



Steven L. Koser, P.E.
Associate Director

PA Asphalt Pavement
Association

STIC Innovations:

**1.) Cold Central Plant
Recycling (CCPR)**

**2.) Fuel Resistant (FR)
Highly Modified Asphalt
Binder – Amish Buggy
Routes**

July 31, 2024

2024 PAPA/PennDOT/PTC Bus Tour



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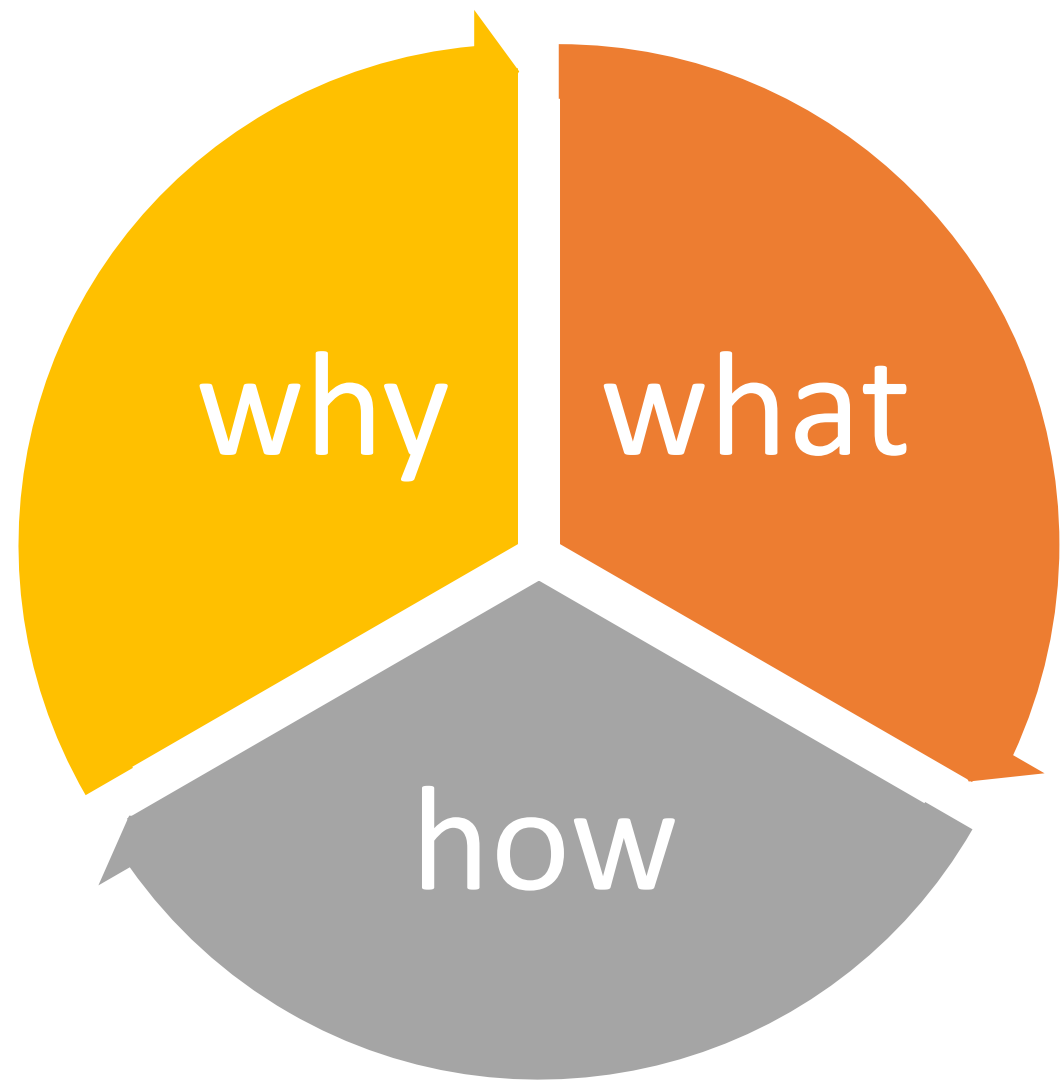
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STIC Innovation: Cold Central Plant Recycling (CCPR)

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2024 PAPA/PennDOT/PTC Bus Tour

CCPR



Sustainability

President Biden, USDOT Announce New Guidance and \$6.4 Billion to Help States Reduce Carbon Emissions Under the Bipartisan Infrastructure Law

Thursday, April 21, 2022

Key program will fund projects that help fight climate change and save Americans money on gas

FHWA 12-22

Contact: FHWA.PressOffice@dot.gov

Tel: (202) 366-0660

WASHINGTON, D.C. – The U.S. Department of Transportation's Federal Highway Administration today announced a new program that unlocks \$6.4 billion in formula funding for states and localities over five years. The new Carbon Reduction Program (CRP), created under the President's Bipartisan Infrastructure Law, will help states develop carbon reduction strategies and address the climate crisis facing our nation. States can use the funds in CRP to expand transportation options for American families that can help them save money on gas.



FHWA Steps Up Efforts to Tackle Greenhouse Gas Emissions from Highway Construction with \$7.1 Million for 'Climate Challenge' Participants

Thursday, October 20, 2022

Challenge will advance the use of sustainable pavements and quantify environmental impacts

FHWA 43-22

Contact: FHWA.PressOffice@dot.gov

Tel: (202) 366-0660

WASHINGTON – As part of the U.S. Department of Transportation's ongoing work to address climate change, the Federal Highway Administration (FHWA) today announced \$7.1 million for 25 state departments of transportation involved in [FHWA's Climate Challenge](#). FHWA launched the Climate Challenge Initiative earlier this year to quantify the impacts of sustainable pavements and to demonstrate ways to reduce greenhouse gas emissions in highway projects using sustainable construction materials. The new funding is being announced as part of the Federal Buy Clean Initiative to promote the use of American-made, lower-carbon construction materials in Federal procurement and Federally-funded projects. More information is available at [FHWA Climate Challenge - Quantifying Emissions of Sustainable Pavements](#).



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Pavement Association
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Sustainability



OFFICE OF THE FEDERAL CHIEF SUSTAINABILITY OFFICER
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HOME ABOUT PLAN POLICY PROGRESS RESOURCES & GUIDANCE

Federal Buy Clean Initiative

[Home](#) / [Federal Sustainability Plan](#) / [Net-Zero Emissions Procurement](#) / [Buy Clean](#)

Federal Sustainability Plan

Carbon Pollution-Free Electricity

Zero-Emission Vehicle
Acquisitions

Net-Zero Emissions Buildings

Net-Zero Emissions Procurement

Federal Buy Clean Initiative

Federal Supplier Climate Risks
and Resilience Proposed Rule

Net-Zero Emissions Operations

Climate Resilient Infrastructure
and Operations

On This Page

- [About the Federal Buy Clean Initiative](#)
- [About the Buy Clean Task Force](#)
- [Buy Clean News and Announcements](#)
- [Frequently Asked Questions](#)

About the Federal Buy Clean Initiative

The Federal Government is the largest purchaser in the world, with annual purchasing power of over \$650 billion. To harness that procurement power to support low-carbon, made in America materials, President's Biden charged his Administration through his December 2021 [Federal Sustainability Plan](#) and [Executive Order 14057](#) to launch a Buy Clean Task Force and initiative to promote use of low-carbon, made in America construction materials. **Through Buy Clean, the Federal Government will for the first time prioritize the use of American-made, lower-carbon construction materials in Federal procurement and Federally-funded projects,** which will advance America's industrial capacity to supply the goods and materials of the future while growing good jobs for American workers.



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Sustainability

Low Carbon Transportation Materials (LCTM) Grant

→ (\$2 Billion - \$1.2 Billion for State DOT's and \$800 Million for Locals)



2024 PAPA ENVIRONMENTAL SEMINAR



April 10, 2024

2024 PAPA ENVIRONMENTAL SEMINAR




EPDs, Benchmarking, and Low Carbon Procurement

April 10, 2024

Joseph Shacat
Director of Sustainable Pavements
jshacat@asphaltpavement.org



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Sustainability

Wolf Administration Highlights Collaborative Pilot To Pave Roadway With Recycled Plastic

10/13/2021

Harrisburg, PA – Officials from the state Departments of Transportation (PennDOT), Conservation and Natural Resources (DCNR), Environmental Protection (DEP), and General Services (DGS) today highlighted a pilot project to pave part of a Ridley Creek State Park roadway with an asphalt and recycled plastic mixture.

The project, coordinated through PennDOT's [Strategic Recycling Program](#) which is funded through DEP, includes two quarter-mile roadway stretches surfaced with an asphalt/recycled-plastic mix. The material is intended to strengthen the roadway surface without leaching plastic material into the surrounding environment.

[Pollution Prevention Strategic Recycling Program Overview.pdf \(pa.gov\)](#)



Sustainability



Two ways to reduce carbon emission in asphalt pavements:

1. Increase RAP
2. Reduce Temperatures

The Road 
Forward

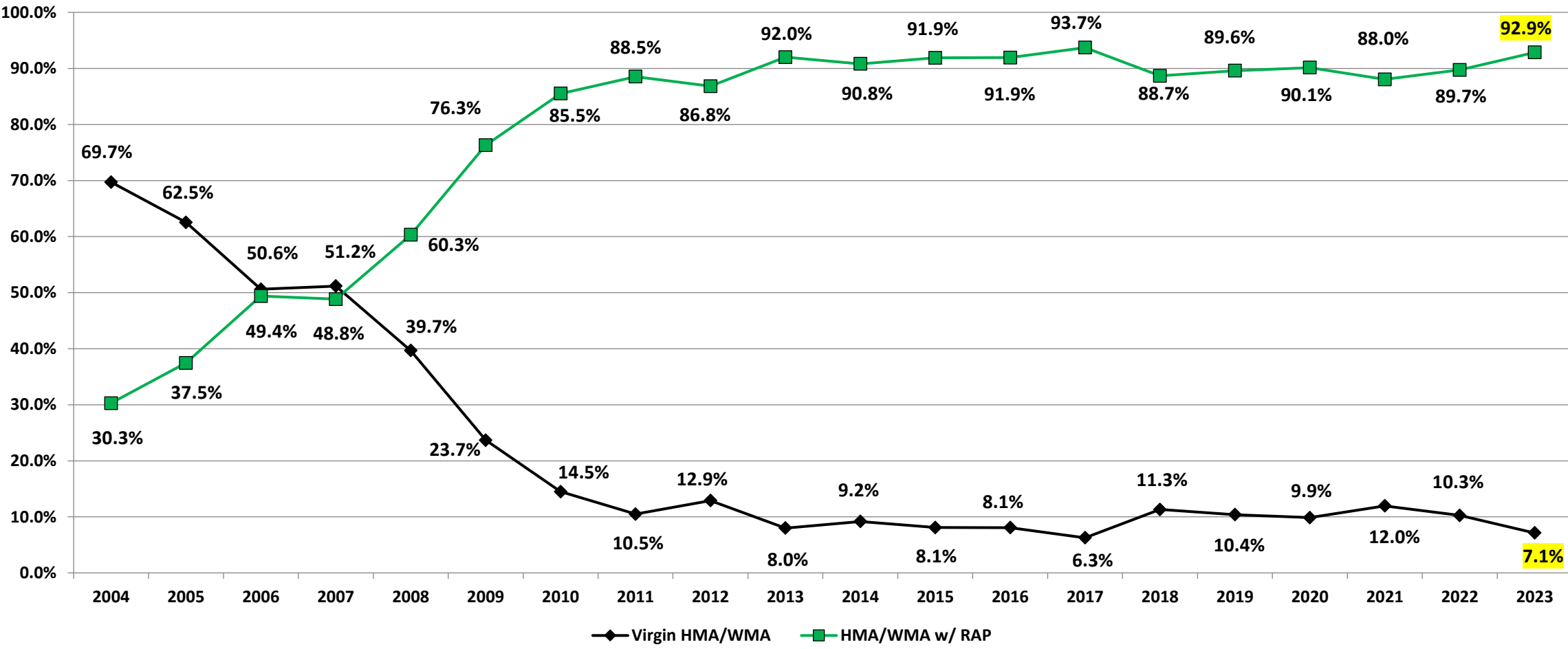
A Vision for Net Zero Carbon Emissions
for the Asphalt Pavement Industry



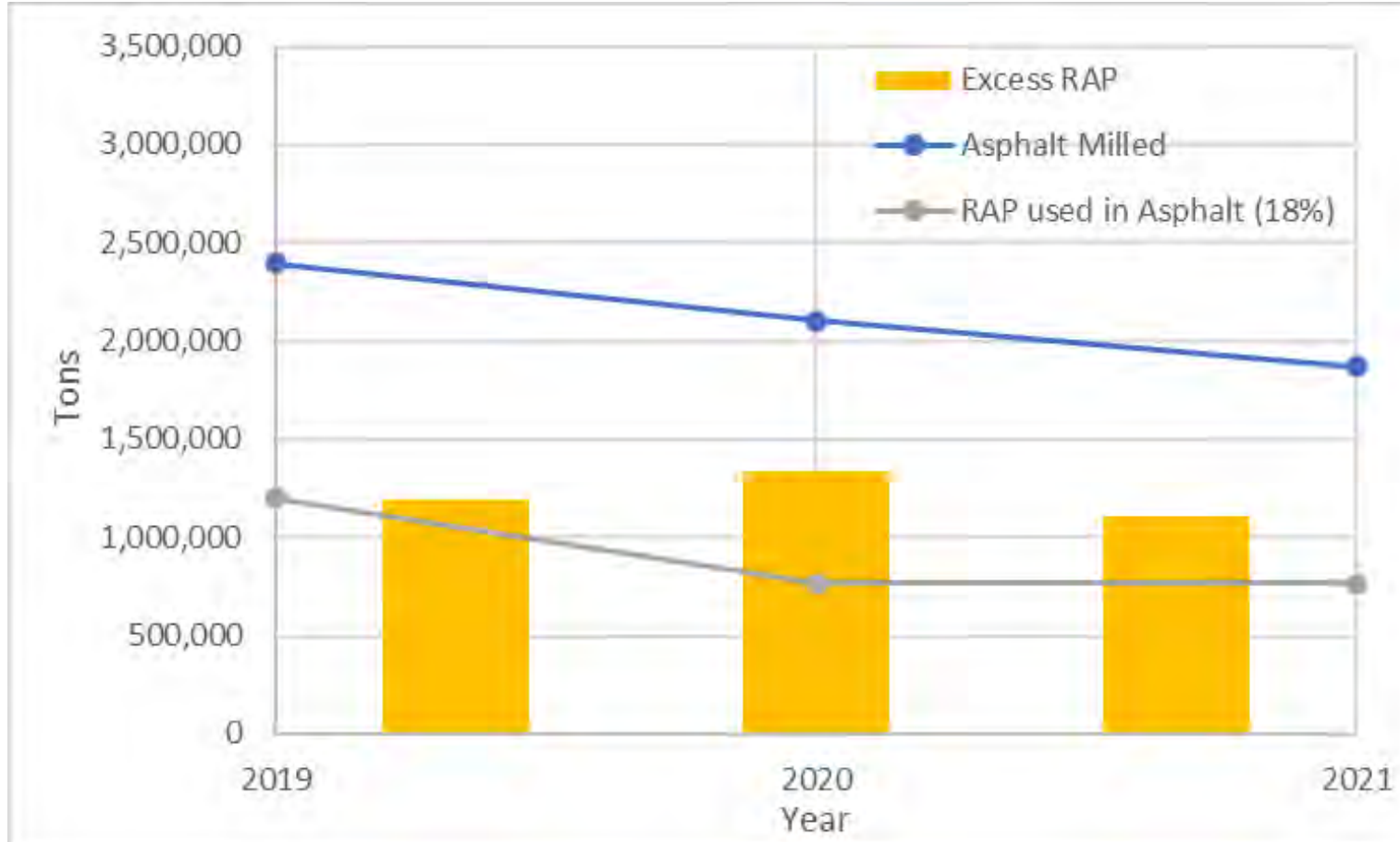
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RAP in PA (From PennDOT)



RAP in PA

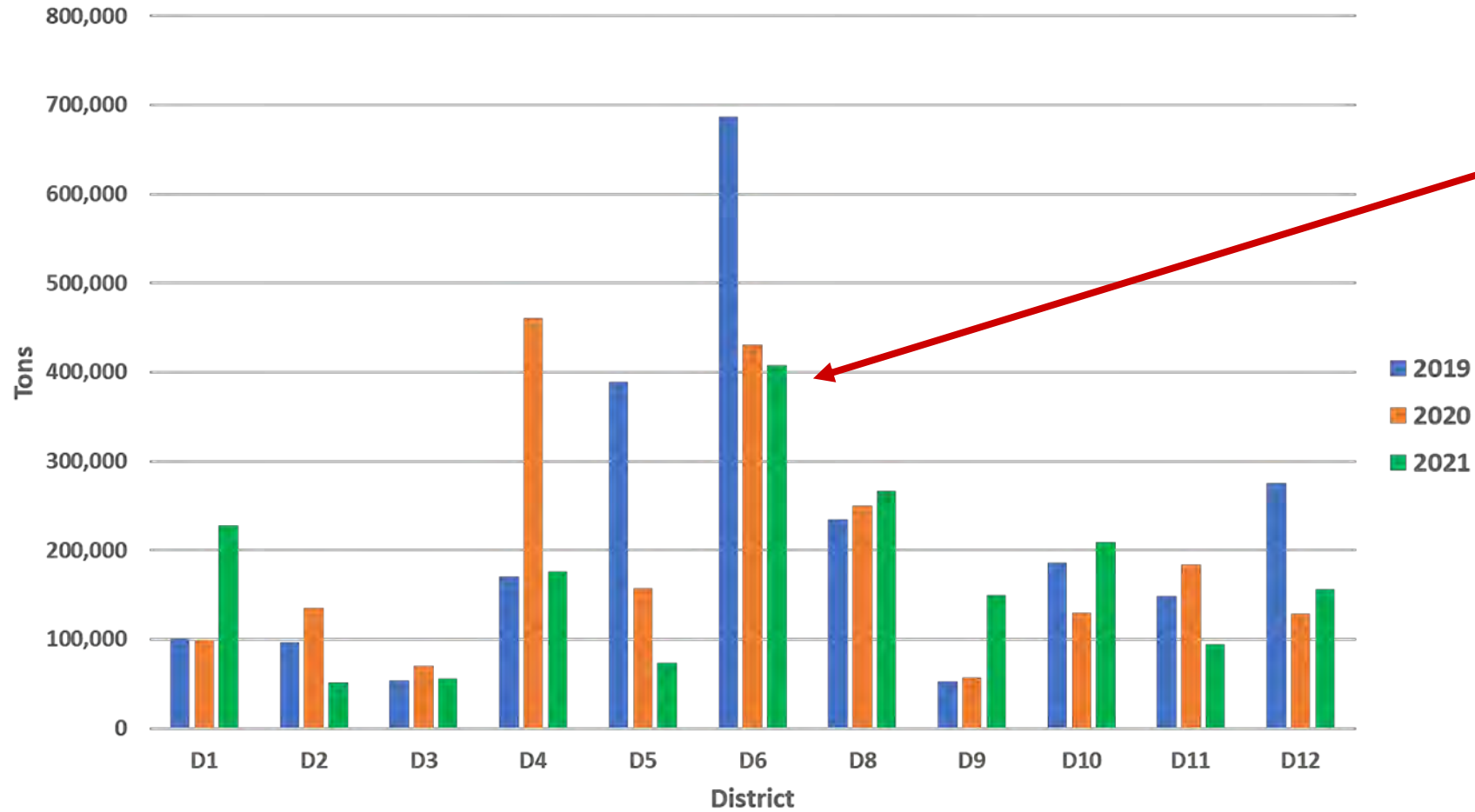


Year	Asphalt Milled	Asphalt Placed	RAP in Asphalt	Difference
2019	2,394,076	6,667,762	1,200,197	1,193,879
2020	2,102,339	4,240,700	763,326	1,339,013
2021	1,869,704	4,252,700	765,486	1,104,218



RAP in PA

Amount of RAP Milled from Pavements



Largest quantities of RAP are in URBAN parts of the state

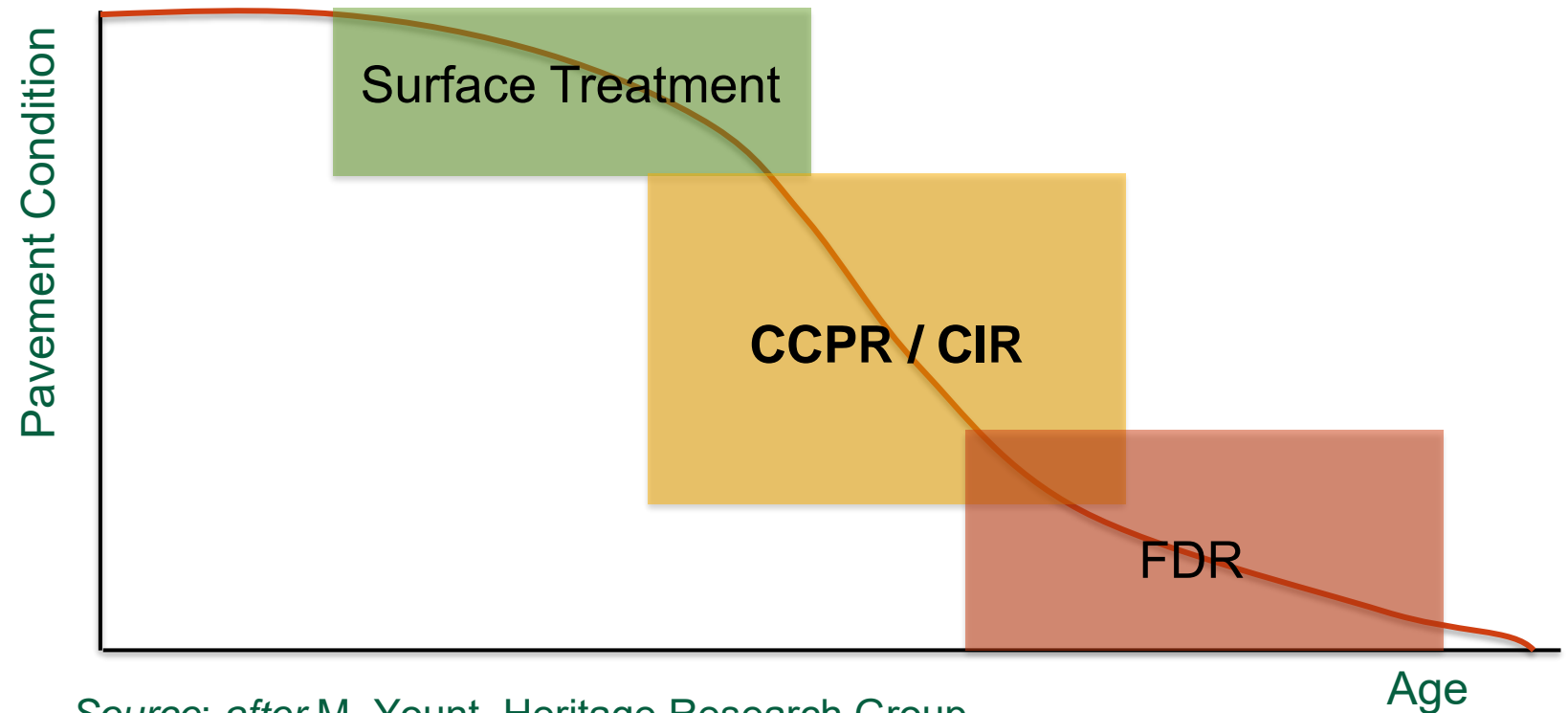
Sustainability

- Be good stewards of the environment
- Utilize excess stockpile RAP (reduces the need for virgin materials)
- Low-cost alternative to plant produced asphalt mix
 - Reducing the cost for rehabilitation/reconstruction means more miles can be addressed
 - Funding opportunities at the federal level (IIJA, Buy Clean, IRA, etc.) that can be used to offset costs



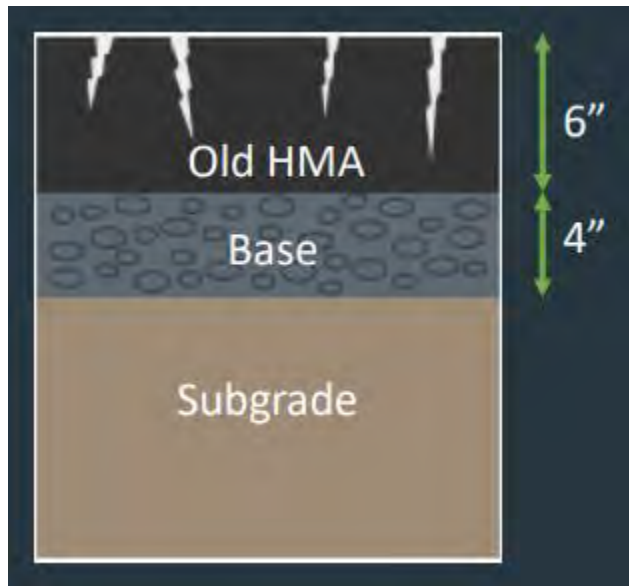
Cold Recycling

- Pavements in poor condition
- Increase structure

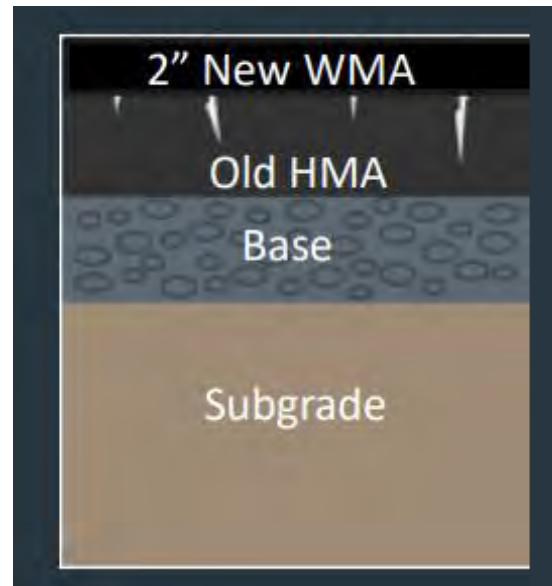


Cold Recycling

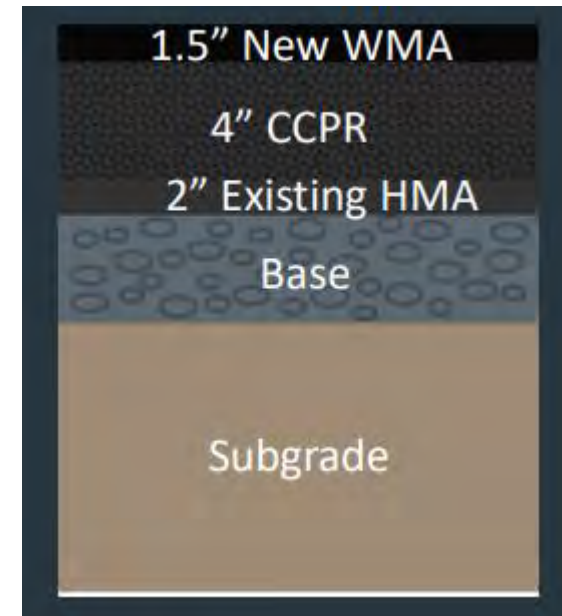
Existing distressed pavement



Mill & fill (band-aid)



Structural rehabilitation with cold recycled mix



Cold recycling reuses existing pavement materials (100% RAP), asphalt emulsion or foamed asphalt, and a small amount of cement to create a new flexible base with increased structural capacity.

Cold Recycling

		
<p>Full Depth Reclamation (FDR)</p> <p>Typical Depth: 5 - 12 inches</p> <p>Stabilizer: Emulsified/ Foamed Asphalt or Portland Cement</p>	<p>Cold In-place Recycle (CIR)</p> <p>Typical Depth: 3 – 5 inches</p> <p>Stabilizer: Emulsified/ Foamed Asphalt</p>	<p>Cold Central Plant Recycle (CCPR)</p> <p>Typical Depth: 3 - 6 inches</p> <p>Stabilizer: Emulsified/ Foamed Asphalt</p>
<p>Agency Usage:</p> <ul style="list-style-type: none"> - Alternative to Reconstruction 	<p>Agency Usage:</p> <ul style="list-style-type: none"> - Alternative to Deep Mill and Fill or Partial Depth Patching 	<p>Agency Usage:</p> <ul style="list-style-type: none"> - Structural Base Layer - Alternative to Deep Mill and Fill

Cold recycling reuses existing pavement materials (100% RAP), asphalt emulsion or foamed asphalt, and a small amount of cement to create a new flexible base with increased structural capacity.



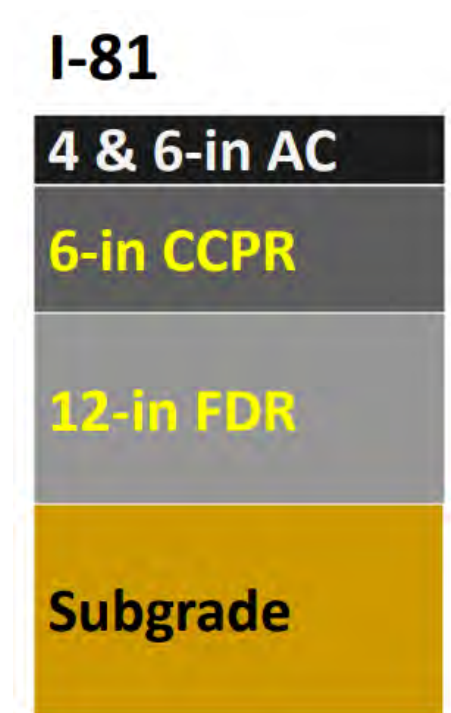
CCPR

- Similar to traditional asphalt mix:
 - Designed mix
 - Considers properties and variation of RAP
 - Dosage of asphalt emulsion/foamed asphalt based on lab testing
 - Hauled to site
 - Paved with paver
 - Compacted
- Different in that
 - RAP %
 - Temperatures
 - Use of cement (1% or less)
 - Cure Time



Uses of CCPR (on High Volume Roads)

- **VDOT, I-81 (3.66 mile section):**
 - 23,000 vpd, 28% trucks
 - Existing condition:
 - structural related distresses
 - deep patching and AC mill and inlays
 - Performed well under interstate traffic
 - Cost savings (depending on alternative):
 - \$7.9 million to \$70 million
 - Shortened construction time (depending on alternative):
 - Several weeks to almost 1 year
 - High structural contribution
 - Structural coefficient estimated at 0.37 – 0.44



I-81 in Virginia (Brian Diefenderfer)

Source: FHWA/VCTIR 15-R1, 2014



CCPR on High Volume Routes

Virginia DOT's Experience with CCPR on Interstates:



I-64, Williamsburg (Segments II and III)

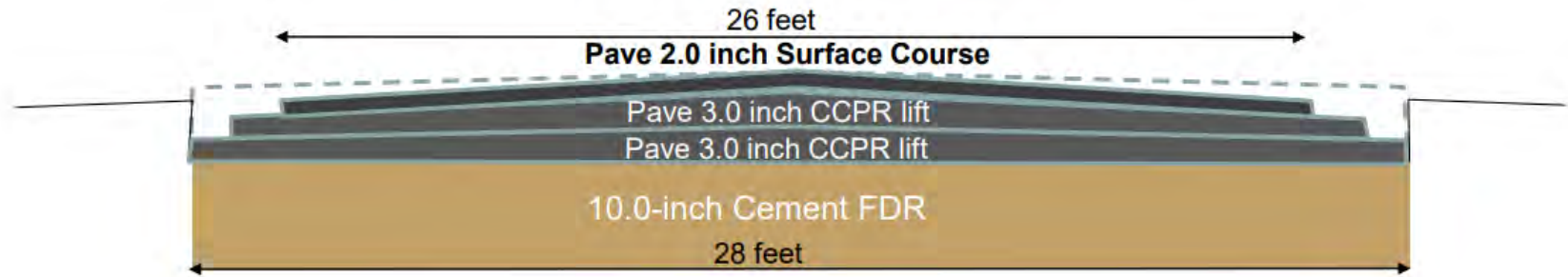
- 43,000 vpd, 9% trucks
- Reconstruction of existing lanes
- Widening (additional lanes)
- Estimated \$10 million cost savings for Segment II
- Segment II used 180,000 tons of stockpiled RAP

https://www.fhwa.dot.gov/pavement/sustainability/case_studies/hif19078.pdf

https://i64widening.org/learn_more/pavement_recycling_methods.asp

Uses of CCPR

- INDOT, SR 236
 - Rural, state collector
 - Distressed pavement with subgrade failures



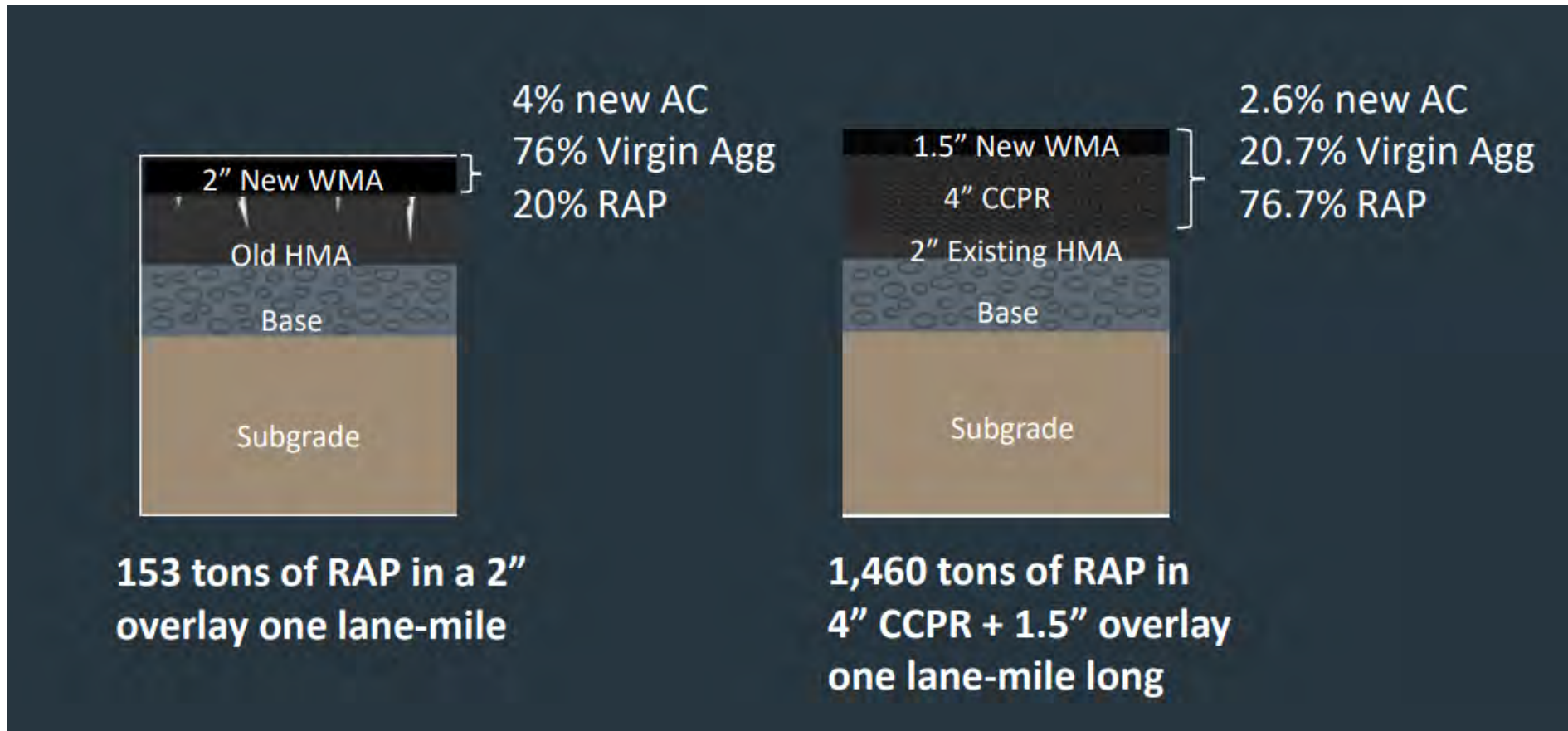
Weighted Cost Comparison- 2020 Averages	
Reconstruction with Recycling	Traditional Reconstruction
Asphalt Milling	Soil Improvements
10" Cement FDR	3" Compacted Aggregate
6" CCPR	3" HMA Base
2" HMA Surface	2.5" HMA Intermediate
	1.5" HMA Surface
78% of cost of Traditional Reconstruction	

Uses of CCPR

- **On top of**
 - Break and seat/ Crack and seat
 - FDR
 - Existing asphalt layer
- **Overlaid with**
 - Surface treatment
 - Thin overlay
 - 2-4" asphalt layer



CCPR



Courtesy: J. Bowers, Ingevity

9.5 times more RAP usage (in this example)



CCPR Next Steps?

- Work Group for path forward (from concept to construction)
 - PennDOT, PTC, FHWA, PAPA
 - National Expertise with CCPR (ECMS Business Partner & Consultant)
- **CCPR Pilot Project identification**
- Funding for Technical Assistance to the STIC CCPR Development Team
 - STIC Innovation funding approved (not allocated) of **\$93,000 federal** (20% state match)
 - **2-year limit** for the STIC Incentive funding
 - **Work Scope:**
 - Review of US Agencies & existing PennDOT CCPR design, specification & best practices
 - Planning Technical Assistance
 - Specifications Development
 - Bid and Kick-off Support
 - PennDOT Policy/Procedure Update





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STIC Innovation:

**Fuel Resistant (FR) Highly
Modified Asphalt Binder –
Amish Buggy Routes**

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Fuel Resistant Highly Modified Asphalt Binder: Amish Buggy Routes



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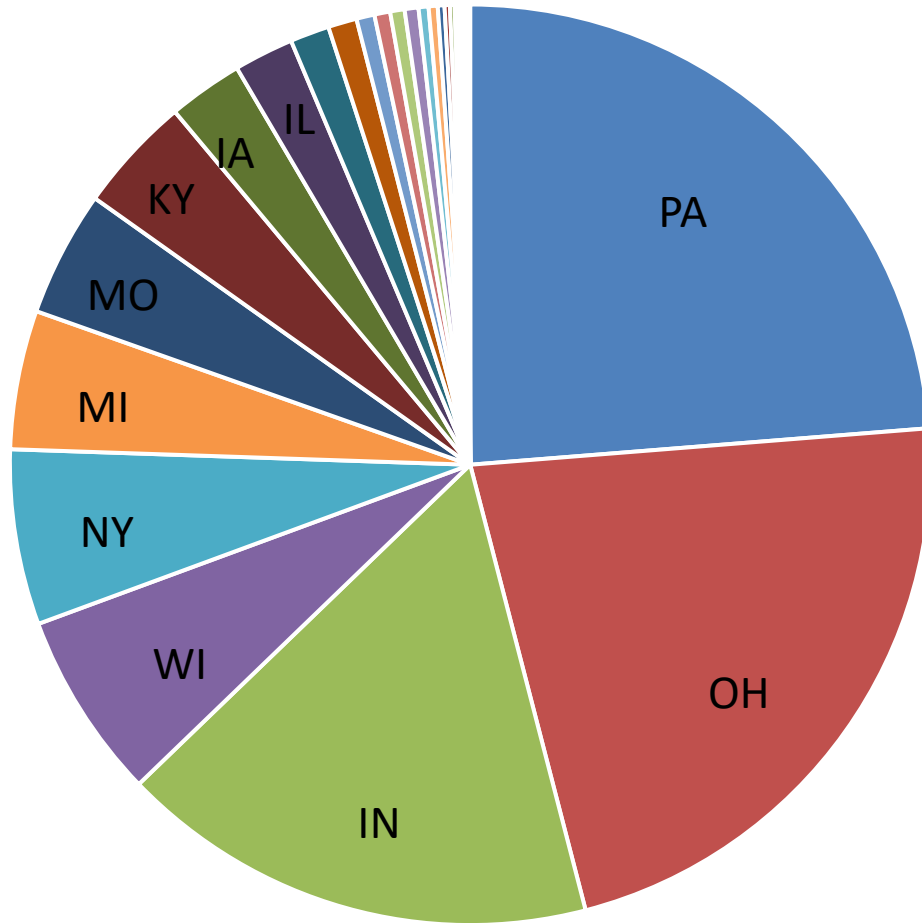
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AMISH IN PA

Amish Population by U.S. State

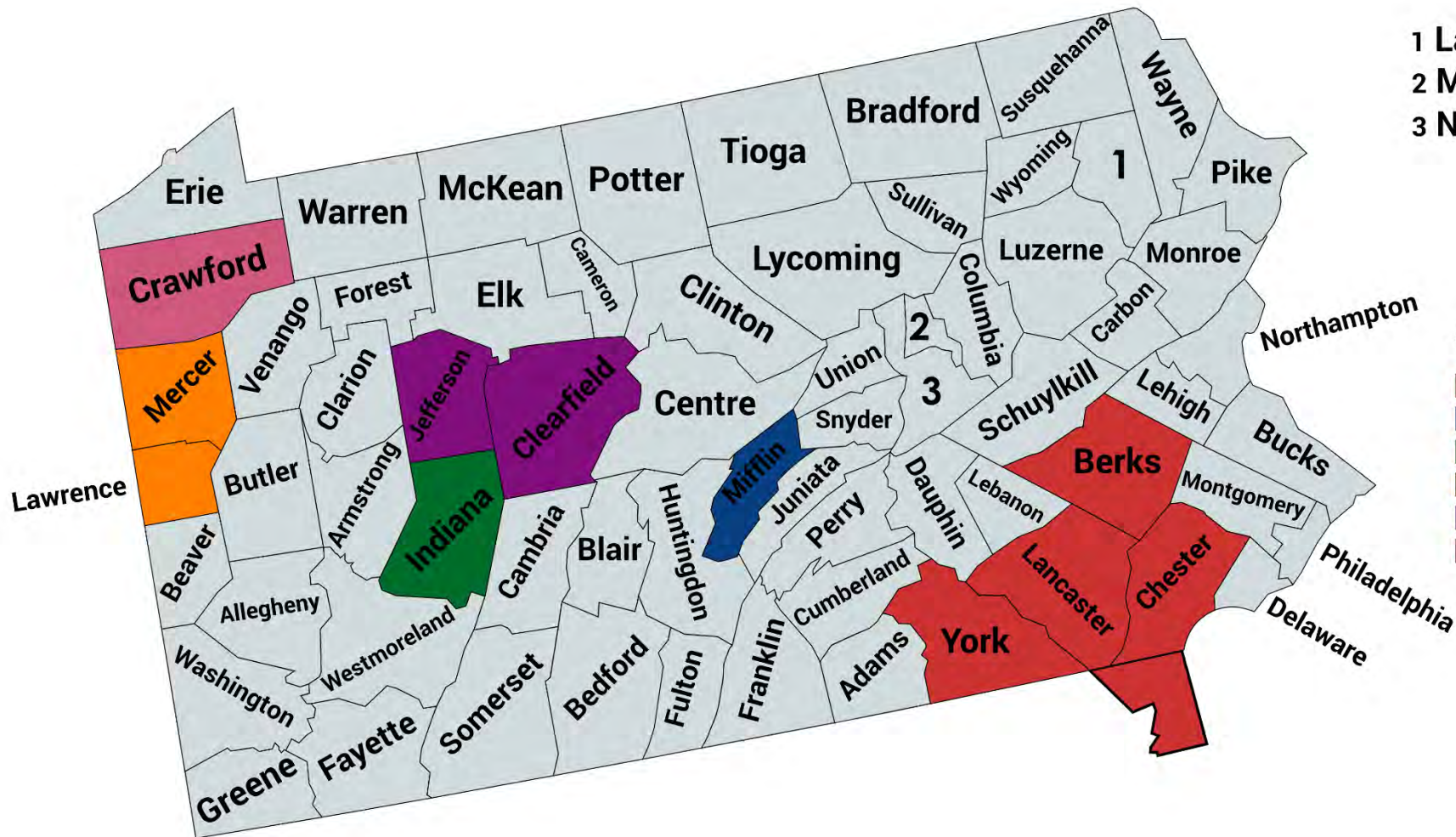


- PA has the largest population of Amish in the U.S.
- Nearly 90,000 Amish across the commonwealth

Source: "Amish Population, 2023." Young Center for Anabaptist and Pietist Studies, Elizabethtown College. <http://groups.etown.edu/amishstudies/statistics/population-2023/>
U.S. Department of Transportation



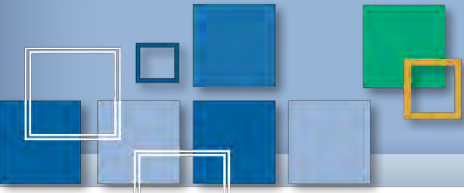
AMISH BUGGY TRAFFIC



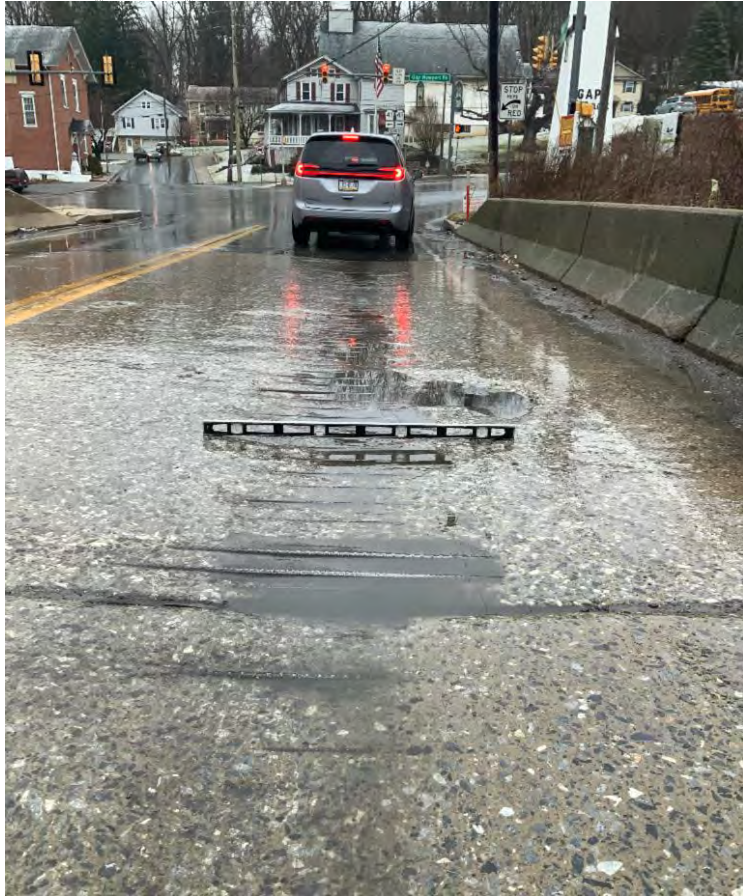
Amish Settlements with > 2000

- Lancaster
- Big Valley/Belleville
- Punxsy/ Smicksburg
- New Wilmington
- Troutville
- Spartansburg





AMISH BUGGY PAVEMENT DAMAGE



Source: Nazzal and Holcombe, 2017

Photos courtesy of Dale Good

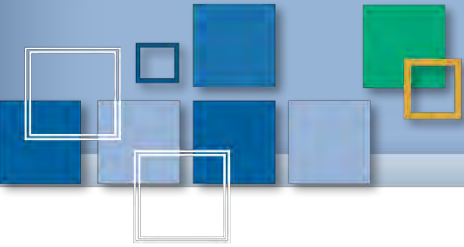


AMISH BUGGY PAVEMENT DAMAGE (CONT'D.)



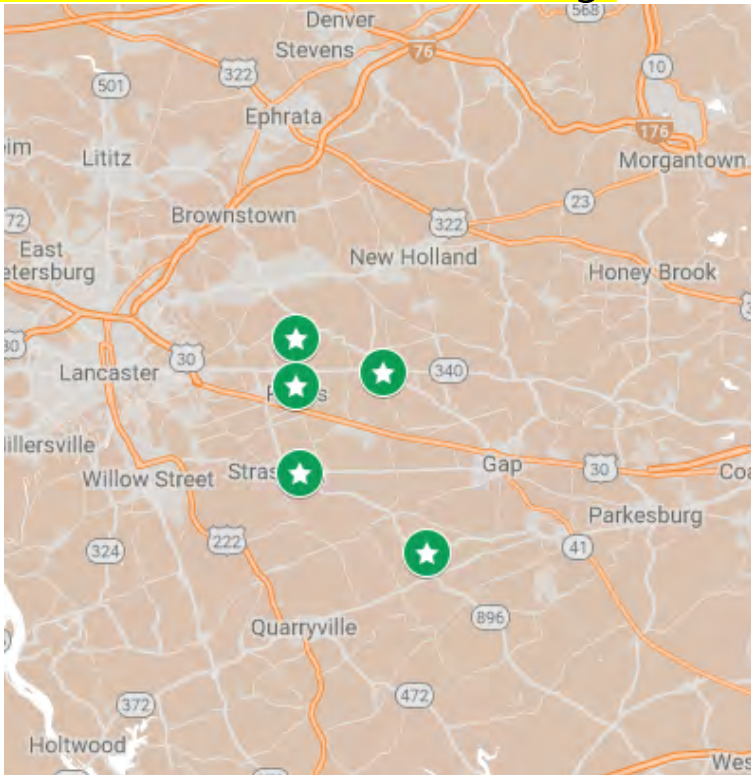
Photos courtesy of
PennDOT Lancaster
County





EFFORTS TO MITIGATE

Repair methods in Lancaster County, PA



EFFORTS TO MITIGATE

Service life of repairs varies:

- Franklin Co.: 1.5 – 2 years
- Lancaster Co.: 2.5 – 3 years



EFFORTS TO MITIGATE

Evaluation of Partial Depth Pavement Repairs on Routes Heavily Traveled by Amish Horse and Buggies-Phase 2



Prepared by:
Munir D. Nazzal
Sang Soo Kim
Ala Abbas
Mandi Lopez

Hamzeh Saqer
Mohammad Al-Khasweneh

Prepared for:
The Ohio Department of Transportation,
Office of Statewide Planning & Research

State Job Number 135526

March 2020

Final Report



91-06

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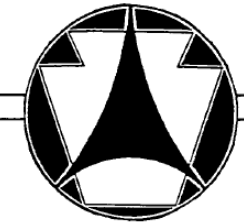
**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION**

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PennDOT Knowledge Center
Commonwealth Keystone Building
400 North Street, 5th Floor
Harrisburg, PA 17120-0041

OR PO Box 3054 • Harrisburg PA 17105-3054
(717) 787-6527 **OR** (717) 705-1546



RESEARCH PROJECT 91-06

**MITIGATION OF HORSESHOE
DAMAGE TO PAVEMENTS**

FINAL REPORT

DECEMBER 1995



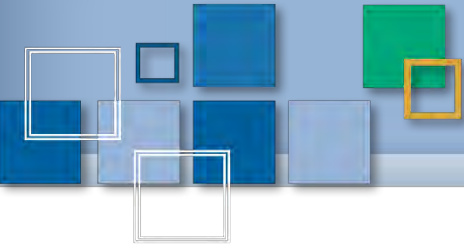
By S. M. Stoffels, T. A. Bitonti, G. L. Gleason, and H. Bahia

PENNSTATE



Pennsylvania Transportation Institute

The Pennsylvania State University
Research Office Building
University Park, PA 16802
(814) 865-1891



EFFORTS TO MITIGATE

3 methods of repair:

1. Continuous paving repair
2. Spot patching repair
3. Chip seal in horsetracks

91-06

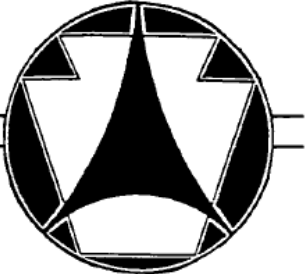
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RESEARCH PROJECT 91-06

MITIGATION OF HORSESHOE DAMAGE TO PAVEMENTS


FINAL REPORT

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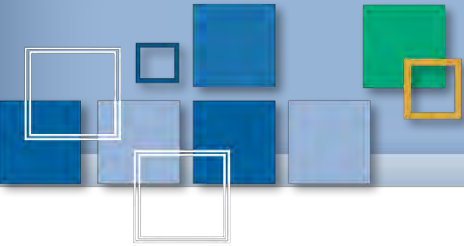
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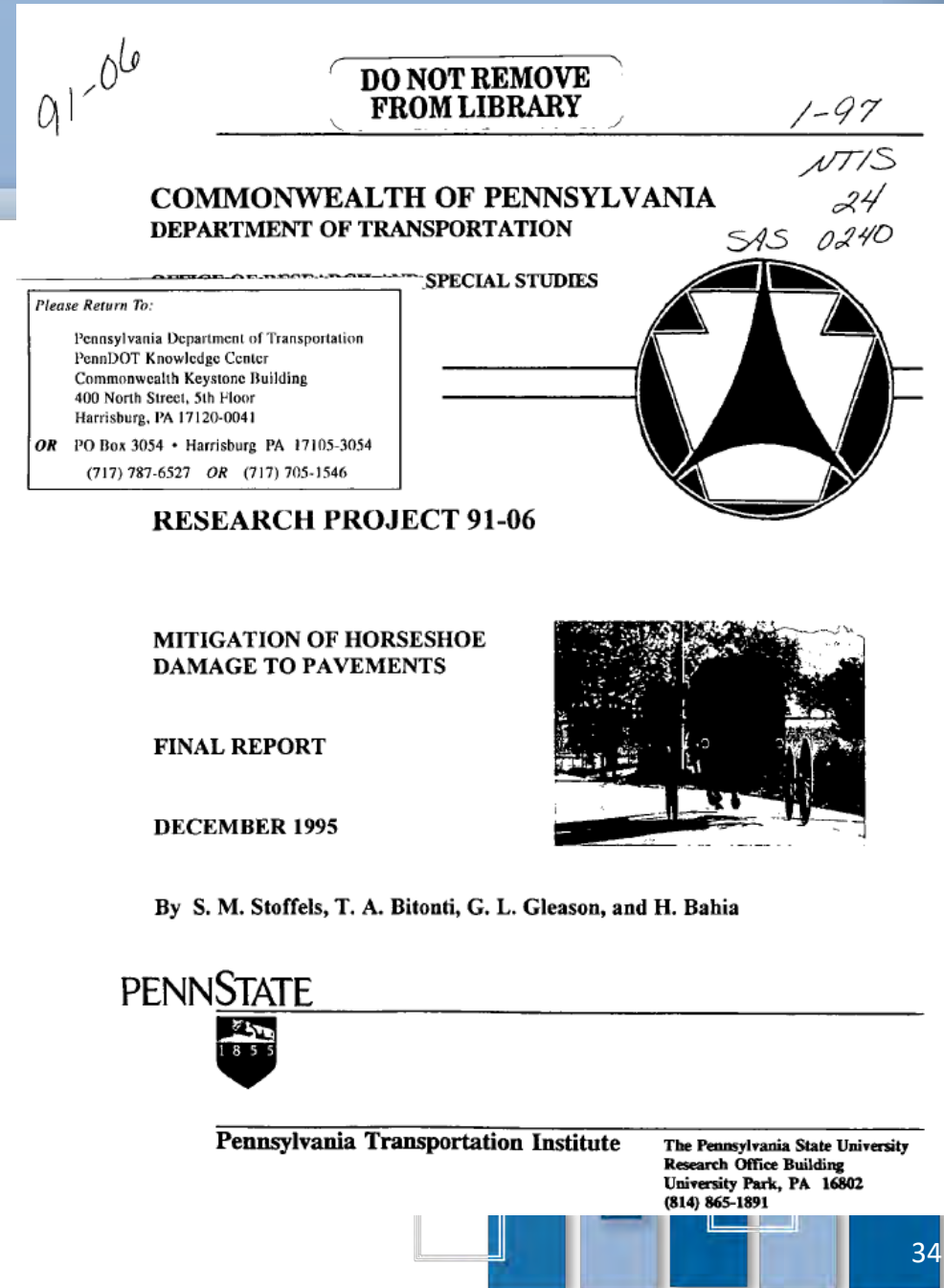
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EFFORTS TO MITIGATE

3 methods of repair:

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EFFORTS TO MITIGATE

Evaluation of Partial Depth Pavement Repairs on Routes Heavily Traveled by Amish Horse and Buggies-Phase 2



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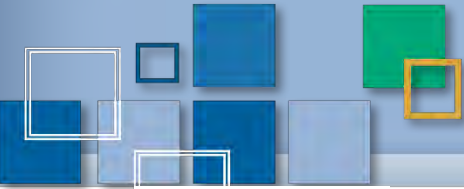
Final Report



Two-pronged Approach:

1. Alternative horseshoes
2. Alternative mix designs





EFFORTS TO MITIGATE

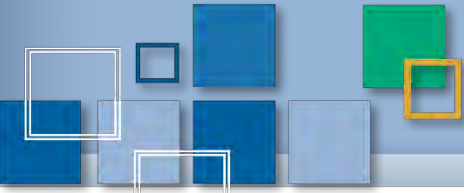


www.globalgilson.com



Source: Nazzal et al., 2020





EFFORTS TO MITIGATE



Current Stud Design



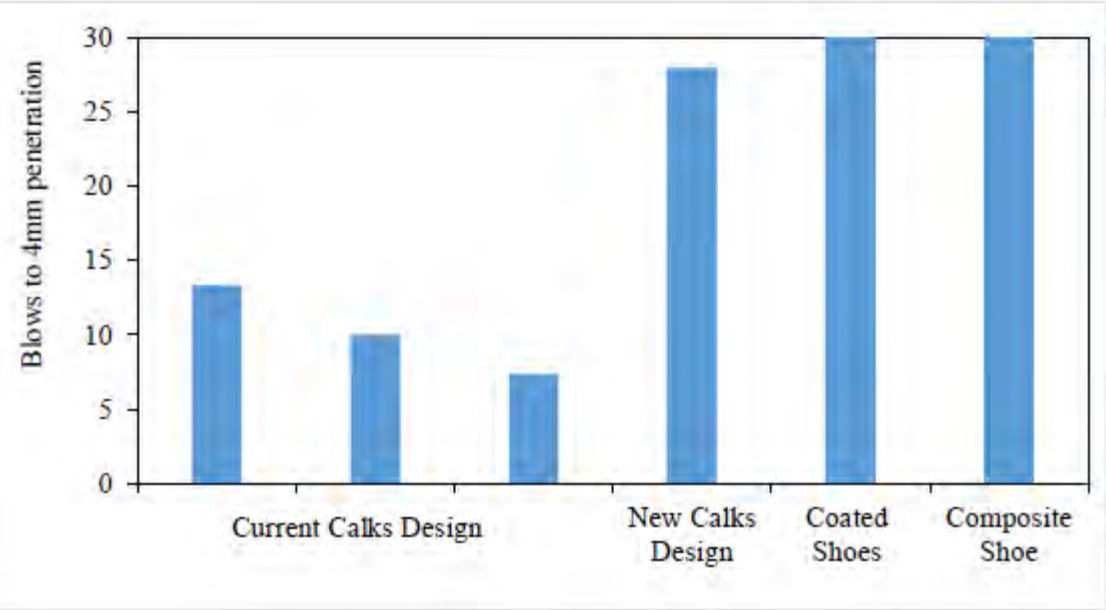
New Stud Design



Tungsten Carbide Coated Design

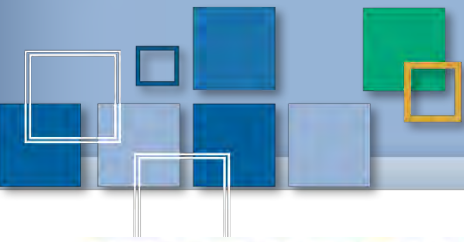


Composite Shoe Design



Source: Nazzal et al., 2020





EFFORTS TO MITIGATE

PENNSYLVANIA REAL-TIME NEWS

Amish upset by Pa. township plan to require buggy registration, horse diapers and rubber horseshoes

Updated: Aug. 03, 2019, 6:32 p.m. | Published: Jul. 30, 2019, 4:59 p.m.

ELIMSPORT – “Blatant discrimination” is what an attorney for Old Order Amish says about proposed ordinances in a rural Lycoming County township that would require horses on public roads to wear a device to collect feces and to have rubber horseshoes.

Transportation Research Record: Journal of the Transportation Research Board

NATIONAL ACADEMIES

TRANSPORTATION RESEARCH BOARD



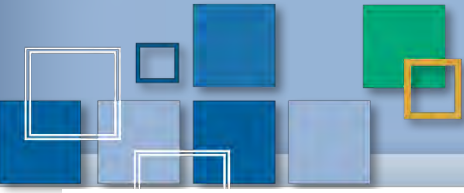
Restricted access | Research article | First published online March 5, 2023

Mitigation of the Damage of Amish Buggies to Local Roads

[Munir D. Nazzal](#), [Hamzeh Saqer](#), and [Mandi J. Lopez](#) [View all authors and affiliations](#)

[OnlineFirst](#) | <https://doi.org/10.1177/03611981231155910>





EFFORTS TO MITIGATE

Fuel-Resistant Asphalt Binder Resists Asphalt Breakdown in St. Augustine

BY ASPHALT TESTING SOLUTIONS & ENGINEERING LLC



An average of 500,000 visitors to St. Johns County each month now get to enjoy the smooth and rut-resistant efforts of Duval Asphalt's project on State Route 5A along the bayfront in St. Augustine.

FDOT uses StellarFlex FR asphalt binder and Evotherm M-1 warm mix asphalt technology to combat pavement issues presented by horse-drawn carriage traffic.

StellarFlex FR[®]

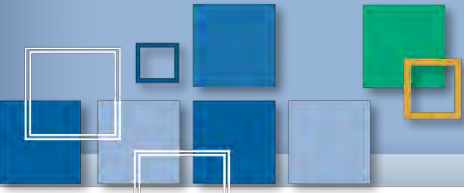
Fuel Resistant Asphalt

Protecting Central Park pavement with PMA

by Ron Corun and John Davis

Central Park, located in the heart of Manhattan in New York City, has been offering recreational activities to millions of visitors since 1857. The Park consists of 843 acres and offers numerous attractions including hiking, biking, rollerblading, a zoo, boating, athletic fields, concerts and horse-drawn carriage rides.



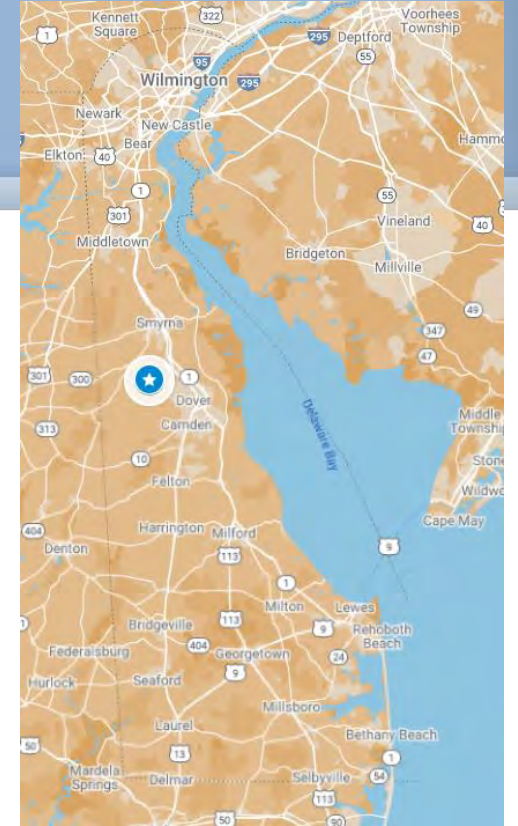


EFFORTS TO MITIGATE

Fuel Resistant Highly Modified Asphalt - DeIDOT Experience (with StellarFlex FR)

- 1 mile stretch in Amish community
- Milled 4.5 in. and placed:
 - Intermediate course @ 2.5 in.
 - Polymer modified, 19 mm Superpave mix
 - Surface course @ 2 in.
 - Mix design based on existing 9.5 mm polymer-modified Superpave mix with the following exceptions:
 - StellarFlex FR binder
 - 50 gyrations
 - Design air voids = 3%

} Increases binder content



FUEL RESISTANT HIGHLY MODIFIED ASPHALT BINDER - DELDOT EXPERIENCE





FUEL RESISTANT HIGHLY MODIFIED ASPHALT BINDER FOR AMISH BUGGY ROUTES: **NEXT STEPS**

NEXT STEPS: PA HAS Many miles of pavement across PA that are in need of repair.

- Obtain **specs** from:
 - DeIDOT (Complete – 9.5 mm and 12.5 mm)
 - Saint Augustine, FL (Complete)
 - Central Park, NYC (TBD)
- Compare specs. to PennDOT specs
- Revise PennDOT specs
- Obtain **performance tests** from DeIDOT & FDOT
- Evaluate performance and cost of material
 - Benefit/cost
- Identify pilot project
- Determine quantity of material needed (2,500 tons or less?)
- Develop decision tree



FUEL RESISTANT HIGHLY MODIFIED ASPHALT BINDER FOR AMISH BUGGY ROUTES: **NEXT STEPS**

Next Steps Cont'd.

- Seek out **funding** (AID [EDC-6 TOPS], AIDPT, STIC Incentive, Carbon Reduction Program [CRP])
- Identify **scope** of pilot project test sections (full width):
 - StellarFlex FR (PG 88-28 FR)
 - HiMA (PG 76E-28 HP)
 - Polymer with Fibers (PG 64E-22)
 - Polymer (PG 64E-22)
 - Unmodified (PG 64S-22)
- Maintenance **repair sections**:
 - StellarFlex FR (width of roller)
- **Deploy** and **monitor**
- Update/include in PennDOT documents:
 - Bulletin 15 (Publication 35)
 - Maintenance Manual (Publication 23)
 - etc.

QUESTIONS/FEEDBACK



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And

Mary Robbins, Ph.D., P.E.
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