

Asphalt Mix Overlay Alternatives for Low Volume Roads on the Local Transportation System

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Outline

- Background
- Objectives
- Research Approach
- Research Results
- Recommendations for Implementation
- Questions



Background

Background

- Pavement resurfacing for **low-volume roads** (~500 vehicles per day) with extensive cracking is an issue faced by many local public agencies (LPAs) in Ohio.
- Current options range from **chip sealing**, which is generally not effective if used on a pavement surface in a poor condition, to **full-depth reclamation**, which is prohibitively expensive for most LPAs especially for roads with very low traffic.

Background (Cont.)

- Another resurfacing option used by some counties in Ohio is **motor paving** with cold mix asphalt followed by chip sealing.
- The advantage of this option is that it provides a **resilient mix** that conforms to the surface of the existing pavement.

Background (Cont.)

- While counties using this option have reported positive results, the required **motor paver equipment is not widely available** in Ohio, making this option expensive for some LPAs.
- As a result, LPAs are interested in having a **hot mix asphalt** – with comparable performance to motor-paving mixes – that can be **produced in existing plants and placed using conventional equipment** commonly available in Ohio.



Objectives of the Study



Objectives of the Study

- Assess the current-state-of-the-practice for pavement resurfacing alternatives currently used by LPAs in Ohio and other states.
- Recommend a cost-effective mix design for an asphalt mixture that is resilient to cracking and environmental conditions prevalent in Ohio.
- Validate the proposed mix design procedure through laboratory testing and in-field evaluations.



Research Approach



Research Approach

- Phase 1:

- ☐ Literature review
- ☐ Current state-of-the-practice with regard to pavement resurfacing for low-volume roads
- ☐ Proposed mix design of asphalt mixture
- ☐ Laboratory testing plan

- Phase 2:

- ☐ Field validation of proposed asphalt mixture



Phase 1

Literature Review

- Asphalt mix design strategies for low-volume roads:
 - Asphalt mixtures with a large aggregate size that would require a smaller amount of asphalt binder
 - Asphalt mixtures with a smaller aggregate size that would allow for constructing a thinner asphalt overlay
 - Incorporating high amounts of RAP (greater than 30% and up to 100%) in the asphalt mixture in order to reduce the amount of virgin materials used in the asphalt mixtures

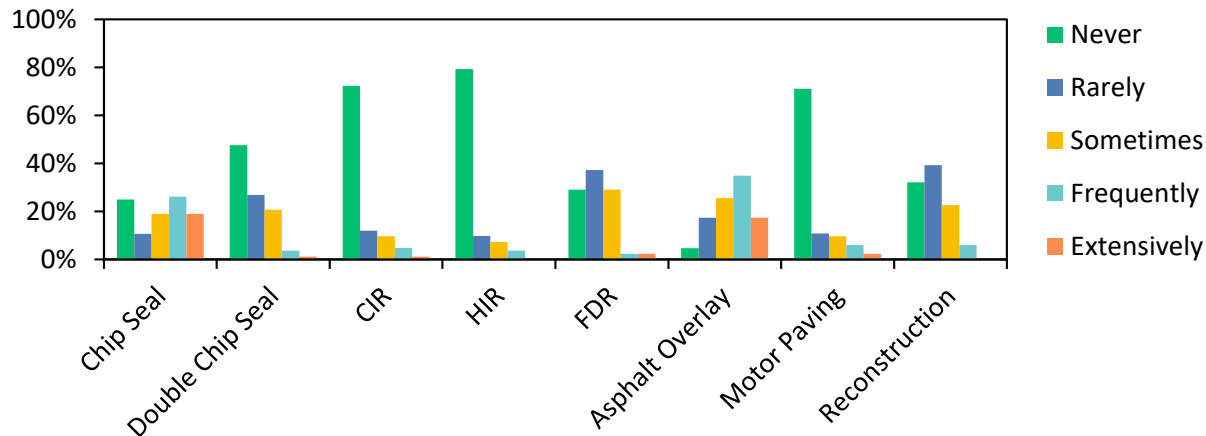
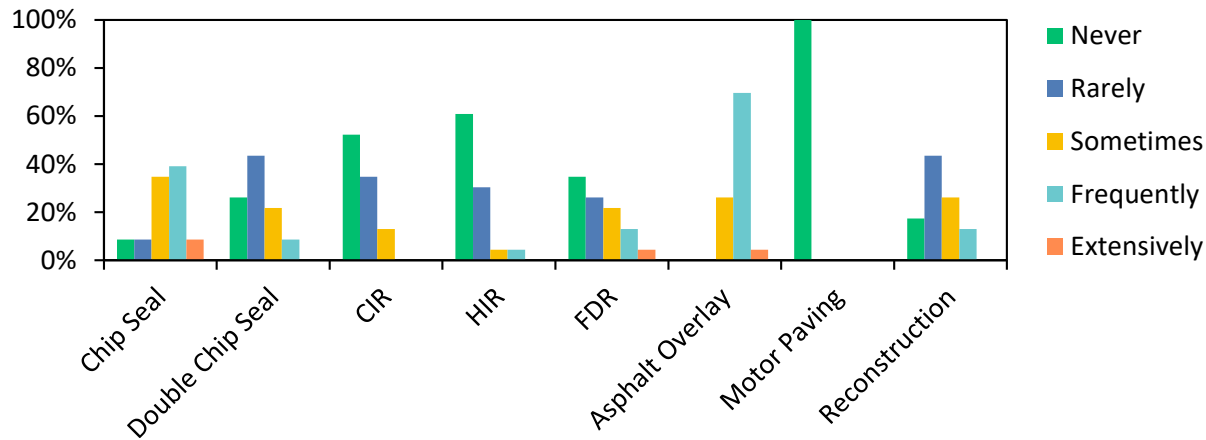
Main objective: Reduce Cost



Survey of State and Local Agencies

- Response to the survey:
 - 28 state agency representatives
 - 100 local agency representatives
(25 city, 35 county, 34 township, and 6 village)

For low-volume roads that exhibit extensive cracking, how frequently are the following resurfacing alternatives used in your jurisdiction?



Survey of State and Local Agencies

■ Comments:

☐ State

- 2 to 4 inches.
- Thinlays are used by some states.
- Chip seal is sometimes used as an interlayer.

☐ Local

- Up to 3 inches. Mostly 2 inches or less.
- Chip seal, SAMI, or fiber mat are sometimes used as interlayers.
- Not getting the service life that they used to.

Medina County Specification (CS) 402

■ Aggregate

- ☐ Type and Size: Achievable using 90% No. 57 Limestone and 10% Natural Sand
- ☐ Properties: Conforms to ODOT C&MS Item 703.05 (Aggregate for Asphalt Concrete)

■ Asphalt Binder

- ☐ Type: PG 58-28
- ☐ Content: 4.3%

Medina CS 402

■ Pavement Rehabilitation

□ CS Item 405 (Cold Mix)

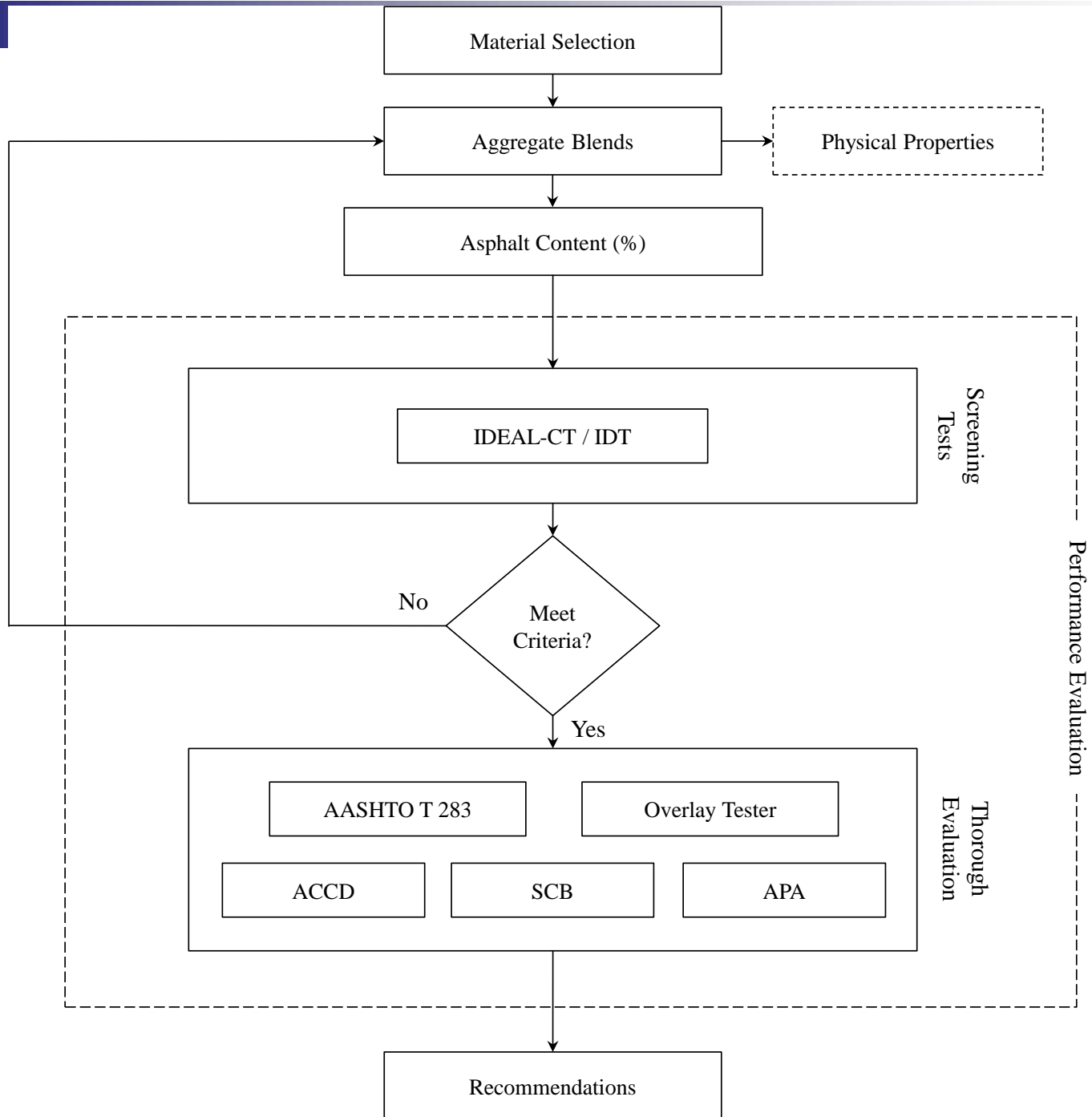
- Pavement Repair
- Milling
- CS Item 405 (2 inch.)
- Initial Rolling
- No. 9 choke agg.
- Final Compaction
- Chip Seal

□ CS Item 402 (HMA)

- Pavement Repair
- Milling
- Tack Coat
- CS Item 402 (2 inch.)
- Initial Rolling
- No. 9 choke agg.
- Final Compaction
- Chip Seal

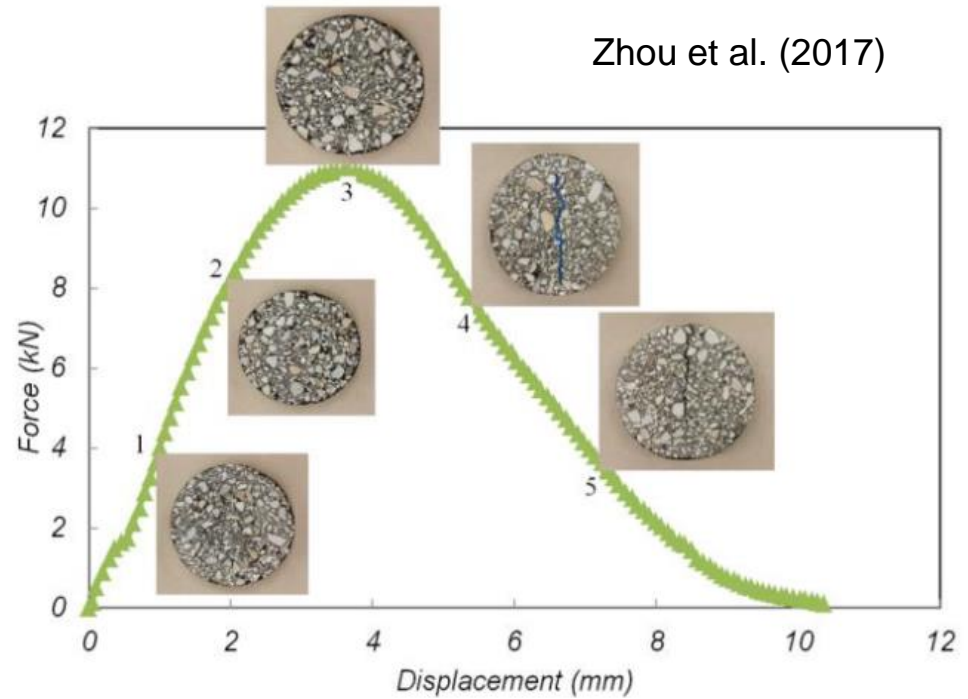


Optimization of Medina CS 402

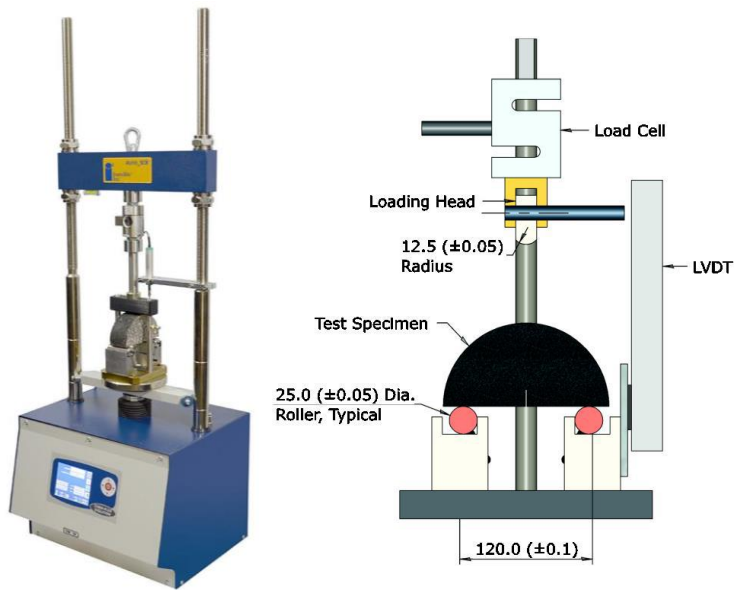




IDEAL-CT Test



$$CT_{Index} = \frac{t}{62} \times \frac{G_f}{|m_{75}|} \times \frac{l_{75}}{d}$$



SCB/I-FIT



APA



Texas Overlay Tester



ACCD

Asphalt Draindown (AASHTO T 305)



1/4-inch Mesh Basket

- Mix weight:
 - 1,200 +/- 200 gm
- Target:
 - < 0.3%

Effect of Binder Type

- Aggregate type:
 - Limestone
- Aggregate gradation:
 - 90% No. 57 + 10% NS
- Binder type:
 - PG 64-22
 - PG 58-28
 - PG 52-28
- Binder content:
 - 4.3%

No. of mixes

$$1 \times 1 \times 3 \times 1 \times 1 = 3 \text{ mixes}$$

Effect of Aggregate Gradation and Binder Content

- Aggregate type:
 - Limestone
- Aggregate gradation:
 - 90% No. 57 + 10% NS
 - 80% No. 57 + 20% NS
 - 75% No. 57 + 25% NS
- Binder type:
 - PG 58-28
- Binder content:
 - 3.3%
 - 3.8%
 - 4.3%
 - 4.8%
 - 5.3%

No. of mixes

$$1 \times 3 \times 1 \times 5 \times 1 = 15 \text{ mixes}$$

Effect of Hydrolene

- Aggregate type:
 - Limestone
- Aggregate gradation:
 - 80% No. 57 + 20% NS
- Binder type:
 - PG 58-28
- Binder content:
 - 4.8%
- Hydrolene content:
 - 0%
 - 4%
 - 6%

No. of mixes

$$1 \times 1 \times 1 \times 3 = 3 \text{ mixes}$$

Effect of Aggregate Type

- Aggregate type:
 - Limestone
 - Natural gravel
 - Crushed gravel
- Aggregate gradation:
 - 80% No. 57 + 20% NS
- Binder type:
 - PG 58-28
- Binder content:
 - 4.8%

No. of mixes

$$3 \times 1 \times 1 \times 1 \times 1 = 3 \text{ mixes}$$

Effect of RAP

- Aggregate type:
 - Limestone
- RAP source:
 - ODOT-certified
 - Uncertified
- Aggregate gradation:
 - 80% No. 57 + 10% NS
 - + 10% RAP
- Binder type:
 - PG 58-28
- Binder content:
 - 4.3%

No. of mixes

$$1 \times 2 \times 1 \times 1 \times 1 = 2 \text{ mixes}$$

Final Mixes

- 90% No. 57 LS + 10% NS + PG 58-28 @ 4.3% (Control)
- 80% No. 57 LS + 20% NS + PG 58-28 @ 4.8%
- 80% No. 57 LS + 20% NS + PG 58-28 @ 5.3%
- 80% No. 57 LS + 20% NS + PG 58-28 @ 4.8% with 4% Hyd
- 80% No. 57 LS + 20% NS + PG 58-28 @ 4.8% with 6% Hyd
- 80% No. 57 Crushed GR + 20% NS + PG 58-28 @ 4.8%
- 80% No. 57 LS + 20% NS + 10% ODOT-certified RAP + PG 58-28 @ 4.3%
- 80% No. 57 LS + 20% NS + 10% Uncertified RAP + PG 58-28 @ 4.3%

Mixes to be Considered for Field Evaluation

- Mixes to be considered for field evaluation:
 - 80% No. 57 LS + 20% NS @ 4.8% PG 58-28
 - 80% No. 57 LS + 20% NS @ 5.3% PG 58-28
 - 80% No. 57 LS + 20% NS @ 4.8% PG 58-28 with 4% Hyd
 - 80% No. 57 LS + 20% NS @ 4.8% PG 58-28 with 6% Hyd
 - 80% No. 57 Cr GR + 20% NS @ 4.8% PG 58-28



Phase 2

Phase 2 Activities

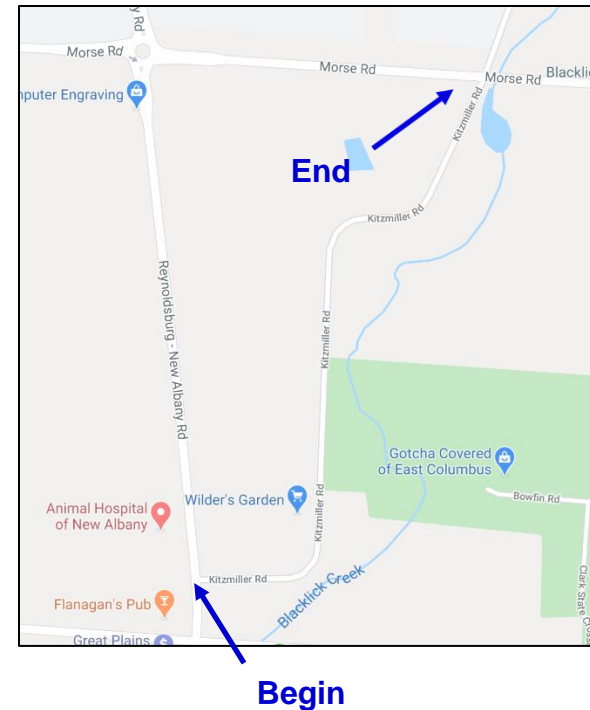
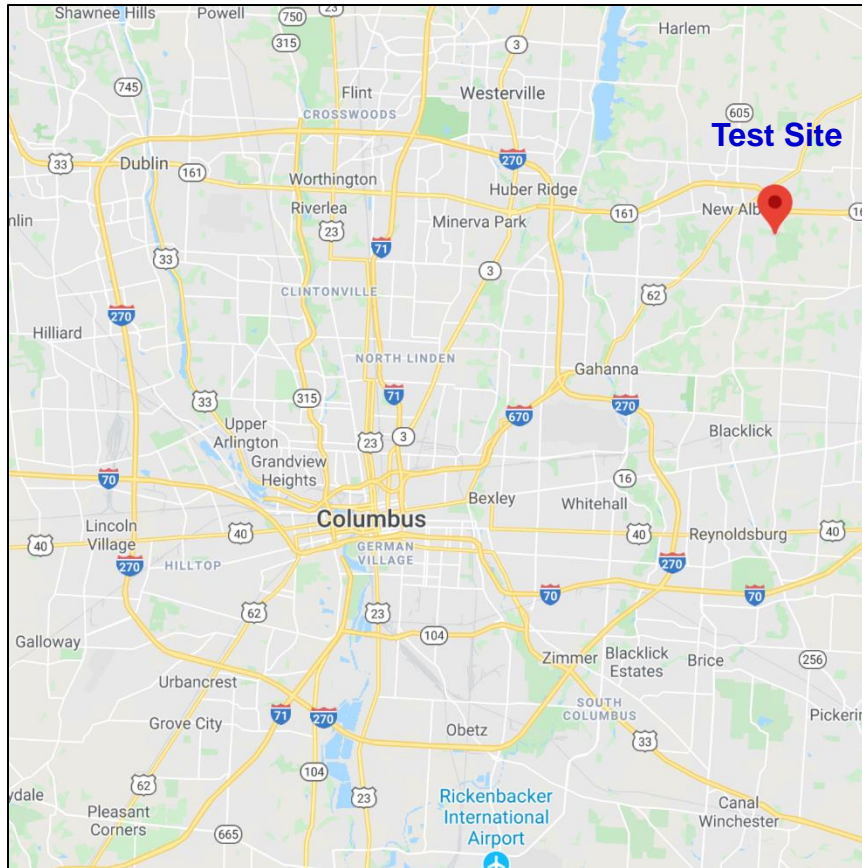
- Selection of test sites:
 - Medina County
 - Franklin County
- Coordination with Medina County and Franklin County regarding the information to be included in the bid documents
- Preconstruction meeting and coordination regarding mix production and construction activities
- Monitoring of construction activities



Phase 2 Activities

- Sampling and testing of loose asphalt mixtures
- Periodic performance evaluation of constructed test sections

Test Site in Franklin County

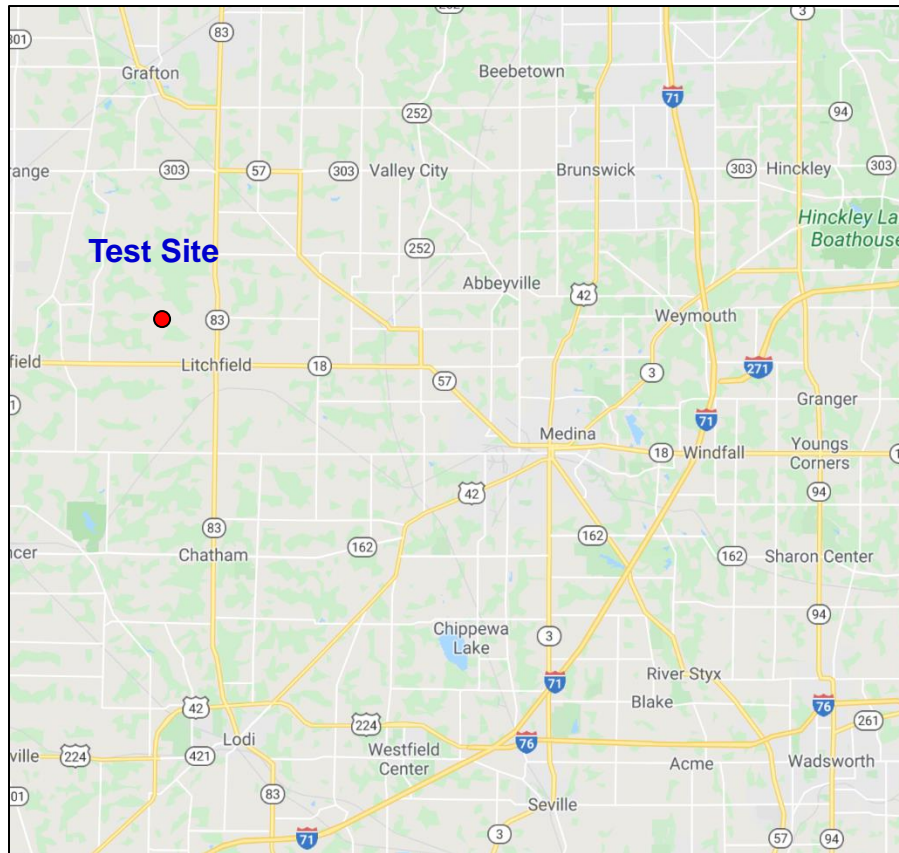




Construction in Franklin County

- Preconstruction meeting: June 11, 2020
- Construction of test sections:
 - Thursday July 9, 2020 – North Bound – Test Sections 1 and 2
 - Saturday July 11, 2020 – South Bound – Test Sections 3, 4, and 5
 - Monday July 13, 2020 – Chip Sealing – All Sections

Test Site in Medina County





Construction in Medina County

- Preconstruction meeting (online): July 23, 2020
- Construction of test sections:
 - Monday August 3, 2020 –Test Sections 1, 2, and 3
 - Wednesday August 5, 2020 – Test Sections 4



Construction of Medina CS 402

- Asphalt mixture production
- Production of asphalt mixes
- Placement of asphalt mixes
- Compaction of asphalt mixes
- Choking with No. 9 LS
- Chip sealing









































Recommendations for Implementation

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- Suggested modifications to Medina CS 402:

- Aggregate gradation:

Sieve	% Passing	
	Current	Proposed
1"	100	100
3/4"	85 – 100	85 – 100
3/8"	20 – 45	25 – 45
No. 4	15 – 30	18 – 30
No. 16	10 – 25	12 – 25
No. 50	3 – 15	3 – 15
No. 200	0 – 5	0 – 5

- Asphalt binder content:

- Increase asphalt content from 4.3% to 5.3%

Recommendations for Phase 2

- Suggested modifications to Medina CS 402:
 - Asphalt type:
 - Continue to use PG 58-28
 - Aggregate properties:
 - Use either limestone or crushed gravel
 - Aggregate absorption less than 3%
 - Use of Hydrolene:
 - Continue to evaluate the performance of the test sections to determine if Hydrolene can be used in Medina CS 402 and at what percentage
 - Asphalt draindown:
 - Require this test as part of the mix design
 - Asphalt draindown $\leq 0.3\%$

Recommendations for Phase 2

- Construction-related specifications:
 - Use a thickness of 2 inches for Medina CS 402.
 - Do not overheat the HMA to avoid damaging the asphalt binder.
 - Spread the HMA when the atmospheric temperature is above 50°F (10°C) and rising.
 - Do not place the HMA when rain is imminent. If rain occurs during placement of the HMA, cease all operations.
 - Ensure that the temperature of the mixture when delivered to the paver is a minimum of 250°F (120°C).

Recommendations for Phase 2

- Construction-related specifications:
 - Use tandem steel wheel rollers weighing 6 to 10 tons (5.5 to 9 metric tons) for compaction.
 - Do not overcompact the HMA to the extent that the aggregate particles are crushed or broken.
 - Immediately following the initial rolling of the intermediate asphalt course, choke the placed HMA mixture using No. 9 aggregates at a rate of 10 lbs per square yard.
 - Chip sealing or an asphalt overlay is required on top of Medina CS 402.



Questions ?