Cold Constructed Asphalt Pavement (CCAP) with Gelled Asphalts
Session 42: 2017 Purdue Road School

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The Asphalt Mixture Performance Test

- Test to measure dynamic modulus
- LVDTs measure deflection during loading
- Mounts are held on by studs
Asphalt Mixture Performance Test

- How do we get the studs to stick?
  - Superglue
  - Normal Superglue runs
  - Gelled Superglue on the bottom stud
What’s the Difference?

- The consistency is different
- Gelled superglue doesn’t run off the stud
- Similar behavior can be accomplished with asphalt
Gelled Asphalt

- Two asphalts
- One is gelled
- One is conventional binder
- Over time conventional begins to flow
  - Asphalt is visco-elastic
- Gelled Asphalt
  - Maintains Shape
  - Chemically Modified
    - “Multigrade Gelled Asphalt”
  - Used in Cold Constructed Asphalt Pavement (CCAP)
CCAP Presentation Overview

- Gelled Asphalt [Chemically Modified Asphalts (CM)]
  - History
  - Applications
- Information on CCAP Mixtures
  - How and Why They Perform
  - Design Recommendations
- CCAP Production and Laydown Best Practices
- Example Projects
CM Asphalts

Gelled Asphalt

- Aka Chemically Modified Asphalt (CM-90, CM-150, CM-300)
- Different Grades for Different Applications
- Technology developed at HRG in late 1980’s

Developed to Replicate High Float Emulsions without Water

- Desired higher film thickness
- Eliminate water component from the emulsion
  - Reduce/ eliminate run-off of the binder
# CM Modified Asphalt Specifications

<table>
<thead>
<tr>
<th>Cold Mix and Multi-Grade Specifications</th>
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<tbody>
<tr>
<td><strong>CM 90, 150, 300</strong></td>
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<tr>
<td>Test Method</td>
</tr>
<tr>
<td>Apparent Viscosity Modified Koppers, ASTM D4957, 77°F (25°C), P</td>
</tr>
<tr>
<td>Tag Flash Point, ASTM D3143-98, °C</td>
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<tr>
<td>Water in Petroleum, ASTM D95-05, %, max</td>
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<tr>
<td>Distillate Test</td>
</tr>
<tr>
<td>Cut-Back Distillation, ASTM D402-02, volume % total to 680°F (360°C)</td>
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<tr>
<td>volume % total to 437°F (225°C)</td>
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<tr>
<td>volume % total to 500°F (260°C)**</td>
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<tr>
<td>volume % total to 600°F (316°C)</td>
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<tr>
<td>Residue from distillate to 680°F (360°C), % volume by difference, min</td>
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<tr>
<td>Residue</td>
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<tr>
<td>Softening Point, ASTM D36-95, °F</td>
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<td>Float Test, 60°C, ASTM D139-95, sec</td>
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<tr>
<td>Penetration, 77°F, dmm, ASTM D 5-05a</td>
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<tr>
<td>Solubility in TCE, ASTM D 2042-01, %</td>
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<tr>
<td>Ductility, 25°C, ASTM D113, cm</td>
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**Meets Recommended Guidelines Established by EPA for non VOC Materials**
CM Asphalt Applications

- CM-90 is used for spray applications
- Hot Applied Chip Seal Binder
- Stiffest Grade
- Excellent Chip Retention
- No “Curing Phase”
- Caution with Heat in Application
CM Asphalt Applications

- CM-150 used in paving applications
- CCAP Pavements
  - Pug Mix
  - Cold Mix
- Grade is stiff enough to carry traffic
- Soft enough to be workable and flow through paver
CM Asphalt Applications

- CM-300 is used in patching applications
- Stays workable in cold temperatures
CCAP

- Blend of crushed aggregate and CM-150
- Antistrips and oils blended into mix to meet climatic and construction needs
CCAP System with CM Asphalt

- CM technology gives conventional asphalt better hot weather stiffness
- Strong, angular aggregates carry load
- Does not hurt asphalts low temperature stiffness
- Maintains flexibility at low temperatures
How Does CCAP Work?

- More flexible than HMA
  - Softer binders used
- Mix can bend more before breaking
  - “Healing” process when it warms and gets kneaded together
- Gelled asphalt allows for increased film thickness
  - Increased film thicknesses help extend the ageing process
- Little to No Draindown
- Crushed aggregate compensates softer binders
CCAP: How Are They Designed?

- Open Graded Mixture
  - Typical Sizes (9’s, 11’s)
  - Combinations

- Crushed Aggregate
  - Carries Load

- Hardness
  - Long term performance

- Absorption
  - Influences AC Content

- Flat and Elongated
CCAP Benefit – Material Yield

- **Yield**
  - Weight of material to cover 1 sq yd at 1 in thick
  - 110 lbs/ sq yd/ in for HMA
  - 80 to 85 lbs/ sq yd/ in for CCAP

- **Example**
  - For 1 mile x 18 ft wide, 3 in lift
    - For HMA, 1742 tons required
    - For CCAP, 1346 tons required
    - Approx. 23% less materials required
Both Aggregates Are Not Ideal for CCAP Usage
CCAP Mix Design

- Aggregate Testing
- Aggregate Gradation influenced by project parameters (lift thickness)
- Coating Tests
  - Determine AC Content to achieve desired coating
  - Anti-strip needed?
    - Moisture Susceptibility
    - Modified Texas Boil
How is CCAP Produced?

- Pugmill to mix the aggregate and CM-150 cold (no heat)
- The pugmill allows for blending of aggregates and proportioning of CM-150 asphalt and aggregate
- HMA plant can also be used
  - Low to no heat
Dual Bin Pugmill

- Dual Bin Allows for Blending Multiple Aggregates
- Better Control than Ground Blending
Production of CCAP
Production of CCAP
Stockpiling CCAP

- Initial coating will vary depending on aggregate moisture
  - “Salt and Pepper Effect”
- Work the pile while loading trucks
Stockpiling CCAP

Key Features

- Waterless
- Thicker films with no draindown or runoff
  - No draindown during precipitation
- Can be stockpiled for extended periods of time
  - Examples of using material a year later
Paving CCAP

- Equipment Required
  - Pugmill
  - Front End Loaders
    - Feed the pugmill
    - Load trucks
  - Conventional Paver
  - 10 Ton Steel Drum Static Roller
  - Chip Spreader/ Truck Mount Spreader
    - Apply blotter aggregate
Starts at the Stockpile
Paving Train
Placed with Conventional Paver
Compaction
Applying Blotter Aggregate
Finished CCAP Product

- Ready for traffic after compaction
- CCAP may have tenderness the first day/ project and climate specific
- Third to fifth day - peak strength
Final Surfacing

- Recommended to Apply Final Surface Year After CCAP Construction
  - Chip Seal
  - HMA
- Seals the Pavement from Water Intrusion
- Gives CCAP Time to Mature
Example Projects/ Agency Use

- Exeter Rd in Monroe County, MI
- CR 100 W Tipton Co, IN
- Boone Co, IN Experience
- Jennings County, IN Experience
Would you pave this road?

Exeter Road Prior to CCAP Paving
Exeter Rd  CCAP Paved in 2010
Exeter Rd Today 2017
Exeter Rd Before and After
CR 100W Tipton Co, IN

- Tipton County, IN 2016
- CR 100W
- Full Depth Cracks
  - Transverse
  - Longitudinal
- HMA Section
  - ~6.0 – 7.0 inches of HMA
CR 100W Tipton Co, IN

- Pavement Relatively in Sound Condition
  - “Mud” not pumping through pavement
- Cracks could reflect through HMA overlay
- CCAP Overlay
  - Mix produced by local contractor
  - Paved by different local contractor
- Chip Seal in 2017
The Road Today
Boone County, IN CCAP Experience

- Boone County approximately 25 years experience with CCAP
- Self Perform
  - Pugmill operation
  - County paving crew
- Convert Gravel Roads to Hard Surface Roads
Boone County, IN CCAP Experience

- Gravel Roads to Surfaced Roads
- Stable Bases
  - CCAP will not “bridge” soft or yielding subgrades
- Good Long Term Performance
Boone County IN CCAP Experience

- Boone County Road 650 South was a gravel road convert with 3 inches of CCAP
- CCAP Construction in 2013
- Double Chip Seal in 2014
Boone County IN CCAP Experience

- Boone County Road 400 South between 25 West and 300 West
- Approximately ten years old
- Single chip seal over that period
- Ready for another surface treatment
Jennings County, IN CCAP Experience

- New to CCAP in 2016
- Farm to Market Roads Need Flexible Structure
- Mix Designs/ Mix Optimization
- Ability to Self Perform
  - Eliminates Time Constraints
- Developing Experience with Product
- Plan on CCAP 2017
Jennings County, IN CCAP Experience
Jennings County, IN CCAP Experience
More Information Available

- Experience from Other Counties
  - Many Indiana Counties have Experience

- Local AMI Sales and Technical Team
  - Connect with Local Representative
  - Heritage Research Group

- Sample of CM-300 Patch Mix Material
  - If interested, contact us
  - Can supply sample material for you to evaluate
Contact Information

- Thank you!
- Questions and Comments

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