Rubblization & HMA Overlay

Presented by Matt Shinners, Antigo Construction, Inc.

at APAM Annual Conference 02/27/2025

Good morning - WAKE UP!!

Presentation Outline

- Rubblization & HMA overlay overview
- History of Antigo's rubblization in Michigan
- Recent Antigo rubblization projects in Michigan
- Rubblization best practices
- Sustainability
- Questions & answers

Reflective Cracking of Asphalt Overlay

Before rubblization

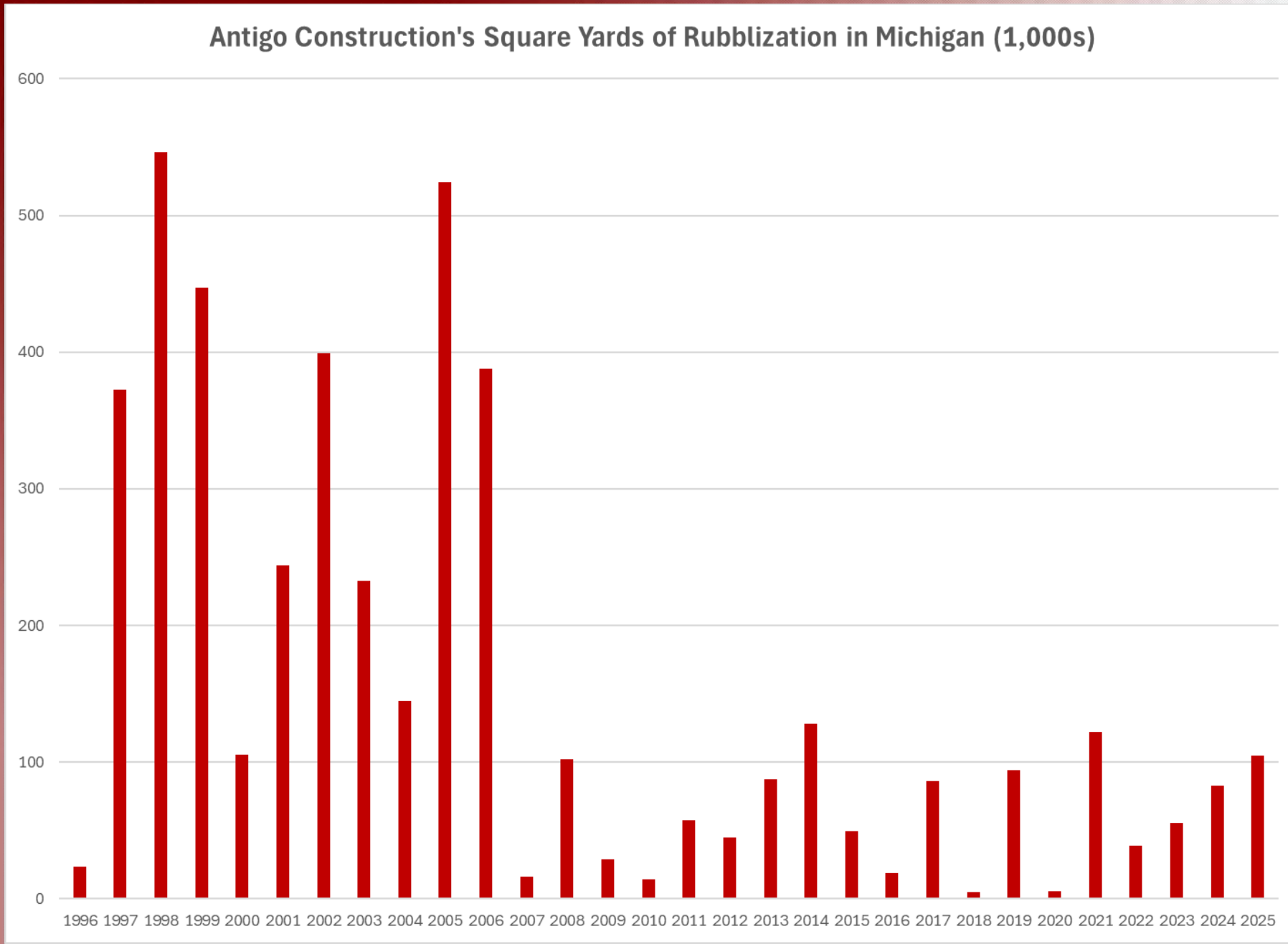
After rubblization

MHB Badger Breaker

Z-Grid Roller

PTR & Smooth Vibratory Rollers

HMA Overlay


Antigo Construction's Square Yards of Rubblization in Michigan (1,000s)
600
500
400
300
200
100
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

N Shore Drive, Ferrysburg, 1996 – 1st MI Project

N Shore Drive, Ferrysburg, 1996

N Shore Drive, Ferrysburg, 1996

USH 23, n/o Milan, 1997

Owner: MDOT

Contractor: Thompson-McCully

Design-Build-Warranty Project

10” JRCP / New 10.5” HMA Overlay w/ SMA

USH 23, n/o Milan, 1997

USH 23, n/o Milan, 1997

I-75, Bay County, 2019

Owner: MDOT

Contractor: C.A. Hull / Ace-Saginaw Paving /M&M Excavating

9” JRCP / New 6.5” HAM Overlay

I-75, Bay County, 2019

I-75, Bay County, 2019

I-75, Bay County, 2019

Maple Road, Saginaw County, 2023 – Modified Rblz

Owner: Saginaw County

Contractor: Pyramid Paving & Contracting

7.0” JRCP / New 5” HMA Overlay

Maple Road, Saginaw County, 2023

Maple Road, Saginaw County, 2023

Holt Road, Ingham County, 2024

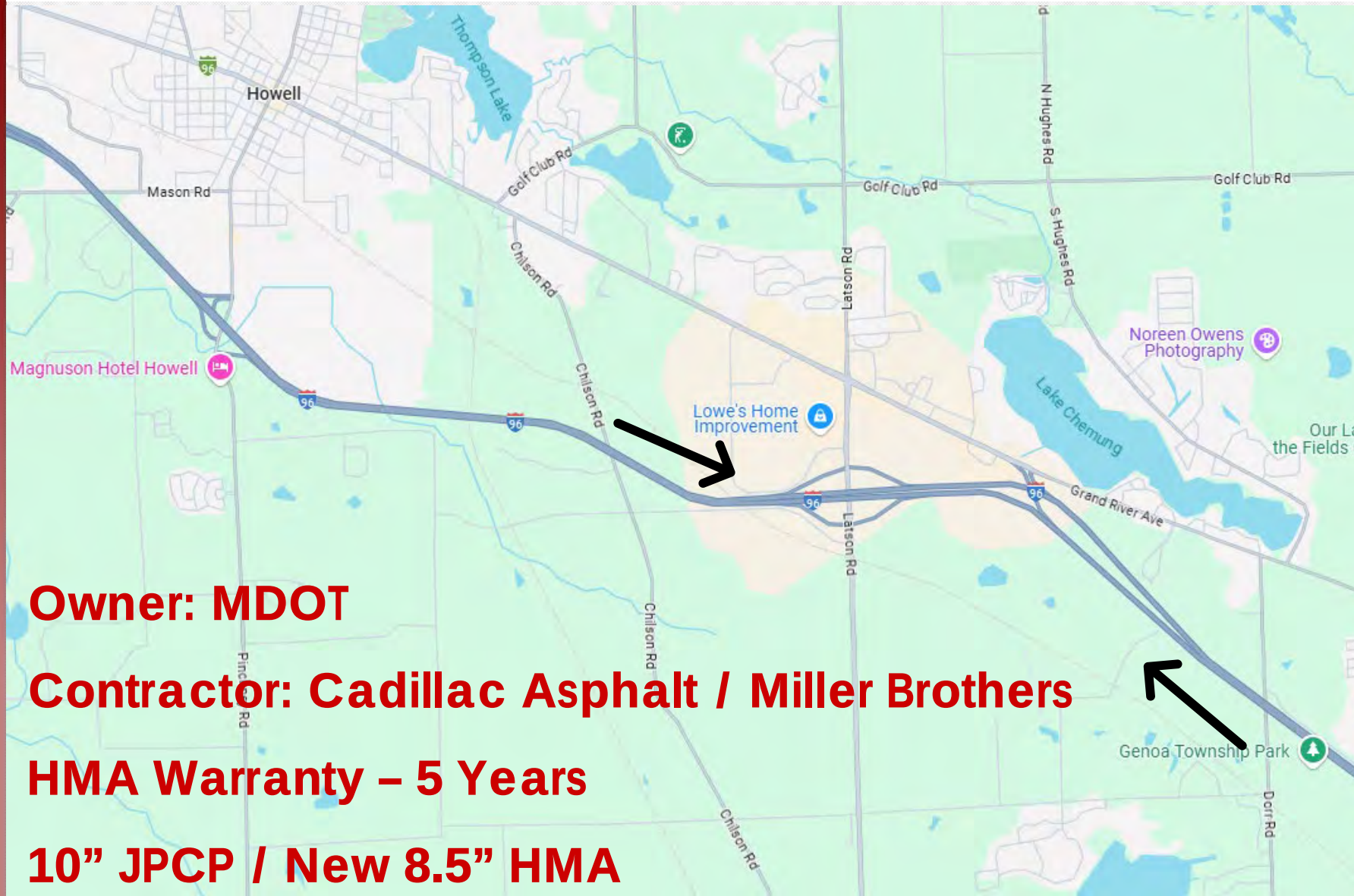
Owner: Ingham County

Contractor: Reith-Riley

9” JPCP / New 6.5” HMA Overlay

Holt Road, Ingham County, 2024

NEXT: I-96, Livingston County, 2025-26



Owner: MDOT

Contractor: Cadillac Asphalt / Miller Brothers

HMA Warranty – 5 Years

10” JPCP / New 8.5” HMA

I-96, Livingston County, 2025-26

Rubblization Best Practices

- ⇨ Reuse existing asphalt overlay as intermediate base layer
- ⇨ Use crushed aggregate as intermediate base layer
- ⇨ Modified rubblization when weaker base/subgrade support
- ⇨ Partial-depth milling of concrete adjacent to curb & gutter
- ⇨ Break & seat and crack & seat with MHB
- ⇨ FAA guidance includes rubblization
- ⇨ Partial-depth milling of rubblized concrete to control final elevation of asphalt overlay
- ⇨Recent reports

Mill overlay, crush, & windrow on shoulder

Rubblize 1st lane

Blade crushed millings over rubblized concrete

Pneumatic-tired roller on crushed millings

Rubblize 2nd lane

Blade crushed millings on 2nd lane

Crush aggregate layer over rubblized concrete

WisDOT addresses modified rubblization in engineer guidance

"Attention must also be paid to constructability. Even if it is possible to produce small particle sizes, the resulting layer must still provide a working platform for paving operations and a stable foundation for the pavement overlay. In cases of isolated, very weak subgrade, subgrade correction may be appropriate. Another way to compensate for weak subgrade is to modify the rubblizing pattern to produce larger particle sizes which maintain more of the existing concrete pavement's structural support. Experience has shown that segments of twelve to eighteen inches in the lower half of the slab are still effective for eliminating reflective cracking."

From Section 3.50 "Rubblizing Concrete Pavement" of the Wisconsin DOT Construction & Materials Manual

Full rubblization

Modified rubblization – significant spalling

Modified rubblization – occasional spalling

Clearly visible cracks

Weak area – should be addressed

Antigo's Modified Rubblization Spec

Description
(1) This section describes modified rubblization and the rolling and seating of existing concrete pavement to create a stable construction platform for a pavement overlay either with or without an intermediate base layer.

General
(1) Use a self-contained, self-propelled multi-head breaker. Use 10-ton or heavier rollers and roll at 6 feet per second or slower. Run vibratory rollers at an engineer-approved frequency and amplitude. A roller pass is defined as down and back in the same path.

(2) Before rubblizing, saw full-depth joints and completely sever load transfer devices to isolate the rubblized area from areas not to be rubblized. Saw jointed pavements at an existing transverse joint. Do not damage adjacent pavement during rubblization. Repair damage to the adjacent pavement caused by contractor operations as the engineer directs.

Modified Rubblization
(1) Fracture the concrete full-depth and uniformly across the pavement width. The engineer will designate one of the two categories of modified rubblization as described below:

Modified Rubblization–significant spalling
Achieve 12-inch minus size particles at the surface, significant surface spalling, and a surface appearance that ranges from smooth to pulverized. 75% of the pieces at the bottom of the slab shall be 15" minus in size. The pavement surface should look similar to the surface in the following two pictures:

Modified Rubblization–significant spalling

Partial-Depth Milling Concrete Adjacent to C&G

Partial-Depth Milling Concrete Adjacent to C&G

Break & seat with MHB – Ohio DOT

Crack & seat with MHB – Iowa Counties

FAA Design Guidance Includes Rubblization

FAA Advisory Circular 150/5320-6G, *Airport* Pavement Design and Evaluation, issued June 7, 2021

https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5320-6G-Pavement-Design.pdf

1. Purpose.

This advisory circular (AC) provides guidance to the public on the design and evaluation of pavements used by aircraft at civil airports.

FAA Design Guidance Includes Rubblization

4.1.5 When considering pavement reconstruction, in-place recycling methods such as full depth reclamation of flexible pavement and rubblization of rigid pavements may be cost-effective alternatives to removal of the existing pavement section.

FAA Design Guidance Includes Rubblization

4.9.3.2 The thickness design procedure for an overlay over a rubblized concrete base is similar to a new flexible or new rigid pavement design. In FAARFIELD, model the rubblized concrete pavement layer as a user defined layer with recommended modulus values ranging from 100,000 to 400,000 psi.

FAA Design Guidance Includes Rubblization

4.9.3.3 Use engineering judgment when selecting the appropriate modulus value to characterize the rubblized concrete pavement layer. Many factors influence the modulus of the rubblized layer including: the thickness, strength and particle size of the rubblized layer, the condition and type of base, subbase and subgrade materials. Refer to AAPTP Report 04-01, Development of Guidelines for Rubblization, and Engineering Brief 66, Rubblized Portland Cement Concrete Base Course, for further information.

Milling 5”-6” of rubblized concrete surface

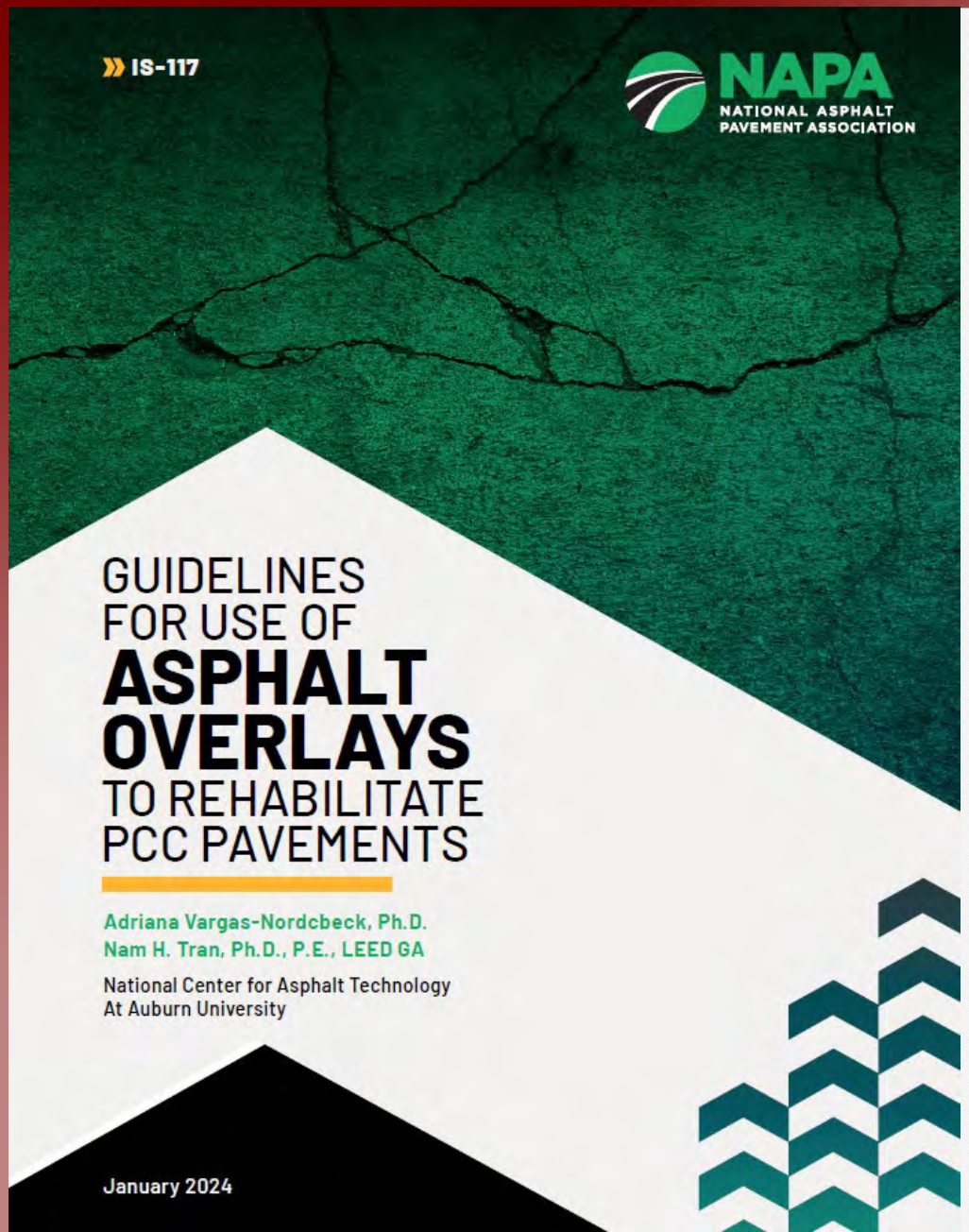
Antigo's Airfield Rubblization in MI

Year	Contractor	Location	Project Limits	County	PCC Type	Thickness	Quantity (SY)	HMA Overlay
2002	Michigan Paving & Materials	Kalamazoo/Battle Creek AP	Taxiway "E"	Kalamazoo	JRCP	08"	5,250	11.5"
2002	Dan's Excavating	Selfridge ANG	Runway 01-19	Macomb	JPCP	13-21"	95,706	7"
2006	Northwest Airlines	Detroit Airport	Test on Connector W-1	Wayne	JRCP	17"	625	n/a

Google: NCAT 20-03

- "The primary objective of this project was to synthesize both the historical and most recent experiences with C&S, B&S, and rubblization methods for the rehabilitation of PCC pavements with asphalt overlays."

- "Rubblized PCC with asphalt overlay had very good performance including resistance to transverse cracking distress, which implies that rubblization practically inhibits reflective cracking."



Google: NAPA IS-117

Contents:

- **Rehabilitation considerations**
- **Reflection cracking of HMA overlays**
- **Slab fracturing process**
- **Structural design of asphalt overlay**
- **Mix design for asphalt overlays**
- **Case studies**

Rubblization & HMA = Sustainability

1. Existing concrete pavement and base recycled in-place reduces need for new materials.
2. Reduction in truck movements and equipment usage when compared to full-depth reconstruction reduces emissions.
3. Good long-term performance of asphalt overlay.
4. Asphalt surface can be replaced as needed over time leaving rubblized layer as is (perpetual pavement).
5. Accelerated construction reduces impact on travelling public and reduces associated emissions.

Good Pavement Performance = Sustainability

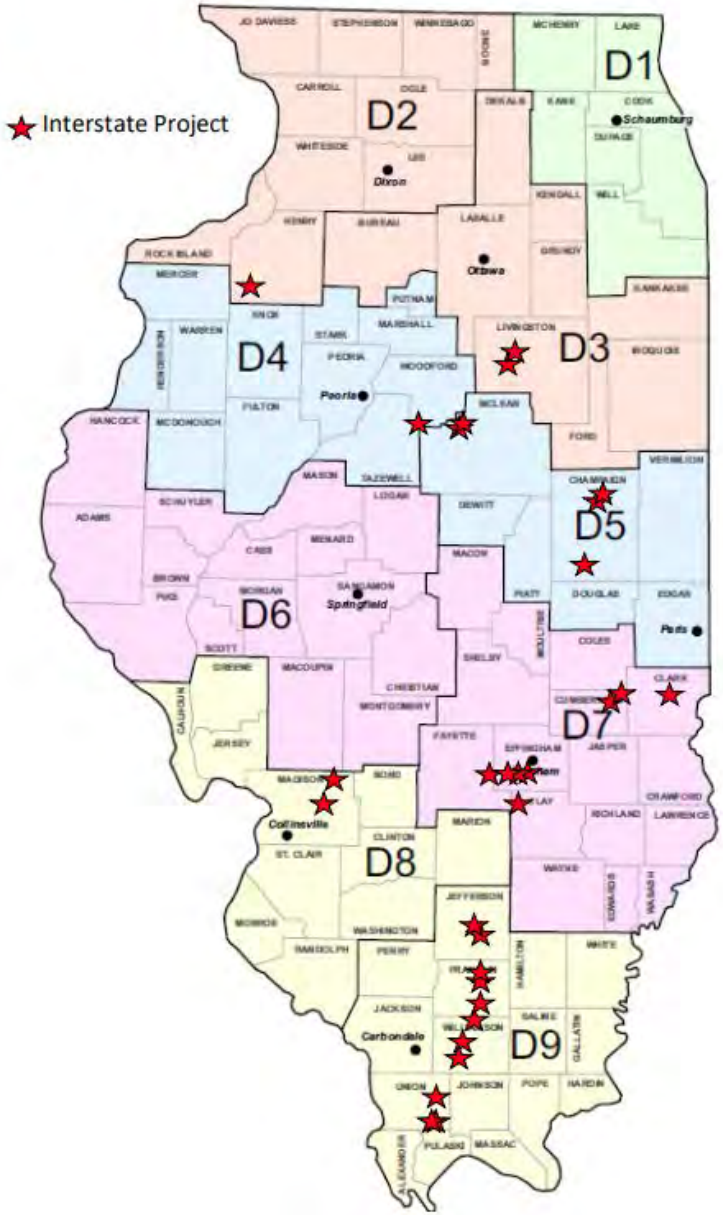
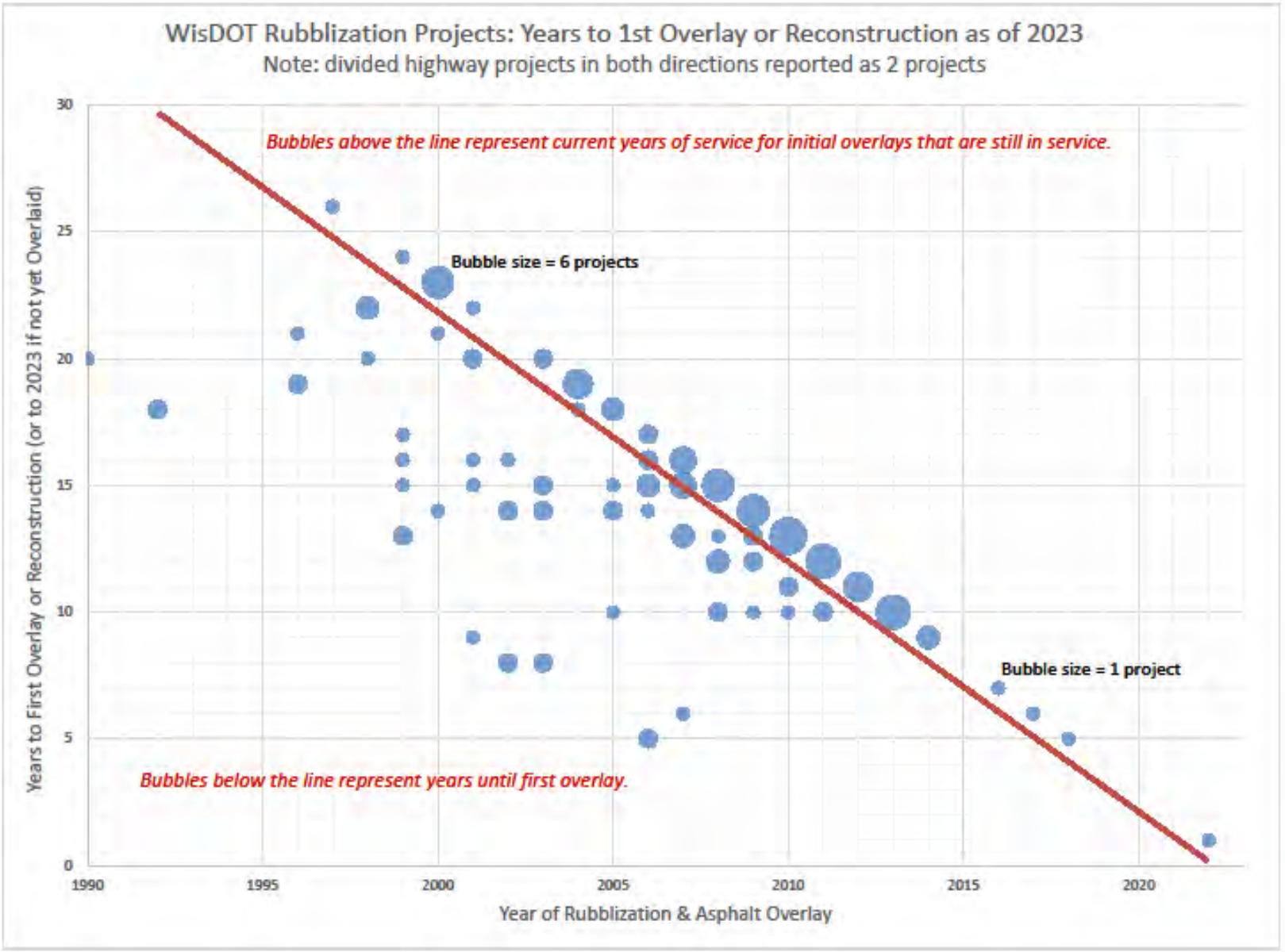


Figure 1. Map. Locations of interstate rubblization projects in Illinois.

CHAPTER 5: FINDINGS

As a result of this study, several findings can be made as to the current state of the practice of rubblizing design, construction, and performance in Illinois, as follows:

- Overall, rubblization is providing good to excellent performance and exceeding design expectations.
- The design process is conservative. Fatigue cracking has not been observed in the original rehabilitation, which is providing service beyond the design traffic. Overlays that result in no additional structure (mill and fill) are not experiencing fatigue cracking.
- Rutting is not excessive and is similar to full-depth HMA. The exception is one project on I-57 (mile post 29.6–32.1 southbound) in which rutting was attributed to a level binder layer being added under the surface to make up for thin pavement.


WisDOT Rubblization Projects: Years to 1st Overlay or Reconstruction as of 2023
Note: divided highway projects in both directions reported as 2 projects
Bubbles above the line represent current years of service for initial overlays that are still in service.
Bubble size = 6 projects
Bubble size = 1 project
Bubbles below the line represent years until first overlay.
Years to First Overlay or Reconstruction (or to 2023 if not yet Overlaid)
Year of Rubblization & Asphalt Overlay
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020

Evaluation of Rubblized Pavement Sections in Michigan Constructed between 1988 and 2002

Final Report

December 2006

Prepared for:
Antigo Construction, Inc.
P.O. Box 12
2520 N. Clermont St.
Antigo, WI 54409

Prepared by:
Applied Pavement Technology, Inc.
115 W. Main St., Suite 400
Urbana, IL 61801
Phone: (217) 398-3977 • Fax: (217) 398-4027

Is it time for an updated study of Michigan rubblization and HMA overlay projects?

Questions & Answers

Antigo Construction Family of Companies

715-627-2222

ac@antigoconstruction.com
www.antigoconstruction.com

2520 Clermont St
Antigo, WI 54409
USA