Ground Tire Rubber

- Ground Tire Rubber (GTR) can contain a wide range of polymers
  - Natural rubber
  - Styrene Butadiene Rubber (SBR)
  - Polybutadiene

- GTR also contains non-polymer ingredients
  - Carbon black
  - Silica
Ground Tire Rubber

- GTR contains polymers that have been locked-up by vulcanization
- Much of the GTR polymer is not available to create a network in the asphalt
- GTR imparts elastomeric properties to asphalt binder by adding discrete rubber particles
Ground Tire Rubber

• Types of GTR asphalt products
  – Dry Process – “Plus Ride”
    • Add GTR into asphalt plant as an aggregate
    • Filler more than modifier
Ground Tire Rubber

– Asphalt Rubber (ASTM Designation) – Wet Process
  • 15-20% GTR added to asphalt in processing unit at the asphalt plant
  • GTR particles absorb light hydrocarbons and swell
  • After swelling, asphalt rubber is used immediately
  • Adequate agitation is necessary
  • Amount of discrete rubber particles requires room in an asphalt mix
    – Used in open graded and gap-graded mixes
    – Cannot be used in dense graded mixes
Ground Tire Rubber

• Types of GTR asphalt products
  – Terminal Blended GTR Modified Asphalt
    • Add GTR into asphalt at a terminal facility
    • Processing techniques and/or additives help stabilize the product
    • Adequate agitation at asphalt plant is suggested
  – Hybrid GTR Binder
    • Terminal blended GTR modified asphalt may add polymer and/or other additives
    • Polymer network helps to hold rubber particles in suspension
    • Adequate agitation at asphalt plant is suggested
• GTR modified asphalt products typically require agitation to prevent separation
StellarFlex GTRH

- StellarFlex GTRH is a Ground Tire Rubber Hybrid asphalt binder produced with chemically-treated GTR and SBS polymer
- Formulated to meet PG 76-22 and PG 64E-22 specifications
- GTR content at least 50% more than SBS content
StellarFlex GTRH

- Early results indicate StellarFlex GTRH is a very stable product not requiring agitation
- Viscosity and workability similar to SBS modified PG 76-22
StellarFlex GTRH-Pennsylvania Experience

• First two GTRH projects supplied to PennDOT
  – Philadelphia District – 10,000 mix tons
  – Pittsburgh District – 2,000 mix tons

• Philadelphia project interrupted by Pope Francis visit
  – All construction halted for one week

• Tested GTRH Stability
  – Turned off agitation and circulation
  – Sampled tank daily for nine days
  – No change in properties or separation results
StellarFlex GTRH

• Project information
  – Used existing 9.5mm mix designs with PG 76-22 – no changes to asphalt content required
  – Neither plant storage tank had agitation
  – No problems running the mix
  – Passing QC test results
    • Asphalt content
    • Volumetrics
StellarFlex GTRH

- Project information
  - Supplied StellarFlex GTRH with Evotherm warm mix additive
  - Plant temperatures 280-320°F
  - No problems running the mix through MTV and paver
  - 95% density after 4 passes of vibratory rollers
StellarFlex GTRH
StellarFlex GTRH
StellarFlex GTRH-Florida Experience

• Project information
  – Florida DOT FC-5 Open Graded Friction Course (OGFC)
  – US 1 in Duval County
  – 4,000 tons
  – No problems running the mix
  – Passing QC test results
    • Asphalt content
    • Sieve analysis
StellarFlex GTRH

- Project information
  - Supplied StellarFlex GTRH with Evotherm warm mix additive
  - Lay-down temperatures 260-290°F
  - No problems running the mix through MTV and paver

US Highway 1 – Jacksonville, FL
StellarFlex GTRH

- Project information
  - Florida DOT FC 12.5C (Dense Graded)
  - SR 19 in Putnam County
  - 10,000 tons
  - 2 Hour haul from plant site to project

Passing QC test results
- Asphalt content
- Volumetrics
StellarFlex GTRH

SR 19 - Palatka, FL
STELLARFLEX GTRH MIX PERFORMANCE
Asphalt Pavement Analyzer (APA) – Rutting Evaluation of HMA

- Moving wheel load (100 lbs) applied to a pressurized hose (100 psi) which lies on top of asphalt samples
- Tested at 64°C for 8,000 loading cycles
- Computer data acquisition system
StellarFlex GTRH Rutting Performance

APA Rutting, mm

- PG 76-22: 3.21 mm
- StellarFlex GTRH: 3.71 mm
Texas Overlay Tester – Fatigue Cracking
StellarFlex GTRH Fatigue Performance

Texas Overlay Test, cycles

PG 76-22: 278 cycles
StellarFlex GTRH: 249 cycles
Hamburg Wheel Tracking Test

- Measures rutting and stripping potential
- Severe test
- Soak samples in 50°C water for 30 minutes
- Test temperature 50°C
- Steel wheel – 158 lbs.
- Number of cycles to 12.5mm rut depth (maximum 20,000 cycles)
- Number of cycles to Striping Inflection Point (SIP)
Hamburg Wheel Tracking Test

Loading Cycles (n)

Vertical Deformation (mm)

TxDOT Specification:
> 10,000 Cycles @ 12.5 mm Rutting

PG 76-22 Mix
Hamburg Wheel Tracking Test

Loading Cycles (n)

Vertical Deformation (mm)

TxDOT Specification:
> 10,000 Cycles @ 12.5 mm Rutting

StellarFlex GTRH Mix
StellarFlex GTRH Mix Performance

• StellarFlex GTRH mix performs equally to PG 76-22 PMA mix in both APA rutting and Texas Overlay Fatigue Cracking

• StellarFlex GTRH mix substantially outperforms PG 76-22 PMA mix in Hamburg Loaded Wheel Test

• How does StellarFlex GTRH perform compared to Asphalt Rubber?

• Cannot put Asphalt Rubber in a dense graded mix
Summary

• StellarFlex GTRH is an effective, high performance GTR product
  – Meets specifications for PG 76-22, including Elastic Recovery
  – Meets specifications for PG 64E-22, including MSCR Recovery
  – Mix performance equal to PG 76-22 (PG 64E-22) in rutting and cracking
  – Stable product – requires no agitation
  – Excellent workability
  – Works in any mix – including dense graded
Questions and Comments