



Fuel Resistant Highly Modified Asphalt Binder: Amish Buggy Routes



Steven L. Koser, P.E.

PA Asphalt Pavement Association

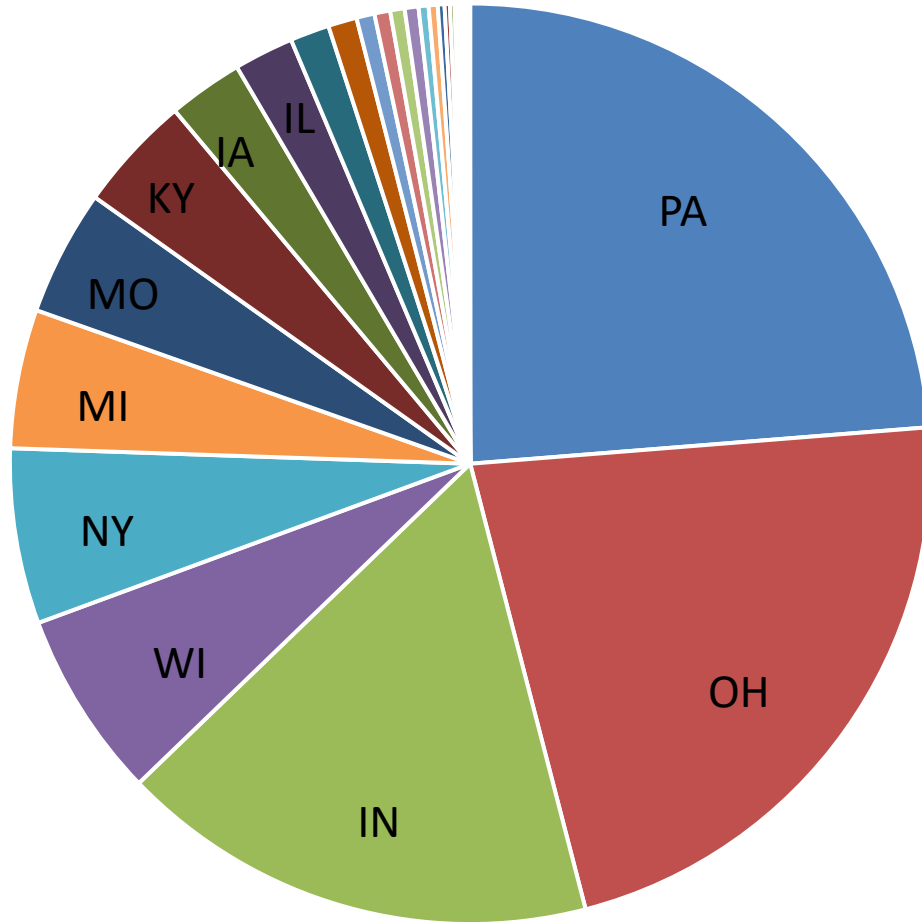
Associate Director



AMISH IN PA

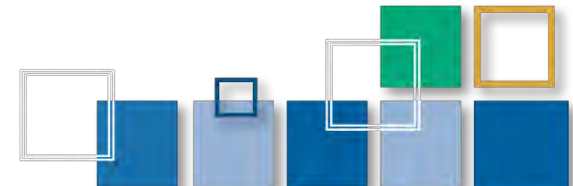
Amish Population by U.S. State

- Pennsylvania
- Ohio
- Indiana
- Wisconsin
- New York
- Michigan
- Missouri
- Kentucky
- Iowa
- Illinois
- Minnesota
- Tennessee
- Kansas
- Virginia
- Delaware
- Maryland
- Montana
- Maine
- Colorado
- Oklahoma
- West Virginia
- Nebraska
- Wyoming
- North Carolina
- Arkansas
- Mississippi
- South Dakota
- Idaho
- Vermont
- Florida
- Texas
- New Mexico

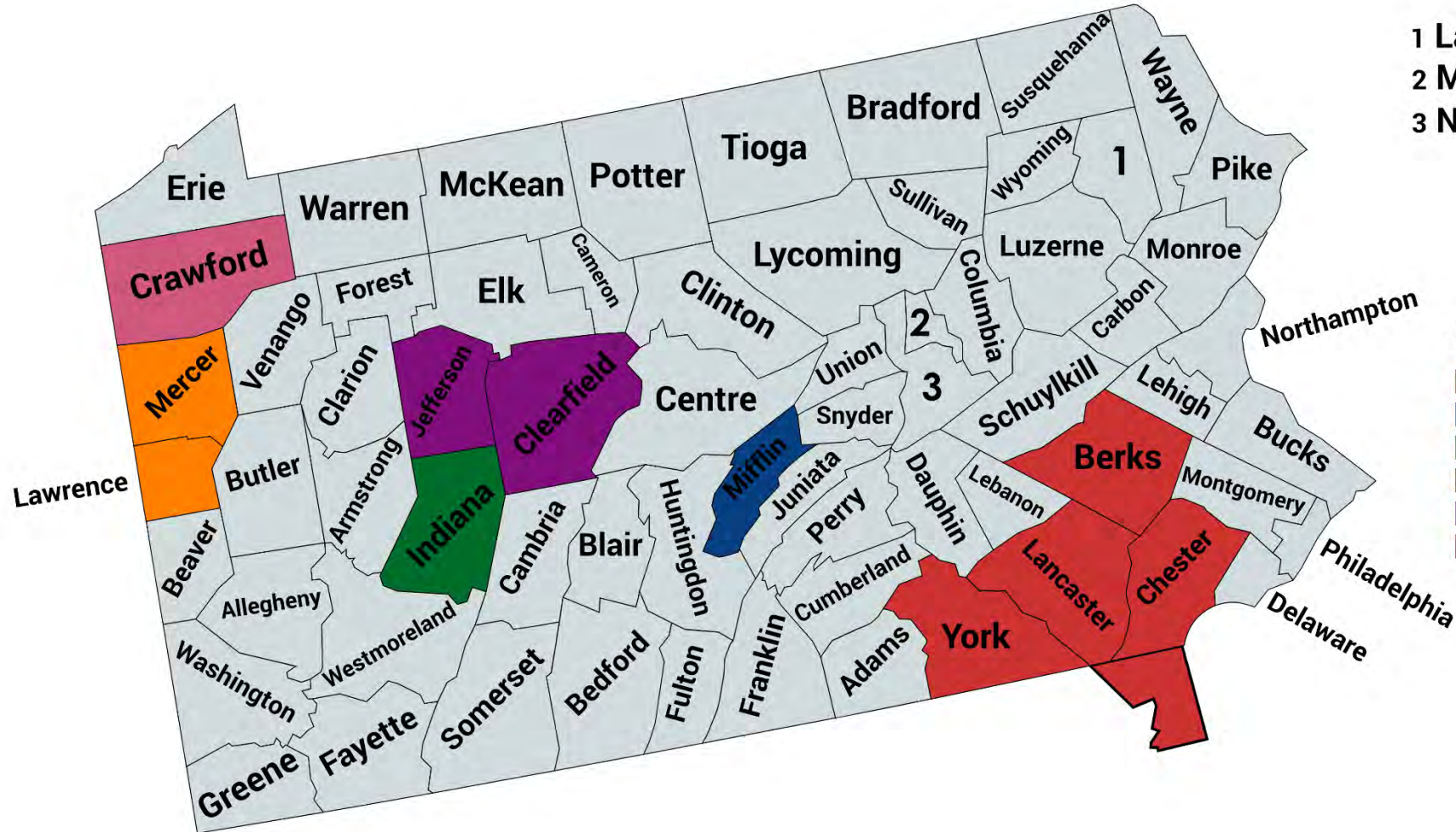


- PA has the largest population of Amish in the U.S.
 - Nearly 90,000 Amish across the commonwealth

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



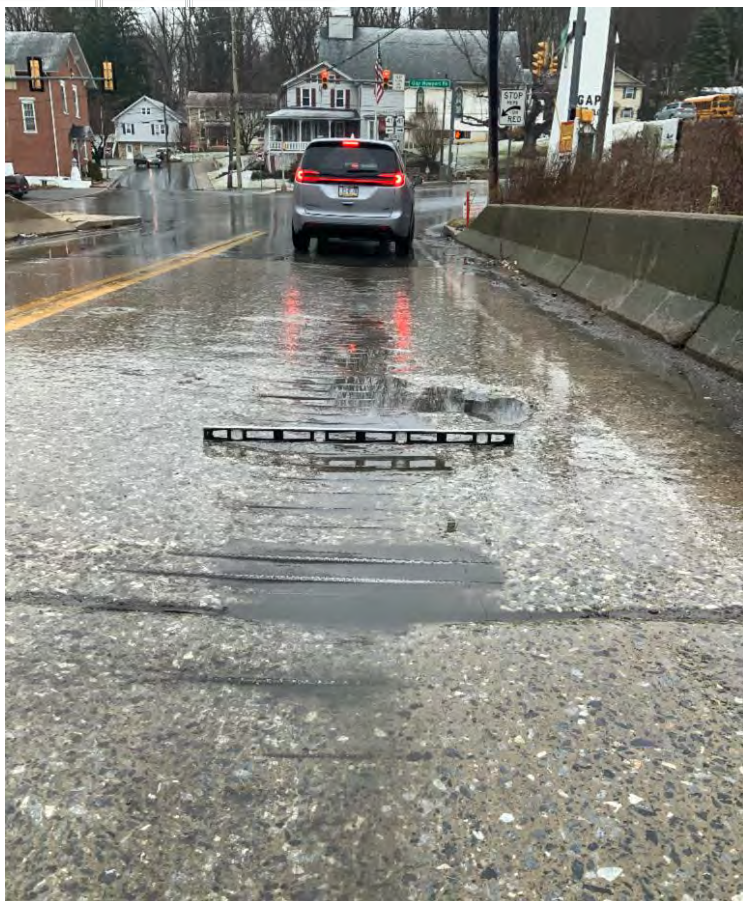
- 1 Lackawanna
- 2 Montour
- 3 Northumberland

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

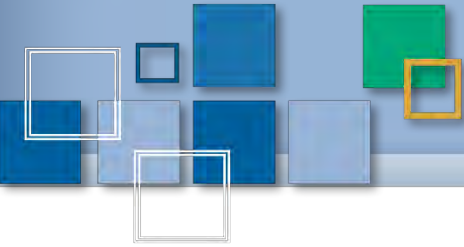


AMISH BUGGY PAVEMENT DAMAGE



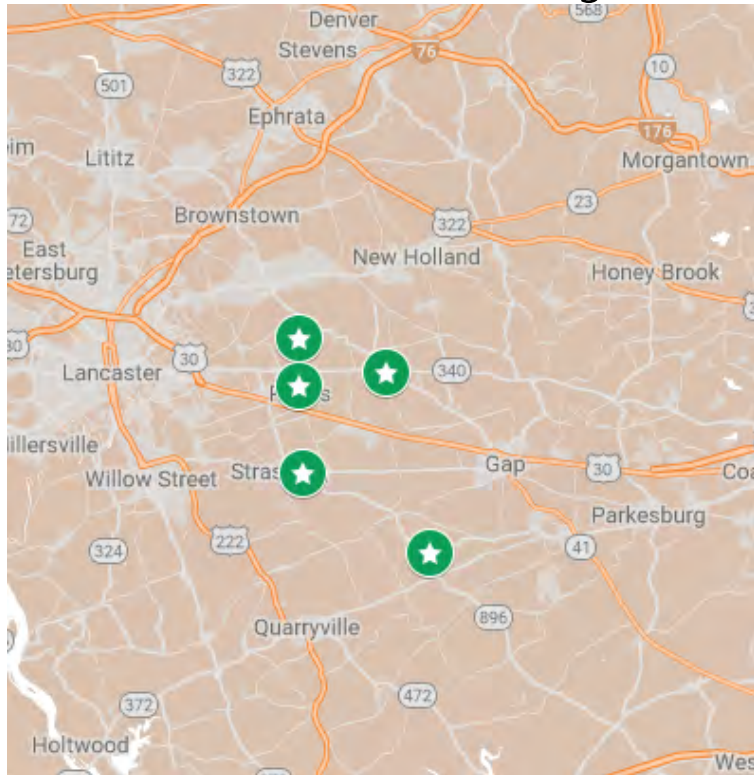
Photos courtesy of
PennDOT Lancaster
County





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:
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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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RESEARCH PROJECT 91-06

MITIGATION OF HORSESHOE DAMAGE TO PAVEMENTS


FINAL REPORT

DECEMBER 1995



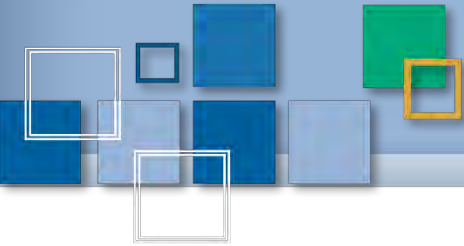
By S. M. Stoffels, T. A. Bitonti, G. L. Gleason, and H. Bahia

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EFFORTS TO MITIGATE

3 methods of repair:

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

91-06

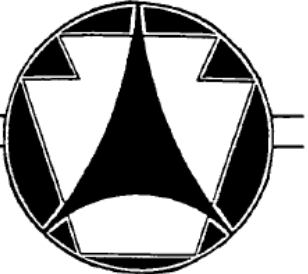
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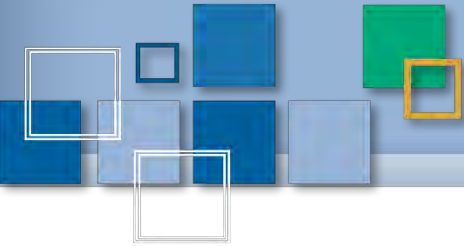


By **S. M. Stoffels, T. A. Bitonti, G. L. Gleason, and H. Bahia**

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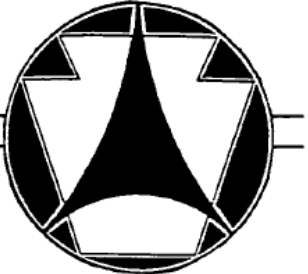
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RESEARCH PROJECT 91-06

**MITIGATION OF HORSESHOE
DAMAGE TO PAVEMENTS**


FINAL REPORT

DECEMBER 1995



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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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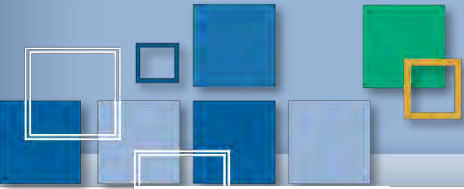
Final Report



Two-pronged Approach:

1. Alternative horseshoes
2. Alternative mix designs





EFFORTS TO MITIGATE

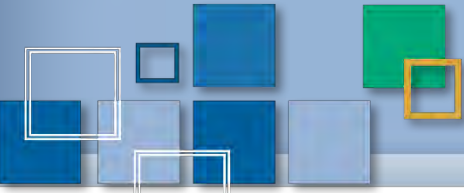


www.globalgilson.com



Source: Nazzal et al., 2020





EFFORTS TO MITIGATE



Current Stud Design



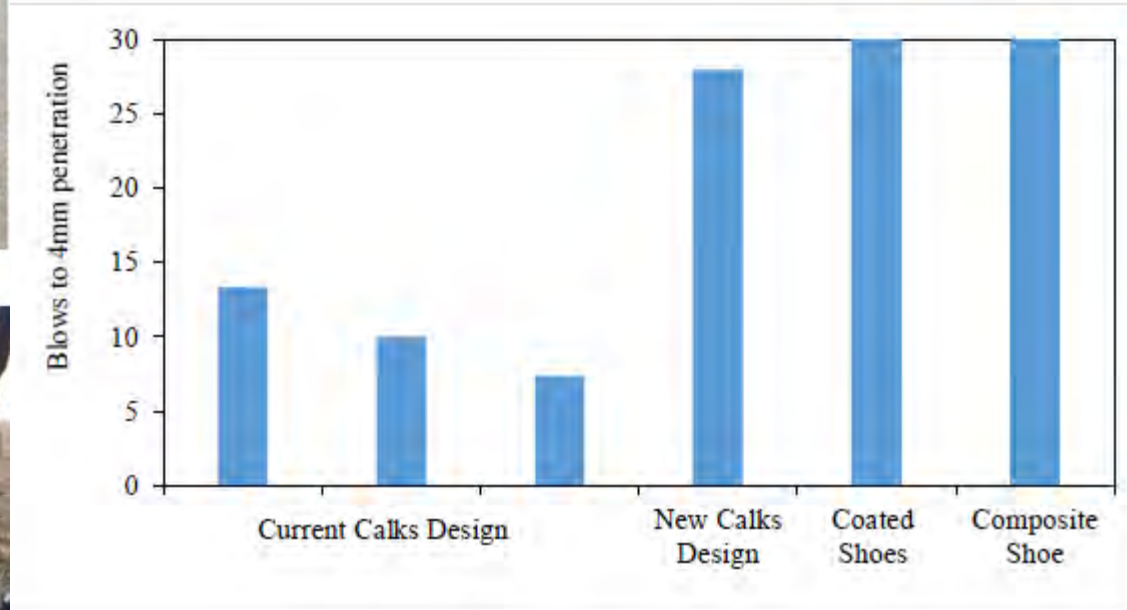
New Stud Design



Tungsten Carbide Coated Design

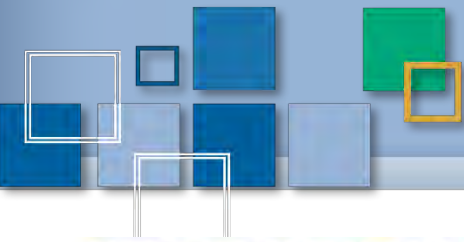


Composite Shoe Design



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

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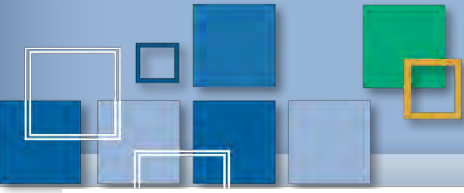
Restricted access | Research article | First published online March 5, 2023

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[®]

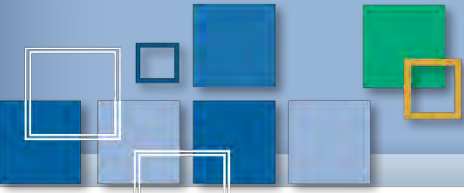
Fuel Resistant Asphalt

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.

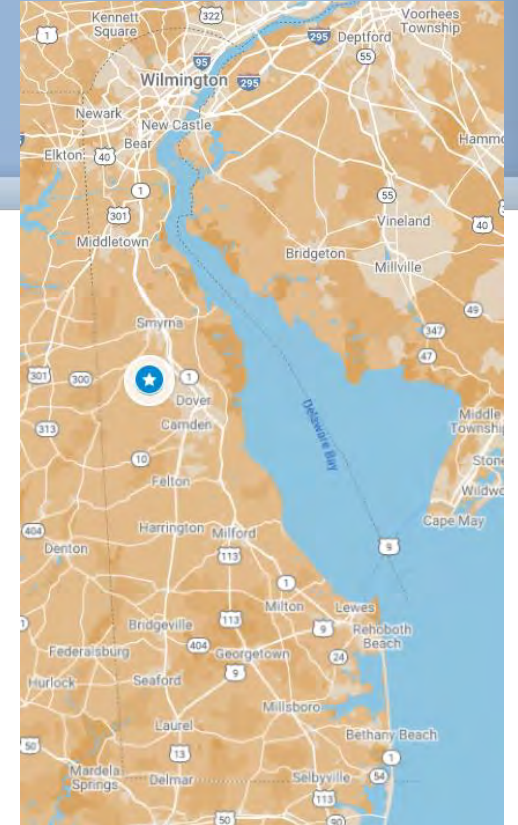




EFFORTS TO MITIGATE

Fuel Resistant Highly Modified Asphalt - DeIDOT Experience

- 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**



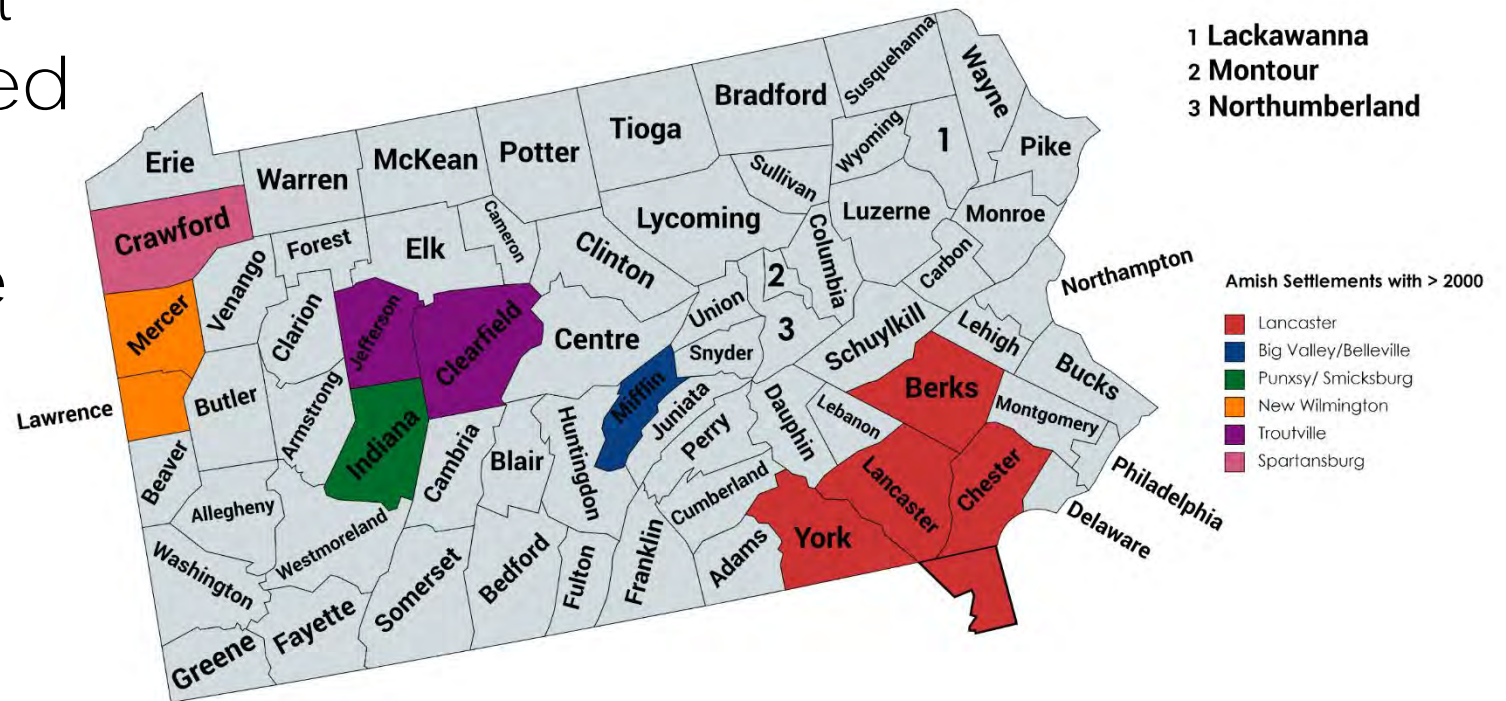
FUEL RESISTANT HIGHLY MODIFIED ASPHALT BINDER - DELDOT EXPERIENCE



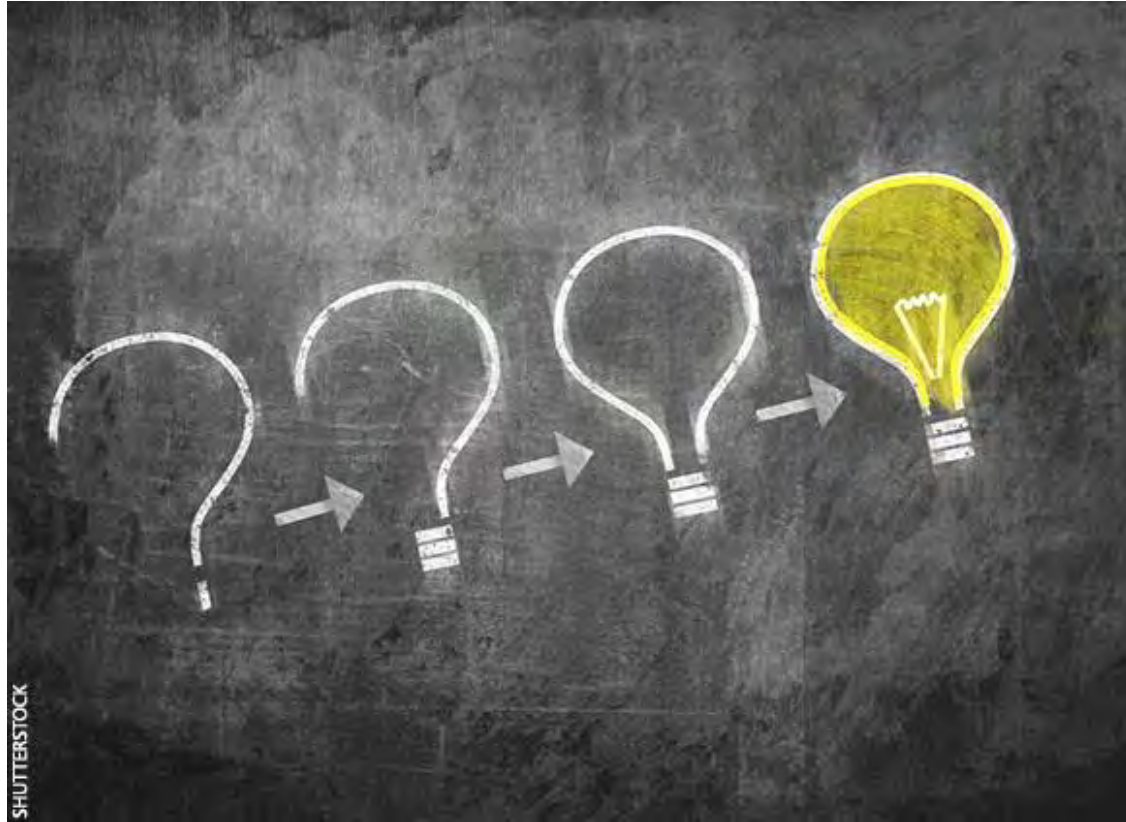
FUEL RESISTANT HIGHLY MODIFIED ASPHALT BINDER FOR AMISH BUGGY ROUTES: NEXT STEPS

Many miles of pavement across PA that are in need of repair.

- Evaluate performance and cost of material
 - Benefit/cost
- Develop decision tree



QUESTIONS/FEEDBACK



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