

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/yd² (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



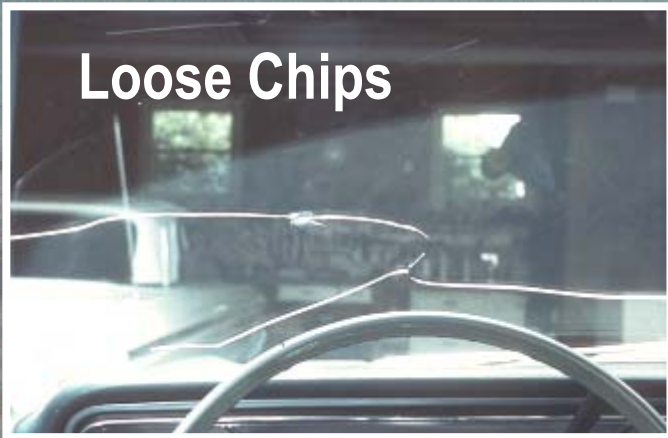


Proper Application

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Loose Chips



Bleeding



Streaking

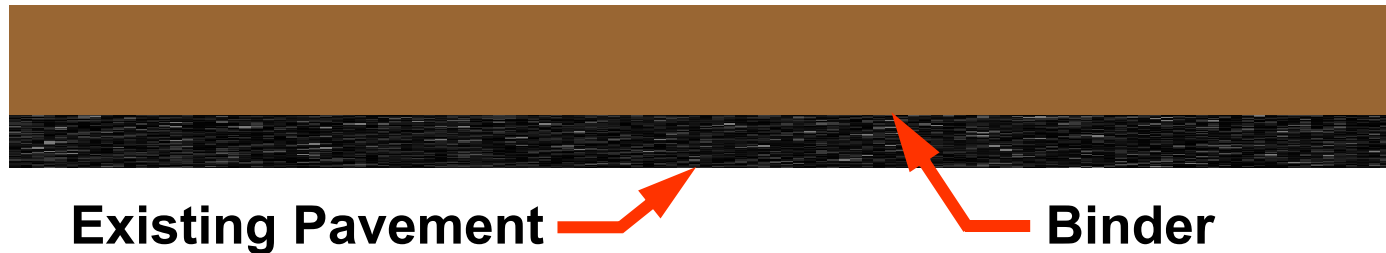


Chip Seal Variations

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

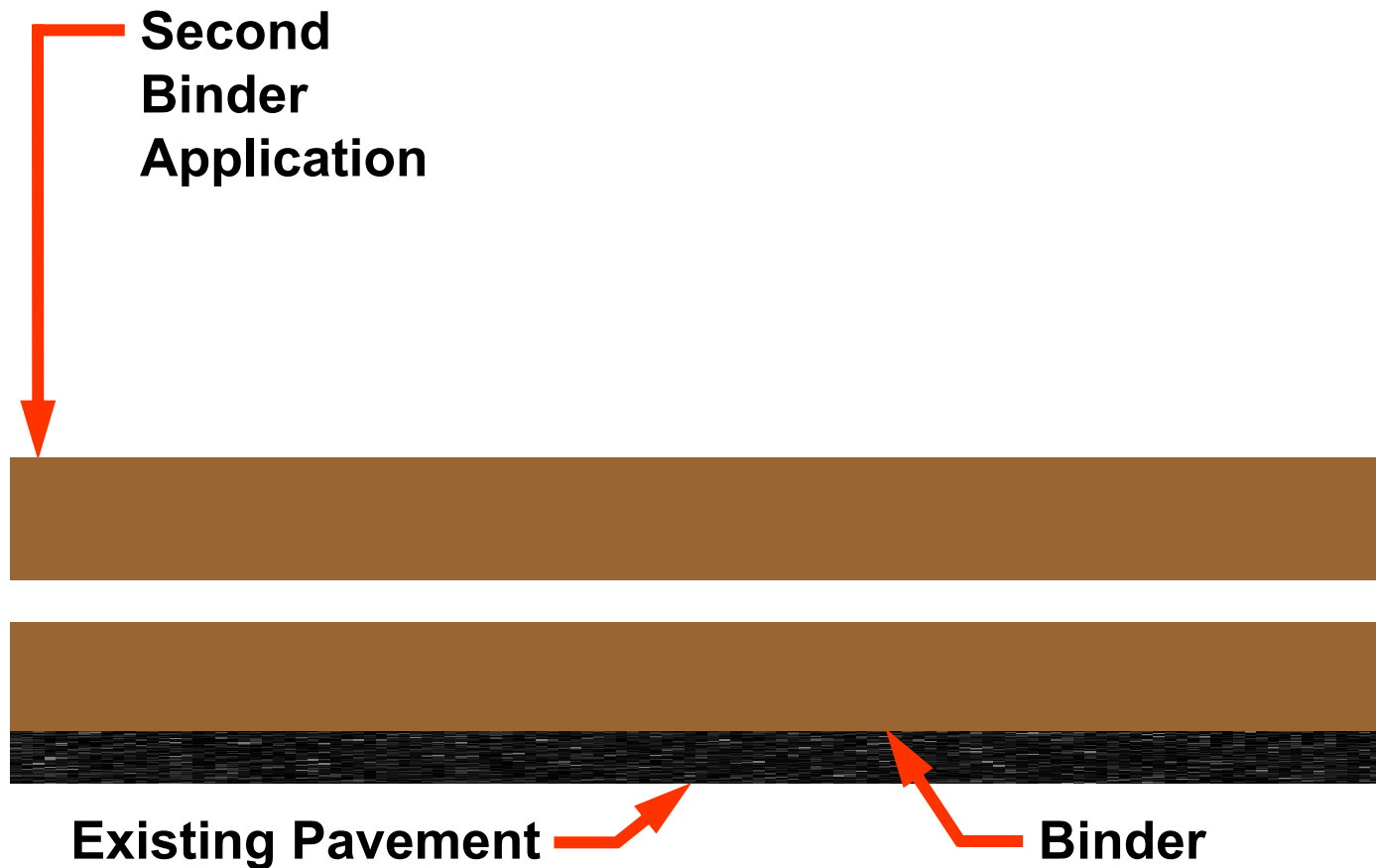
Chip Seal Variations

Single Chip Seals



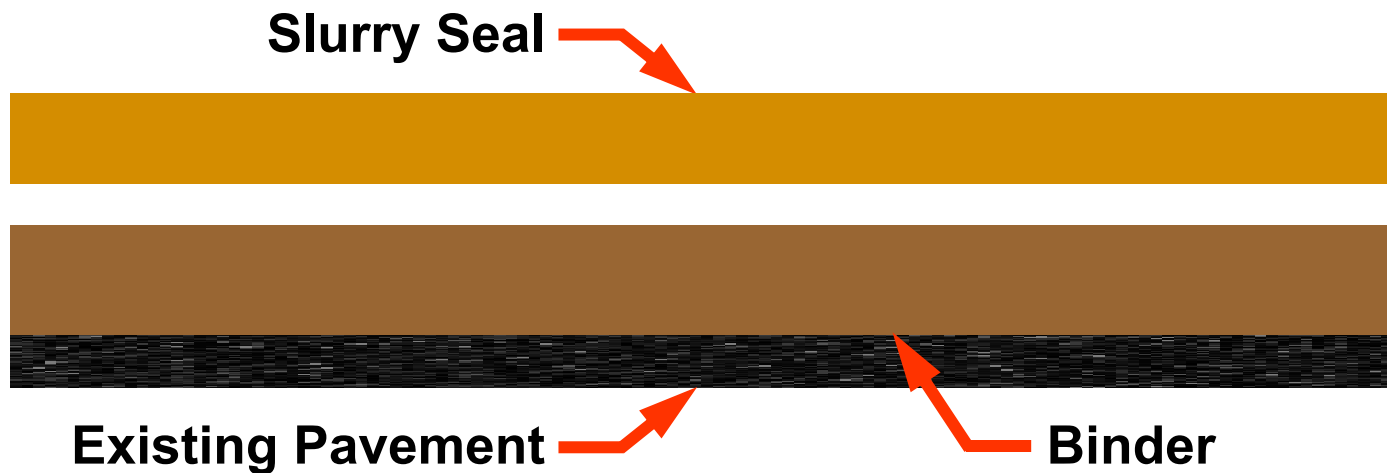
Chip Seal Variations

Double Chip Seals



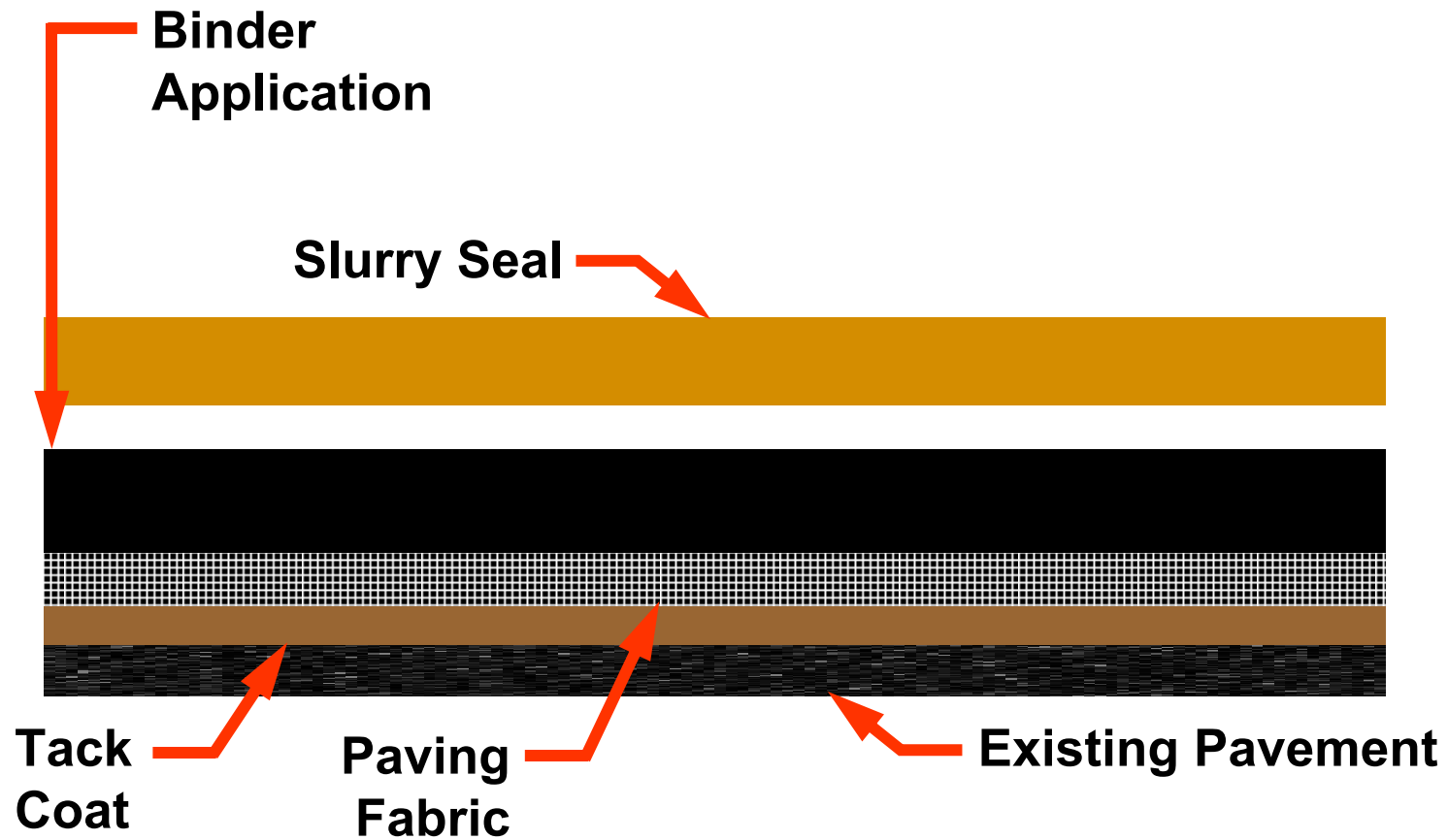
Chip Seal Variations

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

Asphalt Rubber Chip Seal

Reaction Vessel

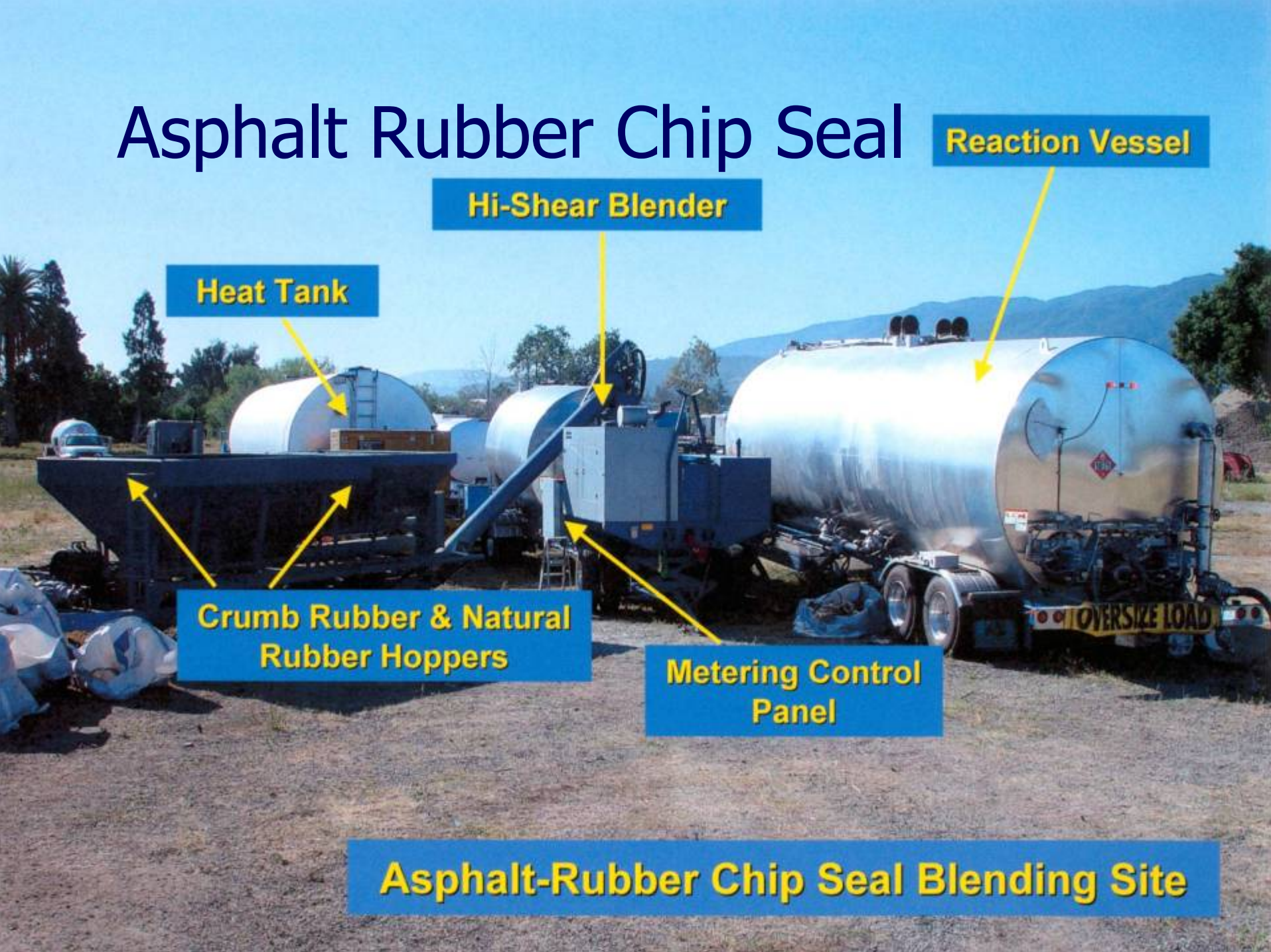
Hi-Shear Blender

Heat Tank

Crumb Rubber & Natural
Rubber Hoppers

Metering Control
Panel

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

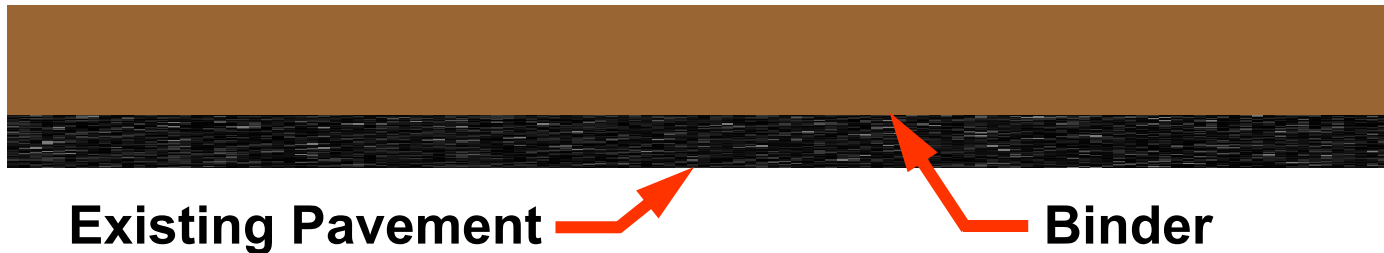
- ☐ Chips can be 1/4" up to 1/2" (18-35 lbs. / sy)
- ☐ Can be applied at temperatures down to 40° F
- ☐ Crack filling is not required

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
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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

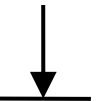
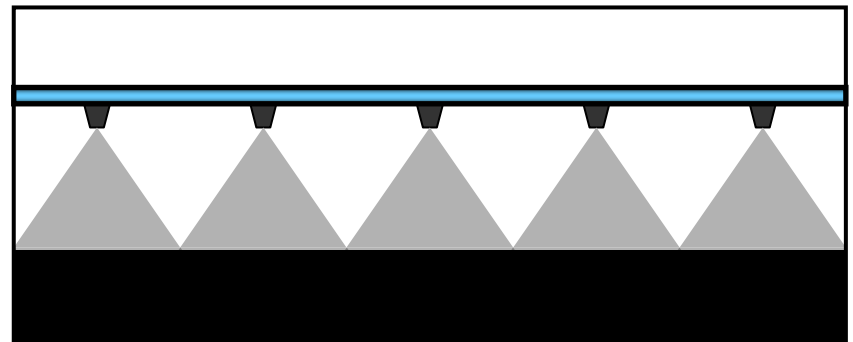
Spray Bar and Nozzles

Single Overlap

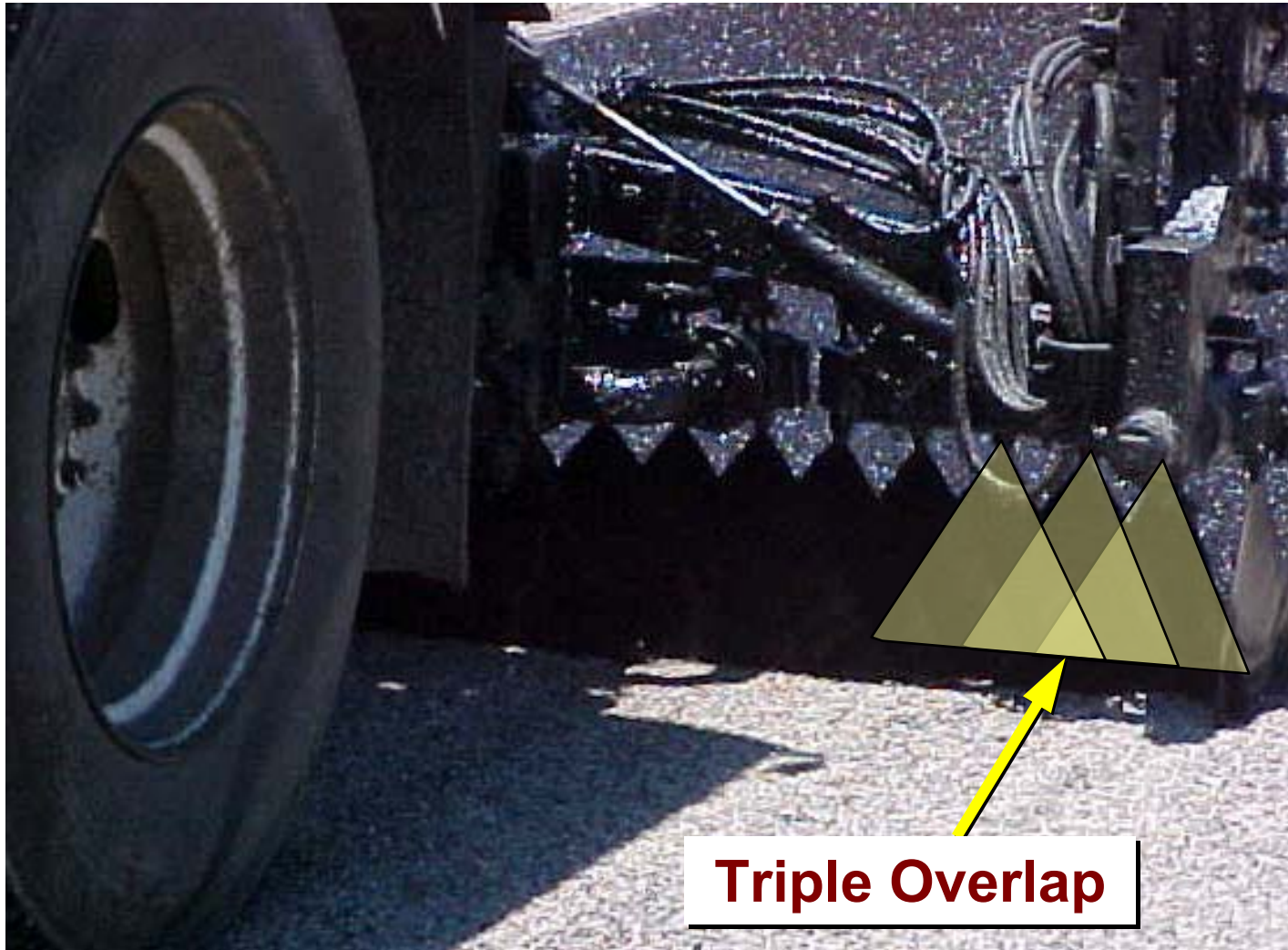
Double Overlap

Triple Overlap

Roadway Surface



Construction - Binder Application Overlap



Construction - Binder Application



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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Quality Control - Post-Application Inspection

- Cleanup
- Opening to traffic

Troubleshooting



Troubleshooting

What is wrong here?

Streaking



Troubleshooting

What is wrong here?

Poor Longitudinal Joint



Troubleshooting

What is wrong here?

Bleeding



Troubleshooting

What is wrong here?

Loss of Cover Aggregate



Troubleshooting

What is wrong here?

Non-uniform Aggregate Coverage



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?

Loss of aggregate due to inadequate curing



Troubleshooting

What is wrong here?

Single Overlap



Troubleshooting

What happened here?



Thank You

Questions?