Type and Use of Asphalt Concrete

This Lecture

- What is asphalt?
- Hot Mix Asphalt (HMA)
  - How do we make it (overview)
- Types of HMA
- What do we use HMA for?
**Bitumen**

- **Tar** (from coal)
  - road tar
  - coal tar

- **Asphalt Binder** (from petroleum crude)
  - asphaltic bitumen
  - asphaltic binder

**Background**

- First US Hot Mix Asphalt (HMA) constructed in 1870's
  - Pennsylvania Ave.
  - Used naturally occurring asphalt binders from surface of lake on Island of Trinidad
- Two sources
  - Island of Trinidad
  - Bermudez, Venezuela

- Each lake asphalt source very consistent
  - Used solubility test to determine source
    - Insolubles differed substantially between sources

- Demand for paved roads exceeded the supply of lake asphalts in late 1800's
  - Led to use of petroleum asphalts binders
Significant Crude Oil Sources

**Domestic**
- Gulf coast
- Mid-continent
- Rocky Mountain
- West coast
- Alaska

**Foreign**
- Mexico
- Venezuela
- Canada
- Middle East

Basics of Refining Crude Oil
Refinery Operations

Asphalt concrete
Asphalt paving mix
Asphalt mix
Asphalt

Hot Mix Asphalt (HMA)
- Asphalt concrete
- Bituminous concrete
- Asphalt paving mix
- Bituminous paving mix
- Asphalt mix
- Bituminous mix

Asphalt Cement
Aggregates
Properly Proportioned & Placed
Placement

Compaction Process

<table>
<thead>
<tr>
<th>Compactive Force</th>
<th>Pressure and/or Vibration</th>
<th>Pressure Manipulation</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push Rollers</td>
<td></td>
<td>Conveyors</td>
<td></td>
</tr>
<tr>
<td>Tow Point</td>
<td></td>
<td>Depth Crank</td>
<td></td>
</tr>
<tr>
<td>Hopper</td>
<td></td>
<td>Screed</td>
<td></td>
</tr>
<tr>
<td>Side Arm</td>
<td></td>
<td>Augers</td>
<td></td>
</tr>
</tbody>
</table>

Temperatures:
- Temperature Zones: 300° - 240°F
- 240° - 200°F
- 170 - 150°F
**Types**

- Asphalt cements
  - Generally refinery produced material
  - Air blown asphalt cements
- Cutbacks
  - Asphalt cements “cut” with petroleum solvents
- Emulsions
  - Mixture of asphalt cement, water, and emulsifying agent

**Cutbacks**

- Rapid cure (RC) (Naphtha or Gasoline)
  - High volatility of solvent
  - Tack coats, surface treatments
- Medium cure (MC) (Kerosene)
  - Moderate volatility
  - Stockpile patching mix
- Slow cure (SC) (Low viscosity oil)
  - Low volatility
  - Prime coat, dust control

**Cutback Asphalts**

<table>
<thead>
<tr>
<th>Rapid Curing (RC)</th>
<th>Medium Curing (MC)</th>
<th>Slow Curing (SC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt + Naphtha Surface Treatment</td>
<td>Asphalt + Kerosene Stockpile Patch</td>
<td>Asphalt + Oil</td>
</tr>
<tr>
<td>RC - 30</td>
<td>MC - 30</td>
<td>SC - 70</td>
</tr>
<tr>
<td>RC - 70</td>
<td>MC - 70</td>
<td>SC - 250</td>
</tr>
<tr>
<td>RC - 250</td>
<td>MC - 250</td>
<td>SC - 800</td>
</tr>
<tr>
<td>RC - 800</td>
<td>MC - 800</td>
<td>SC - 3000</td>
</tr>
</tbody>
</table>
Composition of Cutback Asphalts

RC = Naptha; MC = Kerosene; SC = Light Oil

CUTBACKS - USES

- Rapid Curing
  - Tack coats
  - Surface treatments
- Medium curing
  - Prime coats
  - Stockpile patching materials
  - Road Mixing Operations
- Slow curing
  - Prime Coats
  - Stockpiling
  - Road mixing

Emulsions

- Emulsifier gives surface charge to asphalt droplets suspended in water medium
  - Anionic
    - Negative charge
    - Alkaline
    - Good with limestones (positive charge)
  - Cationic
    - Positive charge
    - Acid
    - Good with silica gravels (negative charge)
EMULSIONS - MANUFACTURE

EMULSIONS - USES

- Slow Setting (SS)
  - Tack coats, fog seals, dense-graded cold mixes
- Medium Setting (MS)
  - Open graded cold asphalt-aggregate mixtures
- Rapid Setting
  - Surface treatments
Single Machine Recycling

The Beginning

Keeping roads good with asphalt paving materials

Questions?

The Beginning
Keeping roads good with asphalt paving materials

http://www.cp2info.org/center