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

Chapter 7 – Chip Seals
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

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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
Proper Application
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

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Chip Seal Variations

Single Chip Seals

Existing Pavement  Binder
Chip Seal Variations

Double Chip Seals

- Second Binder Application
- Existing Pavement
- Binder
Chip Seal Variations

Cape Seals

Slurry Seal

Existing Pavement

Binder
Chip Seal Variations
Fabric and Chip Seals

- Binder Application
- Slurry Seal
- Tack Coat
- Paving Fabric
- Existing Pavement
Chip Seal Variations
Fabric and Chip Seals

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Chip Seal Course
Training Modules Available

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

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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

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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

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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
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

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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

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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

Existing Pavement
Binder
Module 7-2

Construction and Inspection

From… Maintenance Technical Advisory Guide (MTAG)
Topics to be covered

- Construction Procedures
- Quality Control
- Inspection
- Troubleshooting

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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

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Construction - Start and Stop Application on Mat
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Construction - Binder Overlap

Spray Bar and Nozzles

Single Overlap

Double Overlap

Triple Overlap

Roadway Surface

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Construction - Binder Application
Overlap

Triple Overlap
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Construction - Aggregate Application

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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

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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

Chapter 7 – Chip Seals
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

Chapter 7 – Chip Seals
Quality Control - Preliminary Responsibilities

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Chapter 7 – Chip Seals
Quality Control - Post-Application Inspection

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Quality Control - Preliminary Responsibilities

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- Document review
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Chapter 7 – Chip Seals
Quality Control - Pre-Application Inspection (cont.)

- Weather requirements
- Determining application rates
- Checking application rates
- Traffic control plan and setup
Quality Control - Project Inspection

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- Truck operation
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- Longitudinal joints
- Transverse joints
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Chapter 7 – Chip Seals
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

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Troubleshooting

What is wrong here?

Single Overlap

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Troubleshooting
What happened here?

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Thank You

Questions?

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