MTAG Overview
(Rigid Pavements)

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

Overview
## Chapters Covered in MTAG for Rigid Pavements

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**Overview**
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)
Overview

- Purpose of pavement preservation (PP)
- Definition of PP
- Components of PP Program
- PP Concept
- Essentials of PP Program
- Benefits of PP
- Rigid Pavement Performance in California
- Common Rigid Pavement Distresses
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.
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
Essentials of Pavement Preservation Program

- Pavement preservation is an agency program
- An effective pavement preservation program include 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

Chapter 1 - Introduction
Typical Pavement Performance Curve

Chapter 1 - Introduction
Importance of Timely Treatments

Chapter 1 - Introduction
Cost Effects of Treatments

- 40% drop in quality
- $1-$10/sq yd for preventive maintenance here
- Will cost $25-$50/sq yd or more for rehabilitation here to get the same pavement condition from PM

Chapter 1 - Introduction
Rigid Pavement Performance in CA

• Design and Performance
  • Base support. Initially CTB; later LCB. CTPB and ATPB also used.
  • Slab thickness. In the 1950s, an 8-inch. Later 9-inch slab became common. Presently, 10-inch and even 12-inch thick slabs are used depending on projected traffic.
  • Dowels, tie bars, sealed joints were added in 2000.

• Common Distresses and Causes of Rigid Pavement Deterioration
Chapter 2
Surface Characteristics

*From...* Maintenance Technical Advisory Guide (MTAG)
Why are Surface Characteristics of a Pavement Important?

- They are what the public notices
- They also affect their driving and the associated costs of driving
- Customer satisfaction is at the heart and soul of a successful pavement preservation program
Surface Characteristics Deteriorate as the Pavement Wears Out

Chapter 2 – Surface Characteristics
Important Surface Characteristics

- Ride quality—the public demands a smooth ride
- Safety—Safety for users in terms of texture and skid resistance
- Noise—Quieter pavements
- Durability—longer lasting treatments
- Aesthetics—eliminating patches and other surface deficiencies
Ride Quality

- Definitions - deviations in the surface that affect vehicle dynamics, ride quality, and drainage. Smoothness can affect
  - driver safety
  - fuel efficiency, and
  - vehicle wear and tear
- Measuring smoothness
- Factors contributing to poor smoothness
Ride Quality and Profiling

- **Ride** - measuring smoothness
  - Several techniques have been used over the years
  - Profilographs were one of the first and still is used in California for construction quality control

- **Profiling** - measuring the longitudinal profile
  - Common for network pavement data collection
  - Not designed for project level quality control

Chapter 2 – Surface Characteristics
Surface Texture

- Definitions
- Measurements of surface texture
- Importance of surface texture
Techniques to Create Texture

- Drag textures
  - Burlap dragging
  - Broomed surfaces
  - Turf dragging
- Tined textures
  - Transverse
  - Longitudinal
- Diamond grinding
Methods to Measure Texture

- Sand patch method-ASTM 365
- Circular texture meter (CT meter)
- Outflow time (using an outflow meter)
Importance

- Good friction provides for safe roads in wet weather conditions
- Water on pavements also affects splash and spray which can result in a loss of visibility
Measurement of Surface Friction

- Several methods have been used to obtain a number
- Some of the devices used in California include:
  - ASTM locked wheel trailer
  - British pendulum device
  - Dynamic friction tester
  - Caltrans test method
Noise

- Noise is unwanted sound
- Pavement type and texture contribute to noise levels
- Caltrans has developed a pavement advisory guide for quiet pavements which can be found on the following website

www.dot.ca.gov/hq/oppd/pavement/qpavement.htm
Chapter 3
Strategy Selection

From… Maintenance Technical Advisory Guide (MTAG)
Factors to Consider

- Ride
- Skid
- Noise
- Distress Types
- Durability/Longevity

http://www.dot.ca.gov/hq/oppd/pavement/qpavement.htm
Treatment Selection Based on Pavement Condition

Chapter 3 – Strategy Selection
Caltrans Approach to Selecting Maintenance Treatments

- Assess Existing Pavement Conditions
- Determine the Feasible Treatment Options
- Analyze and Compare the Feasible Options

Chapter 3 – Strategy Selection
## Feasible Treatments - Structural

<table>
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<tr>
<th>Distress Type</th>
<th>Preservation Techniques</th>
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<td>Transverse Cracking</td>
<td>Joint and crack sealing</td>
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<tr>
<td>Longitudinal Cracking</td>
<td>Joint and crack sealing, Slab stabilization</td>
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<tr>
<td>Corner Cracking</td>
<td>Joint and crack sealing, Edge joint resealing, Slab stabilization</td>
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<tr>
<td>2nd/3rd stage Cracking</td>
<td>Joint and crack sealing, Slab stabilization; slab replacement</td>
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<td>Spalling</td>
<td>Partial-depth repair, Joint and crack resealing, Full-depth repair</td>
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<tr>
<td>Pumping</td>
<td>Joint and crack resealing, Slab stabilization; dowel bar retrofit</td>
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<tr>
<td>Blow ups</td>
<td>Full-depth repairs</td>
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<tr>
<td>D-cracking (not common in California)</td>
<td>Partial- or full-depth repair; Joint and crack resealing</td>
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Chapter 3 – Strategy Selection
# Feasible Treatments - Functional

<table>
<thead>
<tr>
<th>Distress Type</th>
<th>Preservation Techniques</th>
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<tbody>
<tr>
<td>Surface Polishing</td>
<td>Diamond grinding, Grooving</td>
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<tr>
<td>Noise</td>
<td>Diamond grinding, See Caltrans website for the latest information</td>
</tr>
<tr>
<td>Scaling</td>
<td>Diamond grinding</td>
</tr>
<tr>
<td>Popouts</td>
<td>Diamond grinding</td>
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Chapter 4
Joint Resealing and Crack Sealing

From… Maintenance Technical Advisory Guide (MTAG)
Purpose

Placement of an approved sealant material in an existing joint or crack to reduce moisture infiltration and prevent intrusion of incompressibles.
PCC Joint Resealing

- Debate: to seal or not to seal
- Some believe the benefits do not offset the costs
- Most states seal transverse joints
- Recommendation: continue to reseal joints if they were originally sealed!
Guidelines for Resealing Joints

- Sealant no longer functional
- Pavement not severely deteriorated
- Performed with other CPR activities
- Moderate installation temperatures
- Proper material selection and joint preparation is essential
Guidelines for Sealing Cracks

- Seal working transverse cracks
- Can seal cracks \( \leq 13 \text{ mm (0.5 in)} \) wide
- Use special crack-sawing blades
- Same general *joint* resealing procedures apply to *crack* sealing
Chapter 5
Diamond Grinding and Grooving

From… Maintenance Technical Advisory Guide (MTAG)
Diamond Grinding and Grooving - Benefits

- Restore smoothness
- Improve friction
- Improve cross slope
- Reduction in noise
Diamond Grinding - Project Selection

- Consider effectiveness and limitations
- IGGA and ACPA recommendations
  - Present serviceability index (PSI) range of 3.8 to 4.0
  - Before critical faulting level
- Used with other CPR activities

Chapter 5 – Diamond Grinding and Grooving
Diamond Grinding - Limitations

- Does not address structural or durability problems
- Hardness of aggregate affects costs
- Roughness will return if causes are not addressed
Diamond Grooving - Project Selection

- Historical crash rate, friction number, or macrotexture depth data
- Potential locations for wet weather crashes
- Pavements should be structurally and functionally sound
Diamond Grooving - Longitudinal

• Advantages
  • Restore surface friction
  • Decrease hydroplaning potential
  • Improve curve tracking
  • Easier to conduct under traffic

• Disadvantages
  • Perception poor handling for motorcycles and light cars
Diamond Grooving - Transverse

**Advantages**
- Most direct channel for water drainage
- Introduces a surface that provides significant braking traction

**Disadvantages**
- Maintaining adjacent traffic
- Excessive noise
- Productivity

Chapter 5 – Diamond Grinding and Grooving
Chapter 6
Dowel Bar Retrofit

From… Maintenance Technical Advisory Guide (MTAG)
Dowel Bar Retrofit - Purpose

- Transferring wheel loads across a joint or crack
- Improving load transfer efficiency (LTE)
Load Transfer (continued)

0% Load Transfer
Wheel Load
Direction of Traffic
Slab 1
Slab 2

100% Load Transfer
Wheel Load
Direction of Traffic
Slab 1
Slab 2
Load Transfer Restoration - Benefits

- Reduced probability of pumping, faulting, and corner breaks
- Improved long-term rideability
- Increased service life
Good Candidate Projects

- Relatively good condition but with:
  - Poor load transfer
  - Faulting between 0.125 and 0.5 in
  - <10% slabs with multiple cracks
- Pavements expecting overlays
- Medium to heavy truck traffic
Chapter 7
Isolated Partial Depth Concrete Repair

From… Maintenance Technical Advisory Guide (MTAG)
Purpose

- Removal and replacement of small, shallow areas of deteriorated PCC at spalled or distressed joints.
- Distress limited to upper 1/3 of slab
- Existing load transfer devices are functional
Benefits

- Restores structural integrity
- Improves ride quality
- Extends the service life
- Restores a well-defined uniform joint sealant reservoir
Good Candidate Projects

- Spalling associated with joint inserts
- Spalling caused by intrusion of incompressibles
- Spalling associated with localized areas of scaling, weak concrete, clay balls, or high steel
Poor Candidate Projects

- Joint spalling associated with dowel bar misalignment or lockup
- Spalled cracks
- Spalling associated with durability problems or reactive aggregate
Chapter 8
Full Depth Concrete Repair

From… Maintenance Technical Advisory Guide (MTAG)
Purpose

- Cast-in-place concrete repairs that extend the full-depth of the existing slab
- Repair localized distress
- Preparation for an overlay
Candidate Distresses

- Transverse cracking (M, H)
- Longitudinal cracking (M, H)
- Corner breaks (L, M, H)
- Spalling (M, H)
- Blowup (L, M, H)
- D-cracking (M, H)
- Deterioration of existing repairs (M, H)
Benefits

- Restore rideability
- Restore structural integrity
- Prevent further deterioration
Limitations

- Does not address structural inadequacy
- Not a long-term solution for material-related distresses
- Widespread deterioration
- Cost considerations
# Summary

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Thank You

Questions?

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