Chip Seal Guide

Application and Construction
Pavement preservation Committee

- Doug Forstie, ADOT
- Jake Dominy, Cactus Transport (chairman)
- Chris McWenie, Sunland, Inc.
- Ron Harty, International Surfacing Systems
- Rob Presuhn, Intermountain Slurry Seal
- Kurt Alcumbrac, Southwest Slurry Seal
- Charlie Buchanan, Koch Asphalt Solutions Southwest
- Steve Dempsey, Paramount Petroleum Corp.
- Dennis Ryan, Ergon Asphalt Products, Inc.
- Larry Erickson Crafco Inc.
- Patty Southway, Mesa Materials
- Don Green, United Metro Materials
- John Vincent, Wright Asphalt
- Peggy Simpson, Western Emulsions
Why Are we here today?

- Surveys of Agencies tell us that we have room for improvement

- Chip seal is the single most cost-effective treatment available to our industry
Chip Seal Guide

Application & Construction Produced by:

- AGC Pavement Preservation Committee
  - agencies
  - contractors
  - material suppliers
- Why Do This?
  - identify best practices
  - produce guide for “world class” chip seal
  - Methodical approach to chip seal practices
The Government Accounting Standards Board “Statement 34” says that since 1973,

The national average daily traffic has increased by 86% and the average daily load has increased 550%

This is compared to the number of centerline miles of pavement has increased by only 3%.

MORE WITH LESS!
Definitions

- Chip Seal – application of a liquid asphalt and cover aggregate
- Surface Treatment – chip seal on aggregate base
- Seal Coat – chip seal on hot mix asphalt
- Guidelines apply to all
Purpose of a Chip Seal

- Provide superior, all-weather surface for aggregate surfaced roads
- Seal pavement from moisture
- Provide skid resistant surface
- Reduce dust
- Cost effective preventive maintenance application
Keys to Success

- Surface Preparation
- Materials
- Application Rates
- Construction Procedures
- Independent Inspection, Testing
- Methodic Attention to details
Surface Preparation

- Fix deficiencies
  - patch potholes
  - fill ruts
  - pour cracks
    - > 1/8-inch
Aggregate Materials

- Clean
- Durable
- Crushed
  - two or more crushed faces
- Single Sized
- Cubicle
## Aggregate Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Bulk Specific Gravity</td>
<td>Arizona Test Method 210</td>
<td>2.30 - 2.85</td>
</tr>
<tr>
<td>Combined Water Absorption</td>
<td>Arizona Test Method 210</td>
<td>Maximum 2.5 %</td>
</tr>
<tr>
<td>Sand Equivalent (Minus #8 Material)</td>
<td>Arizona Test Method 242</td>
<td>Minimum 45</td>
</tr>
<tr>
<td>Fractured Coarse Aggregate Particles</td>
<td>Arizona Test Method 212</td>
<td>Minimum 85 %</td>
</tr>
<tr>
<td>Flakiness Index</td>
<td>Arizona Test Method 233</td>
<td>Maximum 20 %</td>
</tr>
<tr>
<td>Carbonates in Aggregate</td>
<td>Arizona Test Method 238</td>
<td>Maximum 30 %</td>
</tr>
<tr>
<td>Abrasion</td>
<td>AASHTO T96</td>
<td>100 Rev., Max. 9 %</td>
</tr>
<tr>
<td>Sodium Sulfate Soundness (Loss @ 5 cycles)</td>
<td>ASTM C88</td>
<td>Maximum 10%</td>
</tr>
</tbody>
</table>
### Aggregate Gradation

*Low Traffic Volume*  (*1/4”)*

<table>
<thead>
<tr>
<th>Size</th>
<th>Percent Passing</th>
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<tbody>
<tr>
<td>1/ 2 inch</td>
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<tr>
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<td>100</td>
</tr>
<tr>
<td>1/ 4 inch</td>
<td>70 - 90</td>
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<td>No. 4</td>
<td>0 - 10</td>
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<td>No. 8</td>
<td>0 - 5</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 1.0</td>
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# Aggregate Gradation

*High Traffic Volume (3/8”)*

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Special Aggregate Requirements

(Pre-coat all cover aggregates)

- Hot Applied Asphalt
  - pre-coated aggregate
  - dry aggregate

- Asphalt Emulsions
  - pre-coated aggregate
  - damp aggregate
Binder Types

- Conventional Emulsified Asphalt Materials
- Modified Emulsified Asphalt Materials
- Polymer Modified Asphalt Materials
- Rubber/Asphalt Binder Materials
- Cutback Asphalt Materials
Modified Binders

- Modifier Types
  - polymers
  - crumb rubber
  - other additives
- High performance
  - high early strength
- Increased service life
Aggregate and Binder Application Rates

- Established by engineered chip seal *design*
  - the “science” part
- Design factors
  - Aggregate gradation and quality
  - Binder type
  - Porosity of roadway
  - Maintenance applications and timing
  - Traffic volume
Aggregate and Binder
Application Rates

- Ideal design results in:
  - One stone deep
  - About 60% embedment
  - 20% void space after some traffic
  - No bleeding
  - No flying chips

A reasonable “target” to start the project
Example Chip Seal Design

Do the Math!

**Calculate aggregate spread rate (S):**
- 0.31 avg particle size, 10% wastage
- 95 lbs/ft³ loose unit weight

\[
S = 0.8 \times 0.28 \times 95 \times 1.10 \\
S = 25 \text{ lbs/yd}^2
\]

**Calculate asphalt shot rate (A):**
- 0.60 traffic (heavy)
- 0.31 avg particle size
- 0.08 surface factor (porous)
- 0.67 residue factor (CRS-2P)

\[
A = (1.122 \times 0.31 \times 0.60) + 0.08 \\
A = 0.43 \text{ gal/yd}^2
\]
Construction Procedures
A methodic Approach

- Clean & dry Surface
- Surface Temp 85° F Minimum
- Ambient Temp 65° F Minimum
  - Caution if > 110° F
- No Threat of Rain
- Warm, Dry Period of Weather, No Wind
  - suggest no asphalt emulsions after October 15
To Joint or to Slobber
(a methodic approach)

- Decide on longitudinal joint method (lap or butt)
- Paper all transverse joints
- Be consistent
Seasonal Limitations

- **USE CAUTION AND COMMON SENSE**

- Mountain Areas > 5000 ft
  - June 1 – August 31

- Foothill Areas > 3500 ft
  - May 1 – September 30

- Deserts < 3500 ft
  - March 15 – November 15

What is the cost to re-do a bad job?
The Distributor

- Certified ADOT 404-3.02
- Good condition
- Uniform application
- Functioning CRC
- Nozzles correct type, **height**, angle, etc.
- Binder at proper temp
Spray bar height must be set exactly for proper coverage.
Volume Measurement

A methodic approach

- Do this often
  - track and record binder used for payment purposes. *Use two methods to verify*
  - check and record application rate for QC purposes. *Use two methods to verify*

- Steps
  - level distributor
  - record volume and temp gauges
AGGREGATE HAULING

- Tailgate discharge
- Positive attachment
- Compatible with chip spreader
Aggregate Application

- Self-propelled
- Calibrated daily w/CRC

- Good condition
- Uniform transverse application
Checking Aggregate Spread

to verify crc
Rolling

- Min 3 rollers, pneumatic-tired
- Roll immediately
- Operate in echelon
- Edge to edge rolling
- Match speed to chip spreader
  - max = 5 mph
- 3000 lbs/wheel
  90 psi or even psi
Sweeping

- Sweep as soon as binder sets
  - binder cure time
  - ambient temp
  - surface temp
- Later sweeping possible
- This will make you or “break” you
Traffic Control

- Keep your people safe
- Use all means to maintain control
- Keep off fresh chip seal
- Max speed 15 mph before sweeping
Specification control

Method specification:
(Cookbook method)
- By the square yard
- By the Ton
- combinations of area and tonnage

End result specifications:
(Warranty)
- contractor decides on aggregate asphalt combinations
- contractor controls application rates
Factors that will always affect your project:

- Temperature (Ground and air)
- Aggregate cleanliness
- Weather
- Shot rate
Quality Chip Seals
A methodic approach

- Necessary road repairs
- Good weather conditions
- High quality materials
- Have equipment ready, calibrated, and in good condition
- Have design ready (guide)
- Apply right amount of materials
- Immediately apply and roll aggregate
- Sweep as soon as binder sets
- Safe and effective traffic control
To Serve and Protect!
Since 1934