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National Center for Asphalt Technology
NCAT
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Evaluation of a Rubber Modified Mixture Designed Using a Balanced Design in Lake Guntersville State Park and De Soto State Park

Year 3 Field Evaluation

Carolina Rodezno, and Grant Julian

1 INTRODUCTION

Asphalt mixtures have been primarily designed using the Superpave mix design method where proportioning of mixture components relies on volumetric requirements. The increased use of recycled asphalt materials and other asphalt modifiers in asphalt mixtures, such as ground tire rubber (GTR), has prompted the implementation of balanced mix design (BMD) efforts. BMD is defined as a mix design procedure that utilizes performance tests to address multiple modes of distress, considering mix aging, traffic, climate, and location within the pavement structure. A BMD mixture is designed to achieve an optimal balance between rutting and cracking resistance rather than relying on volumetric requirements. Since BMD utilizes testing of the mixture rather than individual components, it encourages innovation in incorporating new technologies, such as dry GTR products, to design high-quality asphalt mixtures.

Although strong markets have developed for scrap tires in recent years, current estimates still indicate that millions of scrap tires remain to be disposed of in landfills. Therefore, there is still potential to increase the use of GTR in asphalt pavements. The Alabama Department of Environmental Management (ADEM), through its Scrap Tire Program, is interested in promoting alternative use of scrap tires in engineering applications. In 2021, ADEM funded a demonstration project in Lake Guntersville State Park and De Soto State Park that included test sections with GTR.

2 PROJECT OBJECTIVE

The objective of this project is to evaluate the performance of a rubber-modified mixture designed using a balanced mix. To accomplish this objective, the Alabama Department of Conservation and Natural Resources (ADCNR) resurfaced a portion of the road in the Soto State Park and Guntersville State Park using a balanced mix with a recycled tire rubber (GTR) additive.

3 PROJECT TASKS

This project is divided into five tasks. The following paragraphs describe the tasks and progress as of the end of November 2025.

Task 1. Conduct a Balanced Mix Design (BMD) with a GTR additive selected by the ADCNR

A ground tire rubber (GTR) mix was designed by Wiregrass Construction Company (WCC). The GTR mixture modifier selected was provided by Liberty Tire Recycling at a dosage rate of 12% by weight of the total asphalt binder. The base binder grade was PG 67-22. The mix design information is summarized in Table 1. Samples of this mix were sent to NCAT in September 2021 for BMD evaluation using the IDEAL-CT test and Hot Indirect Tension Test (HT-IDT). The Alabama Department of Transportation (ALDOT) has selected these two tests to evaluate rutting and

cracking resistance of asphalt mixtures. The preliminary BMD criteria required by ALDOT is to have an IDEAL-CT of at least 50 for A/B traffic roads and an HT-IDT of at least 20 psi. The results of these two tests are included in Table 2. As presented, the mix design exceeded the minimum preliminary criteria required for both tests.

Table 1. GTR Mix Design

% Passing	GTR Mix
1/2"	100
3/8"	92
# 4	65
# 8	48
# 16	37
# 30	28
# 50	17
#100	9
#200	6.9
Asphalt Content (AC)%, Total	5.7
AC%, Virgin	4.5
AC% from RAP	1.2
Recycled Binder Ratio (RBR)	20.5%
GTR Dosage (by weight of total AC)	12%
Air Voids (Va), %	2.6
Voids in the Mineral Aggregate (VMA), %	16.1
Dust Proportion (DP)	1.16
Maximum Specific Gravity (Gmm)	2.437
Bulk Specific Gravity (Gmb)	2.374

Table 2. GTR Mix Design BMD Results from NCAT

BMD Test	Minimum Target Result	Avg. Test Result	St. Dev. of Test Result
IDEAL-CT	50	71.8	12.0
HT-IDT, psi (at 50°C)	20	33.2	1.4

Task 2. Monitor the Production of The Mixtures, and the Construction of the Section in Guntersville Park.

WCC placed this mix in Guntersville State Park in November 2021. An NCAT representative was onsite on November 11, 2021, to observe operations and to sample the mix for further testing at NCAT. Figures 1-2 contain pictures of the plant and the paving site. The existing surface mix was in poor condition and was milled. The existing surface in the lane adjacent to the paving lane in Figure 2.

Figure 1. WCC Plant near Guntersville, AL

Figure 2. Paving Site in Guntersville State Park

Task 3. Conduct Performance Tests (Rutting and Cracking) Using Plant Mix Sampled During Construction (Control and Rubber Mix) to Determine Compliance with the Performance Requirements.

The sampled mix was returned to the NCAT lab for testing. IDEAL-CT and HT-IDT specimens were compacted and tested to compare the results with those from the mix design phase in Table 2. The BMD results are provided in Table 3. The plant-produced mix was stiffer than the mix tested during mix design. The rutting resistance results increased, and the cracking resistance results decreased. However, the 49.7 CT-Index was right at the target mix design target 50 and easily surpassed the minimum rutting criteria of 20 psi.

Table 3. BMD Results on Sampled Mix Specimens

BMD Test	Avg. Test Result	St. Dev. of Test Result
IDEAL-CT-CT Index	49.7	8.7
HT-IDT, psi (at 50°C)	36.8	2.1

Task 4. Evaluate Field Performance of the Test Sections Every Year for Six Years.

This evaluation will be conducted using an automated pavement condition survey vehicle. The data collection vehicle used by NCAT is a fully automated PathRunner vehicle. The van is a class 1 inertial profiler with a 3D automated crack and rutting detection system. The van includes an on-board laser package that measures smoothness in terms of International Roughness Index (IRI), rutting, and macrotexture in terms of mean profile depth (MPD), in addition to front-facing super HD cameras, GPS, and 3D automated crack detection software providing a comprehensive pavement evaluation. The first and second field evaluations were conducted in February 2023 and February 2024. The results of the evaluations are summarized in the next section.

Task 5. Prepare Final Report with Findings.

A draft final report will be submitted to the ADCNR after the project (6 years after construction), documenting the field performance of the GTR test sections.

4 YEAR 3 PROJECT EVALUATION

4.1 Condition Survey for Lake Guntersville State Park

A recycled tire rubber (GTR) asphalt mixture was placed in Lake Guntersville State Park in the Fall of 2021. The mix was placed in both lanes for approximately 11 total lane miles of pavement (Figure 3). A one-year survey of the site was conducted on February 24, 2023, using NCAT's high-speed data collection vehicle, shown in Figure 4. A second survey was conducted the following year on February 6, 2024. The purpose of these surveys was to assess the current pavement condition in terms of IRI, rutting, texture, and cracking. Three data collection runs were made in each lane.

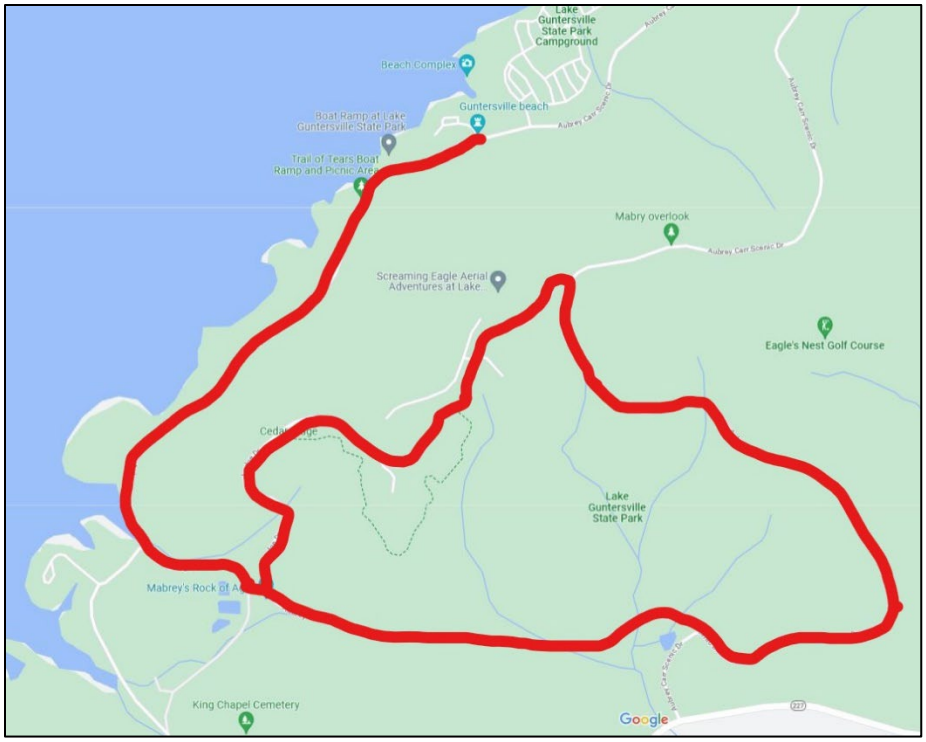

Figure 3. Survey Location for Guntersville Site

Figure 4. Data Collection Vehicle

The pavement surface appeared to be performing well, with no distresses visible to the survey vehicle at the time of the 2023 survey. At the time of the 2024 survey, minimal cracking was detected, with a total cracking rate of less than 0.5% by lane area for all areas. At the 2025 survey, cracking had increased slightly to an average of 1% of the total lane area. Figure 5 shows an example of the transverse cracking observed at the time of the 2024 survey, and Figure 6 shows an example at the 2025 survey.

Figure 5. Example of Cracking Observed at the 2024 Survey

Figure 6. Example of Cracking Observed at the 2025 Survey

There was no measurable rutting at the time of any survey. The average performance data for IRI and texture are shown in Table 4. This data shows there is little change in terms of ride quality and texture as of 2025. Figure 7 shows an overview of the pavement in 2024, and Figure 8 shows an overview in 2025. Figure 9 shows an example of the pavement texture at the time of the 2024 visit, and Figure 10 shows the pavement texture in 2025.

Table 4. IRI and Texture Results

	M_IRI, in/mil			MPD, mm		
	2023	**2024**	**2025**	**2023**	**2024**	**2025**
Loop - Right	83.8	85.0	91.4	0.97	1.08	1.13
Loop - Left	77.8	76.5	81.3	0.95	1.06	1.08
Shore Road NB	99.0	98.3	111.0	0.89	0.96	1.01
Shore Road SB	91.4	100.4	101.6	1.03	1.04	1.08

Figure 7. Pavement Overview during 2024 Survey of Guntersville Site

Figure 8. Pavement Overview during 2025 Survey of Guntersville Site

Figure 9. Example of Pavement Texture during 2024 Survey of Guntersville Site

Figure 10. Example of Pavement Texture during 2025 Survey of Guntersville Site

4.2 Condition Survey for Desoto State Park

Another ground tire rubber (GTR) asphalt mix was placed in Desoto State Park in 2021. This site is a parking lot/circular drive for Desoto Falls, as shown in Figure 11 and Figure 12. Field surveys were conducted each year beginning in 2023. NCAT's high-speed data collection vehicle was unable to travel at speed due to the geometry of the parking lot. Therefore, IRI could not be accurately measured.

A manual survey was conducted each year, and there was no cracking or rutting visible in 2023 or 2024. Figure 13, Figure 14, and Figure 15 show examples of the pavement at the time of the 2023, 2024, and 2025 visits, respectively. In 2025, there were two areas where cracking was observed, as shown in Figure 16 and Figure 17. There were some roller marks noted coming up the hill, as shown in Figure 18. The texture results shown in Table 5 are relatively stable are still within normal ranges observed for dense-graded mixtures.

Figure 11. Survey Location for Desoto Site

Figure 12. Site Overview at Desoto Falls Site

Figure 13. Pavement Example at Desoto Falls Site in 2023

Figure 14. Pavement Example at Desoto Falls Site in 2024

Figure 15. Pavement Example at Desoto Falls Site in 2025

Figure 16. Cracked Area Observed in 2025

Figure 17. Second Cracked Area Observed in 2025

Figure 18. Roller Marks Observed at Desoto Falls Site

Table 5. Texture Results for Desoto Falls Site

	MPD, mm		
	2023	**2024**	**2025**
Left Side	0.85	0.90	0.94
Right Side	0.83	0.98	0.93

At this point, it is concluded that the sites are still performing well, but minimal cracking has been observed in both sites. The year 4 visit scheduled for February 2026 will closely monitor the status of these cracks.