Shingles: Problems and Solutions
Or
Mistakes I Have Made

Steve Jackson
NB West Contracting
St. Louis, MO
N.B. West Contracting

- Founded in 1956
- Two Offices –
  - St. Louis and Sullivan, MO
- 3 Asphalt Plants
  - 300,000 -500,000 Tons Annually
- Novachip, Warm Mix Asphalt, Chip and Seal, some HMA
Ode to David Letterman

- Top 10 Shingles Problems and Solutions from the home office in Indianapolis, IN.
Top Ten Shingle Problems and Solutions

10. Shingles have too much moisture in them causing feed problems, clumps in the mix, rich spots in the mix or dry mix.

Solution: Use Warm Mix Asphalt chemical additive with a good surfactant and cover the shingle pile.
Collar on Asphalt Plant

Clogged every 7,000 Tons
Recycle Chute on Asphalt Plant
Cover the Shingles
9. Shingles are **Too Large** and pop up behind the rollers, mix looks brown, mix falls apart.

Solution: Use MoDOT spec 403.2.6.2

“Shingles shall be ground to 3/8” minus.”
Smaller ground shingles are easier to use, but they take longer to grind
- Release more oil
- “Dissolve” into the asphalt mix easier
- Less chance of tab “pop-ups”
Shingle Grinding
Processed Shingles 2005
Top Ten Shingle Problems and Solutions

8. Over heating the mix to get all of the oil out of the shingles

Solution: Turn the temperature down and add more virgin asphalt cement. High temperatures cause the mix to be brittle.

MoDOT maximum temperature 350°F
Top Ten Shingle Problems and Solutions

7. High shingle content in the mix. Shingle binder is too hard. Mix is prone to cracking.

Or Polymer Modified Asphalt with shingles leads to a hard binder.

Solution: Specify PG XX-28 asphalt cement. MoDOT 403.2.6.2. “Softer” binder provides better crack resistance.
PG 70-22 with 4% Shingles and 11% RAP
Rte. 63 Rolla
6. Thin lift BP-2, 1” or less, high shingle content, mix experiences segregation or shadowing.

Solution: Increase lift thickness, increase mix temperature slightly, use a transfer machine.

Shingle oil “cools” more quickly than virgin on long hauls.
BP-2 or Surface Leveling

» Revised the VMA requirements
  - 13% to 14%
  - Air Voids changed from “3.5% to 4.5%” to 3.5%
  - Reduced field tolerance on AC content from 0.5% to 0.3%
Top Ten Shingle Problems and Solutions

5. High deleterious content in shingles.

Solution: Start with a cleaner source of shingles. Remove as much trash as possible before grinding.
Deleterious Material

- Nails
- Wood
- Plastic
- Cellophane
- Paper
- Fiber Board
Shingle Collection 2010
4. Mix Design: Shingle mix meets all of the requirements on paper, mix looks brown, ship it.

Solution: The mix has to perform in the field. It may meet spec but your laydown crew still has to build the job. Check reasonableness of design, develop a history of successful mixtures.
Top Ten Shingle Problems and Solutions

3. Mix Design: Using too high of specific gravity for the shingles to meet VMA requirements.

Solution: Use a specific gravity that represents the material.
Top Ten Shingle Problems and Solutions

2. Mix Design: Using high asphalt content percentages when designing the mix.

Solution: Do not use the highest asphalt content to design your mix with.
# Shingle Specific Gravity

<table>
<thead>
<tr>
<th>SHINGLES SPECIFIC GRAVITY</th>
</tr>
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<tbody>
<tr>
<td>Dry Sample Weight:</td>
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<tr>
<td>Volumeter Weight:</td>
</tr>
<tr>
<td>Wt. of Volumeter + Sample + Water:</td>
</tr>
<tr>
<td>Dry Back:</td>
</tr>
<tr>
<td>Gmm:</td>
</tr>
<tr>
<td>Gb From Shingles:</td>
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<tr>
<td>% AC From Shingles:</td>
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<tr>
<td>Gse:</td>
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## Change AC content in shingles from 23% to 28%

<table>
<thead>
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<tbody>
<tr>
<td>Dry Sample Weight:</td>
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<td>Wt. of Volumeter + Sample + Water:</td>
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<tr>
<td><strong>Gmm:</strong></td>
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<tr>
<td>Gb From Shingles:</td>
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<tr>
<td>% AC From Shingles:</td>
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<tr>
<td><strong>Gse:</strong></td>
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</tbody>
</table>
Impact

- Shingle Gse changes from 2.472 to 2.739
- VMA increases 0.4% at 3% shingles.
- VMA increases 0.7% at 5% shingles.
Top Ten Shingle Problems and Solutions

1. Over Usage of Shingles as a binder replacement. Trying to use too high of a percentage of shingles.

Solution: Design a mix that has a reasonable amount of shingles.
Shingle Issues

◆ If 3% is good 12% is 4 times as good
  ◆ Durability issues

◆ Wet weather paving without Evotherm
  ◆ Virgin aggregate moisture
  ◆ RAP moisture
  ◆ RAS moisture

◆ Cold weather paving without Evotherm
How to avoid mix design problems - Agency

- Use “Joe’s Spreadsheet” for Effective Binder Replacement

- “RAP AsphaltPercentEffective”

## Contribution of Binder from Recycled Materials

### Effective Binder Computation

<table>
<thead>
<tr>
<th>Pb</th>
<th>Gmm</th>
<th>2.461</th>
<th>Gse</th>
<th>2.670</th>
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<tbody>
<tr>
<td>Pbmv w/o RAS</td>
<td>4.48</td>
<td>Gb</td>
<td>1.026</td>
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<tr>
<td>Pbmv w/ RAS</td>
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<td>Gsb</td>
<td>2.598</td>
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<table>
<thead>
<tr>
<th>Stockpile</th>
<th>Type</th>
<th>P_s</th>
<th>P_br</th>
<th>P_{sr} x P_{br}</th>
<th>F*</th>
<th>P_{smv}</th>
<th>P_{smr}</th>
<th>P_{bmr}</th>
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<td>15.53</td>
<td>0.77</td>
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</table>

| Pb_{be}   | 4.29  |
| P_{bev}   | 2.99  |
| P_{smv}   | 76.78 |
| P_{sr} x P_{br} | 1.32 |
| P_{smr}   | 17.92 |
| P_{bmr}   | 1.25  |

F = 1.00

* Leave F blank to calculate, then insert calculated F in table.
## Contribution of Binder from Recycled Materials

### Effective Binder Computation

<table>
<thead>
<tr>
<th>Stockpile</th>
<th>Type</th>
<th>$P_s$</th>
<th>$P_{br}$</th>
<th>$P_{sr} \times P_{br}$</th>
<th>$F*$</th>
<th>$P_{smv}$</th>
<th>$P_{smr}$</th>
<th>$P_{brm}$</th>
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<td>94.29</td>
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</table>

$P_{be}$ = 4.60  

$P_{bev}$ = 2.90  

$P_{smv}$ = 76.59  

$P_{sr} \times P_{br}$ = 1.50  

$P_{smr}$ = 17.7  

$P_{brm}$ = 1.42  

Total binder ($P_b$) overestimated from reclaimed binder contribution.

* Leave $F$ blank to calculate, then insert calculated $F$ in table.
2012 Changes

- BP-1, BP-2, BP-3 and Bit Base Mixes
  - Lowered the design air voids to 3.5%
  - Increased the VMA requirement on BP-1 and BP-2 (13.5% and 14.0%)
  - Reduced the field tolerance from 0.5% to 0.3% on the asphalt content during production
  - Reduced the design gyrations from 50 to 35. 35 blow Marshall still acceptable
Warm Mix Asphalt and Shingles

- Warm Mix Asphalt
  - Longer Haul
  - Lower Temperatures
    - Moisture?
    - TSR impact
    - Stiff binder
  - Less Aging of Binders
    - Shingles have stiff oil
Warm Mix & Shingles

- **Evotherm 3G M1**

- Surfactant
  - Works with residual moisture in the shingles

- Lower Drying Costs

- Anti-Strip Agent
Warm Mix & Shingles

- **Evotherm 3G M1**
- Compaction Aid
  - Stiffer RAS Oil
- Longer Haul Distances
- Cold Weather Paving
  - 14° F lowest so far
Continuous Grade

- PG 64-22 w/ 38% Virgin Binder Replacement
- WMA with Evotherm
- HMA
# Continuous Grade

<table>
<thead>
<tr>
<th></th>
<th>WMA with Evotherm 3G M1</th>
<th>HMA</th>
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<tbody>
<tr>
<td>High</td>
<td>80.4</td>
<td>82.2</td>
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<tr>
<td>Intermediate</td>
<td>26.6</td>
<td>27.1</td>
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<tr>
<td>Low</td>
<td>-18.9</td>
<td>-17.5</td>
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</tbody>
</table>
Rte. 50, Gasconade County
Hot Mix Asphalt

- SP 125C, PG 64-22
  - RAP
  - Shingles
  - Hot Mix Asphalt
- 60 minute haul to the job
- Experienced VMA Collapse
Rte. 50 Warm Mix Asphalt

◆ 1st Day of Warm Mix
◆ Air voids: 3.5%
◆ Density: 95.9%, 96.1%
◆ Joint Density: 95.0%

◆ Smoothness improved
  □ Less joint bumps
Rte. 50 Warm Mix Asphalt

- **Job Overall**

- **Average density (Job):** 93.5%
  - 19.1% DEDUCT on density
  - Target Range 94.0% +/- 2.0%
Summary

- Shingles are good
- Too many can cause problems
- Proper mix design is essential

Quality Control
- Moisture
- Dust
Contact Information

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