



STRATEGIC RECYCLING PROGRAM FACT SHEET

Original Date: 2020

Project:

Asphalt Rubber Gap Graded (AR-GG)

Site Location:

PennDOT District 5-0
S.R. 0078, Berks County

PennDOT District 3-0
S.R. 0015, Snyder
County

PennDOT District 11-0
S.R. 0376, Lawrence
County

PennDOT District 8-0
S.R. 0015, Adams
County

Date of Projects:

2012-2015

Recycled Material:

Crumb Rubber

Partnerships:

The Pennsylvania Department of Environmental Protection provided funding and assistance for this project.

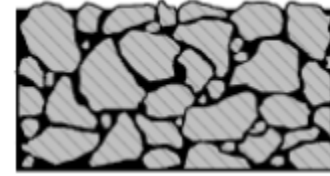
Did you Know?

Due to its success, Project 1 received the Rubber Pavement Association "Outstanding State DOT Program" award in 2012.

Introduction

Although Asphalt Rubber has been used in asphalt wearing courses mixtures in the past, prior to 2012 PennDOT had not performed a project where the material was processed as per ASTM D 6114 type II specifications, AKA "the wet process." There are many types of anti-aging components in tire rubber, which when combined with liquid asphalt binder using the wet process will produce a durable and weather resistant asphalt mixture.

Specifically, asphalt rubber concrete mixtures consisting of gap-graded surface courses are composed of mineral aggregates and a reacted asphalt-rubber binder, mixed in a central mixing plant, and placed on a prepared course.



Pavement Cross-Section Depicting a Typical Gap Graded Asphalt Mixture

Overview of the Project

In 2012, with the assistance of the Federal Highway Administration, PennDOT's District 5-0 performed a demonstration project to evaluate the performance of asphalt rubber gap-graded mixtures in Pennsylvania. The goal of the project was to evaluate the performance of the material on various Average Daily Traffic (ADT) roadways and being subject to Pennsylvania's climate.

Summary of Projects

PROJECT 1: S.R. 0078, Berks County

Completed in 2012, this project consisted of a mill and overlay of approximately 5.4 miles of S.R. 0078. The experimental section of the project consisted of eastbound lanes from Segment/Offset 0104/2396 to 0160/2166 and westbound lanes from Segment/Offset 0105/2528 to 0161/2109. The roadway's ADT in this Section was 18,438 (38% of the volume was trucks). The experimental section of the pavement was improved with the following:

- 1.5" AR-GG, Warm Mixed Asphalt (WMA) Wearing Course, RPS, PG 64-22, >/= 30 M ESALs, 12.5 mm Mix, SRL-E on
- 1.5" AR-GG, WMA Wearing Course (leveling), PG 64-22, >/= 30 M ESALs, 12.5 mm Mix, SRL-L on
- 3.0" Milling of Existing Bituminous Pavement on
- 10.0" Rigid Cement Concrete Pavement (RCCP) on
- 6.0" Special subbase

The project also included a control section which encompassed the westbound travel lane only of S.R. 0078 from Segment/Offset 0151/2528 to 0115/2528. The control section was completed using a Conventional Superpave Asphalt Mixture Design.

During construction of the S.R. 0078 test strip area, quality control issues encountered included; loose dirt piles observed on the areas to be paved, and insufficient tack coat coverage.

During subsequent evaluations, limited reflective cracking was observed in the experimental section. Reflective cracking, low and medium severity cracking with loss of material was observed on the control section. Results of the evaluations showed that the experimental sections performed overall better than the control sections.

To date the experimental section of the project appears to be performing well.

PROJECT 2: S.R. 0015 Snyder County

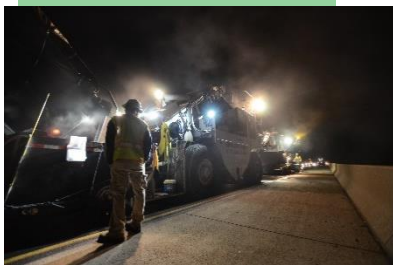
Completed in 2013, this project consisted of a mill and overlay of approximately 2.67 miles of the northbound and southbound lanes of S.R. 0015. The experimental portion of the project was completed from Segment/Offset 0040/0365 to 0100/2680 (northbound) and Segment/Offset 0010/0161 to 0101/2746 (southbound). The roadway's ADT in this Section was 8,000 (6% of the volume was trucks). The pavement was improved with the following:

- 1.5" AR-GG, WMA Wearing Course, RPS, PG 64-22, >/= 30 M ESALs, 12.5 mm Mix, SRL-E on
- Hot Mixed Asphalt (HMA) or WMA Wearing Course (scratch), PG 64-22, 3 to 10 M ESALs, 9.5 mm Mix, SRL-L on
- 2.25" Milling of existing Bituminous Pavement on
- 12" of unknown subbase

The project also included a control section which encompassed the northbound lane from Segment/Offset 0010/0210 to 0040/0365. The control section was completed using a Conventional Superpave Asphalt Mixture Design. This area also has many construction joints, traffic stops, speed changes, turns, and additional lanes, which made it difficult for the inspector to compare to the experimental section.

There were no reported quality control or placement issues encountered during project execution.

During the initial annual evaluation, an area of raveling in the travel lane and shoulder was observed at the north end of the project (southbound lane); however, the raveled area was attributed to a truck fire that occurred post construction. In general during annual evaluations, the project appeared to be performing better than expected.



View of construction of the District 5-0 SR 0078 Crumb Rubber Project



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Summary of Projects Continued

PROJECT 3: S.R. 0376, Lawrence County

Completed in 2014, this project consisted of a mill and overlay of approximately 5.13 miles of the eastbound and westbound lanes of S.R. 0376. The experimental portion of the project was completed from Segment/Offset 0040/1425 to 0090/1775 and Segment/Offset 0045/0890 to 0091/1815. The roadway's ADT in this Section was 6,000 (12% of the volume was trucks). The pavement was improved with the following:

- 1.5" AR-GG, WMA Rubber Gap Graded Wearing Course, RPS, PG 64-22, 3 to <10 M ESALs, 12.5 mm Mix, SRL-E on
- 2.5" to 4" Superpave Asphalt Mixture Design, HMA Binder Course, RPS, PG 64-22, 3 to <10 M ESALs, 19.0 mm Mix Modified on (variable depth binder is for cross slope buildup/correction)
- 0.75" Superpave Asphalt Mixture Design, HMA Wearing Course (Scratch), PG 64-22, 3 to <10 M ESALs, 9.5 mm Mix, SL-L on
- 9" existing reinforced concrete pavement over 12" of existing subbase.

The project also included a control section which encompassed the westbound lane from Segment/Offset 0041/1373 to 0045/0890. The control section was completed using a conventional Superpave Asphalt Mixture Design.

For this project, all the joints over the concrete slabs were saw cut and overbanded. The crumb-rubber section was overbanded with asphalt cement while the control section (non-crumb-rubber section) was overbanded with a lighter emulsion.

During the 2nd year evaluation, the inspector observed expansion of various longitudinal joints, some spalling, and shoulder edge deterioration in the control section only. With the exception of these failures, the overall condition of the project appeared to perform better than expected.



General view of the S.R. 0376 Project Area

PROJECT 1: S.R. 0015, Adams County

Completed in 2015, this project consisted of a mill and overlay of approximately 14.8 miles of the southbound lanes of S.R. 0015. The project was completed from Segment/Offset 0011/0000 to 0271/3556. The roadway's ADT in this Section was 9,600 (19% of the volume was trucks). The pavement was improved with the following:

- 1.5" AR-GG, WMA Wearing Course, PG 64-22, 3 to <10 M ESALs, 12.5 mm Mix, SRL-H on
- 2.5" Depth min. Superpave Asphalt Mixture Design, WMA Binder Course (leveling), PG 64-22, 3 to <10 M ESALs, 19.0 mm Mix, 2.5" Depth min. on
- existing 10" of RCCP 61.5' Joint spacing/dowel over 6" of special subbase.

A control section was not completed as part of this project. Construction of this project was completed without any reported concerns with the roadway or the material.

During the subsequent evaluation, no evidence of significant distressing was observed on the roadway.

Project Updates

Formal evaluations of the project are being conducted for a period of 10 years from the placement of the asphalt mix. To date, these projects have performed well. In 2018, three years after the completion of these projects, PennDOT formally approved the use of AR-GG and included the technology in Publication 408 – Construction Specification. These projects will continue to be monitored on an annual basis.



View of the S.R. 0015 Project from the project limits

Project Contacts:

- District 3-0 - Mr. Kenneth Klingerman & Mr. Justin Blakeney
- District 5-0 – Mr. Keith Fink
- District 8-0 – Mr. David Fratangeli
- District 11-0 – Mr. Jason Molinero

For Additional Information:

Go to the Strategic Recycling Program page on the PennDOT website at: <https://www.penndot.gov/ProjectAndPrograms/RoadDesignEnvironment/Environment/PollutionPrevention/Pages/default.aspx>. or send a request to PennDOTSRP@pa.gov.

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