Chapter 7
Chip Seals

From… Maintenance Technical Advisory Guide (MTAG)

Managers' Overview

From… Maintenance Technical Advisory Guide (MTAG)

Chip Seal

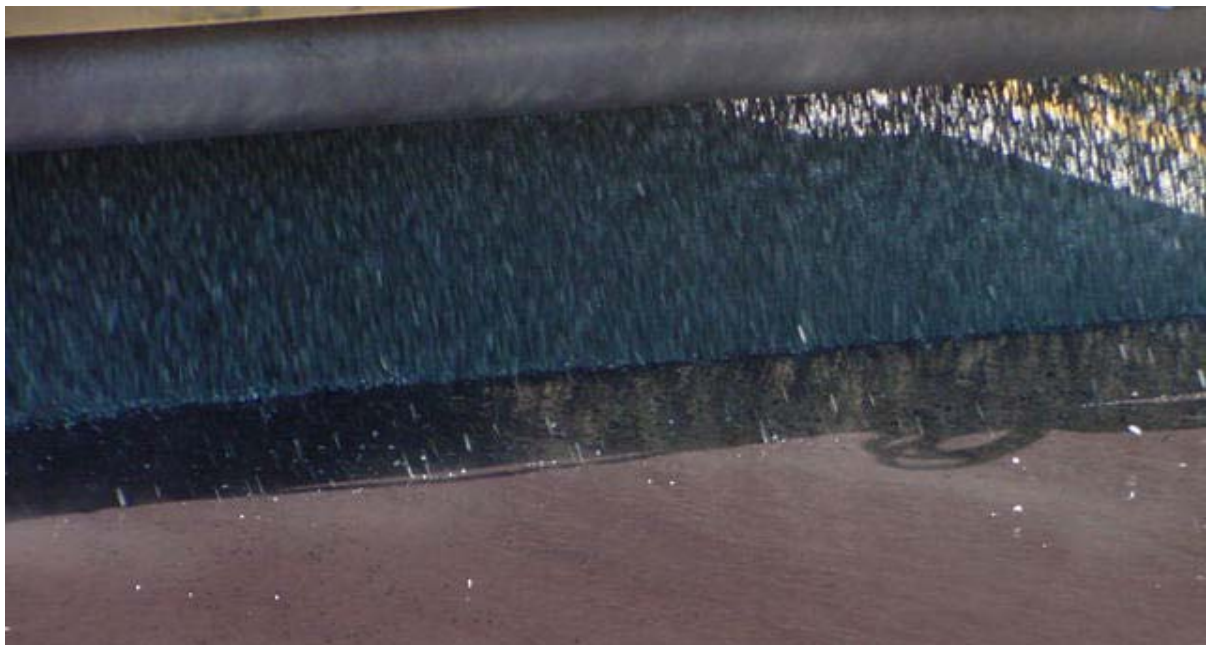
- What is Chip Seal?
- Why use Chip Seal?
- When to use Chip Seal?
- Where to use Chip Seal?
- Chip Seal Variations

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^2 (depending on oil price)



Where and When to Use

- Surface for light to medium traffic (ADT<30,000)
- Waterproof layer
- Skid resistant surface
- Seal the 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

Keys for Success

- Proper surface preparation
- Use the right binder and clean aggregates
- Follow the construction specs, including the need for traffic control
- Chip seal in good weather conditions

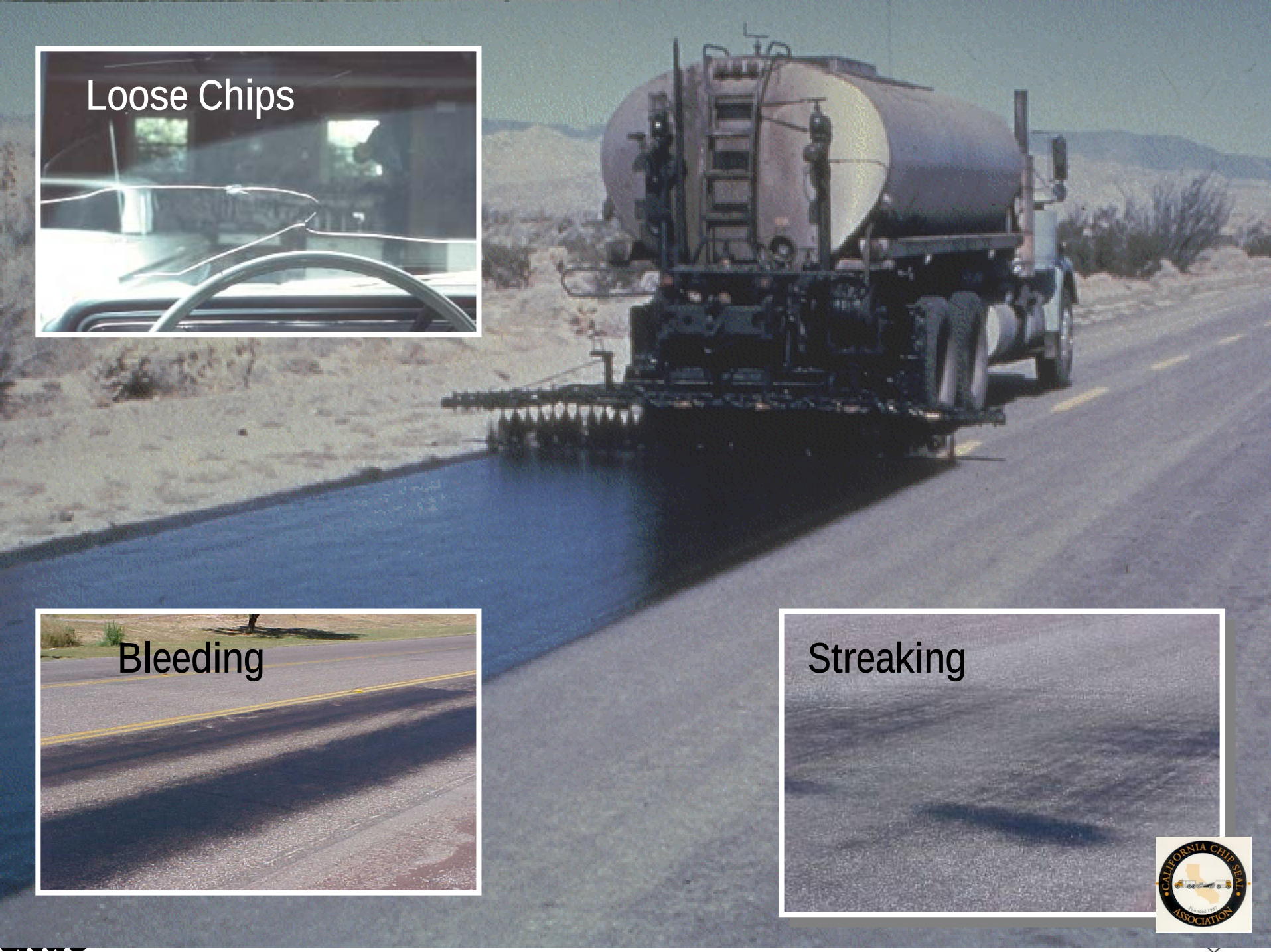
Sweeping (before and after)


Binder Application


Aggregate Application

Rolling


Proper Application


Loose Chips
Bleeding
Streaking
CALIFORNIA CHIP SEAL ASSOCIATION

Chip Seal Variations

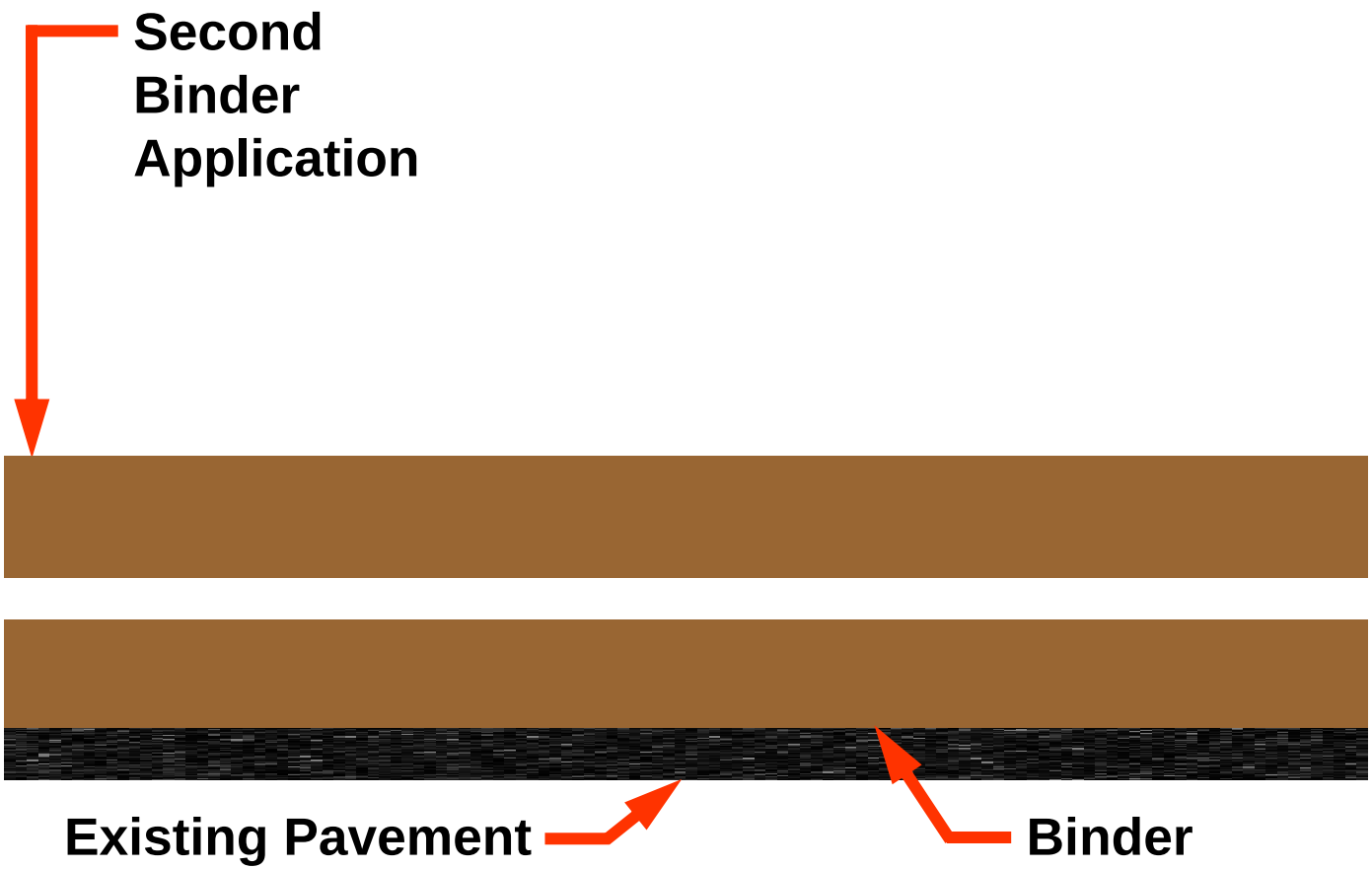
- Applications
  - Single chip seals
  - Double or triple chip seals
  - Cape seals
  - Fabric and chip seals
  - Scrub seals
- Asphalt Binder Types
  - PME
  - PMA
  - AR

Chip Seal Variations

Single Chip Seals

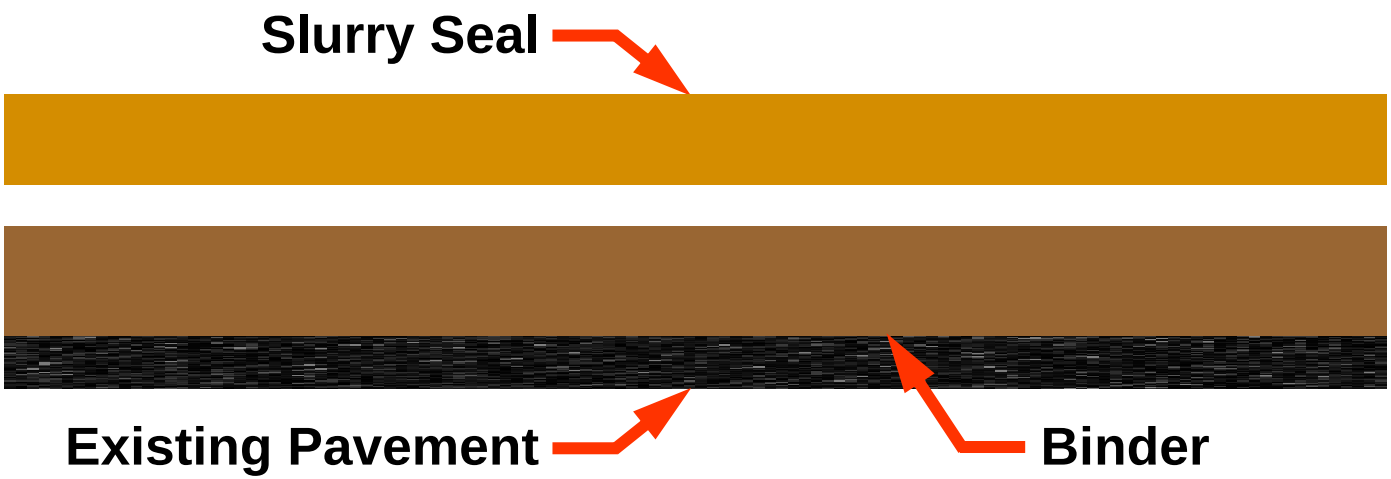
Chip Seal Variations

Double Chip Seals



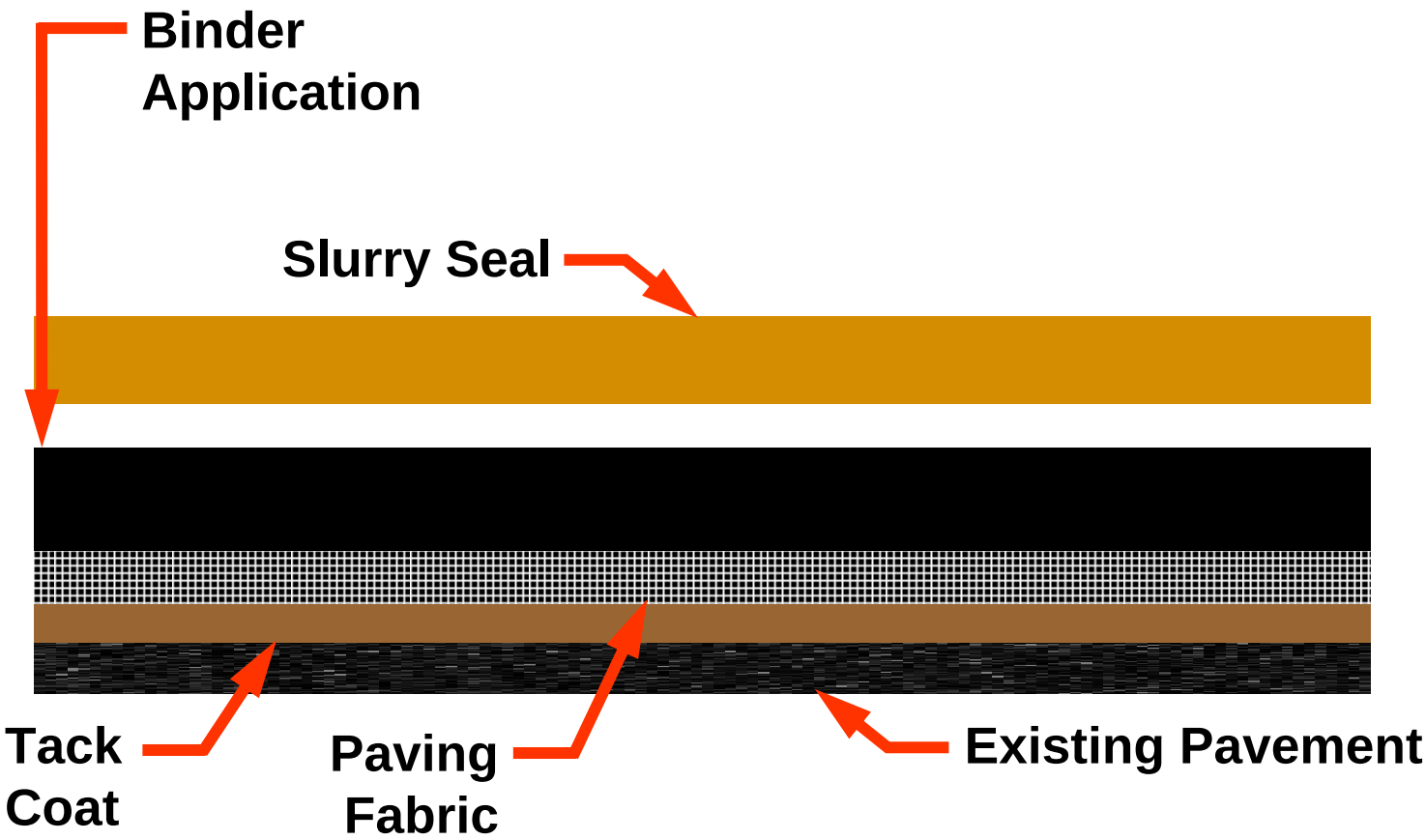
Chip Seal Variations

Cape Seals



Chip Seal Variations

Fabric and Chip Seals



Chip Seal Variations

Fabric and Chip Seals

Chip Seal Course
Training Modules Available

1. Design, Materials & Specifications
2. Construction, QC & Trouble Shootings

Module 7-1

Design, Materials & Specifications

From… Maintenance Technical Advisory Guide (MTAG)

Topics to be covered

- Chip Seal Design Process
- Design Considerations - Quantity Selection
- Chip Seal Design Methods
- Material Selection – Binder and Aggregate

Chip Seal Design Process

- Assess existing pavement
  - Based on Traffic, climate (add table 7-2)
- Select compatible binder and aggregate
- Determine quantity

Determine Quantity

- Residual asphalt content
  - Asphalt cement factor = 1.0
  - Emulsion factors range = 0.65 to 0.70
- Aggregate application rate
  - Single chip layer
  - No more than 10% excess chips
  - 70% embedment recommended

Chip Seal Design Methods

- McLeod procedure
- Asphalt Institute method

Asphalt Institute Method

1. Determine aggregate size and specific gravity
2. Aggregate and binder quantities from table
3. Adjust aggregate (if necessary)
4. Adjust asphalt content based on condition of road (if necessary)

Material Selection - Binder

Material Selection - Binder

- Polymer-modified emulsions
- Polymer-modified binder
- Polymer-modified rejuvenating emulsions (PMRE)
- Asphalt Rubber

Material Selection - Emulsion Ingredients

- Asphalt
- Water
- Emulsifying agent (surfactant)

Material Selection

Asphalt Rubber Chip Seal

Asphalt Rubber Chip Seals

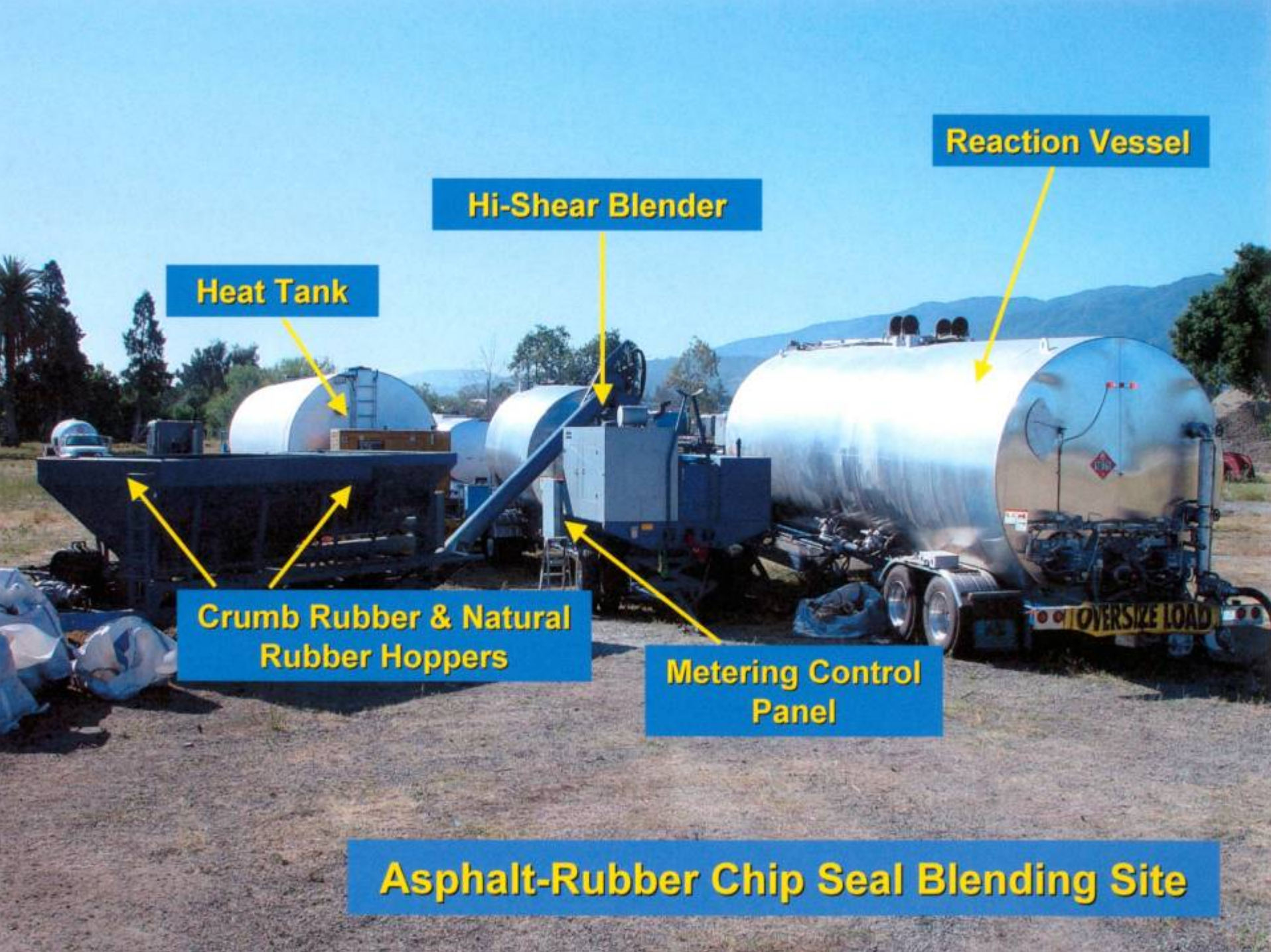
Binder Material

Field Blended (min. 45 minutes and viscosity 1,500 cps-4,000) hot asphalt, extender oil, crumb rubber, and high natural.

AR binder application is usually .60 gal / square yard through an agitated distributor truck attached with a vapor recovery system.

Aggregate

Chips are always hot pre-coated, and applied at 35-40 lbs. per square yard


Reaction Vessel
Hi-Shear Blender
Heat Tank
Crumb Rubber & Natural Rubber Hoppers
Metering Control Panel
OVERSIZE LOAD
Asphalt-Rubber Chip Seal Blending Site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Polymer Modified Asphalt Chip Seals

Binder

Terminal Blended using hot asphalt, polymer and can use crumb rubber.

Application rate is 0.35 - 0.50 gals/sy depending on size of chip

Chips

- Chips can be 3/8” up to 1/2” (25-35 lbs. / sy)
- Chips are required to be pre-coated and heated

Polymer
Modified Emulsion
Chip Seals

Crack Seal before
PM Emulsion Seal

PMRE Scrub Seal

Binder

Polymer modified emulsion with a solvent free rejuvenating agent additive

Application rate is 0.25 - 0.40 gals/sy depending on size of chip and degree of cracking.

Chips

- Chips can be 1/4” up to 1/2” (18-35 lbs. / sy)
- Can be applied at temperatures down to 40^{o} F
- Crack filling is not required

Material Selection - Aggregates

- Clean and durable
- One size: 6 to 16 mm (0.25 to 0.6 in)
- Cubical shape
- Flat and elongated particles limited to 25 to 30 percent
- Fines limited to 1 to 2 percent

Material Selection

Problem With Flat Aggregates

Module 7-2

Construction and Inspection

From… Maintenance Technical Advisory Guide (MTAG)

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CP² Task Group

Topics to be covered

- Construction Procedures
- Quality Control
- Inspection
- Troubleshooting

Construction

Construction - Conventional Chip Seal Procedure

1. Clean existing pavement
2. Apply binder
3. Spread aggregate
4. Roll
5. Allow binder to cure or cool
6. Broom loose aggregate
7. Apply a flush coat

Construction - Cleaning Existing Pavement

Construction - Start and Stop Application on Mat

Construction - Binder Application

Construction - Binder Overlap

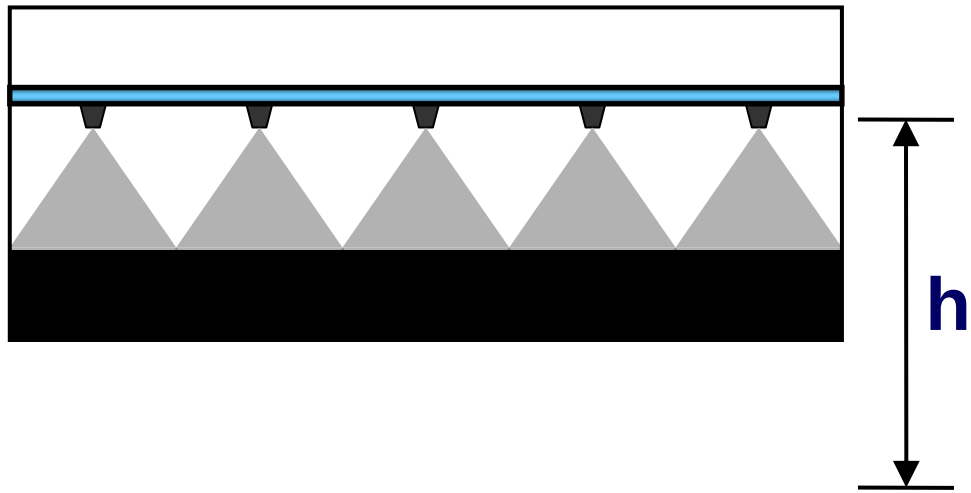
Spray Bar and Nozzles

Single Overlap

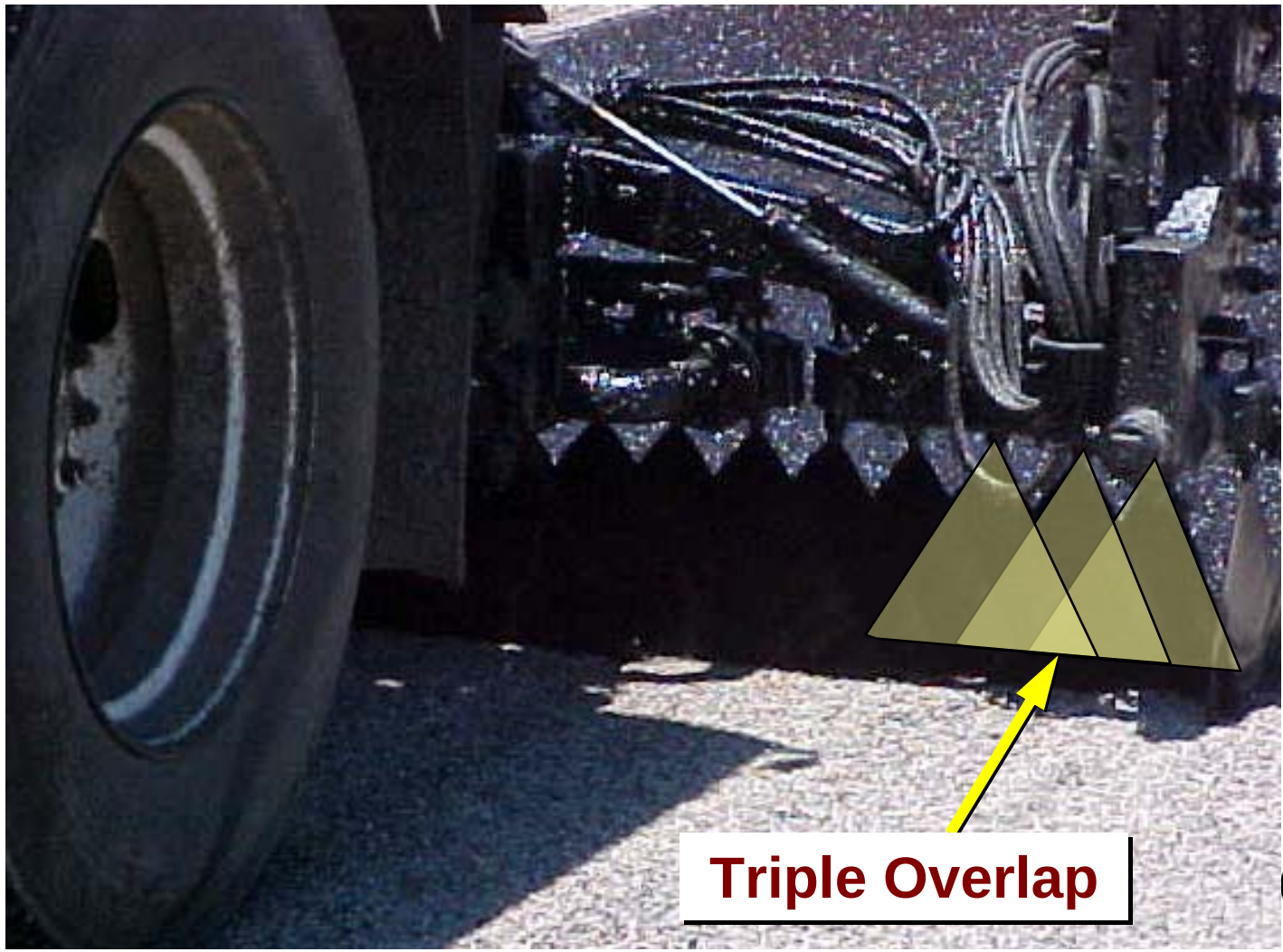
Double Overlap

Triple Overlap

Roadway Surface



Construction - Binder Application Overlap



Construction - Binder Application

Caltrans

CP² TASK GROUP

Construction - Aggregate Application

Construction - Aggregate Application

Construction - Rolling

- Immediate rolling of aggregate
- Pneumatic-tired rollers
- No fewer than three passes
- Full coverage necessary before asphalt cures or cools

Construction - Rolling

Construction - Rolling

Construction - Curing of Emulsion

- Time depends on temperature and relative humidity
- Emulsion break should begin just after first roller pass
- Open to traffic in about 2 hours

Construction – Cooling of Hot Binder

- Time depends on temperature and relative humidity
- Binder should be cured prior to open to traffic. Time frame is more like 3 to 6 hours depending on climatic conditions

Construction - Brooming Loose Aggregate

Quality Control - Preliminary Responsibilities

- Project review
- Document review
- Material checks

Quality Control - Pre-Application Inspection

- Surface preparation
- Equipment inspection
  - Asphalt distributor
  - Chip spreader
  - Haul trucks
  - Rollers
  - Brooms

Quality Control - Pre-Application Inspection (cont.)

- Weather requirements
- Determining application rates
- Checking application rates
- Traffic control plan and setup

Quality Control - Project Inspection

- Asphalt application
- Aggregate application
- Truck operation
- Rolling
- Longitudinal joints
- Transverse joints
- Brooming

Quality Control - Post-Application Inspection

- Cleanup
- Opening to traffic

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Troubleshooting

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What is wrong here?

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What is wrong here?

Troubleshooting
Possible Construction Problems

- Problem:

  Aggregate embedment > 80 percent

  - Potential causes? (Refer to Table 7-7)

Troubleshooting
Possible Construction Problems

- Problem:

  Aggregate embedment < 50 percent

  - Potential causes? (Refer to Table 7-7)

Troubleshooting

What is wrong here?

Troubleshooting

What is wrong here?

Troubleshooting

What happened here?

Thank You

Questions?