Beneficial Use of Materials in Transportation Projects

WHERE THE RUBBER MEETS THE ROAD

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Objectives

- Market trends (Nationally and in Oklahoma)
- Authority to develop new markets
- Past attempts to promote use of ground tire rubber (GTR) in asphalt
- Current collaborative project
- Where do we go from here?
Trending Nationally

U.S. Scrap Tire Market Trends 2009 - 2017

Slide used with permission (USTMA, 2018)
U.S. Scrap Tire Disposition 2017

Civil Engineering 8%
Ground Rubber 25%
Land Disposed 16%
Other 8%
Tire-Derived Fuel 43%
Reclamation Projects 3%
Electric Arc Furnace 5%
Processor Inventory/Unknown 3%
Exported 3%

Total annual generation = 4,189 thousand tons

Slide used with permission (USTMA, 2018)
U.S. Ground Rubber Markets 2017
(percent of total pounds of scrap tires consumed in market)

- Automotive & Export: 2%
- Asphalt: 12%
- Sports surfaces: 23%
- Molded/Extruded: 38%
- Playground Mulch: 24%

Did you know?

- Total tire rubber consumed in ground rubber markets: about 1,340,000,000 pounds\(^1\)
- Total scrap tires diverted to these markets: About 1,013,320 tons or about 62 million tires

\(^1\)This value represents the weight of processed ground rubber (with wire, fluff and agglomerated rubber removed) that is consumed in ground rubber end-use markets. In contrast, the data represented in other areas of this report refer to the weight of whole tires diverted to all scrap tire markets, including ground rubber.
FY-2019 Used Tire Market Distribution

- 77% FY 2019- Crumb
- 13% FY-2019 - Shreds
- 10% FY-2019 - TDF

Trending in Oklahoma
Authority

- 27A O.S.§ 2-11-401.5
- Accrued funds can be used for remediation of tire dumps and projects to increase market demand for products made from Oklahoma used tires.
- Prioritization for projects with the greatest potential to benefit schools, communities and local governments.

Photo credit: DEQ Staff
Previous Attempt

- Literature review (OU)
- Demonstration Project (Wagoner County)
- Testing and Evaluation (OU)
Advantages of GTR

- Increases viscosity of the binder (improves elasticity and allows for expansion)
- Increases resistance to permanent deformation (i.e., rutting)
- Increases resistance to cracking (i.e., more flexible)
- Improves fatigue resistance (i.e., lasts longer)
- Fewer loose aggregates (i.e., fewer windshield cracks)
Advantages of GTR

- Better friction (i.e., fewer accidents)
- Retains color
- Improves ice control in pavements
- Less spray and better visibility
Wet and Dry Process

- **Wet Process** — Dissolves tire rubber into the binder as a modifier (i.e., polymers).
  
  GTR is added to binder

- **Dry Process** — Replaces a portion of fine aggregates with ground tire rubber (mesh 30 inch minus or smaller...looks like powder). Binder is added at the job site

GTR is added to the aggregates

Wet Process

- Mixing GTR into the asphalt binder at high temperatures (176-226 °C)
- Cook and digest for several hours to days
  - At job site
  - Terminal and then shipped to job site (can settle out)
- Continued agitation (binder and GTR have different densities and will separate easily)
Dry Process

- GTR is added to the hot aggregates (GTR acts as an aggregate)
- Need to have chemically treated rubber (Engineered rubber)
- GTR is added to the hot aggregate at the plant
- Aggregate and the binder is combined at the job site using conventional equipment
Dry Process

Elastiko\(^R\) ECR

Bagged Elastiko\(^R\) ECR At Cummins Plant Site

Dry Process

Video credit: K. Suitor, ODOT
Advantages of Dry Process

- Cost effective
- Increases performance grade
- Reduced mix stickiness
- Improved workability

Photo credit: K. Kennedy, DEQ
Advantages of Dry Process

- Contractors like it
- Lighter material results in less wear and tear on equipment
- More affordable = more desirable

Photo credit: K. Kennedy, DEQ
Disadvantages

- Relatively new (less than 10 years)
- Lack of standards/specifications among DOTs
- Something new is scary
Collaborative demonstration project

- Funding through State Transportation Innovation Council (STIC)
  - Grant amount is $60,000 (est. total cost $80,000)
- Collaborative project with ODEQ, ODOT, FHWA
- Other partners include OAPA, Contractor, Asphalt Plus, OSU, and OU
- Asphalt Plus is the driving force providing the equipment at the plant, expertise, mix design, specifications, and GTR

Photo credit: F. March, DEQ
Collaborative Demonstration Project

Photo credit:  K. Kennedy, DEQ
Map Source:  Clark (2019)
Collaborative Demonstration Project

- Asphalt mix was a fine-dense-graded mix design (PG70-28 binder)
- Base binder was PG58-28 and polymer modified to bump up performance grade to PG70-28
- Two mix designs were used
  - Polymer modified binder
  - Polymer modified binder and aggregate plus 5% by wt. of virgin binder dry process engineered GTR Elastiko® ECR

- Reason for adding the GTR was to assess whether it can be used as an alternative to polymer modified binders

Photo credit: K. Kennedy, DEQ
Collaborative Demonstration Project

Photo credit: K. Kennedy, DEQ
Where are we going?

- Testing and evaluation (lab and field)
- Develop specifications in OK
- Demonstrate market viability by laying down more rubber
- Demonstrate cost effectiveness
- Increase use of Oklahoma rubber
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Clark, R. (n.d.). *System design, lab and field evaluation of dry process crumb rubber modified asphalt* [PowerPoint slides]. Barrington, IL: Asphalt Plus, LLC.

