Update on Performance of Thin Asphalt Overlays

Pennsylvania Asphalt Pavement Association
55th Annual Conference

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Outline

• Thin Asphalt Overlay Pilot Projects
• Mix Design/Lab Performance

• Field Performance
PennDOT Research Project on THMAO

Four Year Project: June 2012 – June 2016

Three Pilot Projects

- District 8-0, Dauphin County, SR 0022
- District 8-0, Lancaster County, SR 0230
- District 3-0, Lycoming County, SR 0220
Mix Design
Lab Performance
6.3 mm NMAS Mix
Placed at 1 inch thickness

Aggregate: Skid Resistance Level (SRL): E
Polymer Modified Binder: PG 76-22
Gyration Level: 75

Design Air Void: 4%, Min. Design VMA: 17

Design Binder Content: 6.7%; 7.0%; 6.9%
NO RAP
Performance Evaluation - HWTD

Specimens under water
Test Temperature: 50ºC
20,000 Passes
50 Passes per minute
158-lb load
Performance Evaluation - HWTD

Thin Asphalt Overlay Project
Hamburg Wheel Tracking Tests - 8/23/2012

1st Pilot Project – SR 0022

Temperature = 50ºC
Performance Evaluation – Texas Overlay Tester
Performance Evaluation – Overlay Tester

Cycles to failure $> 500$

Good Performance
Tack Coat Evaluation

Trimmed Core

Direct Shear Mold Schematics
Tack Coat Evaluation

Shear Strength = 44.5 psi (307 KPa) - Good Performance
Field Performance
SR 0022 – 26 Months
SR 230 – Finished Overlay
SR 230 – 16 Months
SR 230 – 16 Months
SR 230 – 16 Months
SR 220 – Existing Sealed Pavement
SR 220 – 13 Months
Skid Resistance Results
Friction Improvement

N. Cameron Rd. (SR 0022) Skid Resistance

Data: Courtesy of PennDOT BOMO
Friction Improvement

SR 230 - Lancaster Co, PA

Data: Courtesy of PennDOT BOMO
Friction Improvement

SR 220 - Lycoming Co. PA

Data: Courtesy of PennDOT BOMO
Ride Quality (Smoothness) Improvement

SR 0022 - N. Cameron Rd
Segment 330, Eastbound

April 2012 - Prepave
July 2012 - Patched
September 2012 - Post Paving
November 2013 - 16 Months
June 2014 - Two Years
September 2014 - 26 Months
Ride Quality (Smoothness) Improvement

SR230 Segment 280, Eastbound

IRI, in/mile

Travel - Left
Travel - Right
Passing - Left
Travel - Right

May 2013 - Prepave
July 2013 - after Paving
June 2014 - One Year
September 2014 -15 Months
Ride Quality (Smoothness) Improvement

SR230 Segment 281, Westbound

IRI, in/mile

- Travel - Left
- Travel - Right
- Passing - Left
- Travel - Right

May 2013 - Prepave
July 2013 - After Paving
June 2014 - One Year
September 2014 - 15 Months
Ride Quality (Smoothness) Improvement

SR 0022 - N. Cameron Rd
Segment 340, Eastbound

Travel - Left
Travel - Right
Passing - Left
Passing - Right

IRI, in/mile

April 2012 - Prepave
July 2012 - Patched
September 2012 - Post Paving
November 2013 - 16 Months
June 2014 - Two Years
September 2014 - 26 Months
Ride Quality (Smoothness) Improvement

SR 220, Segment 10
Northbound

Travel - Left
Travel - Right
Passing - Left
Passing - Right

IRI, in/mile

June 2013 - Prepave
November 2013 - Paved
June 2014 - 9 Months
September 2014 - One Year
Ride Quality (Smoothness) Improvement

SR 220, Segment 50
Northbound

Travel - Left
Travel - Right
Passing - Left
Passing - Right

IRI, in/mile

June 2013 - Prepave
November 2013 - Paved
June 2014 - 10 months
September 2014 - One Year
Rut Measurements
Rutting, SR 230

SR230 Eastbound, 900 ft.
October 15, 2014

≈ 1/8”
Rutting, SR 220

≈ 1/10"
Ground Penetrating Radar

AID Integrated Testing Vehicle
Courtesy of Advanced Infrastructure Design, Inc.

Can GPR provide a reliable estimate of mat density?
Air Coupled GPR
LOW dielectric area (estimated HIGH air voids)

HIGH dielectric area (estimated LOW air voids)
GPR Dielectric-Air Void Relationship

SR 0022 - Dauphin Co., PA

\[ y = 49.862e^{-0.503x} \]

\[ R^2 = 0.3783 \]
GPR Dielectric-Air Void Relationship

\[ y = 158.25e^{-0.84x} \]

\[ R^2 = 0.7981 \]
GPR Dielectric-Air Void Relationship

SR 220 - Lycoming Co. - PA Section 1

\[ y = 169.7e^{-0.651x} \]

\[ R^2 = 0.9167 \]
GPR Dielectric-Air Void Relationship

\[ y = 675.91e^{-0.961x} \]

\[ R^2 = 0.9494 \]

(excluding 3 data points shown in red)

SR 220 - Lycoming Co. - PA
Section 2
Summary/Findings

- Most Dominant Distress: Reflection of Cracks
- Improved Ride Quality
- Improved Skid Resistance
- Minor Rutting