Georgia DOT Micro-milling and Thin Overlay

Presented by

Yichang (James) Tsai, Ph.D., P.E., Professor
Georgia Institute of Technology

Erany Robinson-Perry, P.E., Assistant State Maintenance Engineer
Georgia Department of Transportation

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Acknowledgement

- Georgia Department of Transportation
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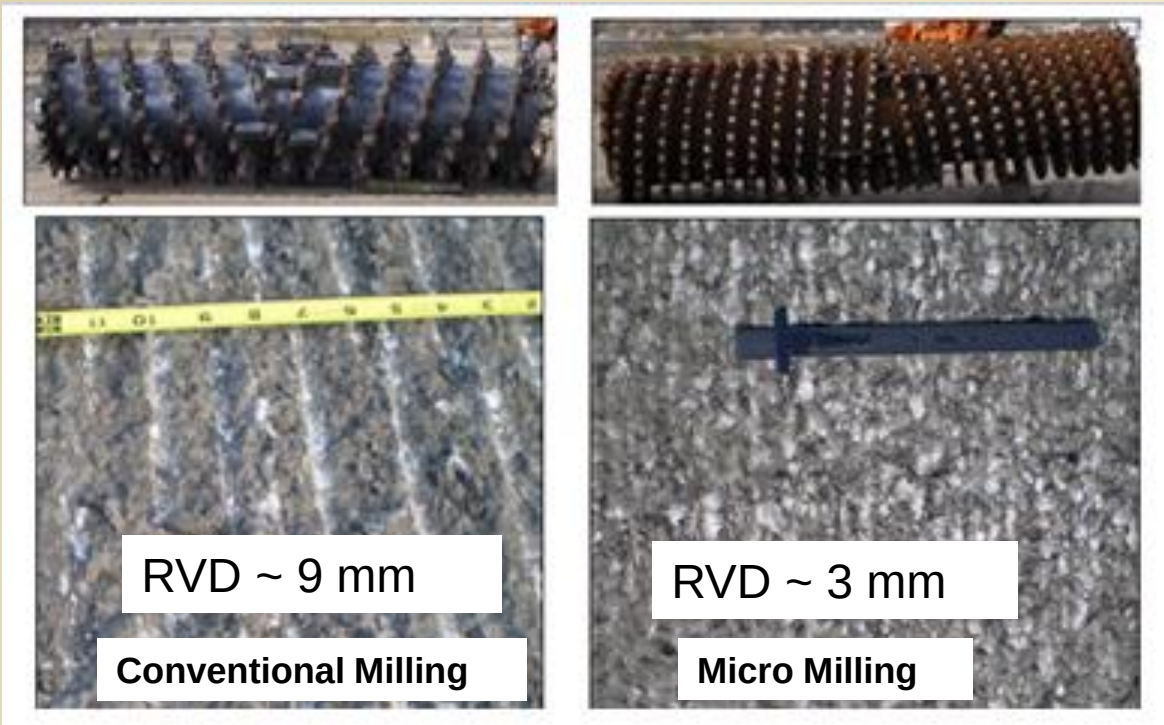
Outline

- Micro milling and its advantages
- Motivation
- Objectives
- Procedures of micro-milling and thin overlay
- Long-term benefit cost analysis of micro-milling and thin overlay
- Conclusions
- Moving forward

What is micro-milling?

A micro-milling operation can produce fine and smooth texture on the milled surface because of the dense spacing and the large numbers of teeth on the milling drum.



Advantages of Micro-milling

Micro-milling offers several advantages over conventional milling:

- **Improve smoothness, safety, and comfort**
- **Improve work flexibility**
- **Improve overlay quality**
- **Save materials and costs**

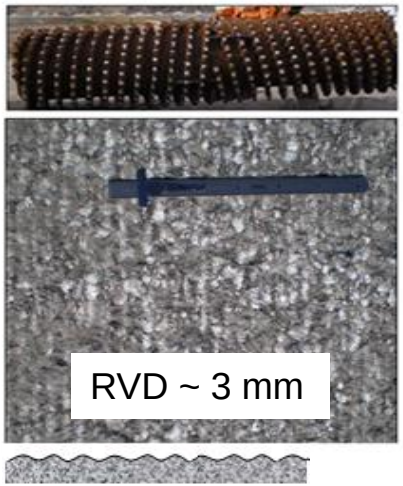
Motivation

- GDOT is actively searching for new pavement preservation methods
- In 2007, GDOT challenged its common practices for preserving its interstate highways and developed a new pavement preservation alternative, which can cost-effectively replace only the deteriorated thin open-graded top surface layer (3/4” to 8/7”) without removing the large sound underlying layer.
- Unlike Virginia and Maryland, to only provide good ride quality using micro-milling, GDOT uses the **micro-milling with thin overlay**.
- It micro mills only 7/8” of the top OGFC and inlay 7/8” of OGFC without disturbing the underlying SMA and base that are still LARGELY sound.
- The estimated savings compared to the traditional pavement preservation method is more than $60,000 per lane mile.
- **Savings on I-95 project**: 14 miles * 6 lanes * $60,000 = **$5,040,000**

New Method: Micro-milling & Thin Overlay

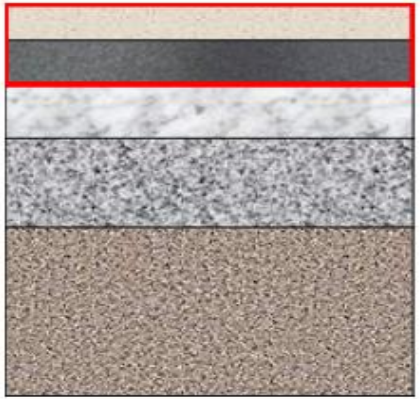
Conventional Method

Micro-milling & Thin Overlay



A: 7/8" OGFC or 1 ¼" PEM
B: 1.5" SMA
C: Asphaltic Concrete "B" – 2 in (19 mm)
D: Asphaltic Concrete Base – 4 in (25 mm)

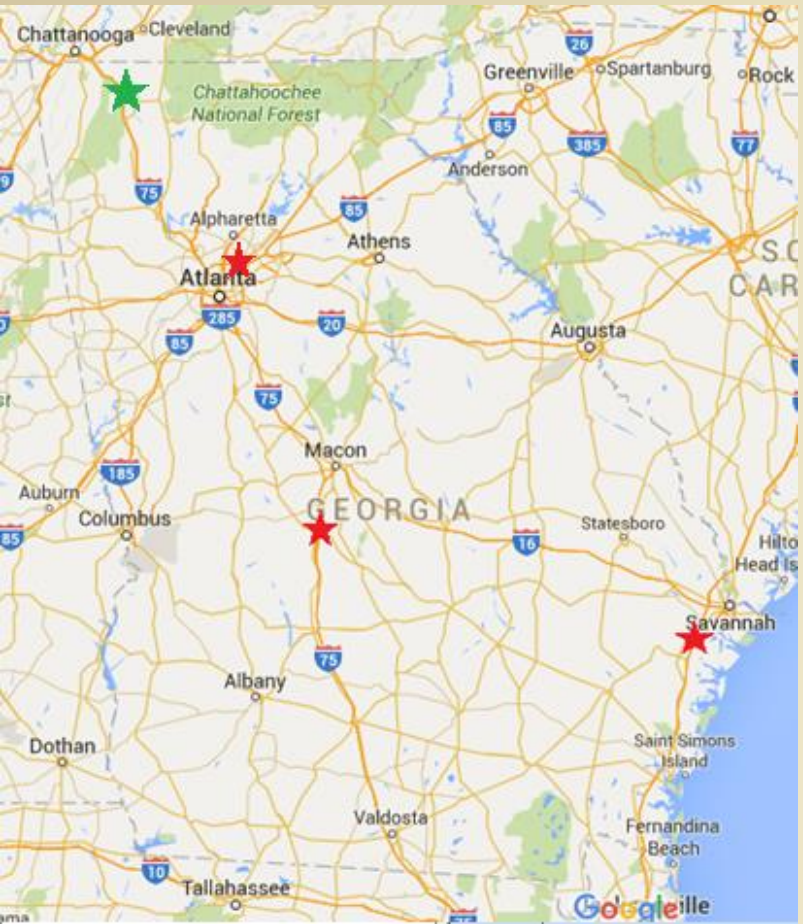
E: Graded Aggregate Base- (GAB) - 10 in



Successful Implementation

- **To ensure a successfully implement of the new method, GDOT, working with Ga Tech, developed new processes.**
  - Construction procedure, including pre-treatment, micromilling, cleaning, etc.
  - A 1000-ft test section was used for adjusting Micro-milling operation, such as milling speed and milling drum speed (revolution per minute, RPM), to achieve the required quality on the milled pavement surface.
  - An Ridge-to-Valley Depth (RVD) indicator was developed to quantitatively evaluate the micromilled pavement surface texture.
  - An automatic RVD measuring method for effective, real-time quality acceptance. GDOT's Road Laster Profiler was retrofitted to provide a fast, continuous measure of RVD on the micro-milled pavement surface before paving to ensure the quality and provide real-time feedback.
  - Quality acceptance requirements are specified in GDOT Special Provision Section 432 "Mill Asphaltic Concrete Pavement (Micro-Mill)."

Micro-milling & Thin Overlay Projects



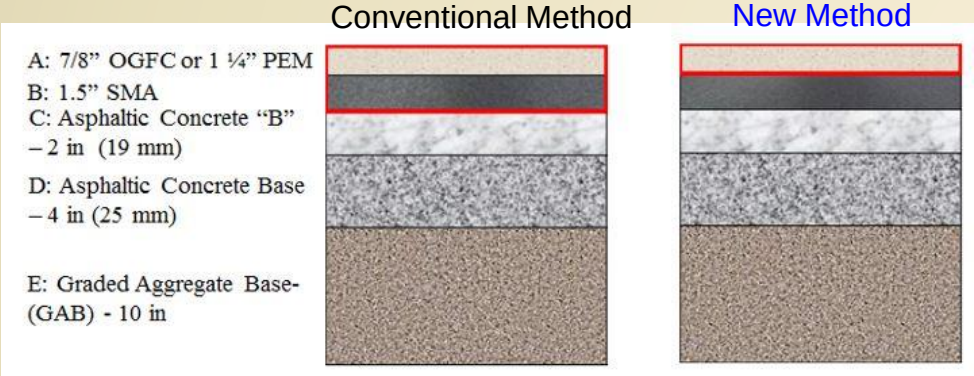
- ✓ 96 lane-mile I-75 in 2007
- ✓ 100 lane-mile on I-95 in 2011
- ✓ 100 lane-miles on I-285 in 2012

Innovation of New Method

- New pavement layer design
- Enhanced new micro-milling operations to generate the desirable surface texture, etc.
- New performance indicator, Ridge-to-Valley (RVD), for micro-milled surface
- Enhanced sensing device to measure RVD for construction quality control.
- A new specification has been developed.

Key Research Questions

- A new pavement preservation technology (Micro-milling and thin overlay) has been developed. It saves more than $5 million **on material cost only** for a 16 centerline miles of interstate highway (96 lane miles).
- **Key questions: (compared to the conventional method)**
  - **What is the actual performance/life?**
  - **What is the long-term benefit cost ?**



Objectives

- To present the procedures of micro milling and thin overly.
- To critically evaluate the long-term performance and the long-term benefit cost of the new pavement preservation method (micro milling and thin overlay). a new pavement preservation method (micro-milling and thin overlay).

Procedures of Micro milling and Thin overlay

Conventional Mill vs. Refined Micro-mill

A: 7/8" OGFC

B: 1.5" SMA

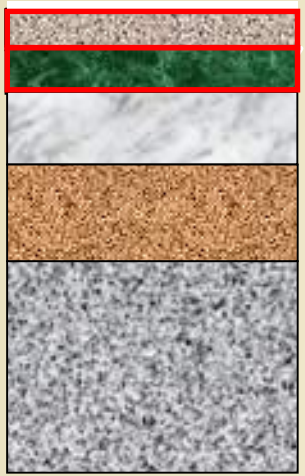
C: Asphaltic Concrete "B" - 2in (19 mm)

D: Asphaltic Concrete Base- 4 in (25 mm)

E: Graded Aggregate Base- (GAB) - 12 in

Conventional Mill

- Mill A and B
- Inlay A and B

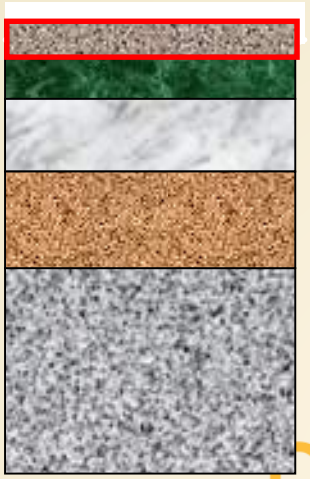


Micro-mill

- Mill A and B
- Inlay A and B

GDOT's Micro-mill

- Mill A
- Inlay A

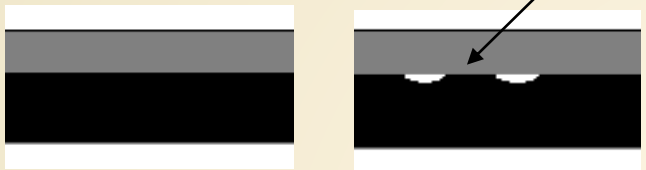


Laser Setup for 7/8” Milling

Milling of 7/8” OGFC

Cleaning of Milled Surface

Quality Assurance ad Quality Control

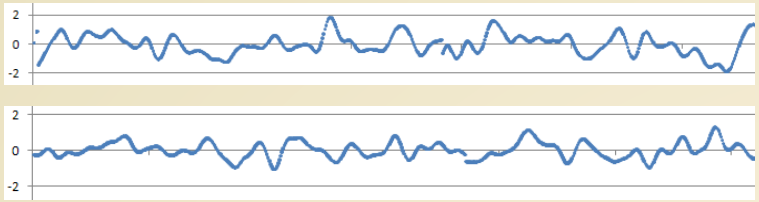


Acceptable surface

Surface with voids

Micro-milling Quality Control

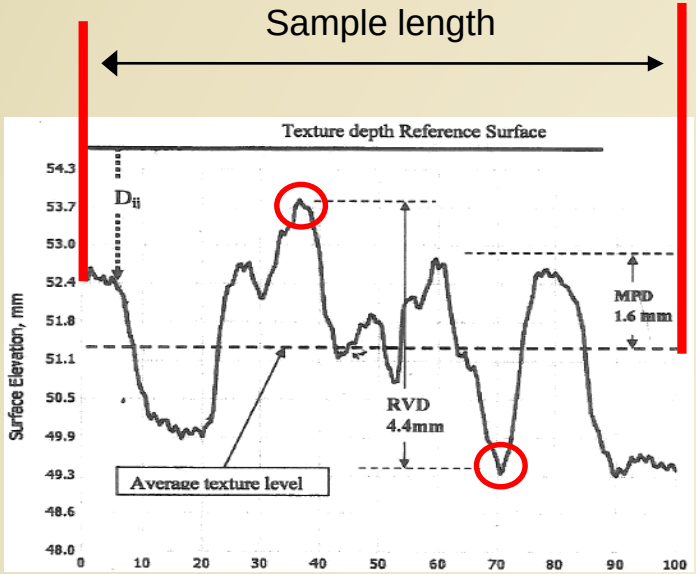
Run IRI and RVD for every 0.5 miles



DATE COLLECTED:	11/09/2010		TIME COLLECTED:	12:24:16						
FILENAME:	D:\D5\BRYAN\NHS-977\SR040500.P08									
COUNTY:	29		ROUTE:	SR						
DIRECTION:	North(+)		OPERATOR:	**********						
DRIVER:	**********		VEHICLE:							
EQUIPMENT:	402-0299		WEATHER COND:	PC/76						
RUN TYPE:	General		DISTRICT:	5						
# OF LANES:	5		CONTRACT ID #:	B13309-09-S00-0						
CONTRACTOR #:	2PL500		LANE TESTED:	1						
PROJECT #:	**********		UNIT #:	5						
STAGE OF CONSTRUCTION:	PROGRESS		SURFACE TYPE:	MILLING						
TYPE MIX:	MICRO-MILLING									

Miles			MM/KM			MM			MM	95%	
From	To	Rough Dist	IRI 1	IRI 2	Hcs IRI	MPD	% Error	RVD	RVD	Text Pos
86.500	87.000	0.50	647	802	547	1.312	1.300	3.113	4.495	1
87.000*	87.500	0.39	714	994	652	1.034	1.381	2.543	4.144	1
87.500*	88.000	0.47	700	865	590	0.811	1.343	2.001	3.060	1
88.000	88.325	0.33	721	748	563	1.085	1.242	2.713	4.072	1

Ridge-To-Valley (RVD)



Micro-milled Surface Texture

Smooth Section

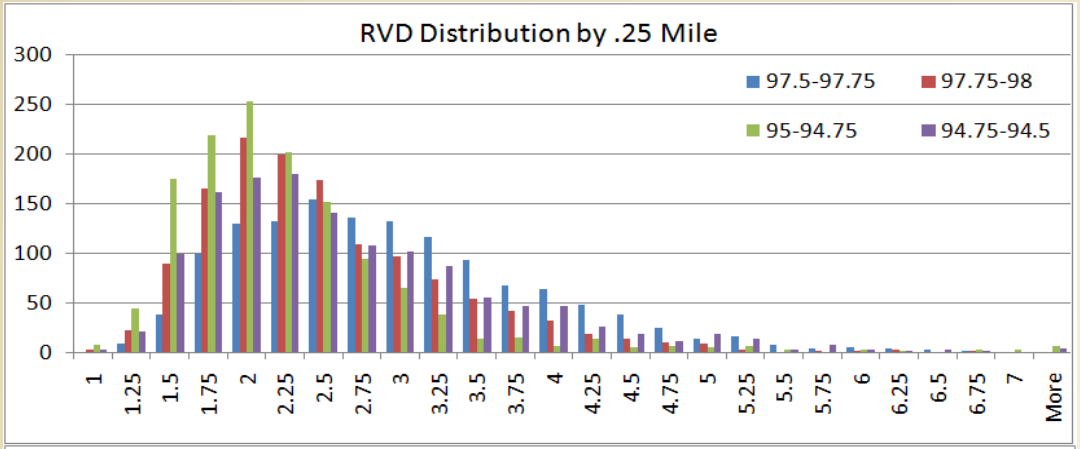
Travel Direction

Rough Section

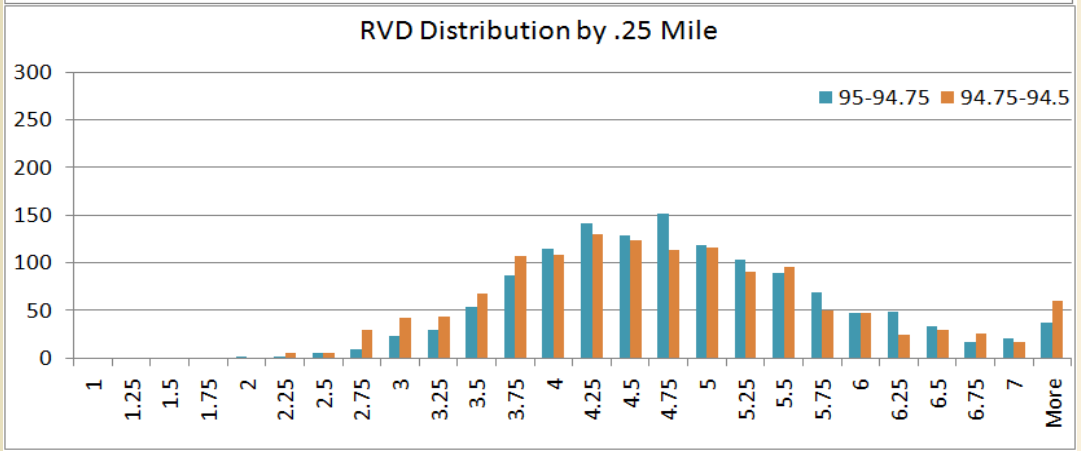
Travel Direction

What Are Actual RVD Distributions?

Smooth



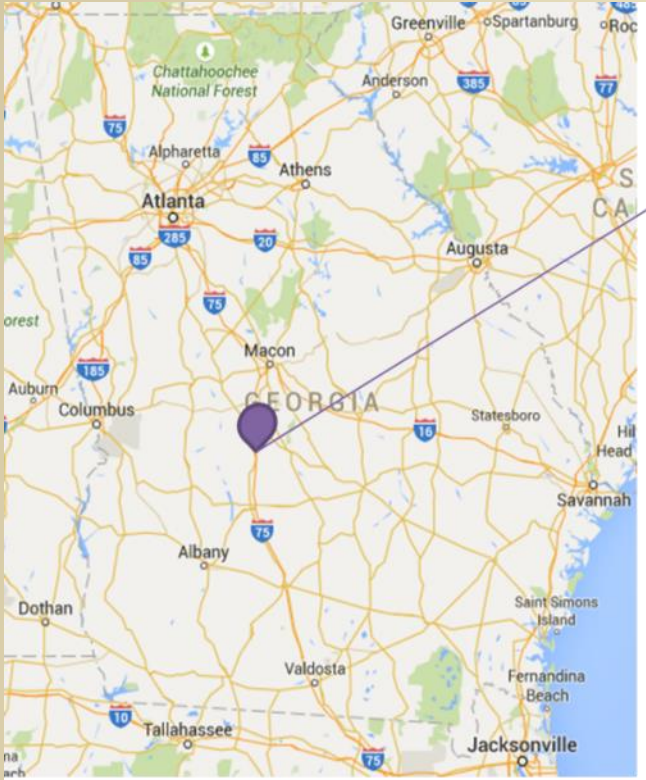
Rough



1’ by 1’ Micro-milling Sample for Detailed Texture Analysis

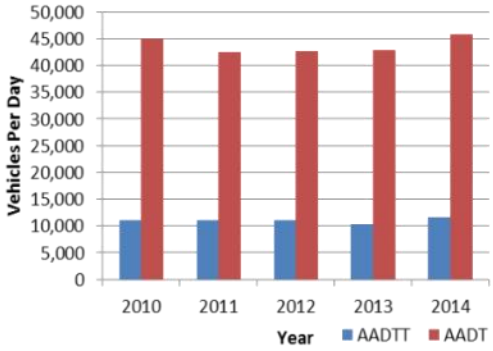
LONG-TERM BENEFIT COST ANALYSIS OF MICRO-MILLING AND THIN OVERLAY (CASE STUDY ON I-75)

Project Description



(a) Project location

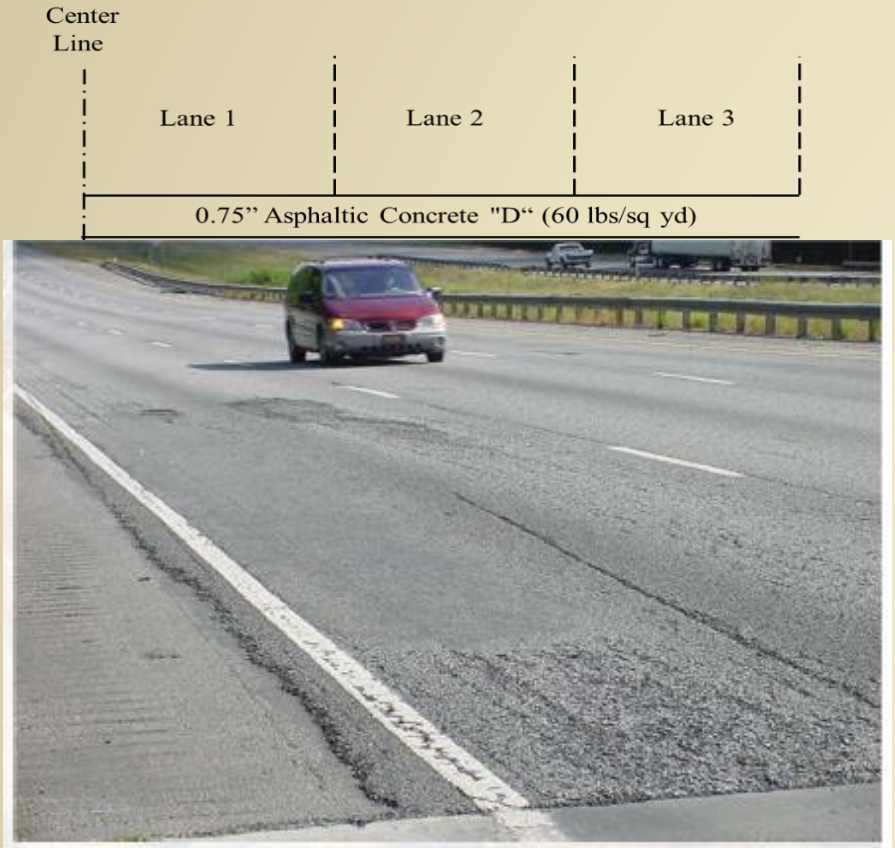
(b) Lane configuration



(c) Yearly traffic

- I-75 near Perry, GA
- 15.3 miles
- 6 lanes
- 46,000 AADT (25% of truck)

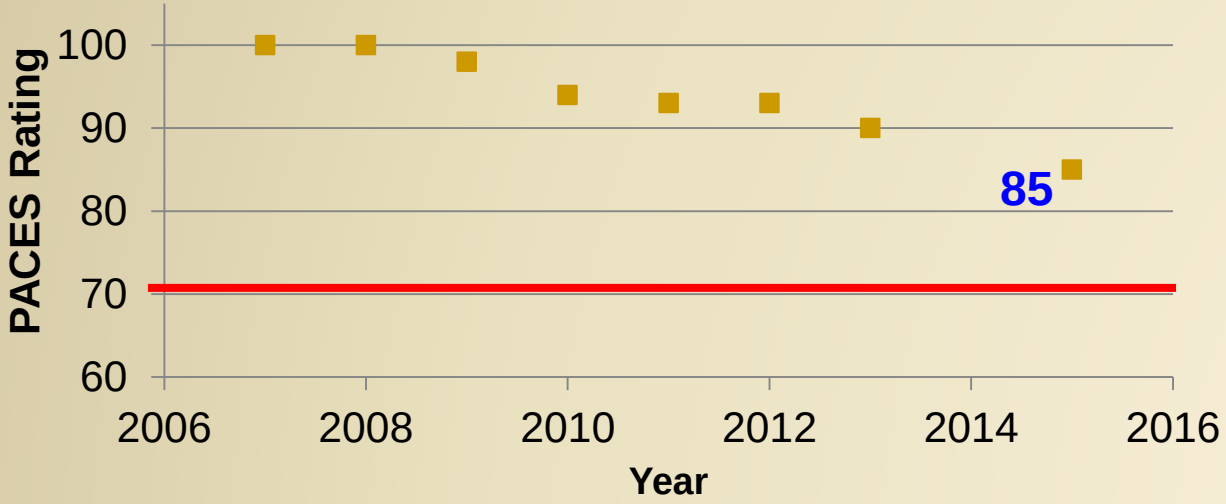
Pavement Design



- JPCP in 1964
- AC overlay in 1994
- Micro-milling & thin overlay in 2007

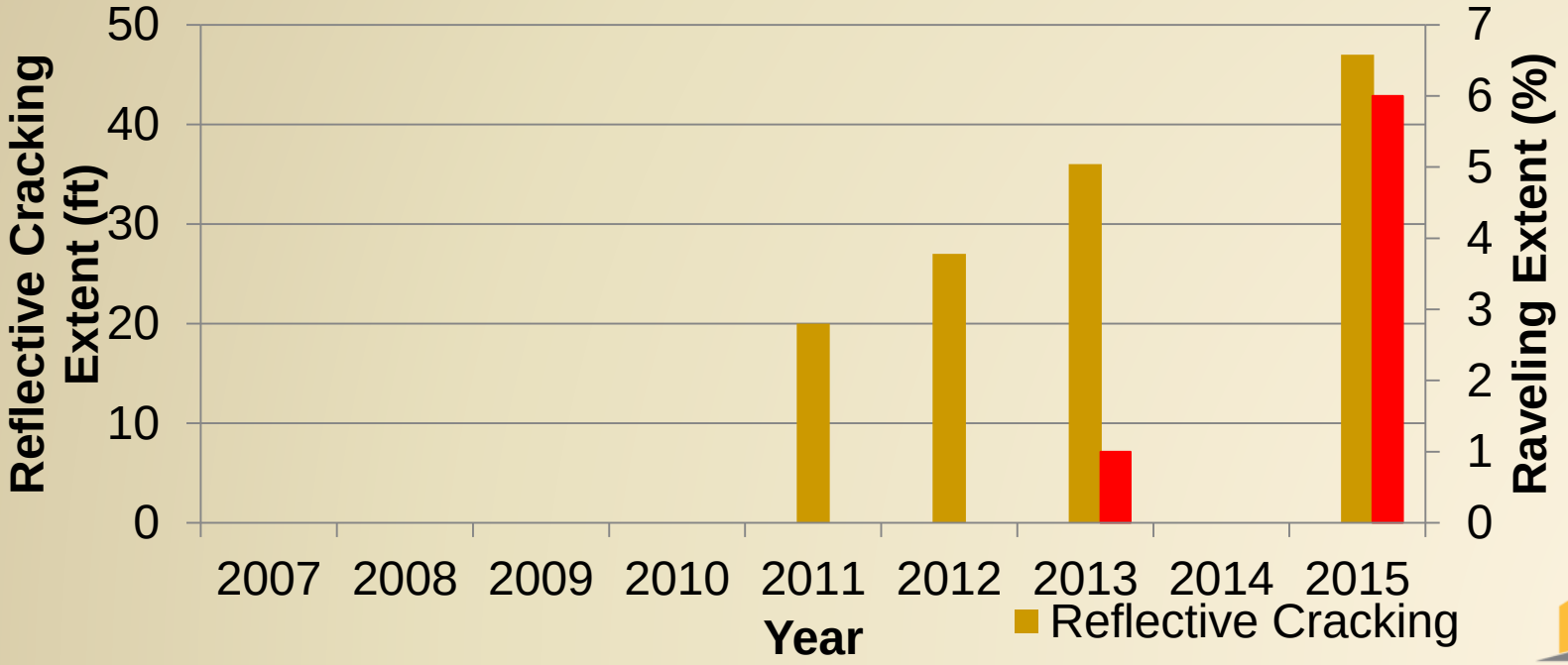
Performance: COPACES (Rating)

- Fairly good condition in 2015 (8 years after micro-milling and thin overlay) with a rating of 85 (typically a rating of 70 triggers resurfacing)



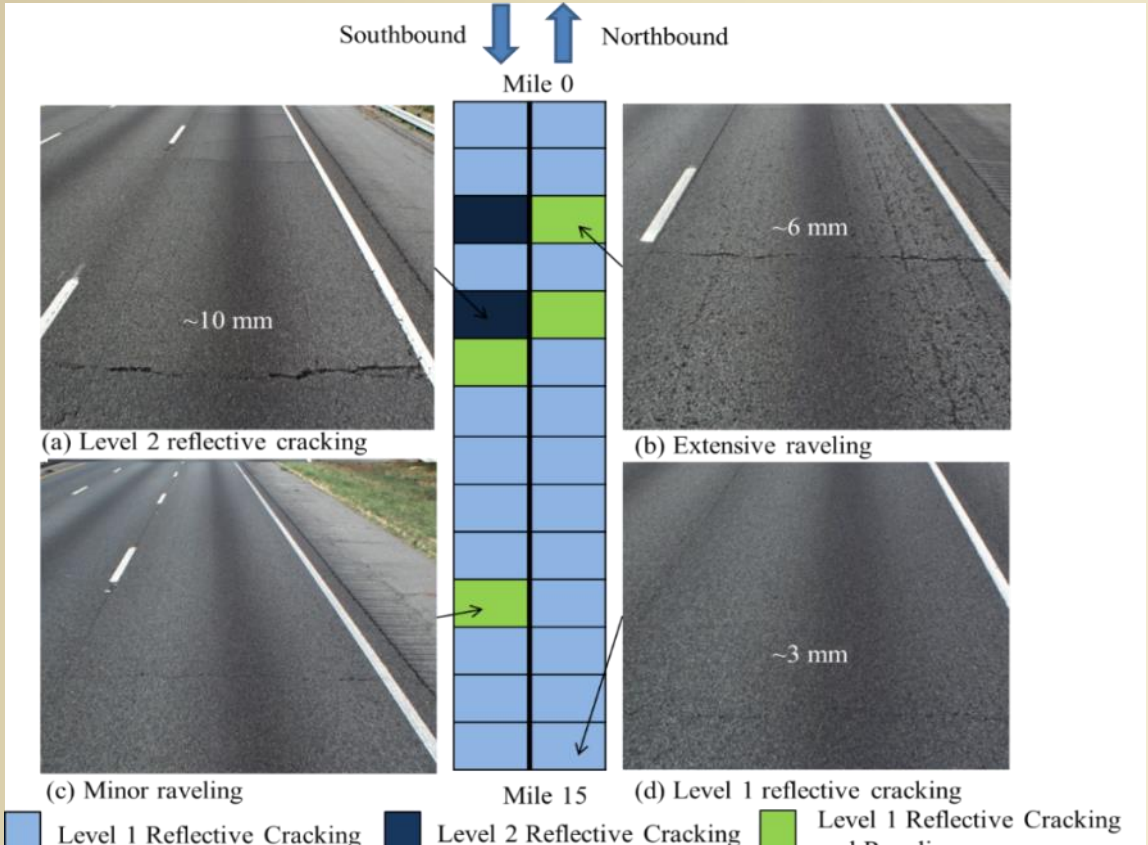
Performance: COPACES (Distresses)

- Reflective Cracking: 4 years after micro-milling & thin overlay
- Raveling: 6 years after micro-milling & thin overlay



Pavement Distresses: 3D Pavement Data

Data collected in July 2014



Comparable Service Life!

- Anticipate another 2-3 years
- New method: 10 + years
- Conventional method: 10-12 years

Cost Effectiveness Analysis

Item	New Method (I-75 Project Cost 2006-2007)	Conventional Method[1&2] (Mean Item Cost 2006-2007)
Service interval	10 years	12 years
Discount rate	4%	4%
PEM	$50,500	$50,500
SMA	$0	$62,400
Micro-milling3	$47,500	$0
Conventional Milling (2 ¾ ")	$0	$34,600
Total Cost (per lane-mile)	$98,000	$147,600
Equivalent Uniform Annual Cost	$12,000	$18,200

Notes:

1. **The costs include material, labor, and equipment.**
2. **The unit cost is based on Mean Item cost 2006-2007.**
3. **The unit cost is based on a weighted average (by quantity) of GDOT's micro-milling projects**

Estimated saving on Georgia's interstate system (assuming 1300 centerline miles with 6 lanes in each mile): **~480 million**

Conclusions

- The new method, micro-milling & thin overlay, has been proved to be cost-effective.
- Case study shows the new method has a service life of 10+ years, comparable to that of the conventional method (10-12 years).
- Estimated saving on Georgia's interstate system over a 10-year life cycle is $480 million over the conventional method.
- Other benefits observed include:
  - Reduced the recycled material
  - Environmental friendly
  - Less traffic congestion during construction
  - Improved safety during construction

Moving Forward

- Incorporate this new method into GDOT's life cycle pavement preservation practices and management.
- Study the criteria for micro-milling & thin-overlay (i.e., conditions are suitable for this method?) to have broader application.
- Develop pre-treatment methods (e.g., crack sealing or filling with different materials) for different prior pavement conditions, especially for low-severity cracks.
- Quantify the environmental impact and sustainability benefits of the proposed method.
- Establish a national standard and specification on this new pavement preservation technology.

Q/A