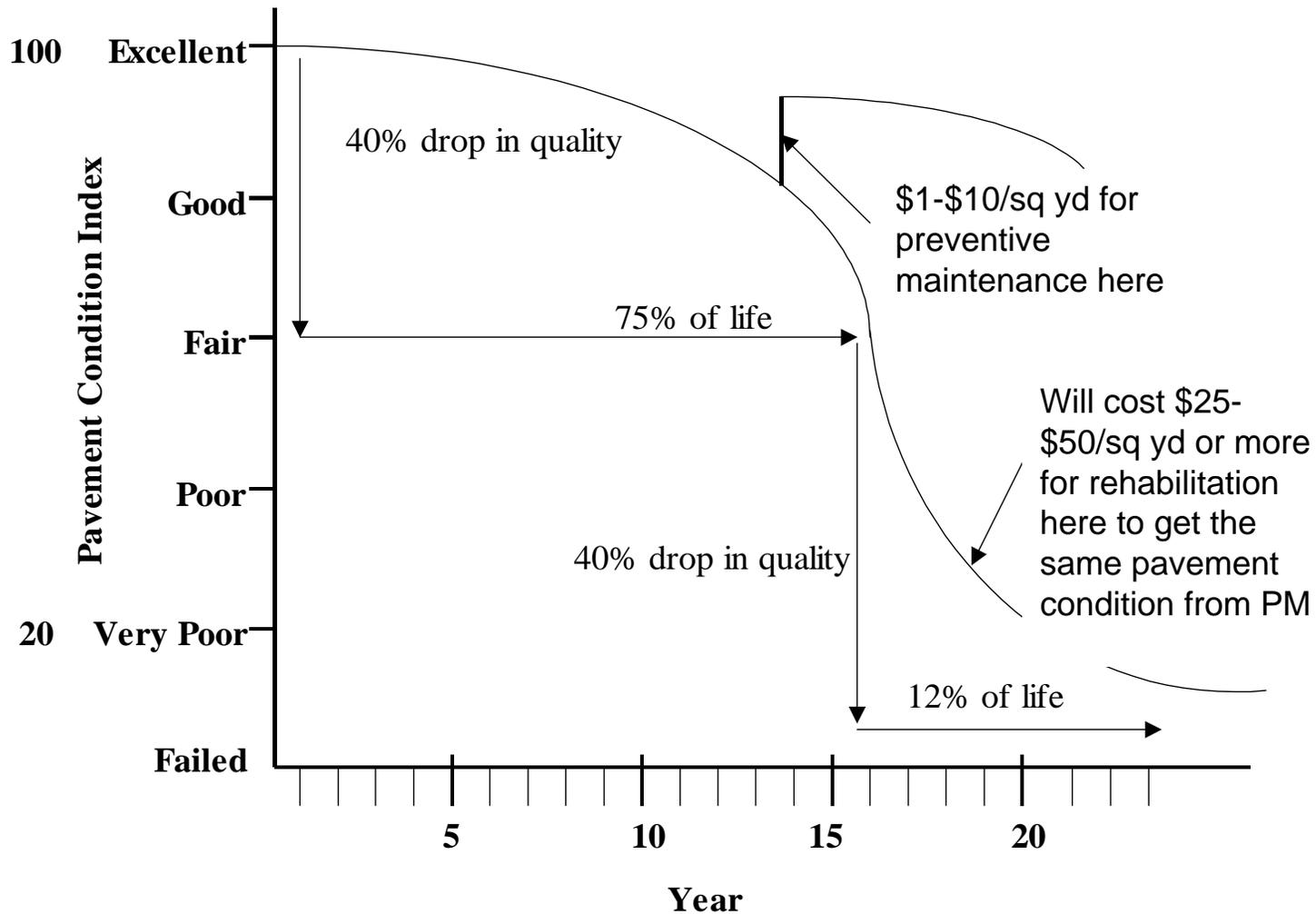
# Typical Pavement Performance Curve



# Importance of Timely Treatments



# Cost Effects of Treatments



# Fundamentals of Pavements

- Function of pavements
- Factors affecting pavement performance
  - Subgrade soil
  - Pavement materials characteristics
    - Asphalt cement
    - Aggregate
    - Modifiers for asphalt cement (e.g., rubber and polymers)
    - Additives or stabilizing agents for aggregates (e.g., lime and cement)
  - Traffic loading
  - Environment
    - Moisture; and
    - Temperature
- Common flexible pavement distresses

# Chapter 2

## Materials

From... Maintenance Technical  
Advisory Guide (MTAG)

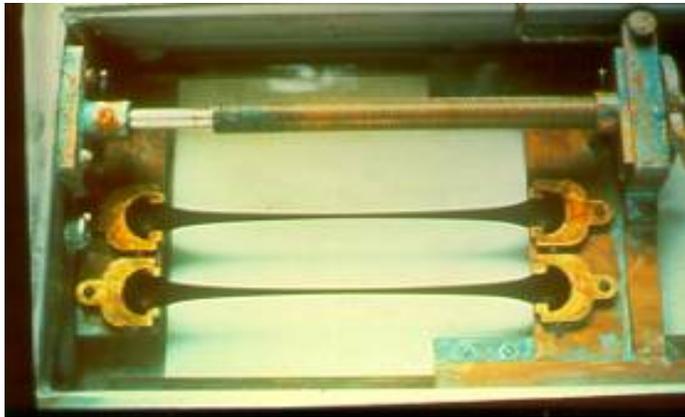
# Asphalt Binders

- Paving Asphalt Constituent
  - A refined material from crude oil
  - Asphalt properties depend on its chemical composition, crude source and type
  - Highly temperature dependent
- Caltrans requirements for asphalt binders – Section 92 of the Standard Specifications

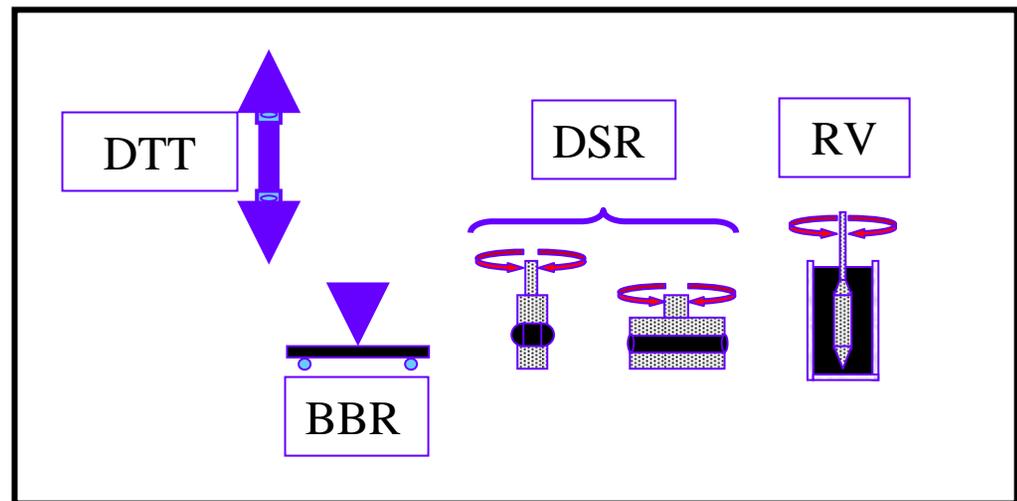


# Asphalt Binders – Specifications

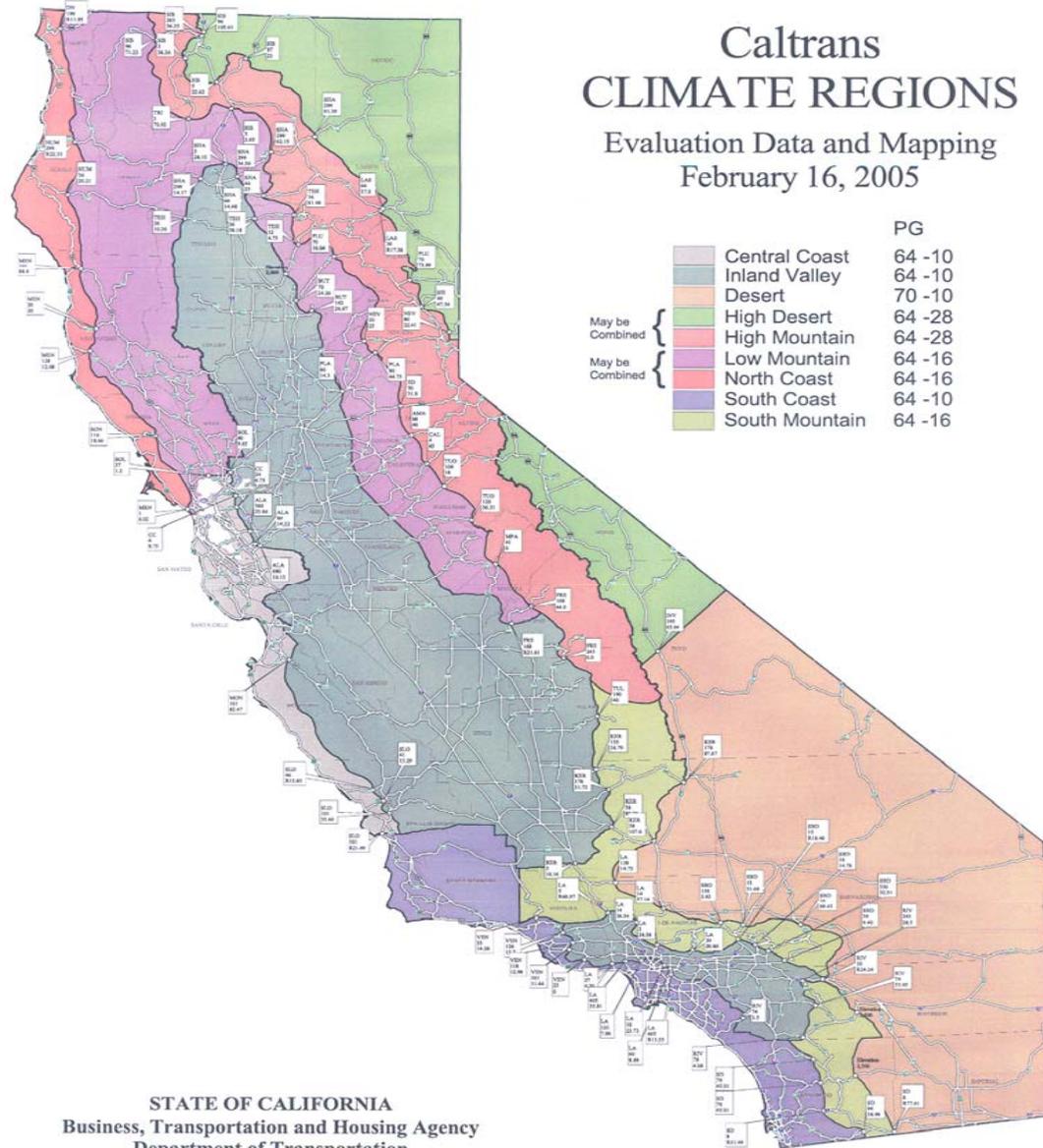
Caltrans adopted the Performance Graded (PG) system for asphalt binder since 2006 for conventional binders and 2007 for modified binders



*Elastic Recovery*



# Asphalt Binders – Where to Use?



# Asphalt Binders – Where to Use?

Binder  Climatic Region	Conventional Hot Mixed Asphalt				RAC
	Dense Graded HMA		Open Graded		Base Stock for RAC-O and RAC-G
	Typical	Special <sup>1</sup>	Placement Temperature		
			>70°F	<70°F	
South Coast Central Coast Inland Valleys	PG 64-10	PG 70-10 PG 64-28 PM	PG 64-10	PG 58-34 PM	PG 64-16
North Coast	PG 64-16	PG 64-28 PM	PG 64-16	PG 58-34 PM	PG 64-16
Low Mountain South Mountain	PG 64-16	PG 64-28 PM	PG 64-16	PG 58-34 PM	PG 64-16
High Mountain High Desert	PG 64-28	PG 58-34 PM <sup>2</sup>	PG 64-28	PG 58-34 PM	PG 58-22
Desert	PG 70-10	PG 64-28 PM	PG 70-10	See Note 3	PG 64-16

## Notes:

1. PG 76-22PM may be specified for conventional dense graded hot mixed asphalt for special conditions in all climatic region when specifically requested by the District Materials Engineer.
2. PG 64-28 PM may be specified when specifically requested by the District Materials Engineer.
3. Consult the District Materials Engineer for appropriate binder grade.

# Asphalt Emulsions

- Emulsion Constituent
  - An asphalt dispersed in water
- Breaking
  - The process of separating the asphalt and water
- Curing
  - The process by which the asphalt expels water and dries to a film on the aggregate or surface

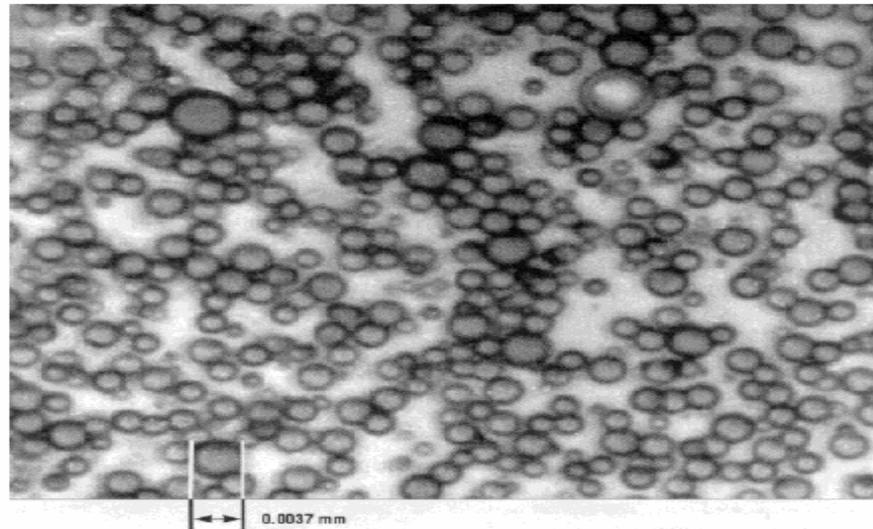
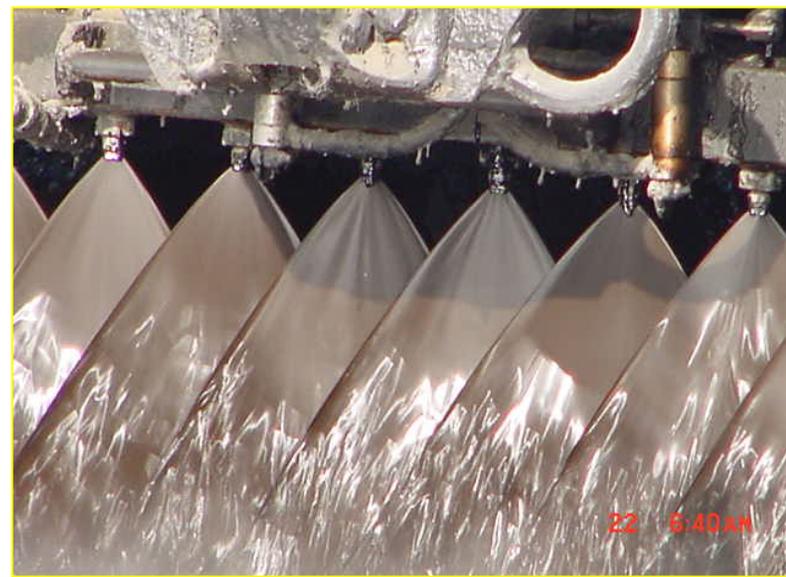


Figure 2.6-1 Relative Sizes and Distribution of Asphalt Particles in an Emulsion

# Asphalt Emulsions

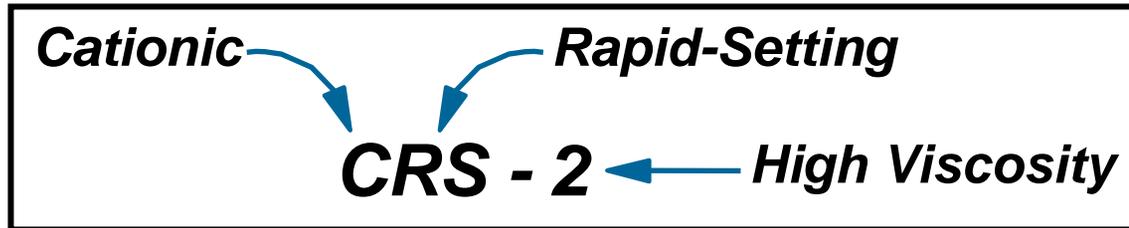


- **Caltrans Specifications**

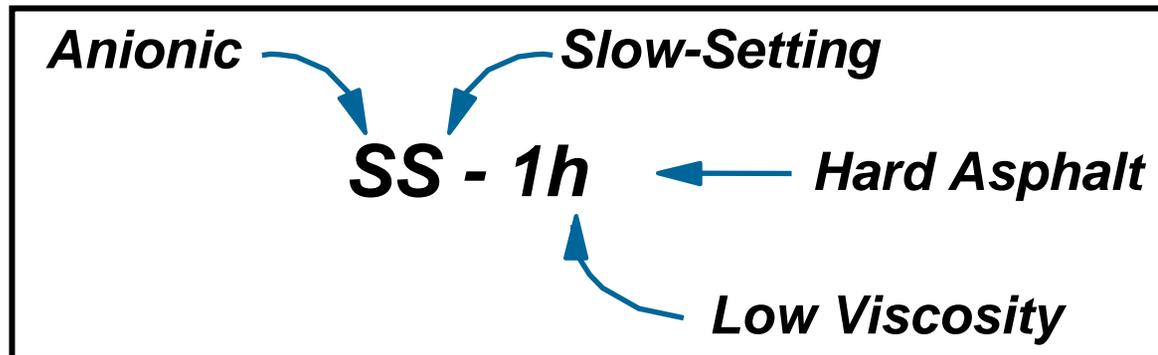
- Anionic emulsions: rapid set (RS), Medium Set (MS), and Slow Set (SS)
- Cationic emulsions: rapid set (CRS), Medium Set (CMS), and Slow Set (CSS)
- Polymer modified emulsions
- Quickset slurry emulsion

# Asphalt Emulsions

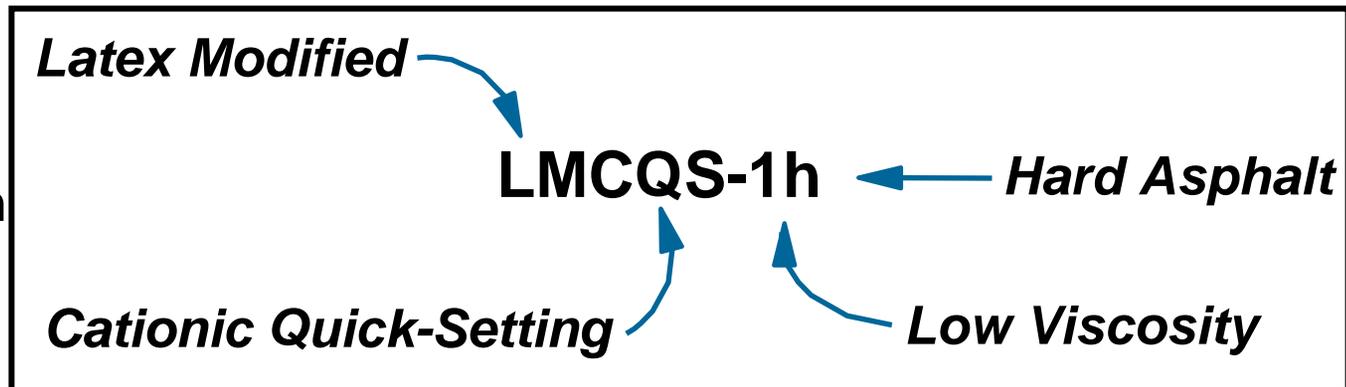
Chip Seal  
Emulsion



Tack Coat



Slurry  
Emulsion



# Cutback Asphalts

- In California, only slow cure cutbacks are still made and used
- The main use for cutbacks is prime coats over aggregate base materials prior to placement of an asphalt-wearing course in new construction

# Polymer Modified Binder

- Polymers are large molecule additives that are used to enhance the performances of asphalt cement and asphalt concrete pavement, particularly at high temperatures
- Some purposes of polymers
  - Increase serviceable temperature range
  - Improve durability at all temperatures
  - Reduce moisture damage
  - More forgiving binder

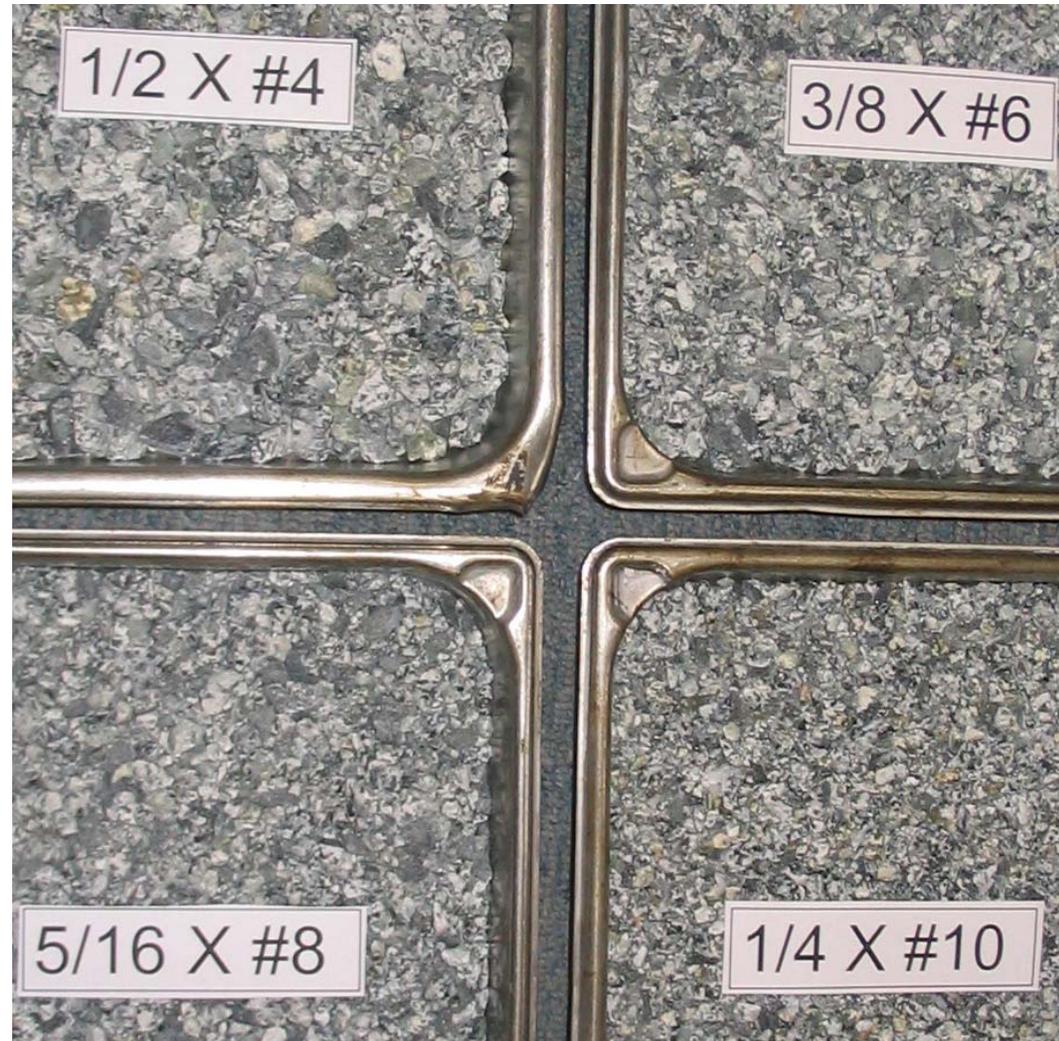
# Asphalt Rubber

- Asphalt rubber constituent
  - Crumb Rubber Modifier (CRM)
    - Scrap Tire Rubber
    - High Natural Rubber Content Scrap Rubber
  - Asphalt Cement
  - Extender Oil – Caltrans
- Some purposes of AR
  - Use waste tires
  - Increase viscosity, elasticity, and resilience
  - Improve durability



# Aggregates

- The major building material for pavements
- Form the structural matrix in HMA mix
- Types
  - Igneous
  - Sedimentary rocks
  - Gravel
  - Sands
  - Slag



# Aggregate Properties

- Chemical
  - Affinity to asphalt
- Physical
  - Grading or particle size distribution
  - Cleanliness or presence of deleterious materials
  - Hardness or abrasion resistance
  - Durability or soundness
  - Particle shape and surface texture
  - Absorption characteristics

# Chapter 3

## Framework for Treatment Selection

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is Treatment Selection?

A guide to assist maintenance personnel in making better and more informed decisions in selecting and applying maintenance treatments

In other words...

What do we do with this?



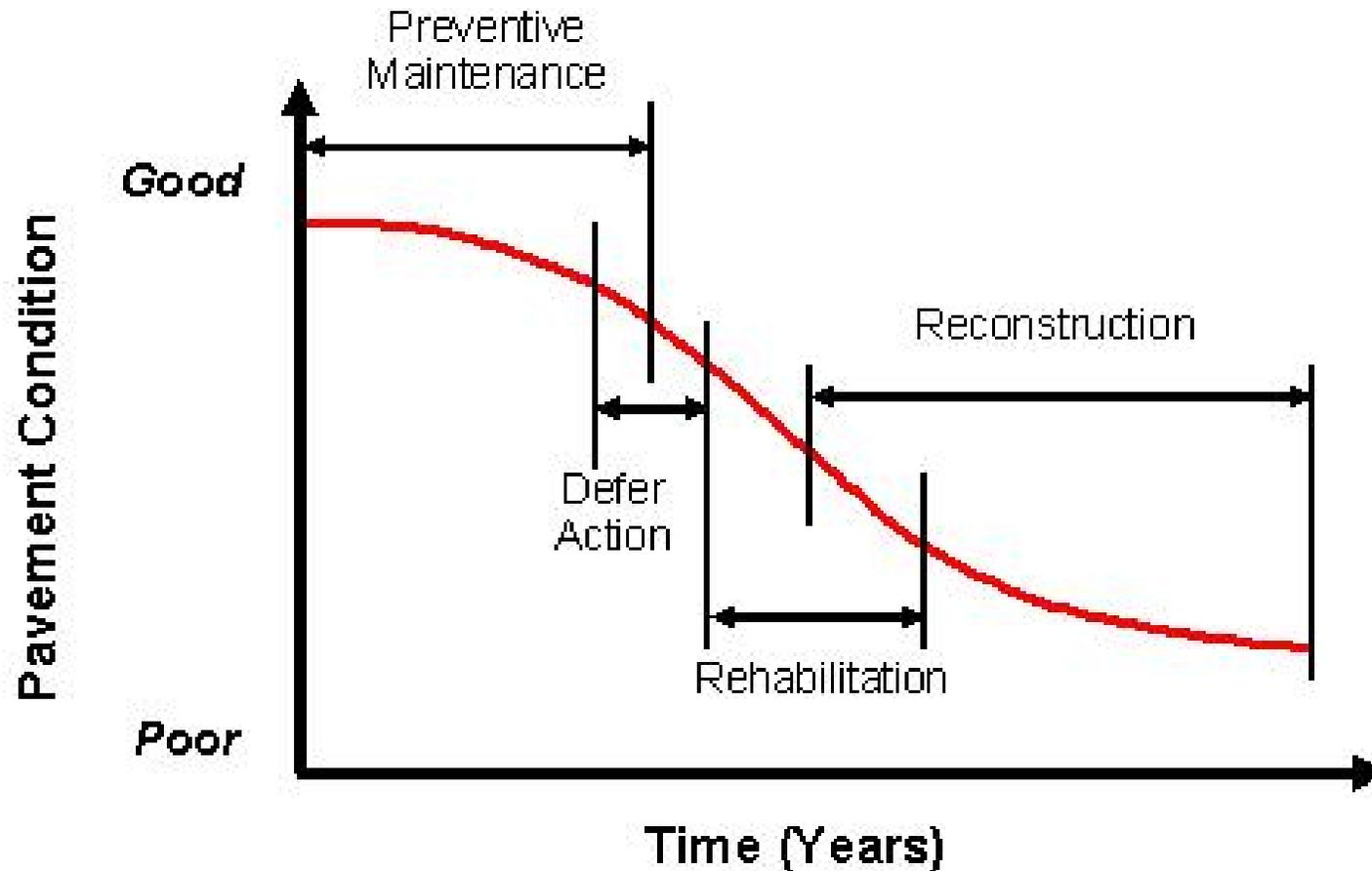
# Treatment Selection Matrix

- Covers all the major treatment types currently used by Caltrans for flexible pavements and allows for inclusion of future strategies
- Treatment selection is a complex, yet important procedure to ensure a optimum pavement treatment

# Factors Affecting Treatment Selection

- Pavement age, condition
- Climate
- Traffic levels, expected future plans
- Available funding
- Agency policy

# Treatment Selection Based on Pavement Condition



# Treatment Selection Training Modules Available

1. Treatment Selection Matrix
2. Life Cycle Cost Analysis

# Chapter 4

## Crack Sealing, Crack Filling, and Joint Sealing

From... Maintenance Technical  
Advisory Guide (MTAG)

# Why Treat Cracks?

- Prevent water from entering and weakening the base and subgrade
- Prevent debris (incompressible materials) from entering cracks/joints
- Prepare road surface for overlay or maintenance treatments
- Cost Effective – “fix the roof now so that you don’t have to fix the house later”



# When to Use?

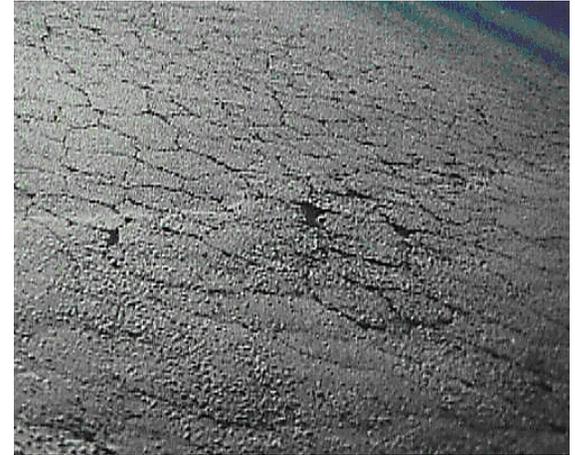
- Longitudinal Cracking
- Transverse Cracking
- Block Cracking



- Crack width should be 0.12 – 1.00 inch

# When NOT to Use?

- Crack sealing/filling is not efficient on:
  - Alligator Cracking (due to poor subgrade support)
  - Fatigue Cracking (due to fatigue failure)
  - Reflective Cracking
  - Edge Cracking
  - Slippage Cracking



# Performance

- Depending on sealant and method used:
  - Asphalt emulsion placed in flushed configuration, in unrouted cracks: 2 – 4 years
  - Hot-applied rubber and fiber modified asphalt placed in flush or overbanded configuration: 6 – 8 years

# Chapter 5

## Patching and Edge Repair

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is Patching?

- Patching consists of removing and replacing the material in a highly distressed area, or adding additional material to cover up the distressed area



# Why Use Patching?

- Restores the pavement surface to a state where other preservation treatments can be used with a good chance of success
- Often done in preparation for other forms of corrective maintenance, pavement preservation, or pre-treatment prior to an overlay

# When to Use?

- Patching is not pavement preservation
- Emergency-temporary patches to reduce likelihood of vehicle damage and/or accidents which they might cause
- Before localized areas of distress become problematic
- Prior to overlays or other pavement treatments

# Where to Use?

- Localized areas where even the underlying support materials have disintegrated, contaminated, or lost their load-carrying capacity
- Pavement failure along the edges due to traffic and loss of edge support



# Where to Use?



*Localized High Severity  
Alligator Cracking*



*Pothole*

# Chapter 6

## Fog and Rejuvenating Seals

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is a Fog Seal?

A mixture of asphalt emulsion and water applied to the asphalt surface of a road, street or highway. The primary purpose is to seal the road surface and defer surface degradation



# Why Use Fog Seal?

- An inexpensive way of arresting raveling and adding binder back to aged surfaces
- Fog seals are also useful in chip seal applications to hold chips in place in fresh seal coats to help prevent vehicle damage arising from flying chips
- improve sealing or waterproofing
- improve the surface appearance

# When/Where to Use Fog Seal?

- Pavement surface condition – Dry mixes, high air voids, and surfaces showing minor and/or moderate raveling.
- When chip seals are in need to prevent aggregate loss.
- Pavement age – relatively newer pavement (not more than 2 years in service)
- Pavement surface mix – can be used on dense-, gap-, and open-graded mixes; however, the seal must penetrate.

# What is a Rejuvenating Seal?

- A combination of various chemicals or a mixture of asphalt emulsion and recycling agents applied to the asphalt pavement surface
- The primary purpose is to soften the stiffness of the oxidized HMA pavement surface and to extend the life of the pavement surface by adjusting properties of the HMA mixture

# A Rejuvenating Seal Job...



# Why Use a Rejuvenating Seal?

- A way to soften the hardness of oxidized asphalt concrete surface, making it less brittle
- The major benefit of the rejuvenating seals is to improve the flexibility of the asphalt binder and slow down the rate of aging and oxidization

# When to Use a Rejuvenating Seal?

- Old and fairly oxidized pavement surface or surface starting to oxidize or show raveling
- In addition to oxidation a pavement surface may begin to show evidence of distress cracking; if this is the case a rejuvenating scrub seal should be used
- Generally used on pavement over 2 years or more

# Where to Use Rejuvenating Seal?

- Can be used on dense-, gap- and open-graded pavement surface mixes



**Heavily aged,  
dense-graded HMA**



**Open-graded  
HMA**

# Chapter 7

## Chip Seals

From... Maintenance Technical  
Advisory Guide (MTAG)

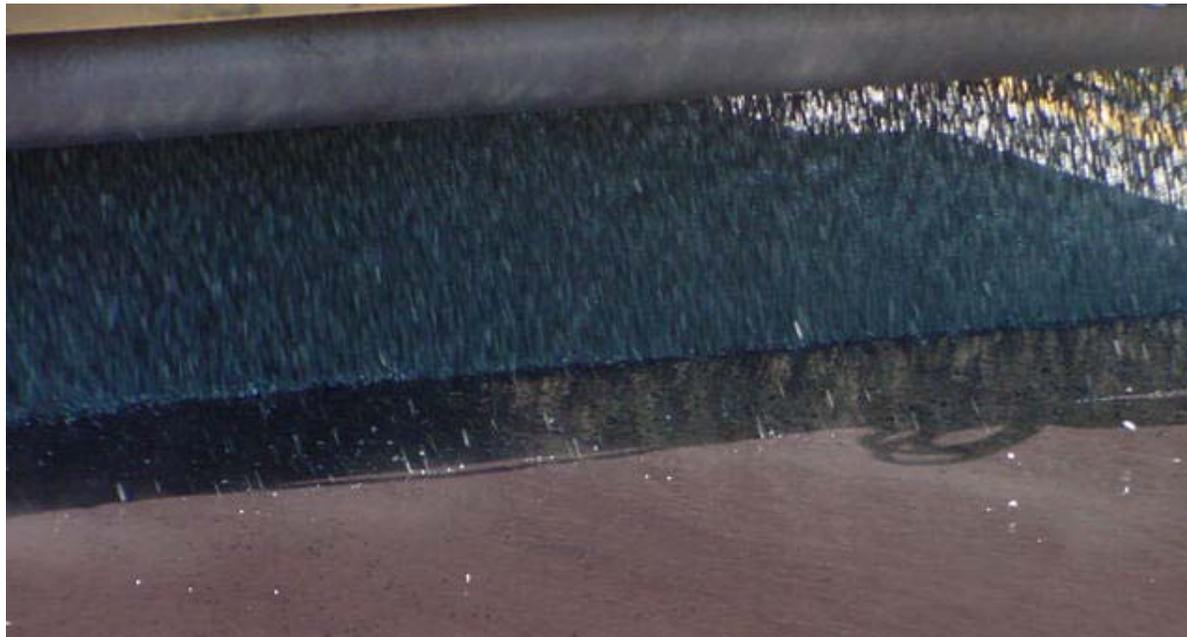
# What is Chip Seal?

Application of asphalt binder on existing pavement followed by a layer of aggregate chips. The treatment is then rolled to embed the aggregate into the binder.



# Why to Use - Performance and Cost

- Performance
  - Typical treatment life: 5 to 10 years
  - Function of climate, existing pavement condition, traffic, type of chip seal
- Average cost
  - \$2.50 to \$5.00/yd<sup>2</sup> (depending on oil price)



Chapter 7 – Chip Seals

# Where and When to Use

- Surface for light to medium traffic (ADT < 30,000)
- Waterproof layer
- Skid resistant surface
- Restore weathered surface
- Address bleeding
- Temporary base course cover
- Define shoulders



# When NOT to Use!

- Structurally deficient pavements
- Cracks  $>1/4$  in width unless sealed
- Large number of potholes
- Rutting  $>1/2$  in
- Ride quality needs significant improvement



# Chip Seal Variations

- Applications
  - Single chip seals
  - Double or triple chip seals
  - Cape seals
  - Fabric and chip seals
  - Scrub seals
- Asphalt Binder Types
  - PME
  - PMA
  - AR

# Chapter 8

## Slurry Seals

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is Slurry Seal?

- A thin maintenance treatment
- A mixture of:
  - asphalt emulsion
  - graded aggregates
  - mineral filler
  - water
  - Additives



- When placed on the pavement surface the mixture breaks and cures creating a new wearing surface.

# Why Use Slurry Seals?

- Cost Effective
- Benefits:
  - minimize oxidation/ageing
  - reduce water infiltration
  - provide skid resistance
  - improve aesthetics
  - correct raveling and weathering
- Average performance life: 3 to 5 years

# Where to Use?

- Hot Mix Asphalt Pavements:
  - Roadways (All traffic levels)
  - Parking Lots
  - Taxiways and Runways
  - Bridges and Over-Crossings
- Geographic Regions/Climate Zones:
  - All throughout California



*Cape Seal (Slurry over Chip Seal)*

# When to Use?

- To correct/improve:
  - raveling and weathering
  - loss of frictional properties
  - aesthetics
- To prevent/reduce:
  - ageing/oxidation of asphalt concrete
  - surface water infiltration
  - pavement degradation due to the elements



# When NOT to Use?

- On pavements with structural defects:
  - Alligator Cracking
  - Rutting
  - Bumps and Depressions
  - Potholes
- Nighttime construction



# Chapter 9

## Microsurfacing

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is Microsurfacing?

- A thin maintenance treatment
- A mixture of:
  - polymer modified emulsion
  - graded aggregates
  - mineral filler
  - water
  - Additives
- Instead of breaking and curing via evaporation, like slurry, a chemical reaction causes the material to set-up.



# Why Use Microsurfacing?

- Cost Effective
- Benefits:
  - minimize oxidation/ageing, reduce water infiltration, correct raveling and weathering
  - provide skid resistance
  - improve aesthetics
  - correct rutting and minor surface profile irregularities
- Average performance life: 5 to 7 years

# Caltrans District 11 -



Before



After

**Type III Micro Surfacing Project,  
Contract No. 11-276004, 11-SD-76-30.2/52.9  
Intermountain Slurry Seal**

# Where to Use?

- Hot Mix Asphalt Pavements:
  - Roadways (All traffic levels)
  - Taxiways and Runways
  - Bridges and Over-Crossings
- Geographic Regions/Climate Zones:
  - All throughout California

# When to Use?

- To correct/improve:
  - raveling and weathering
  - loss of frictional properties
  - aesthetics
  - rutting and surface profile irregularities
- To prevent/reduce:
  - ageing/oxidation of asphalt concrete
  - surface water infiltration
  - pavement degradation due to the elements

# When NOT to Use?

- On pavements with structural defects:
  - Alligator Cracking
  - On-going Rutting
  - Bumps and Depressions
  - Potholes



# Microsurfacing Vs. Slurry Seal

<b><i>Differences in:</i></b>	<b><i>MICROSURFACING</i></b>	<b><i>SLURRY SEAL</i></b>
<b>Asphalt Emulsion</b>	<b>always polymer modified, quick set</b>	<b>could be polymer modified</b>
<b>Aggregate Quality/Gradation</b>	<b>stricter spec. for sand equivalent; use only Type II and Type III</b>	<b>Can use Type I, II or III</b>
<b>Additives/Break</b>	<b>chemical break largely independent of weather conditions</b>	<b>breaking and curing dependent on weather conditions</b>

# Microsurfacing Vs. Slurry Seal

<b><i>Differences in:</i></b>	<b><i>MICROSURFACING</i></b>	<b><i>SLURRY SEAL</i></b>
<b>Mix Stiffness/ Equipment</b>	<b>stiffer mix, use augers in the spreader box and secondary strike-off</b>	<b>softer mix, use drag box</b>
<b>Applications</b>	<b>same as slurry seal + rut filling, night work, correction of minor surface profile irregularities</b>	<b>correct raveling, seal oxidized pavements, restore skid resistance</b>

# Distress Conditions

## Pavement Distress

## Slurry Microsurfacing

### Surface cracking

Early longitudinal

X

X

Hairline

X

X

### Full depth cracking

Thermal or Transverse

-

-

Fatigue or Alligator

-

-

Block

-

-

Reflective

-

-

Late longitudinal

-

-

Slippage (tack failure)

-

-

Corrugation or Shoving (wash boarding) -

X

X Recommended; - Not recommended

# Distress Conditions (cont.)

<b>Pavement Distress</b>	<b>Slurry Microsurfacing</b>	
<b>Rutting</b>		
Sound base	-	X
Unsound base	-	-
<b>Raveling</b>	X	X
<b>Bleeding</b>	-	X
<b>Polishing (loss of skid resistance)</b>	X	X
<b>Patched pothole</b>		
Structure unsound	-	-
Base repaired patch	X	X
<b>Loss of profile (crown, edge, etc.)</b>	-	X

X Recommended; - Not recommended

# Chapter 10

## Thin Maintenance Overlays

From... Maintenance Technical  
Advisory Guide (MTAG)

# What Are Thin Maintenance Overlays?

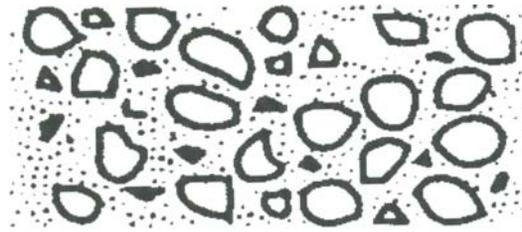
- Defined as thin treatment using a hot mix system
- Non-structural layer
- Applied as a maintenance treatment (corrective or preventive)
- Thickness:
  - Caltrans: 1¼ in
  - Nationally: less than 1½ in

# Types of Thin Maintenance Overlays

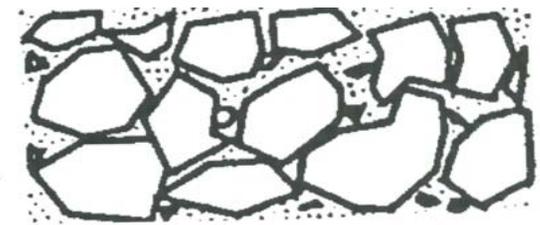
- Dense-graded: HMA Type A and B
- Open-graded: OGFC, RHMA-O and RHMA-O-HB
- Gap-graded: RHMA-G



a) Dense Graded



b) Gap Graded



c) Open Graded

# Why Use Thin Overlays?

- Extends Pavement Life
- Improves Ride Quality
- Mitigates Distresses
  - Raveling
  - Oxidation
  - Cracking
  - Skid problems
  - Flushing surfaces



# When to Use?

- Structurally sound pavement
- Rut depth < 1/2"
- Minor cracking
- cracking
- Minor to moderate bleeding
- Raveled surface

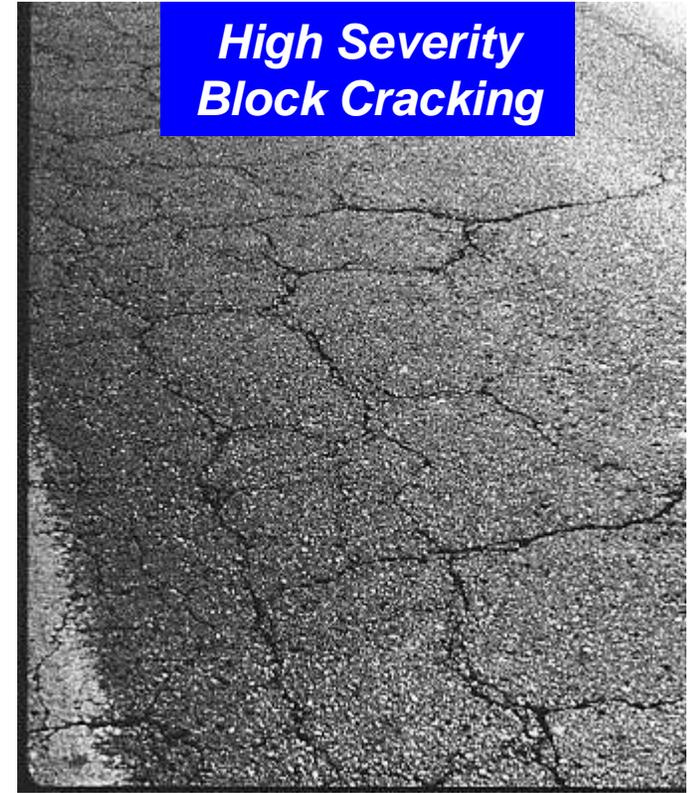


# When NOT to use! Poor Candidates

**High Severity  
Alligator Cracking**



**High Severity  
Block Cracking**



**Rutting  
>1/2"**



**High Severity  
"D" Cracking**



# Where to Use?

- As a surface treatment over asphalt concrete pavements and on portland cement concrete pavements
- Over structurally sound pavements
- For reducing oxidation
- For mitigation of cracking
- For improving skid resistance

# Where to Use?

## Open- and Gap-Graded Overlays

- In sections with high frequency of wet weather accidents or when recommended to minimize wet weather accident occurrences
- For improving skid resistance
- For noise reduction

# Chapter 11

## Bonded Wearing Course

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is BWC?



- **A thin Hot Mix Asphalt Overlay placed over a polymer modified emulsion membrane which:**
  - **seals the existing pavement**
  - **bonds the two surfaces**
- **The roadway is open to traffic very quickly**
- **This process is done in a single machine**

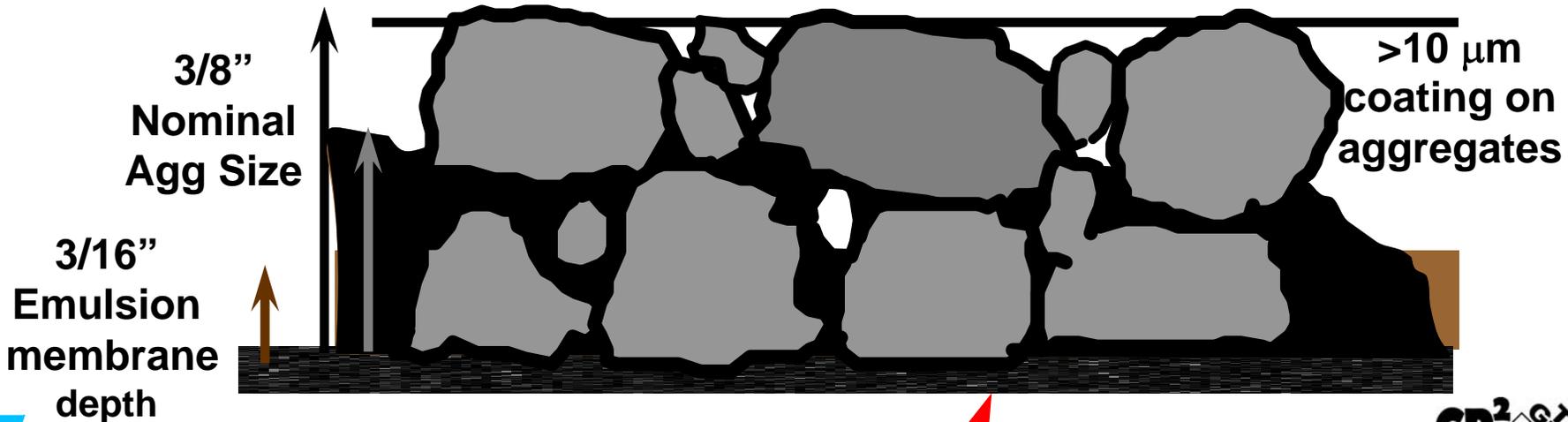


# What is BWC?

*Emulsion membrane “wicks up”  
around the HMA aggregates*

*The emulsion cures,  
bonding the mix & pavement*

3/4” Typical  
Mix Depth



# When to Use?

## Site Selection Guidelines

- Structurally sound pavement
- Rut depth < 1/2"
- Minor to moderate transverse & longitudinal cracking
- Bleeding minor to moderate
- Raveled

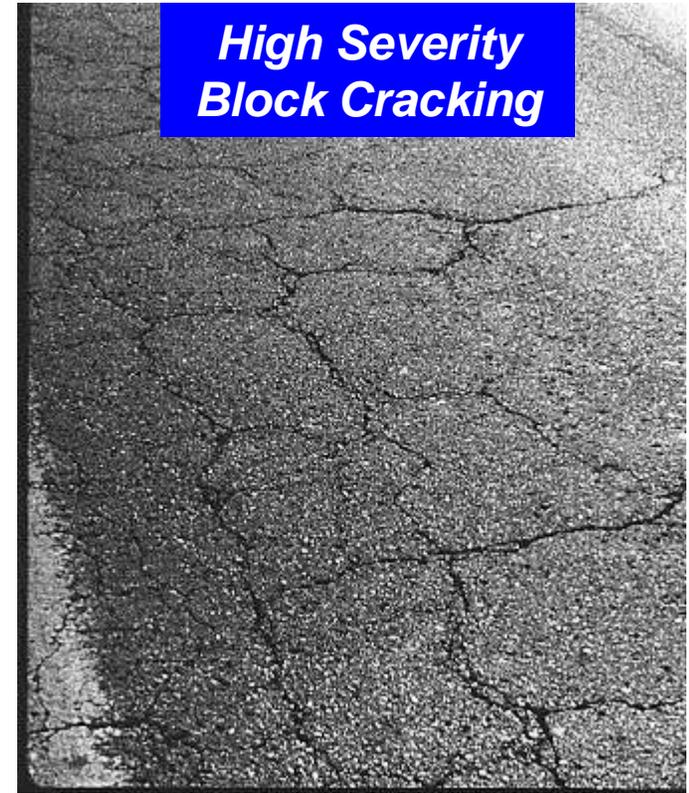


# When NOT to Use! Poor Candidates

**High Severity  
Alligator Cracking**



**High Severity  
Block Cracking**



**Rutting  
>1/2"**



**High Severity  
"D" Cracking**



# Where/Why to Use (cont.)

- Quick return to traffic- Reduced Work Zone Time (*Workers' Safety*)
- Noise Reduction- Open/Gap Graded Mix
- Night Work- Min Temp 45° F (*More working days*)
- Reduced Backspray- Open/Gap Graded Mix
- High Volume Roadways- Faster Paving Process (*Get In- Get Out*)

Hwy 99 RBWC



Hwy 73 BWC



Where to Use?

# Chapter 12

## Interlayers

From... Maintenance Technical  
Advisory Guide (MTAG)

# Chapter 13

## In-Place-Recycling

From... Maintenance Technical  
Advisory Guide (MTAG)

# Types of In-Place-Recycling

- Cold-In-Place Recycling (CIR), HMA<3”
- Hot-in-Place Recycling (HIR), HMA<3”
- Full Depth Reclamation (FDR) – this topic is not addressed in the MTAG 2<sup>nd</sup> edition for flexible pavements

# Cold In-Place Recycling (CIR)

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is Cold In-Place Recycling?

**Distressed Pavement = New Pavement Using A Train of Equipment that:**

- **Mills deteriorated pavement**
  - **Reclaimed asphalt pavement (RAP)**
- **Crushes RAP to gradation**
- **Mixes with recycling emulsion**
- **Re-Paves recycled mix**
- **Compacts to specified density**
- **Ready for surface treatment**

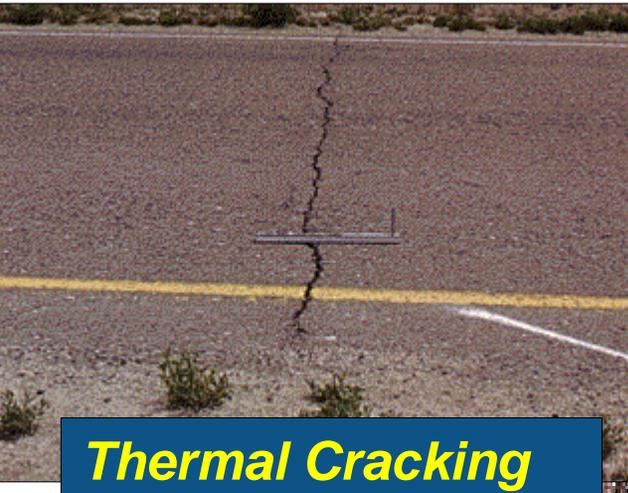


# Why Use Cold In-Place Recycling?

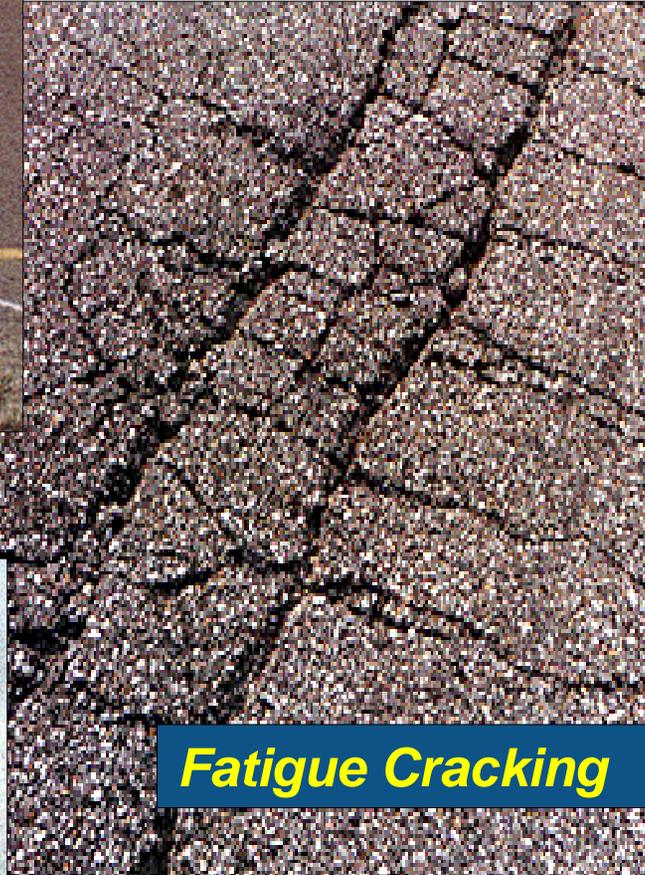
- **Maintains and Restores Deteriorated Pavements**
- **Disrupts Reflective Cracking**
- **Cost Effective up to 50% Less than Traditional Method of Mill and Fill**
- **Up to 75% Reduction in Working Days**
- **Lowers User Delays**
- **Conserves Natural Resources & Energy**
- **Eliminates 98% of Construction Truck Traffic**
- **Recycling Credits**



# When to Use Cold In-Place Recycling?



***Thermal Cracking***



***Fatigue Cracking***



***Poor Rideability***



***Patched***



***Dry, Raveled***

# Where to Use Cold In-Place Recycling?

- Anywhere mill and fill is considered
- Will handle all cracking distress provided not base related
- Where surface maintenance is no longer effective
- To repair raveling & potholes
- Where safety is a concern
- When life cycle costs dictate
- No limitation to traffic/ADT



# Hot In-Place Recycling (HIR)

From... Maintenance Technical  
Advisory Guide (MTAG)

# What is HIR?

**Distressed converted to New Pavement Using A Train of Equipment that:**

- **Heats deteriorated pavement surface**
- **Mills Reclaimed asphalt pavement (RAP)**
- **Mixes with recycling agent and new HMA**
- **Re-Paves recycled mix**
- **Compacts to specified density**



# Hot In-Place Recycling

- Three methods: surface recycling, remixing, and repaving
- Typical depth: 15 to 50 mm (0.6 to 2.0 in)
- RAP mixed with additives and relaid
- Immediate opening to traffic
- Applicable for all traffic levels

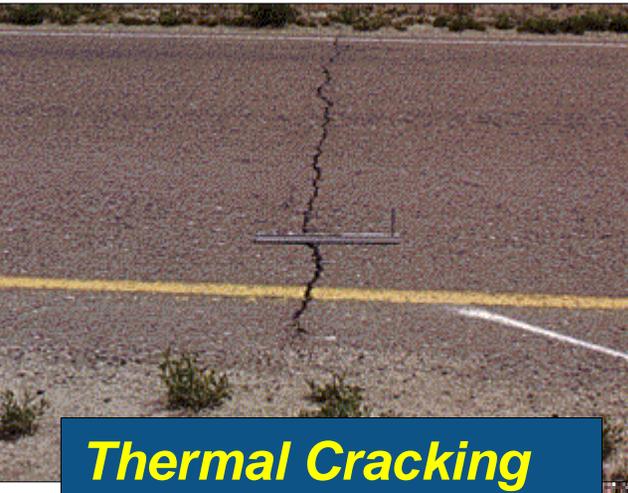
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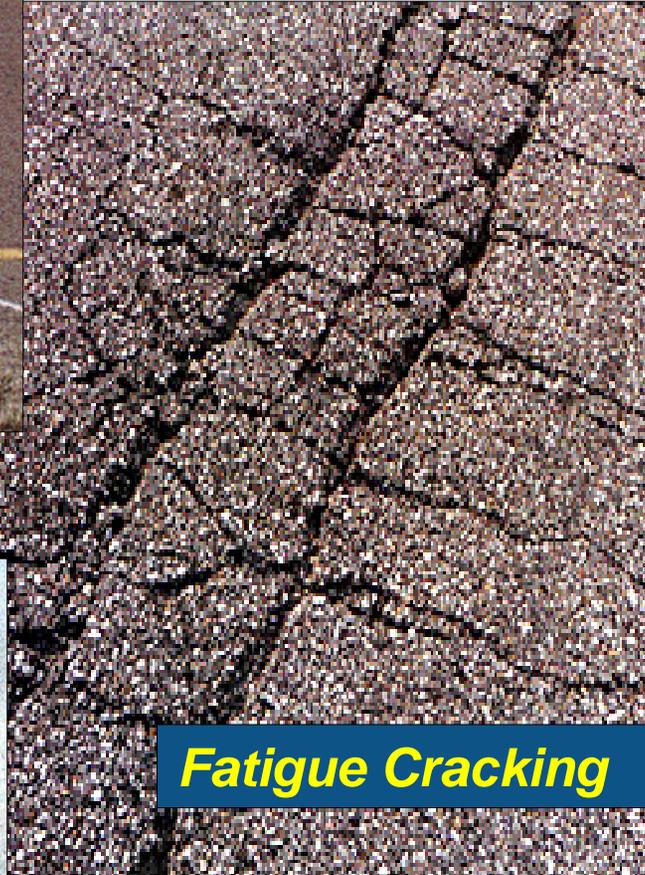


After

# When to Use HIR?



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***Fatigue Cracking***



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***Dry, Raveled***

# Where to Use HIR?

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# HIR - Limitations

- Influence of mix variation
- Cannot recycle fabrics or interlayers
- Problems with deep ruts
- Trouble recycling large stone mixes
- Difficulties from rubber in the mix
- Higher moisture content reduces production rate

# Summary

Chapter	Topic
1	Introduction
2	Materials
3	Framework for Treatment Selection
4	Crack Sealing, Crack Filling, and Joint Sealing
5	Patching and Edge Repair
6	Fog and Rejuvenating Seals
7	Chip Seals
8	Slurry Seals
9	Microsurfacing
10	Thin Maintenance Overlays
11	Bonded Wearing Courses
12	Interlayers
13	In-Place Recycling

DRAFT



**MAINTENANCE TECHNICAL ADVISORY GUIDE**  
**Volume I – Flexible Pavement Preservation**  
**Second Edition**



**State of California Department of Transportation**

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# Thank You

June 29, 2007

