Cold Constructed Asphalt Pavement (CCAP) with Gelled Asphalts
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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>
<th>CM-90</th>
<th>CM-150</th>
<th>CM-300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Method</td>
<td>CM-90</td>
<td>CM-150</td>
<td>CM-300</td>
</tr>
<tr>
<td>Apparent Viscosity Modified Koppers, ASTM D4957, 77°F (25°C), P</td>
<td>1500-20000</td>
<td>800-10000</td>
<td>300-5000</td>
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<tr>
<td>Tag Flash Point, ASTM D3143-98, °C</td>
<td>66 min</td>
<td>66 min</td>
<td>66 min</td>
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<tr>
<td>Water in Petroleum, ASTM D95-05, %, max</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
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<tr>
<td>Distillate Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut-Back Distillation, ASTM D402-02, volume % total to 680°F (360°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>volume % total to 437°F (225°C)</td>
<td>0-4</td>
<td>0-5</td>
<td>0-5</td>
</tr>
<tr>
<td>volume % total to 500°F (260°C)**</td>
<td>0-5</td>
<td>0-5</td>
<td>0-5</td>
</tr>
<tr>
<td>volume % total to 600°F (316°C)</td>
<td>10–65</td>
<td>30-75</td>
<td>40-85</td>
</tr>
<tr>
<td>Residue from distillate to 680°F (360°C), % volume by difference, min</td>
<td>80 min</td>
<td>75 min</td>
<td>70 min</td>
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<tr>
<td>Residue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softening Point, ASTM D36-95, °F</td>
<td>170°F min</td>
<td>170°F min</td>
<td>170°F min</td>
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<tr>
<td>Float Test, 60°C, ASTM D139-95, sec</td>
<td>1200 min</td>
<td>1200 min</td>
<td>1200 min</td>
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<tr>
<td>Penetration, 77°F, dmm, ASTM D 5-05a</td>
<td>90-225</td>
<td>100-275</td>
<td>200 +</td>
</tr>
<tr>
<td>Solubility in TCE, ASTM D 2042-01, %</td>
<td>99.0 min</td>
<td>99.0 min</td>
<td>99.0 min</td>
</tr>
<tr>
<td>Ductility, 25°C, ASTM D113, cm</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</table>

**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
CCAP Production and Laydown Best Practices

The Heritage Group
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
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
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 CCAP After 2 Years (2012)
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
CR 100W Tipton Co, IN

- 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
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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