PENNDOT’S MATERIAL SPECIFICATIONS AND FACT SHEETS
PennDOT SRP Development:

Created in 1998 as a tool to systematically identify, evaluate, and implement recycling opportunities throughout Pennsylvania.

PennDOT SRP Objectives:

1) Realize economic savings and environmental enhancement to PENNDOT and the Commonwealth;

2) Continued development and improvement to pollution prevention, recycling, energy efficiency efforts; and

3) Sound environmental management practices.
STRATEGIC RECYCLING PROGRAM
FIVE KEY FOCUS AREAS

**Research** – To collect information on recycled materials and to identify and resolve data gaps associated with the use of recycled materials.

**Specifications** – To develop, obtain, and/or disseminate user guidelines, provisional special provisions and Publication 408 specifications at the Municipal, District and Statewide levels.

**Projects** – The overall objective is to successfully incorporate recycled materials in transportation-related projects, including post-construction monitoring.

**Outreach** – To disseminate the results and experiences of recycled materials projects to PENNDOT, Commonwealth agencies and the public.

**Contracting** – To provide technical assistance to the Engineering Districts in developing construction contract mechanisms to specify or provide for recycled material use.
Recycled Asphalt Pavement (RAP) – Used as aggregate, sub-grade, and sub-base material and roadway shoulders; may be blended with steel slag, virgin aggregate, or crushed waste concrete in these same applications – currently governed under a PA DEP Co-product Determination or General Permit);


Asphalt Shingles – Over-cuts, tabs, and post-consumer shingles as ingredients in Hot Mix Asphalt;

Reclaimed Portland Cement Concrete (RPCC) – as aggregate, road sub-base, rip-rap, gabions, concrete pavement, and miscellaneous drainage;

Blast Furnace Slag – anti-skid material, fine or coarse aggregate, concrete pozzolan, select granular material;

Steel Slag – fine or coarse aggregate, sub-base, select granular material, select materials surfacing, shoulders, and bituminous surface courses, blending with RAP materials;
CURRENT SPECIFICATIONS (CONTINUED)

Fly Ash – cement concrete, flowable fill, concrete pozzolan;

Bottom Ash – anti-skid material;

Spent Foundry Sand – fine aggregate, flowable fill;

Aluminum – road, highway, and recycling center signs;

Scrap Tires – Tire Shreds as Structural Fill (TDA), Crumb Rubber with Stone Mix Asphalt (SMA) DRY or WET Method, Crumb Rubber as a Stabilizer, Crumb rubber for Absorptive Noise Barriers, Tire chips filler for Carsonite Sound Walls (plastic wall modules containing recyclable tire rubber).

Compost – Soil Amendments, Mulching, Compost FilterSock, Compost Blanket and Compost Filter Berm.
PENNDOT’S EXPERIENCE

Material

Fact Sheets
GLASS CULLET PROJECTS

Lackawanna County – District 4-0 at SR 6 and 247
- Pipe trenches bedded with glass aggregate and topped with crushed glass;
- Four feet of glass aggregate capped with 12-inch layer of natural aggregate.
- Four-year inspection/evaluations performed;
- Provisional Specification for Glass Cullet as backfill, meeting Pub. 408, Section 703, AASHTO No. 8 gradation requirements; Table B, Type C quality requirements (expect allowance of 100% glassy particles.)
GLASS CULLET PROJECTS
INTRODUCTION:
Crushed glass is recycled glass cullet defined by PADEP Act 101 as “Post Consumer Material”. Early PennDOT research projects demonstrated that crushed glass could be used as a viable alternative to conventional aggregates. Some viable applications for which provisional specifications are available include: utility bedding and backfill, drainage material, flowable fill, embankment fill.

OVERVIEW OF PROJECT:
PennDOT’s District 5-0 used crushed glass and backfill in a 100% substitution of conventional aggregate on SR 222 in Berks County. The project used 700 tons of crushed glass. Provisional specifications included the requirement that the crushed glass met AASHTO No. 8 gradation and Pub 408 Type C Coarse Aggregate quality requirements. Minus 3/8” gradation and Section 107 Type C, Coarse Aggregate specifications were met. PennDOT’s construction contractor encountered some difficulty in obtaining compaction during placement of the initial material, requiring extra effort. Throughout compaction attempts, the crushed glass exhibited the tendency to ‘slide’ rather than compact. As a result, PennDOT revised the scope of work to use crushed glass only as pipe bedding material for this project. Follow-up testing of the on-site materials indicated that although the crushed glass met the minus 3/8” gradation specification, it did not meet the AASHTO No. 8 gradation.

Another consideration is that coarser crushed glass material had a courser gradation in the upper ranges, thus potentially contributing the difficulty of compaction. One explanation considered was that the upper ranges of this material still contained some elongated pieces that contributed to the “slide.” In conclusion, although the minus 3/8” specification was met, the material did not meet the required gradation and the difference may have contributed to compaction problems.

Potential solutions considered: mandatory full gradation testing of supplier stockpile; limiting crushed glass use to pipe bedding only; and/or using crushed glass meeting AASHTO No. 10 as gradation requirement. At minimum, compaction of this material should be closely monitored.
SMA CRUMB RUBBER
PROJECT JULY 2011

Utilized Crumb Rubber Modified Asphalt (CRMA) at District 9-0 Nicktown Stockpile staging area

- Minimize stormwater runoff from leaving the site;
- Direct stormwater to the existing detention system;
- Evaluate performance of CRMA in an area which see use of heavy equipment in a confined area.
STRATEGIC RECYCLING PROGRAM
FACT SHEET

FY 2012

INTRODUCTION:
In the mid 1990’s PennDOT implemented three experimental projects that used asphalt modified with treated crumb-rubber material. The performance of these earlier experimental projects was mixed. However, more recent projects, such as the one executed in District 1-0 on SR 0086 (2005) that used crumb rubber material in a thin wearing course show promising results. The purpose of this project is to evaluate the effectiveness of CRMA in an area of heavy equipment travel and to improve the drainage characteristics of the facility by minimizing stormwater runoff offsite.

OVERVIEW OF PROJECT:
PennDOT District 9-0 completed a paving project at their Nicktown Stockpile (Cambria County, 9-3) located on the northside of State Route 0553 in July 2011. The stockpile is located approximately 1.5 miles southeast of Nicktown, Pennsylvania. Approximately 65,000 square feet of the stockpile staging area was paved using Stone Matrix Asphalt (CRMA) modified with crumb rubber in a 4-inch base course and a 2-inch wearing course. The purpose of this project was to evaluate the effectiveness of the CRMA in an area of heavy equipment travel and to improve the drainage characteristics of the facility, ultimately conveying stormwater to the onsite stormwater detention basin. PennDOT will monitor the performance of the CRMA towards reducing rutting, cracking, and also monitor the material durability.

Prior to the actual paving start date, site improvements were completed which included; grading of the material staging yard, and milling (maximum depth of 1-inch) of an asphalt area in front of the salt storage sheds. The milling was completed to achieve the necessary grade to direct stormwater runoff away from the salt storage sheds, along the northeast property boundary, and into the onsite detention basin. Following completion of the CRMA wearing course placement and compaction, a CRMA berm was installed along the northeastern property boundary to direct stormwater into the detention basin and prevent offsite runoff.
Project Overview (cont.)

The base course was produced following a JMF C143 design mix modified with 0.5% (by total weight) crumb rubber, and JMF 111 design mix with a 0.5% crumb rubber component. Additionally, the design mix used stone aggregate limited to 25 mm for the base course, and 9 mm for the wearing course. PennDOT placed approximately 2,200 tons of CRMA that included approximately 11 tons of crumb rubber by weight contributing to the mix. Crumb rubber was added to the asphalt binder using a dry process. In the dry process, granulated or ground rubber and/or crumb rubber is used as a substitute for a small portion of the fine aggregate. The rubber particles are blended with the aggregate prior to the addition of the asphalt binder. A standard vibratory roller was used for compaction.

As part of PennDOT’s Strategic Recycling Program (SRP), the Pennsylvania Department of Environmental Protection (PADEP) underwrote the material costs on this project, funding 80% of the total $201,754 project costs. This project demonstrates PennDOT’s continued commitment to find solutions to create longer lasting pavements, and safer roads.

Manufacturer

Go to the SEM web page at:
http://www.dot.state.pa.us

For more information on Crumb Rubber specifications and other recycling material projects.
TIRE SHREDS
LIGHTWEIGHT FILL

Tarrtown Bridge - Armstrong County SR 4023, Section 150

- First scrap tire recycling project in PA;
- 750,000 tires (7,500 tons) used Scrap tires from 4 community collection days, river sweeps, 6 abandoned tire piles, and PADEP Clean-ups;
- Shredded tires used as lightweight geotechnical fill (50lb/ft³);
- Joint funding provided by PADEP
**INTRODUCTION:**
As a first of such projects in the Commonwealth, PennDOT District 10-0 constructed the Tarrtown Bridge using shredded tires as lightweight embankment fill on two bridge approaches along State Route (S.R. 4023, Section 150). The bridge spans a small tributary stream to the Allegheny River and services a high traffic load.

The Tarrtown bridge project is an innovative project for several reasons. First, lightweight geotechnical fill was required at the two bridge approaches due to existing soft soil conditions at the site. Thus, the use of shredded scrap tires as embankment fill was selected based on material characteristics and anticipated shortened settlement times, allowing for a more expedited construction schedule.

**OVERVIEW OF PROJECT:**
Approximately 557,000 scrap passenger tires (5,570 tons) were incorporated into the two bridge embankments. A wide targeted approach was used to collect the large amount of scrap tires to execute this project, including: tires from four community collection/drop off days, tires from six Pennsylvania abandoned tire piles, tires from sites under consent orders for cleanup, and other traditional sources such as tire dealers. The Pennsylvania Department of Environmental Protection (PADEP) provided joint funding and assistance for this project.

For comparisons, shredded tires weight is estimated at 50 lbs/CF, while regular soil at 120 lbs/CF. One layer of shredded tires was used in designated bridge embankment 1, while two layers of this lightweight material were used in embankment 2. The bridge was let into service in the fall of 2005. Further, as an innovative project, PennDOT incorporated over 230 separate embankment and bridge instruments to monitor through construction and post-construction the bridge response and settlement. Collected data will assist the Department in modeling and design of future similar projects.
STRATEGIC RECYCLING PROGRAM
FACT SHEET

PROJECT OVERVIEW (cont.)

A six-acre site, located near the bridge site was selected to be used to process and stockpile tires. All shredding of tires was performed at this site. Tires were shredded per specifications that set specific restrictions to length, gradation, free and exposed steel and amount of allowable deleterious materials (oils, gasoline, diesel fuel, hydraulic fluid, grease, ice, snow, and burnt tires).

During the project over 230 embankment and bridge instruments were incorporated into the bridge project, where data collection is performed manually and through automated systems. The instruments are used to monitor site conditions and bridge response through various bridge construction phases and post-construction conditions.

ADDITIONAL PROJECT PHOTOS:

Instruments used include inclinometers, total pressure cells (pressure against abutments), piezometers (subsurface water pressure), and thermistors (temperature). Twenty inclinometers with dual purposes, measuring both horizontal (inclination) and vertical (settlement) movement, are used to monitor each embankment. Four inclinometers were installed to monitor the four most critical centerline road stations. Each inclinometer contains between five to fifteen monitoring magnets, including a combination of datum, plate, and spider magnets. Datum magnets are imbedded in bedrock and are used as a stationary reference point. Plate magnets are used in-between soil and tire shred layers to differentiate between tire shred compression and foundation consolidation. Spider magnets are free to slide up or down the inclinometer as the foundation settles.

The Pollution Prevention Section Program Office assisted District 10-0 in specification development and project implementation. The Pollution Prevention Section Program Office can be contacted for further information at (717) 783-3616.

Project Contacts:

Gary Madey of PennDOT District 10-0 is the Assistant Construction Management Engineer for the project.

Steve Geidel is the PennDOT District 10-0 Geotechnical Engineer for the project.

Go to the PennDOT Web site at:

http://www.dot.state.pa.us

Click on More Links—Strategic Recycle Program for more information.

Tarrtown Data Website:

http://www.dot.state.pa.us/Penndot/Districts/D10Const.nsf/FSTarrtownBridge?OpenFrameSet
ASPHALT RUBBER GAP GRADED PROJECT 2012

- Interstate – 78 District 5-0 Berks County
  - Mile post 11 to 16 East and West bound.
- Mill existing 3" of bituminous material to concrete, 24' wide and two feet into outside shoulder.
- Pave two lifts of 1.5" AR-GG (Asphalt Rubber Gap Graded) for total of 3".
- Mill outside shoulder of pave with regular bituminous asphalt mix.
- A total of 27,500 tons of AR-GG will be placed.
- 467.5 tons of CRM @ $0.35/lb = $327,250

27500 tons at 8.5% liquid binder = 2337.5 tons liquid binder, at 20% crumb rubber = 467.5 tons
ASPHALT RUBBER GAP GRADED PROJECT
CRUSHING OPERATION FOR RECLAIMED PORTLAND CEMENT CONCRETE (RPCC)

- **Project Location:** Interstate 79 (I-79), District 1-0 approximately 1.5 miles from the McKean exit;

- **Source of RPCC Material:** derived from previous work done on I-79 and Interstate 90 (I-90). A mixture of pavement, bridge piers and abutments, posts for signs and guiderails, remnants of slab and joint repair work, and other miscellaneous concrete-related materials.

- **Materials Generated:**
  - **R4 Stone**, used for repairing roadway washout areas;
  - **2A Stone**, used as pipe backfill replacement, restoration, and roadway shoulder backup. The 2A stone will also be blended with the fines generated from the RAP/#8 stone project to create an asphalt binder.
CRUSHING OPERATION
PENN DOT’S RECYCLE MATERIAL BRIEF
Benchmark current recycled material use practices and identify future trends for the application of recycled materials in highway infrastructure applications.
PennDOT’s Survey -
- Identified materials and their applications;
- Analyzed current state attitudes to using recycled materials;
- Noted the barriers to using recycled materials and identify issues that promote their use;
- Determined the future application use of recycled materials in Highway Civil Engineering.

Successes and Challenges
- Structure and Funding
- Large Industry
- Use of Design-build Projects
- Lack of Incentives
- Project Tracking