

Ground Tire Rubber (GTR) Asphalt Study

Research Objectives

- Develop specifications and testing parameters for GTR-modified asphalt mixtures
- Perform cost-benefit estimates of incorporating GTR in WisDOT pavements
- Identify challenges of incorporating rubber modified mixtures into practice

Research Benefits

- Determined that each tested GTR mixture offers improved performance over the control mixture
- Affirmed economic benefit of incorporating GTR into asphalt pavements
- Recommended Wisconsin-specific GTR mixture specifications and testing parameters

Background

The push for state transportation agencies to recycle ground tire rubber (GTR) into asphalt pavements originated as a strategy for disposing of scrap tires. The practice continues in states that have found the benefits to extend beyond waste reduction to improved performance and service life of pavements. Rubber slows oxidative aging and therefore the brittleness of asphalt cement that generally increases over time. Performance benefits include increases in rutting resistance, skid resistance, ride quality and pavement service life and decreases moisture susceptibility, cracking potential and noise levels. WisDOT has not yet specified or placed GTR mixtures. The main objective of this research was to develop mixture specifications and testing parameters for incorporating GTR in Wisconsin pavements.

Methodology

A special provision (SPV) was drafted outlining mixture design guidance for terminal and dry process GTR. The SPV included Hamburg Wheel Tracking, Disk-Shaped Compact Tension (DCT) and Illinois Flexibility Index (I-FIT) performance tests. Short- and long-term aging was performed on DCT and I-FIT samples to determine long-term performance. Test strips were constructed on USH 51 consisting of control, terminal blend (TB), terminal blend hybrid (TBH) and dry process (DP) sections. A preliminary pavement distress survey was performed to quantify pavement distresses before construction of the overlay test sections. Another pavement distress survey was performed approximately one year after construction. A cost-benefit analysis was performed comparing bid prices with improved performance compared to the control.



Dry crumb rubber addition system at plant

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“This project advances WisDOT’s efforts to successfully implement ground tire rubber in hot mix asphalt mixtures.”
– Dan Kopacz,
WisDOT

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Final report is available at:
[WisDOT Research website](#)

Results

All GTR mixtures improved pavement performance to varying degrees. TBH and TB mixtures met or exceeded the performance of the control in both cold- and intermediate-temperature cracking resistance and rutting resistance. The TBH mixture was the most economical in terms of performance per dollar spent when compared to the control. The biggest challenge in working with GTR mixtures was swelling. While the DP mixture costs less per ton than the control mixture, it was more difficult to work with and exhibited far more variability in testing.

Any long-term pavement performance issues will likely appear after five- and ten-year time periods and offer a better perspective on which process of the rubber-modification performs best.

Recommendations for implementation

The research team advises WisDOT to specify TB or TBH mixtures, as they both offer significant improvements in every metric at an economical cost. The TBH, however, may be the most economical, since it offers improved rutting resistance; substantially better low-temperature cracking performance; and a similar flexibility index in the short and long term for only \$3.59 more per ton than the control. Additional condition surveys of the test sections should be taken after five and 10 years in service to better track and understand long-term performance of these mixtures.

WisDOT specifications consider “modifiers” separate from “additives.” Both are inclusions in an asphalt mixture; the former changes binder performance grade (PG), and the latter does not. Depending on the blend, GTR could be considered either a modifier or additive. If WisDOT chooses to use PG grade as the specification equivalency standard, TB processes are recommended substitutes for any type of mixture. DP is recommended for stone matrix asphalt mixtures only. Specifying by a performance testing equivalency would enable WisDOT to allow contractors either TB or DP, as long as they meet the required performance parameters. This type of specification allows the most options for contractors and, in turn, could provide more competitive bid prices.

The research team also advises WisDOT update its specifications on GTR material quality, plant modifications, mix design procedures, verification mix testing and performance test methods.

This brief summarizes Project 0092-19-05,
“Rubber Asphalt Study for Wisconsin”
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