Louisiana DOTD
Asphalt Binder Specifications

Jason Davis
LA DOTD Materials Laboratory
LTEC 2007
SHRP Tests (AASHTO M320)

- Strategic Highway Research Program
- Binder graded by service temperature

PG 64-22

Average pavement maximum (°C)

Pavement design minimum (°C)
SHRP Tests (AASHTO M320)

• Strategic Highway Research Program
• Binder graded by service temperature
• Constant specification limit
• Test temperature changes
• Grades perform similarly in design use
SHRP Tests (AASHTO M320)

- High-Temperature Tests
  - Rotational Viscosity
  - Dynamic Shear Rheometer
    - Original
    - RTFO Residue
  - Flash Point
SHRP Tests (AASHTO M320)

- Intermediate Temperature Tests
  - Dynamic Shear Rheometer
    - PAV

- Low Temperature Tests
  - Bending Beam Rheometer
SHRP Tests (AASHTO M320)

- Miscellaneous tests
  - Mass Loss
  - Solubility
Additions to AASHTO M320

• Additional Louisiana DOTD Tests
  – PG+ Specifications (polymer tests)
    • Force Ductility
    • Elastic Recovery
    • Separation of Polymer
  – Ductility
  – PG 64-22 Original DSR Requirement
Rotational Viscosity

- Flow properties at mix temperature
- Relates to pumping / handling
- QA consistency measure
Rotational Viscosity

• Set sample size and calibrated spindle

• Constant RPM

• Resistance measured

• Maximum 3.0 Pa-s
Flash Point

- Safety test
- Possible indication of contamination

- Sample heated at constant rate
- Flame applied at intervals until flash
- Minimum 230 ºC
Solubility

• Used to identify source asphalt (1903)
• Test binder for insolubles
  – Insolubles may stiffen binder, but give no other performance benefits
• Newer test for polymer modifier issues
• Sample dissolved in solvent
• Minimum 99%
Dynamic Shear Rheometer

- High and intermediate temperatures
- Stiffness and elasticity
- Resistance to rutting and fatigue cracking
- May identify other problems
  - Incorrect material
  - Potential contamination
Dynamic Shear Rheometer
Dynamic Shear Rheometer

- Asphalt between plates
- Torque applied
- Response measured
Dynamic Shear Rheometer

- Original Material
- Minimum initial stiffness
- QA test may assure aged properties
- Minimum 1.0 kPa
Rolling-Thin Film Oven

• Simulates hot-mix operations
• Residue used for
  – DSR
  – Mass Loss
  – Elastic Recovery
  – Ductility
  – PAV
Mass Loss on Heating

- Measures susceptibility to loss of light ends during mixing operations
- Sample jar in rotating oven
- Air injected over time
- Aged residue weighed
- Maximum 1.0%
Dynamic Shear Rheometer

- RTFO Residue
- Minimum stiffness after oven aging
- Relates to stiffness after mixing
- Minimum 2.20 kPa
Pressure Aging Vessel

- Simulates long-term aging
- Heat and pressure applied over time
- Residue used for
  - DSR
  - BBR
Dynamic Shear Rheometer

- PAV Residue
- Maximum stiffness after pressure aging
- Relates to long-term aging
- Resistance to fatigue cracking
- Maximum 5000 kPa
Bending Beam Rheometer

- Binder properties at low pavement temperatures
- Long-term durability measure
- Resistance to thermal cracking
Bending Beam Rheometer

- Molded beam of asphalt
- Constant load on beam
- Creep stiffness and rate measured
“PG +” Specifications

- Polymer can raise binder price 30%
  - $75 - $100 / ton Aug. 2006 to Jan. 2007
- Must ensure quality / quantity of polymer
- Added tests for polymer
Force Ductility

- Polymer strength under stress
  - Retained strength under strain
Force Ductility

- Polymer strength under stress
  - Retained strength under strain
- Molded sample elongated at low temp.
- Initial and 30cm stress
Elastic Recovery

• Recovery after stress
  – Resistance to permanent deformation
• Molded sample elongated and cut
Elastic Recovery

- Recovery after stress
  - Resistance to permanent deformation
- Molded sample elongated and cut
- Recovery measured
Separation of Polymer

- Check for unstable blending
- Sample tube in oven for 48 hours
Separation of Polymer

- Check for unstable blending
- Sample tube in oven for 48 hours
- Solidified in freezer
- Tests run on top and bottom sections
Ductility

- Performed on RTFO residue
- May detect materials considered lower performance for paving
  - Excessive air-blown
  - Mayan crude
Ductility

- Performed on RTFO residue
- May detect materials considered lower performance for paving
- Molded sample elongated to 100+ cm
PG 64-22 Original DSR

• AC-10 / 20 may pass SHRP PG 64-22

• Set at 1.30 kPa

• In line with AC-30 (PG 67-22)
MSCR Test

- Multiple Stress Creep Recovery
- Intended to replace PG+
- Repeated cycles of stress and recovery
MSCR Test

- Multiple Stress Creep Recovery
- Intended to replace PG+
- Repeated cycles of stress and recovery
Polymer Content By FTIR

- Fourier-Transform Infrared
- Analyze polymer-modified asphalt
- SB / SBR / SBS polymers
Polymer Content By FTIR

Infrared Scan of Polymer Modified AC
Polymer Content By FTIR

- Samples of known polymer content
- Develop “calibration” curve
- Determine % polymer of unknown AC
Summary

• AASHTO M320 testing

• PG + for added performance

• Investigating new tests

• Quality Assurance of asphalt binder
Thank you!

Questions?