Basics of a Good Road: Part 3

Foundation Prep, Testing Standards, Quality and Inspection
Pavement Performance

- Appropriate Specifications
- Adequate and Properly Prepared Foundation
- Adequate Thickness for Traffic Use
- Appropriate and Quality Materials
- Appropriate Blend of Materials (Mix Design)
- Plant Production Control (Mixture QC)
- Placement Control (QC & Inspection)
Appropriate Specifications

Industry Road Construction Standard (not just for State Highways)

(Section 400 & 900)

AMERICA RIDES ON US
Preparation for Paving

• New Construction
  – Subgrade Treatments
  – Proofrolling

• Base Widening & Profile Correction

• Overlays
  – Wedge and Level
  – Base Widening

• Patching
• Milling
• Tack Coat
A pavement asset starts with a good foundation
Subgrade Treatment Types
–New Construction

- Compacted Aggregate Base (CAB) #53's
- Chemical Stabilization
- Compacted Soil (Density & Moisture)
- CAB w/ Geogrid
- Geogrid

Subgrade (foundation)
Testing the Foundation

- **Proofrolling** - (Loaded Triaxle)
- **In-Place Moisture-Density**
  - Nuclear
  - Sand cone
- **Dynamic Cone Pentrometer (DCP)** – measures stiffness
Widening

• 402 mixtures
• Pay Item - “Widening with HMA, Type _____”
• Cost of excavation & disposal included in “Widening” pay Item
• ≤ 3.0 ft. – use trench roller
• Roller passes specified
Wedge & Level

- 402 mixtures
- Current use of W & L is generally being replaced by Milling
- Pay Item - “HMA Wedge and Level, Type_____”
Widening & Profile Correction
AMERICA RIDES ON US
Crown Wedge
The Problem with Wedging

Non-uniform compaction

Too thin, fractures course rock, drags screed, poor compaction

Too thick, poor compaction
## Mixture Thickness Standard

\[2 - 4 \times \text{Max. Particle Size}\]

<table>
<thead>
<tr>
<th>Layer</th>
<th>NMAS</th>
<th>Max. size of aggregate in mixture</th>
<th>Recommended Compacted Thickness Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>4.75mm (#4 sieve)</td>
<td>3/8”</td>
<td>3/4” -1-1/2”</td>
</tr>
<tr>
<td></td>
<td>9.5 mm (3/8”)</td>
<td>1/2”</td>
<td>1”-2”</td>
</tr>
<tr>
<td></td>
<td>12.5 mm (1/2”)</td>
<td>3/4”</td>
<td>1-7/8”-3.0”</td>
</tr>
<tr>
<td>Intermediate</td>
<td>9.5 mm (3/8”)</td>
<td>1/2”</td>
<td>1.0”-2.0”</td>
</tr>
<tr>
<td></td>
<td>12.5 mm (1/2”)</td>
<td>3/4”</td>
<td>1 7/8”-3.0”</td>
</tr>
<tr>
<td></td>
<td>19.0 mm (3/4”)</td>
<td>1.0”</td>
<td>2.0”-4.0”</td>
</tr>
<tr>
<td></td>
<td>25.0 mm (1.0”)</td>
<td>1-1/2”</td>
<td>3.0”-6.0”</td>
</tr>
<tr>
<td>Base</td>
<td>19.0 mm (3/4”)</td>
<td>1.0”</td>
<td>2.0”-4.0”</td>
</tr>
<tr>
<td></td>
<td>25.0 mm (1.0”)</td>
<td>1-1/2”</td>
<td>3.0”-6.0”</td>
</tr>
</tbody>
</table>
MILLING BENEFITS

- Removal of distressed pavement
- Improved smoothness
- Reshape Cross slopes (uniform overlay thickness)
- Eliminate shoulder work after new layer(s) are placed (inlay).
- Maintain or create curb exposure
- Maintain clearances at overhead structures.
MILLING BENEFITS (cont’d)

• Maintain or create drainage.
• Transition between HMA layers
• Transition to approaches or other existing pavements.
• Removal of any existing asphalt joint repair material.
• Create a textured surface to help prevent sliding of new HMA overlays.
Milling Types

- Asphalt scarification & profile
- Approach milling
- Asphalt Milling
- Asphalt removal
- PCCP milling
- Transition milling
Asphalt scarification and profile

- Prepare a base for resurfacing by removing the existing asphalt material. (crack sealing)
- The entire surface will be roughened by the milling process.
- This item may specify cross slope correction.
- QCP straightedge and Macrotexture requirements apply to this item.
- 5 day cover on the mainline. 10 days off the mainline.
Approach Milling

- Milling the surface and cutting a wedge at the driveways, commercial or public road approaches.
- $\frac{1}{4}''$ minimum depth (texturing).
- Automatics not required
- No macrotexture & straightedge required.
Asphalt Milling

- Removal by milling to a specified average depth. (Ex. “Milling, asphalt, 1.5”)
- This item may also specify cross slope correction/maintenance.
- Macrotexture and grade requirements apply.
- 5 day cover-up
Asphalt Removal

- Complete removal of the existing asphalt (by milling) from a Portland cement concrete or brick base.
- Minor amounts of asphalt pavement material bonded to a concrete base at joints and cracks may remain in place.
- Macrotecture and grade requirements do not apply.
PCCP Milling

• Consists of preparing a base for resurfacing by removing the existing PCCP material to a specified average depth. (Ex. Milling, PCCP, 1.5”)

• Macrotexture and grade requirements apply.
Transition milling

• Cutting a wedge at the beginning and ending of projects and paving exceptions. The existing pavement shall be cut to provide a nearly vertical face of 1.5” for the termini of each overlay lift of base.

• Automatics grades controls not required

• QCP standards do not apply to this item.
MILLING TEXTURE

- Drum condition
  Holders/ teeth
- Drum type
  Standard spacing or micro-milling
- Drum RPM
- Machine working speed
- Roadway conditions
  Unraveling
Patching

- Marked by agency personnel
- 402 mixtures
- Typical Sections
- Pay Item - “HMA Patching, Type _____”
- Excav. & Prep. cost included in Patching
Sample Typical Section for Patching

- 165 lb/yd² QC/QA HMA, 2, 64, SURFACE 9.5 mm
- 275 lb/yd² QC/QA HMA, 2, 64, INTERMEDIATE 19.0 mm
- HMA FOR PATCHING, TYPE B
- EXISTING PAVEMENT
- VARIES
Tack Coat
Tack Application

- **Materials**
  - AE-T
  - AE-PMT
  - SS-1h
  - AE-NT

- **Application Rate** = 0.03 - 0.08 gallons/ sys
- Too little is better than too much
- Uniformly without puddling or streaking
Tacking the Edges
AMERICA RIDES ON US

OK?
Partially Broken Tack
Traits of a Good Asphalt Pavement?

Need Appropriate Materials and Mix Design to Achieve
Testing Standards
One size does not fit all
Mix Type Selection

- ESAL’s (Equivalent Single Axle Load)
  - Traffic Type (trucks) and Volume
  - Design life
- Traffic Speed
  - High, Slow or Stopped
- Layer
  - Base, Intermediate, Surface, Drainage
- Design Thickness
18 kip - ESAL’s’s

One

= 6000
<table>
<thead>
<tr>
<th>ESAL Cat.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>ESAL s</td>
<td>&lt;0.3M</td>
<td>.3-3M</td>
<td>3-10M</td>
<td>10-30M</td>
<td>&gt;30M</td>
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<tr>
<td>Approx. AADT</td>
<td>4000</td>
<td>4k-15k</td>
<td>15k-30k</td>
<td>&gt;30k</td>
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<tr>
<td>Design Gyrations</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>100</td>
<td>125</td>
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<tr>
<td>% Crushed</td>
<td>55</td>
<td>75</td>
<td>85/80</td>
<td>95/90</td>
<td>100</td>
</tr>
</tbody>
</table>
Job Mix Formulae

- Superpave® System (SP Gyratory Compactor)
- Mix Design - laboratory process for material selection and proportioning to develop a job mix formula (JMF)
SUPERPAVE DESIGN METHODS

- Gyratory Compactor (SGC)
- Superpave Gradation Master Bands
- Traffic Categories (ESAL’s)
- Aggregate properties (consensus)
- Trial blends (trial and error)
- Blend selection and binder content
- Stripping test verification
Design Test Properties

- Maximum Specific Gravity
- Bulk Specific Gravity
- Voids in the Mineral Aggregate (VMA, packing of the aggregates)
- Air Voids (AV) (target = ±4.0%)
- Voids filled with Asphalt (VFA)
- Moisture sensitivity (stripping potential)
## INDOT DMF/JMF Standard Form

**INFORMATION FOR INDOT DMF/JMF STANDARD FORM**

**HMA PRODUCER:**
Roth-Riley Const. Co. Inc.

**PLANT LOCATION:**
90th St.

**CERTIFIED PLANT NUMBER:**
3316

**APPROVED DESIGN LAB:**

- **MATERIALS (Aggregate Size / Source / Ledge / %):**
  - #11 Slag Beemsterboer, 18.0%
  - #11 Dolomite Delphi #2421, DRM72034, L1-3, 21.0% Used
  - #24 Dolomite SS Delphi #2421, DRM72034, L1-3, 24.5% Used
  - #24 Slag, M-M #3311, O.F., 20.0%
  - #11 Steel Slag Pittsburg, 2186, 8.0%
  - Shingles, 2.0%
  - 1/4" Frap, Roth-Riley #3316, 5.0%
  - SHF-Roth-Riley #3316, 1.5%

**PG BINDER (Grade / Source):**
64-22

**OTHER ADDITIVES (Type / Source / Rate):**

---

**DMF/JMF number (401 only):**

<table>
<thead>
<tr>
<th>RAP in mixture, %</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAP binder, extracted, %</td>
<td>5.2</td>
</tr>
</tbody>
</table>

**DMF/JMF number (402 only):**

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Ignition oven test temp., °C (°F)</th>
<th>538 c</th>
</tr>
</thead>
<tbody>
<tr>
<td>All applicable 401 ESAL Categories</td>
<td>Ignition oven calibration factor</td>
<td>0.57</td>
</tr>
<tr>
<td>All applicable 402 Types</td>
<td>Ignition oven number</td>
<td>3316</td>
</tr>
<tr>
<td>PG-High Temp. Grade (equivalent)</td>
<td>Binder, ignition (actual), %</td>
<td>8.0</td>
</tr>
<tr>
<td>Mixture course</td>
<td>Binder, extracted, %</td>
<td>5.8</td>
</tr>
<tr>
<td>Mixture designation</td>
<td>Extraction required?</td>
<td>*Yes or No</td>
</tr>
<tr>
<td>Maximum particle size</td>
<td>Binder, calculated effective, %</td>
<td>4.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spec</th>
<th>Mass</th>
<th>Volume</th>
<th>Gyrations N/n0/Nmax</th>
<th>8</th>
<th>100</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Pass 37.5mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>Mass gyratory p/q @ Nides, g</td>
<td>4820.8</td>
<td></td>
</tr>
<tr>
<td>%Pass 25.0mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>Gmm</td>
<td>2.529</td>
<td></td>
</tr>
<tr>
<td>%Pass 19.0mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>Gmm w/dry back?</td>
<td>Yes or No</td>
<td></td>
</tr>
<tr>
<td>%Pass 12.5mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>Gmm % @ N 0 and Nmax</td>
<td>96.7</td>
<td>97.5</td>
</tr>
<tr>
<td>%Pass 9.5mm</td>
<td>60-100</td>
<td>60</td>
<td>100</td>
<td>Gmm % @ N 00</td>
<td>2.428</td>
<td></td>
</tr>
<tr>
<td>%Pass 4.75mm</td>
<td>&lt;= 60</td>
<td>60.3</td>
<td>60.6</td>
<td>Air Voids @ N 00</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>%Pass 2.36mm</td>
<td>90-67</td>
<td>46.5</td>
<td>50.0</td>
<td>VMA @ N 00</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>%Pass 1.18mm</td>
<td>26.4</td>
<td>26.8</td>
<td>26.8</td>
<td>VFA @ N 00</td>
<td>7.41</td>
<td></td>
</tr>
<tr>
<td>%Pass 600μm</td>
<td>18.4</td>
<td>18.6</td>
<td>18.6</td>
<td>Coarse agg. ang. 1 &amp; 2 face, %</td>
<td>65.0</td>
<td></td>
</tr>
<tr>
<td>%Pass 300μm</td>
<td>11.8</td>
<td>11.6</td>
<td>11.8</td>
<td>Fine aggregate angularity</td>
<td>47.4</td>
<td></td>
</tr>
<tr>
<td>%Pass 150μm</td>
<td>7.2</td>
<td>7.3</td>
<td>7.3</td>
<td>Sand equivalency</td>
<td>90.1</td>
<td></td>
</tr>
<tr>
<td>%Pass 75μm</td>
<td>2-10</td>
<td>4.8</td>
<td>4.9</td>
<td>Dust/calc. effective binder</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

**Aggregate blend Grb | 2.700**

**Mix temp. Min. °C (°F):**
127°C

**Mix temp. Max. °C (°F):**
160°C

**Mix compaction temp. lab °C (°F):**
150°C

*Note: Written request required, submit with DMF*

**MAF by DMF for PE/PS:**
1.026
**HMA PRODUCER:** Rieth-Riley Const. Co., Inc.

**PLANT LOCATION:** 96th St

**CERTIFIED PLANT NUMBER:** 3316

**APPROVED DESIGN LAB:**

**MATERIALS (Aggregate Size / Source / Ledge / %)**

- **#11 Slag Beemsterboer:** 18.0%
- **#11 Dolomite Delphi #2421, Q#972034, L1-3, 21.0% Used**
- **#24 Dolomite SS Delphi #2421, Q#972034, L1-3, 24.5% Used**
- **#24ss, M-M #2311, Q#., 20.0%**
- **#11 Steel Slag Pittsboro, #2186, 8.0%**
- **Shingles, 2.0%**
- **-1/4" Frap, Rieth-Riley #3316, 5.0%**
- **BHF-Rieth-Riley #3316, 1.5%**
- **PG BINDER (Grade / Source):** 64-22

**OTHER ADDITIVES (Type / Source / Rate)**
### Material Code

- **All applic. 401 ESAL**
- **Categories**: 4
- **All applicable 402 Types**: A,B,C,D
- **PG-High Temp. Grade (equivalent)**: Surface
- **Mixture designation**: 9.5mm

### Maximum particle size

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<tr>
<th></th>
<th>Spec</th>
<th>Mass</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Pass 37.5mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>%Pass 25.0mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>%Pass 19.0mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>%Pass 12.5mm</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>%Pass 9.5mm</td>
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<td>92.6</td>
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<tr>
<td>%Pass 4.75mm</td>
<td>&lt;90</td>
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<tr>
<td>%Pass 2.36mm</td>
<td>32-67</td>
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<tr>
<td>%Pass 1.18mm</td>
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<td>29.8</td>
<td></td>
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<tr>
<td>%Pass 600µm</td>
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<tr>
<td>%Pass 300µm</td>
<td>11.6</td>
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</tr>
<tr>
<td>%Pass 150µm</td>
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<tr>
<td>%Pass 75µm</td>
<td>2-10</td>
<td>4.8</td>
<td>4.9</td>
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### Aggregate blend Gsb

- **2.700**

### Mix temp. Min. °C (°F)

- **127c**

### Mix temp. Max. °C (°F)

- **160c**

### Mix compaction temp. lab °C (°F)

- **150c**
<table>
<thead>
<tr>
<th>Test Parameter</th>
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<tr>
<td>RAP in mixture, %</td>
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<tr>
<td>RAP binder, extracted, %</td>
<td>5.2</td>
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<tr>
<td>Ignition oven test temp., °C (°F)</td>
<td>538 c</td>
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<td>Ignition oven calibration factor</td>
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<tr>
<td>Ignition oven number</td>
<td>3316</td>
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<tr>
<td>Binder, ignition (actual), %</td>
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<tr>
<td>Binder, extracted, %</td>
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<tr>
<td>*Extraction required?</td>
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<td></td>
</tr>
<tr>
<td>Binder, calculated effective, %</td>
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<td></td>
</tr>
<tr>
<td>Gyrations Nini/Ndes/Nmax</td>
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<td>100</td>
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<tr>
<td>Mass gyratory pill @ Ndes, g</td>
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</tr>
<tr>
<td>Gmm</td>
<td>2.529</td>
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<tr>
<td>Gmm w/ dry back?</td>
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<td>Gmm % @ Nini and Nmax</td>
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<td>Gmb @ Ndes</td>
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<tr>
<td>Air Voids @ Ndes, %</td>
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<td></td>
</tr>
<tr>
<td>VMA @ Ndes, %</td>
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</tr>
<tr>
<td>VFA @ Ndes, %</td>
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<td>Coarse agg. ang. 1 &amp; 2 face, %</td>
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<tr>
<td>Fine aggregate angularity</td>
<td>47.4</td>
<td></td>
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<tr>
<td>Sand equivalency</td>
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<td></td>
</tr>
<tr>
<td>Dust/calculated effective binder</td>
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<tr>
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<tr>
<td>Date ignition.oven samples submitted</td>
<td>upon request</td>
<td></td>
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<tr>
<td>MAF calculated by Designer</td>
<td>1.026</td>
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<tr>
<td>MAF by DMTE for PE/PS</td>
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**INDIANA DEPARTMENT OF TRANSPORTATION**

**DIMENSION OF MATERIALS AND TESTS**

**HMA PRODUCER:** Rath-Ray Constr. Co., Inc. 965 S. 2349

**PLANT LOCATION:** 965 S. 2349

**CERTIFIED PLANT NUMBER:** 3316

**APPROVED DESIGN LAB:** 3316

**MATERIALS (Aggregate Size / Source / ledge / %):**
- #11 Slag Beaumite: 18.0%
- #11 Dolomite Delphi #926-2349: 1.0 (%): 24%
- #24 Dolomite SS Delphi #926-2349: 1.0 (%): 28%
- #11 Slag Polk Polk #926-2349: 1.0 (%): 29%
- #1 Slag Beaumite: 18.0%

**Gyrations Nini/Ndes/Nmax:** 8 100 160

**Air Voids @ Ndes, %:** 4.0

**VMA @ Ndes, %:** 15.5

**MAF calculated by Designer:** 1.026

**MAF by DMTE for PE/PS:** 1.026
Quality and Inspection
A System is in Place........

- Primary Reference
  - Material Specs
  - Construction Specs
  - Sampling Testing & Procedures
    - ASSHTO
    - ASTM
    - ITM
- Certification Programs
Reference INDOT Standard HMA Specifications and you get……..

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Status</th>
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<tbody>
<tr>
<td>Certified HMA Plant</td>
<td>✓</td>
</tr>
<tr>
<td>Certified CAPP Aggregates</td>
<td>✓</td>
</tr>
<tr>
<td>Certified Asphalt Supplier</td>
<td>✓</td>
</tr>
<tr>
<td>Certified HMA Technicians</td>
<td>✓</td>
</tr>
<tr>
<td>Plant Quality Control Plan –QCP (ITM 583)</td>
<td>✓</td>
</tr>
<tr>
<td>Job Quality Control Plan (ITM 803)</td>
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</tr>
<tr>
<td>Mix design by approved design lab</td>
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</tr>
<tr>
<td>Approved mix design (JMF)</td>
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</tr>
<tr>
<td>Certified HMA Field Supervisor (ITM 803)</td>
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</tbody>
</table>
Certified Aggregate Producer

- Quality Control Plan
  - Sampling & tested
- Certified Technicians
- Annual INDOT Audit
- Quality tested by INDOT
Certified Binder Supplier

- Quality Control Plan
- Annual INDOT Audit
- Comparison Testing
- Daily Sample from tank & random acceptance testing by INDOT
Certified HMA Plant

- Written Quality Control Plan (at site)
- Certified HMA Technicians
- Quality Control Lab at plant site
- Annual INDOT Audit
Approved Mix Design Lab

- Lab assessment by ASSHTO Material Reference Lab (AMRL)
- Comparison Samples from AMRL
- Regularly scheduled equipment calibration
QC Testing at the Plant

- Compacted Gyratory specimens-Specific Gravity
- Max. Theoretical Specific Gravity
- Ignition Oven/Extraction
- Mix Gradation
- Aggregates
Type “D” Certification

- Record of daily QC testing of the mixture, signed by a Certified HMA Technician

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**INDIANA DEPARTMENT OF TRANSPORTATION**
**HOT MIX ASPHALT (HMA) CERTIFICATION**

**CONTRACT NUMBER** ___________________________ **DATE** ____________

**CERTIFIED HMA PRODUCER** ___________________________ Rieth-Riley Construction Co Inc

**CERTIFIED HMA PLANT NUMBER** #3184 **DMF/JMF NUMBER** ___________

**PG BINDER SOURCE** ___________ **PG BINDER GRADE** ___________

**MIXTURE TYPE AND SIZE** ____________________________________________________________________________

**DESIGN ESAL** ___________

Air Voids _______ (from DMF/JMF) Binder Content _______ (from DMF/JMF)

This is to certify that the test results for Air Voids and Binder Content represent the HMA mixture supplied to this contract.

Air Voids _______ (± 1.5 % from DMF/JMF) Binder Content _______ (± 0.7 % from DMF/JMF)

* [ ] Test results are not available for submittal. A production sample shall be taken within the first 250 t (250 Mg) and each subsequent 1000 t (1000 Mg) for base and intermediate mixtures and each subsequent 600 t (600 Mg) for surface mixtures.

* ✓ If Applicable

___________________________________________
Signature of HMA Producer Official

___________________________________________
Certified – Qualified Technician

Title of Official

---

**FOR PE/PS USE ONLY**

**PAY ITEM(S)** ___________________________ **BASIS FOR USE NO.** C999998

**SPECIFICATION REFERENCE**

| __ 304.04 - Patching | __ 402.07(c) - Temporary HMA | __ 610.02 - Approaches |
| __ 304.05 - Widening | __ 503.03(e) - Terminal Joints | __ 611.02 - Crossovers |
| __ 402.04 - HMA Pavements | __ 507.05(b) - Partial Depth Patching | __ 718.04 - Underdrains |
| __ 402.07(a) - Rumble Strips | __ 604.07(c) - Sidewalk | __ 801.11 - Temp. Crossovers |
| __ 402.07(b) - Wedge & Leveling | __ 605.07(c) - Curbing | |

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APAI Guide to Specifying HMA Pavements for Local Agencies

2014 version available soon
A product for your preservation tool box
Benefits of 4.75 mm

• Low life-cycle cost
• Maintain grade and slope
• Handles heavy traffic
• Smooth surface
• Seal the surface
• No loose stones
• Minimize dust
• Min. traffic delays

• No curing time
• Low noise
• No binder runoff
• Can be recycled
• Stage construction
• Easy to maintain
• Restore skid resistance

AMERICA Rides ON US
### Performance - Pavement Life

<table>
<thead>
<tr>
<th>Location</th>
<th>Traffic</th>
<th>Underlying Pavement</th>
<th>Performance, yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>High/Low</td>
<td>Asphalt</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Composite</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Composite</td>
<td>7</td>
</tr>
<tr>
<td>North Carolina</td>
<td>----</td>
<td>Concrete</td>
<td>6 – 10</td>
</tr>
<tr>
<td>Ontario</td>
<td>High</td>
<td>Asphalt</td>
<td>8</td>
</tr>
<tr>
<td>Illinois</td>
<td>Low</td>
<td>Asphalt</td>
<td>7 – 10</td>
</tr>
<tr>
<td>New York</td>
<td>----</td>
<td>Asphalt</td>
<td>5 – 8</td>
</tr>
<tr>
<td>Indiana</td>
<td>Low</td>
<td>Asphalt</td>
<td>9 – 11</td>
</tr>
<tr>
<td>Austria</td>
<td>High/Low</td>
<td>Asphalt</td>
<td>≥10</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Concrete</td>
<td>≥8</td>
</tr>
<tr>
<td>Georgia</td>
<td>Low</td>
<td>Asphalt</td>
<td>10</td>
</tr>
</tbody>
</table>
# HMA Ultra-Thin High Value Pavement Enhancement

**Preventive Maintenance Treatments Cost Comparison**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>$/syd **</th>
<th>Cost/mile (24' wide)</th>
<th>Life extension range* (years)</th>
<th>Life extension range* avg (years)</th>
<th>Cost/mile per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro-surface</td>
<td>$2.44</td>
<td>$34,354</td>
<td>3-5</td>
<td>4</td>
<td>$8,588</td>
</tr>
<tr>
<td>Ultra-thin low</td>
<td>$2.20</td>
<td>$30,975</td>
<td>5-9</td>
<td>7</td>
<td>$4,425</td>
</tr>
<tr>
<td>Ultra-thin med</td>
<td>$2.55</td>
<td>$35,903</td>
<td>5-9</td>
<td>7</td>
<td>$5,129</td>
</tr>
<tr>
<td>Ultra-thin high</td>
<td>$2.83</td>
<td>$39,845</td>
<td>5-9</td>
<td>7</td>
<td>$5,692</td>
</tr>
</tbody>
</table>

* Average Life Extension estimated by APAM

** Unit Prices based on Weighted bid prices from last 12 MDOT lettings (thru June '08)
Project Selection

Avoid Projects Needing Structural Rehabilitation!!
Where to use - Types of distress

- Raveling
- Longitudinal Cracking (less than 3/8”)
- Transverse Cracking (less than 3/8”)
- Alligator Cracking
- Rutting & Flushing
- Polishing
Raveling
Longitudinal Cracking (not in wheel path)
Longitudinal Cracking (wheel path)

Temporary Fix for Minor Distress
Transverse Cracking
Alligator (Fatigue) Cracking
Rutting or Shoving
<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Per Cent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 mm (1/2”)</td>
<td>100.0</td>
</tr>
<tr>
<td>9.5 mm (3/8”)</td>
<td>95.0-100.0</td>
</tr>
<tr>
<td>4.75 mm (#4)</td>
<td>90.0-100.0</td>
</tr>
<tr>
<td>1.18 mm (#16)</td>
<td>30.0-60.0</td>
</tr>
<tr>
<td>75µm (#200)</td>
<td>6.0-12.0</td>
</tr>
</tbody>
</table>
Thank you...Questions?

Dudley Bonte, APAI
mdbonte@asphaltindiana.org
(317) 281-5011