

# Road Recycling & Improvement Program



## SUMMARY & FIRST YEAR REVIEW

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*Director of Engineering & Deputy Managing Director*

County Engineers' Workshop

February 6, 2019



# Welcome to our story...

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# SUCCESS IS AN ICEBERG

What people see:  
**SUCCESS**

What really happens:  
**FAILURE**  
**SETBACKS**  
**NAYSAYERS**  
**DOUBTS**  
**HARD WORK**  
**MORE HARD WORK**  
**MORE FAILURES**  
**SACRIFICES**  
**RISKS**  
**LATE NIGHTS**  
**EARLY MORNINGS**  
**COURAGE**  
**PERSISTENCE**  
**ACTION**



# Overview

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- ❑ What is Our “Why?”
- ❑ What is Recycling, and How Are We Doing It?
- ❑ Things to Know
- ❑ The Case for Recycling



# Overview

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□ What is Our “Why?”

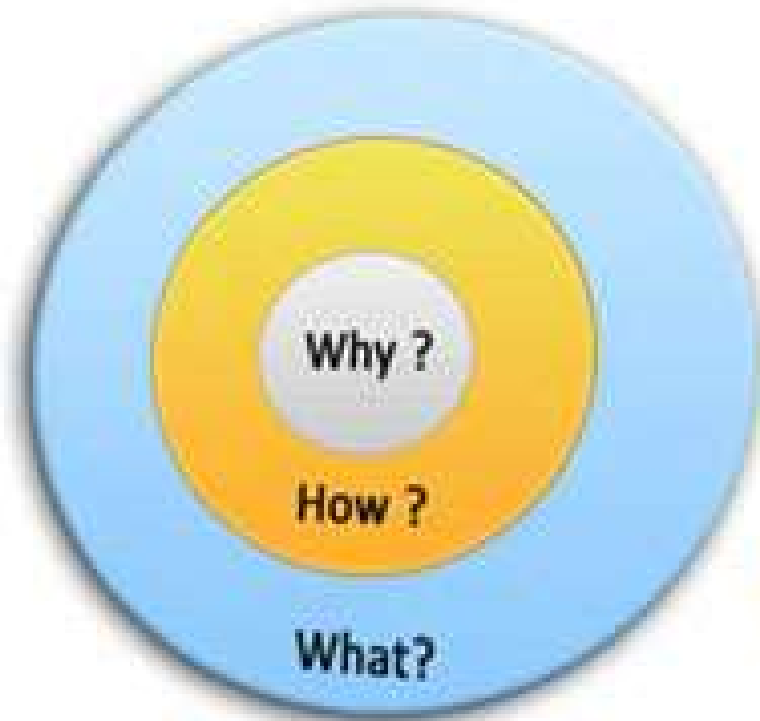
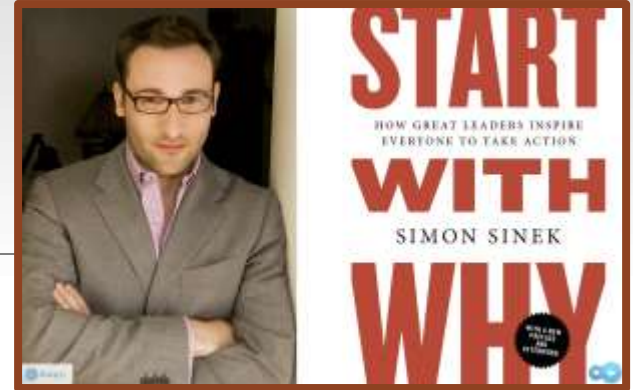
□ What is Recycling, and How Are We Doing It?

□ Things to Know

□ The Case for Recycling



# What is our “Why”?



**Why** = The Purpose

*What is your cause? What do you believe?*

**How** = The Process

*Specific actions taken to realize the Why.*

**What** = The Result

*What do you do? The result of Why. Proof.*















# What if...

this was our average road?



# 2017 PASER Ratings: Primary Roads

## GOOD



24%  
133 miles

PASER 10, 9, 8

Routine:

- Crack Fill
- Minor Patching

## FAIR



35%  
190 miles

PASER 7, 6, 5

Preventive:

- Chip Seal
- HMA Wedging
- Concrete Joint Repair

## POOR



41%  
223 miles

PASER 4, 3, 2, 1

Rehab/Reconstruct:

- Resurface
- Pulverize/HMA Paving
- Replace Concrete Slab
- Reconstruct

*PASER – Pavement Surface Evaluation & Rating System*



# 2017 PASER Ratings: Local Roads

## GOOD



PASER 10, 9, 8

Routine:

- Crack Fill
- Minor Patching

## FAIR



PASER 7, 6, 5

Preventive:

- Chip Seal
- HMA Wedging
- Concrete Joint Repair

## POOR



PASER 4, 3, 2, 1

Rehab/Reconstruct:

- Resurface
- Pulverize/HMA Paving
- Replace Concrete Slab
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*PASER – Pavement Surface Evaluation & Rating System*





# Our Mountain to Climb

1,500+ Mile Road System

- 550 Primary
- 900+ Locals (80% Paved)

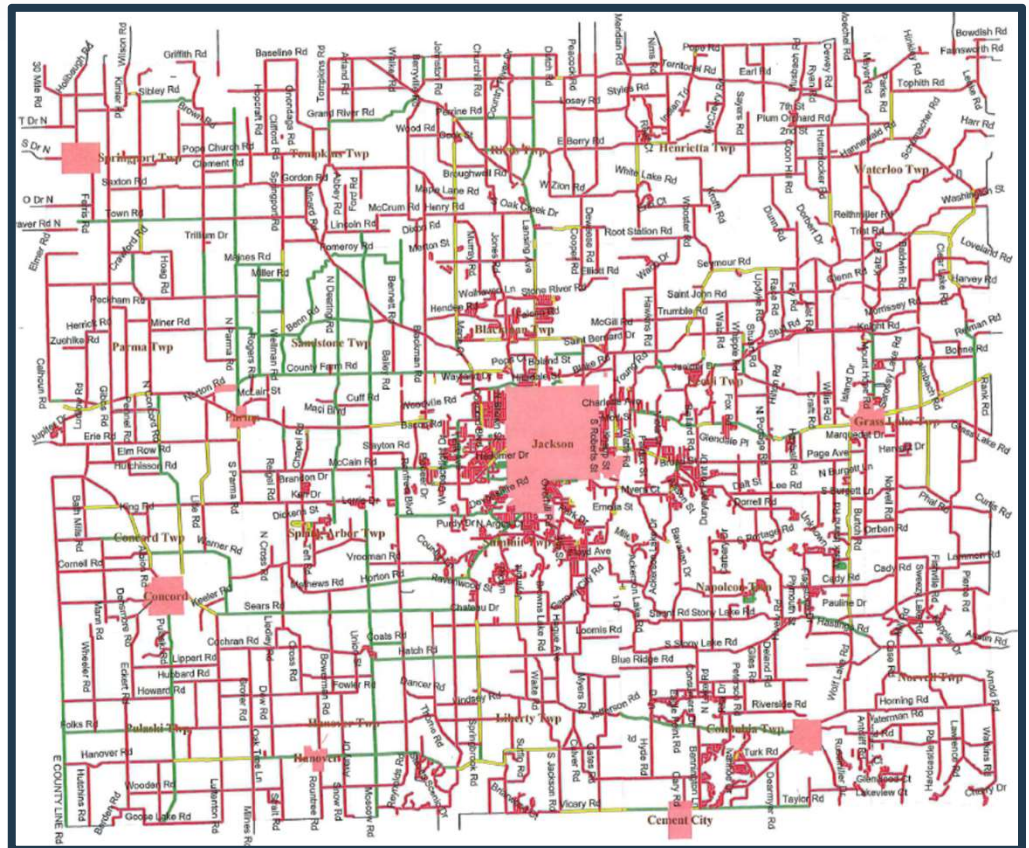
Reconstruction required on:

- 50% of Primaries (220 miles)
- 85% of Locals (680 miles)

\$63 Million+ in township road work currently programmed

- 3-Year “Extreme Makeover”
- ~30% of Local Roads

**Red** = PASER < 4  
**Yellow** = PASER = 5  
**Green** = PASER > 6



# Our Why...our “BHAG”

## Build GREAT roads!

Roads that are built:

- **Strong** – from the bottom up.
- **Durable** – in all seasons.
- At the **same cost** – or *less*.
- While being **GREEN** – Reducing, Reusing, Recycling, and minimizing environmental impacts.



BHAG: Big, Hairy, Audacious Goal, “Built to Last: Successful Habits of Visionary Companies” by James Collins and Jerry Porras





# Overview

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What is Our “Why?”

**What is Recycling, and How Are We Doing It?**

Things to Know

The Case for Recycling

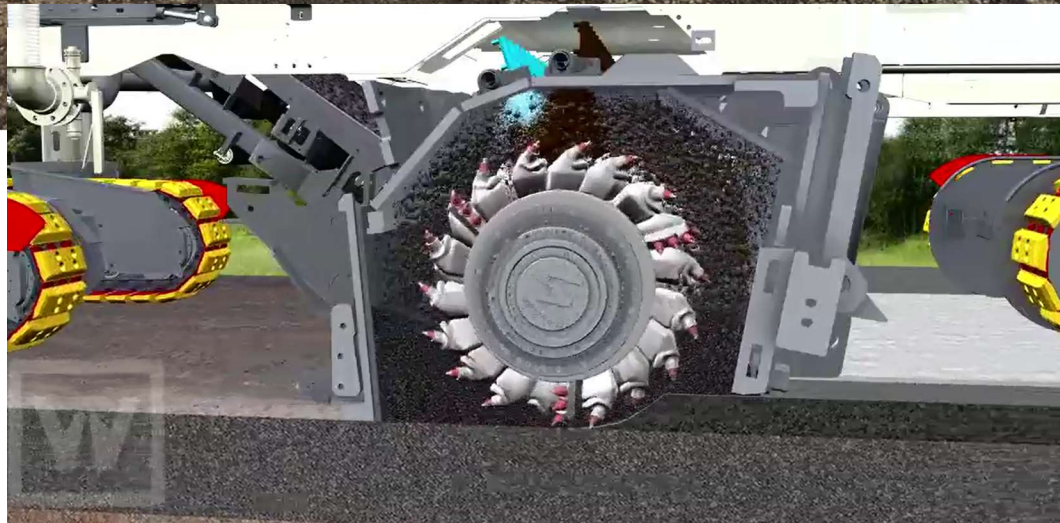


# It's Basically Like Rototilling Your Garden...



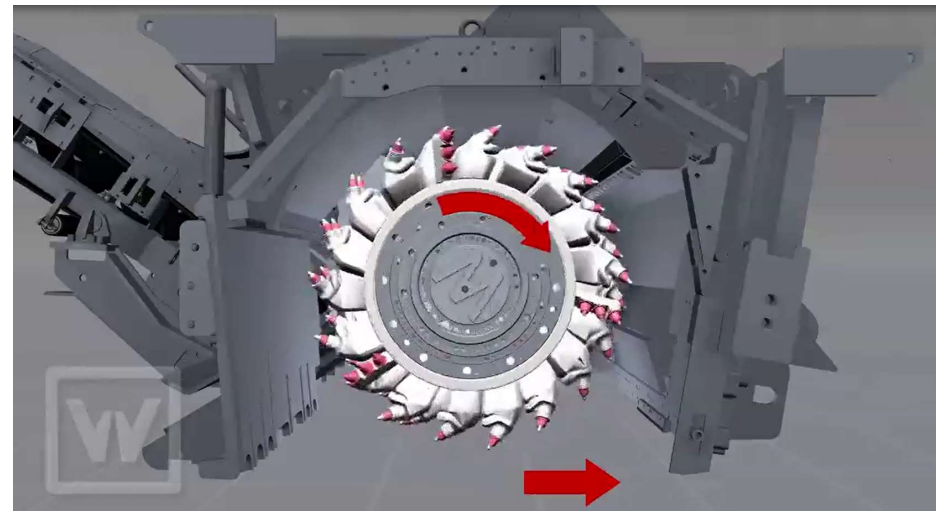
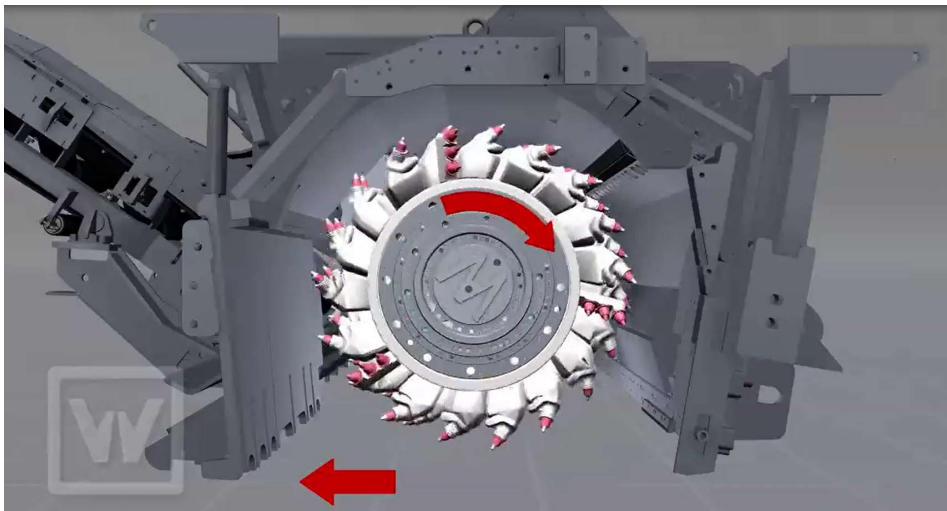
# With LOTS of Power!





# Versatility: Milling and Recycling

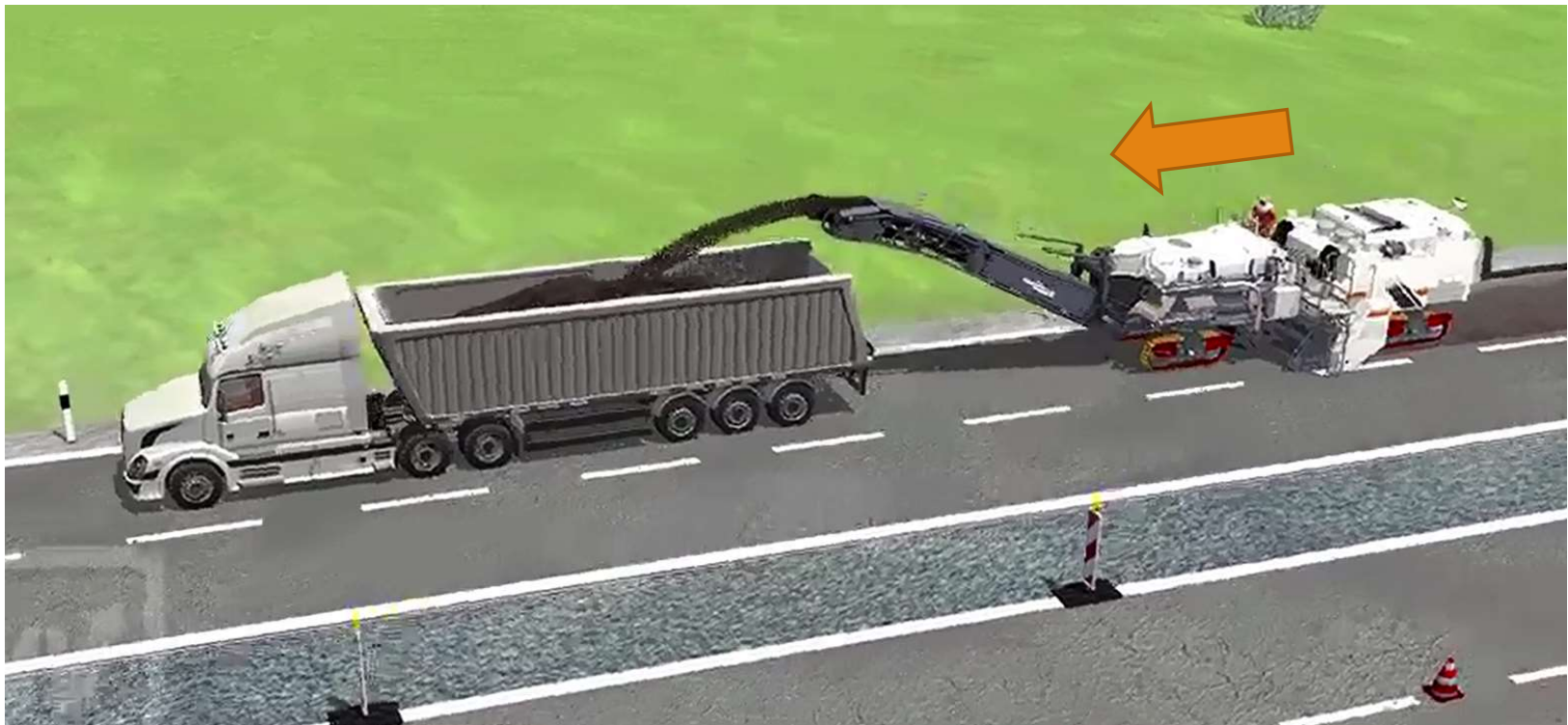
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# Recycling 101

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## Milling - upcutting



# Recycling 101

## Recycling - downcutting

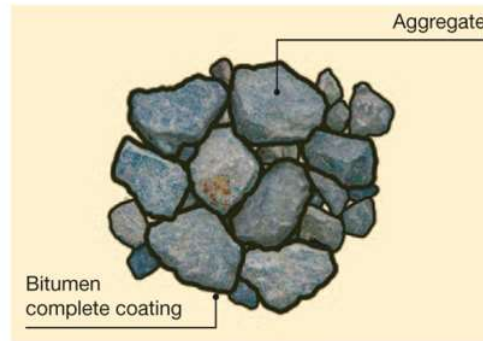
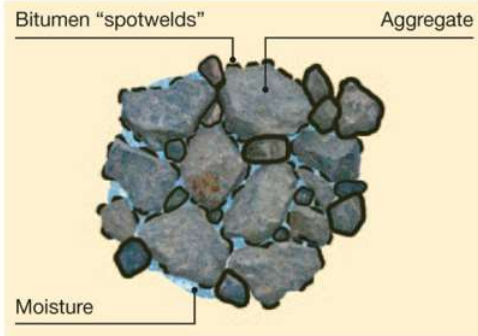


# Recycling 101 – The Train





# Two Methods: Emulsion vs. Foamed Asphalt (PG)



Non continuously bound layer  
resists reflective cracking



# Asphalt Paving Systems (Florida) Using Emulsion



















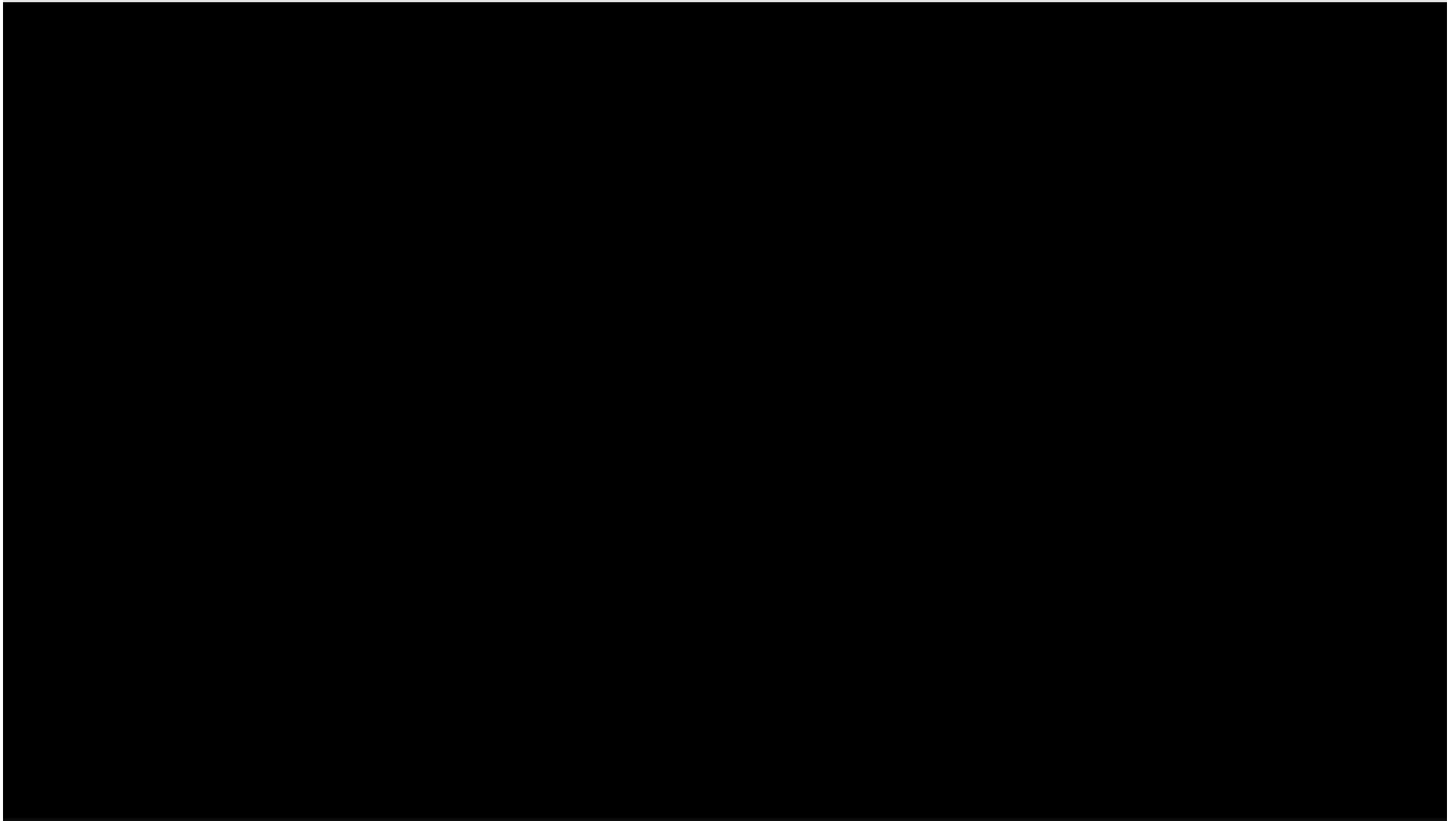








# JCDOT's Crew: Time-lapse of the Process (Foamed Asphalt, PG58-28)



# Overview

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What is Our “Why?”

What is Recycling, and How Are We Doing It?

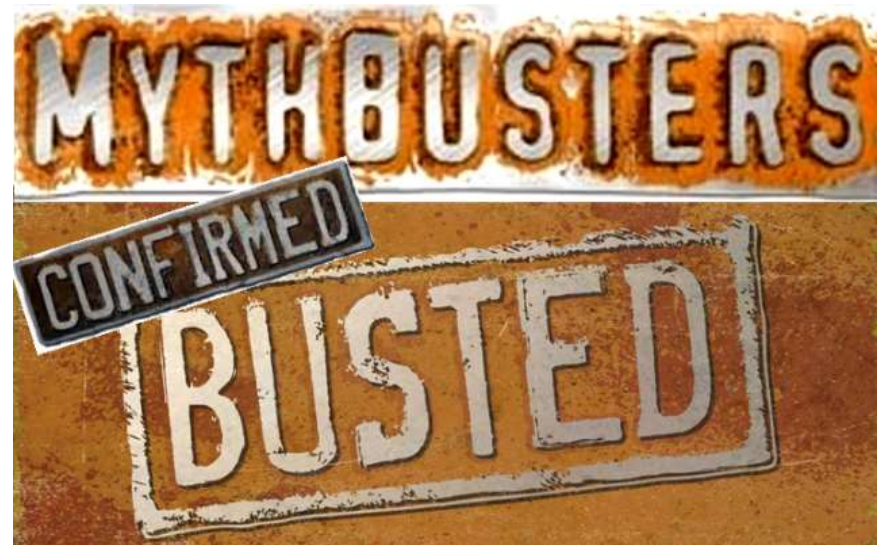
Things to Know

The Case for Recycling



# Misinformation abounds!

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# The technology is here and ready...

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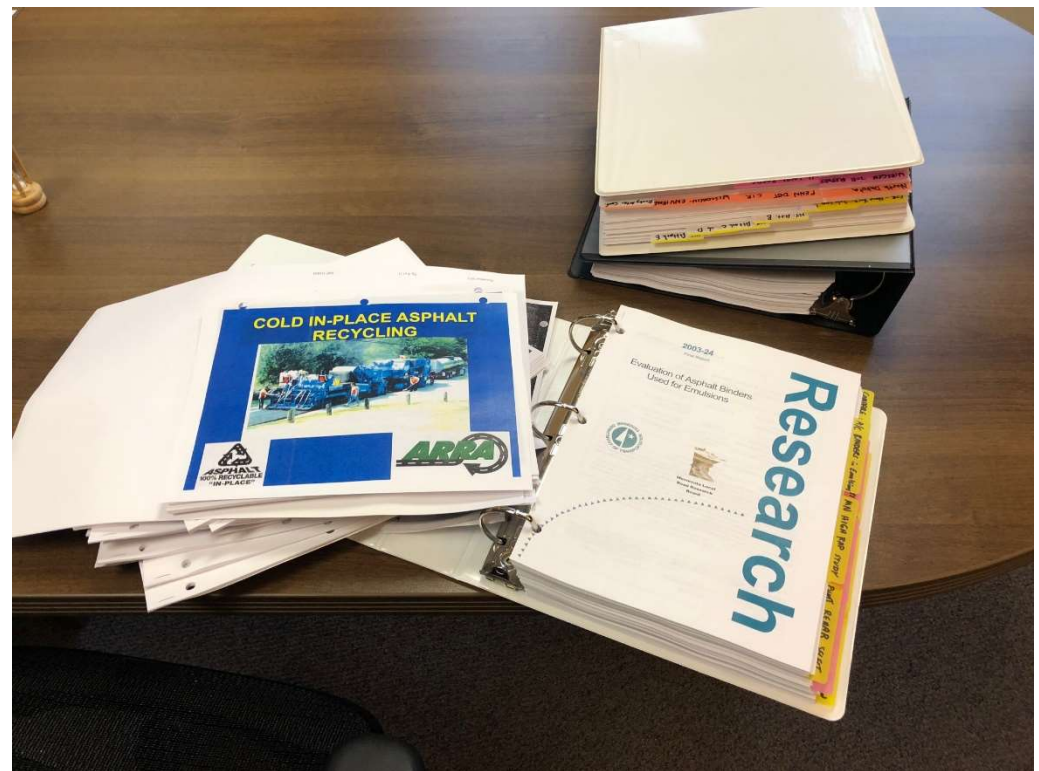
30+ years of research & development...a lot has been learned

Proven technology

Preferred fix – especially in cold climates

Durable base – perpetual?

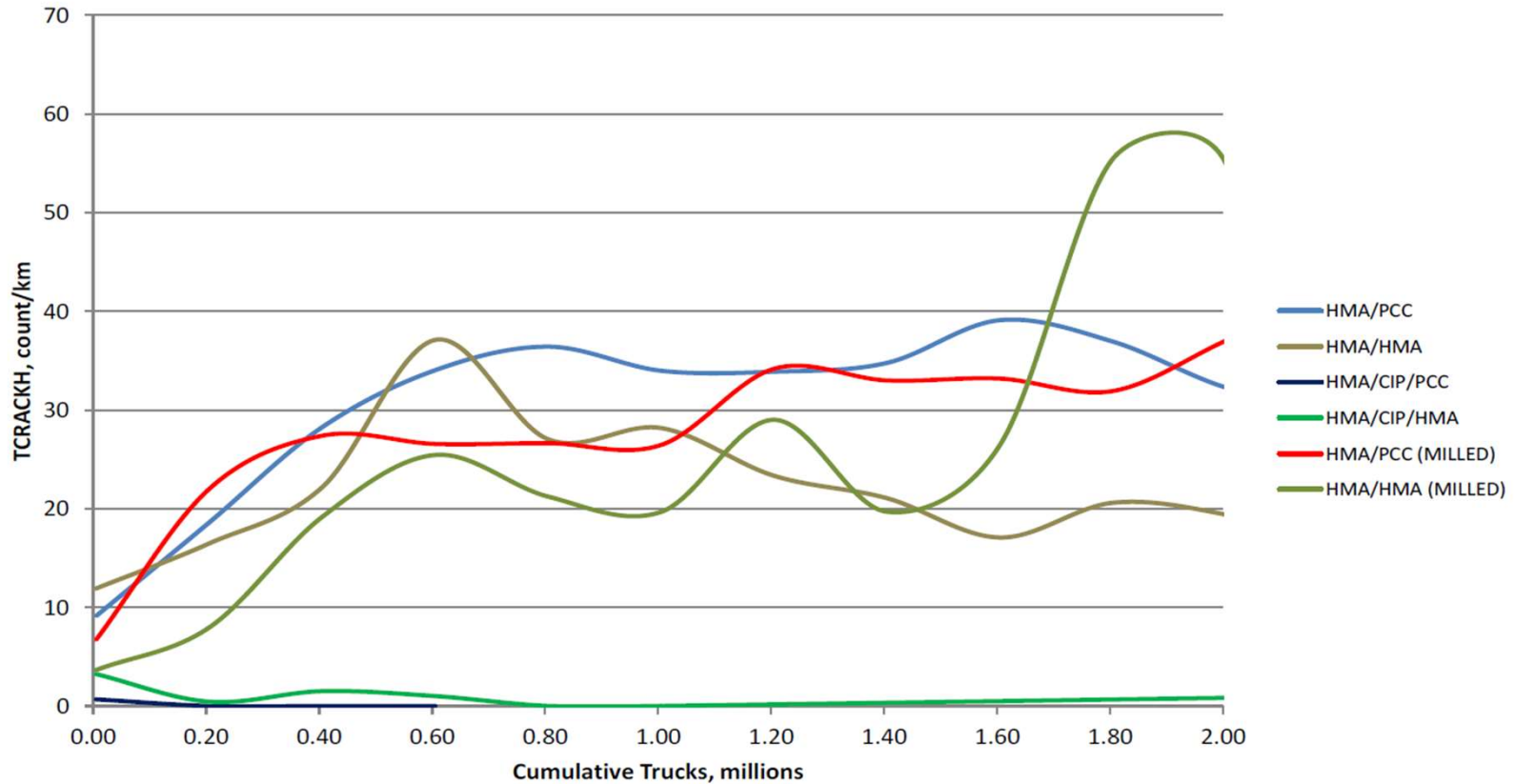
Diverse applications



# Crack performance is outstanding...

## Iowa Field Performance

Average High Severity Transverse Cracking  
10 Year Span (3-4 inches HMA Surface)



# Economics...

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Multiple pieces of equipment required to have a comprehensive, effective, and high quality program

\$5-6M financed by an equipment bond issue

Relatively quick Return on Investment (ROI)



# Economics...

The comprehensive program includes the following major pieces:

• Cold-in-Place Recycler/Mill (full lane width 3800CR)	\$1,488,000
• Preparatory Mill (W150 2-5 ft. variable width drum)	\$ 665,000
• Paver – Heavy-duty screed	\$ 540,000
• Roller – Steel Drum Vibratory	\$ 148,000
• Roller – 18-ton Pneumatic	\$ 128,000
	<hr/>
	\$2,969,000
• Mobile Cold Recycling Plant (KMA220i)	\$ 933,500
• Ground Penetrating Radar/LIDAR Vehicle	\$ 225,000
• Additional supporting equipment	\$2,000,000
• Water Truck, 2 flatbed haulers, 2 50-ton haulers, semi tractors, cement spreader, lab equipment, etc.	



# Variable-width Mill (W150)

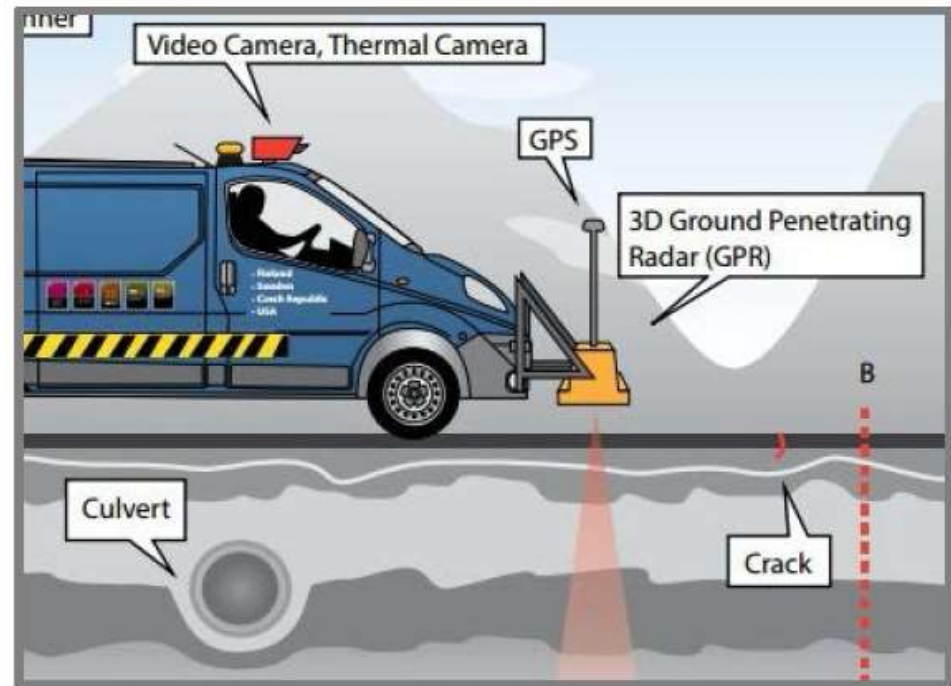
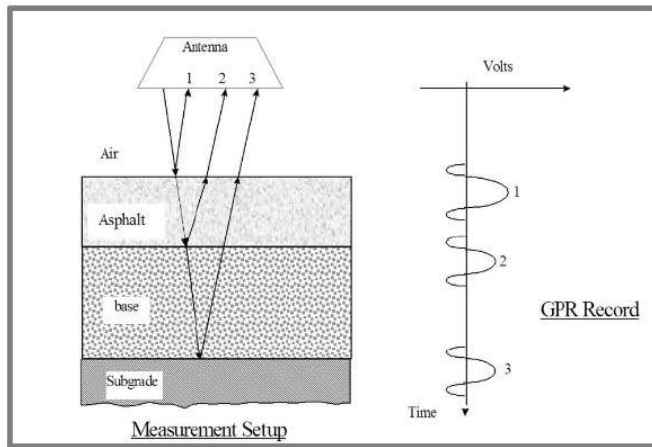
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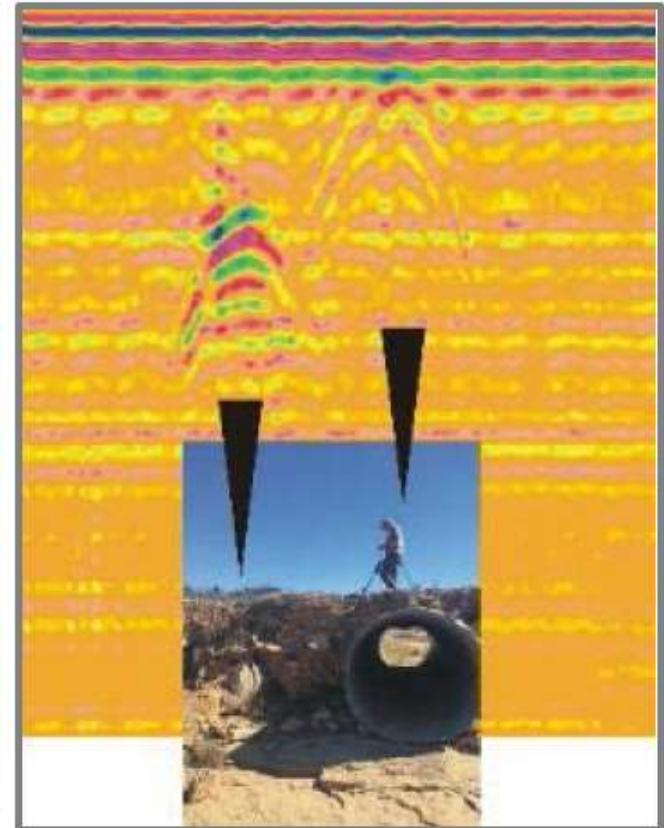
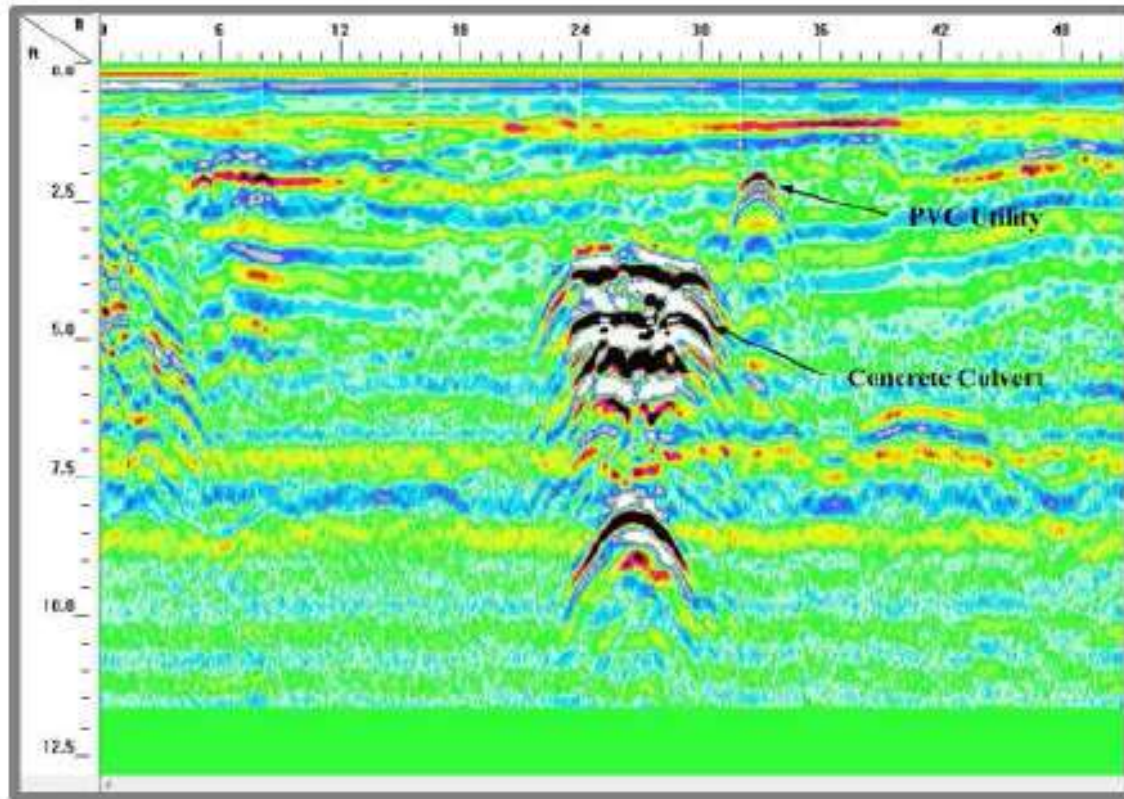
# Mobile Cold Recycling Plant (KMA220i)



# Ground Penetrating Radar (GPR)



# Ground Penetrating Radar (GPR)





# Engineering Lab Enhancements



Collect samples and do our own mix designs

Extensive training with experts in the field of foamed asphalt mix design



# Some of our problems and issues...

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Cutting an 8-inch depth and getting a smooth base surface during the paving and rolling phase

Determining the best rolling pattern

Training the operators

Not having all the new equipment for the first season

Water truck issues and keeping up with water

Portland cement spreader issues (on the rental)

Skid steer loader availability

Only being able to trench one side at a time so water and excess material trucks can maneuver in the other lane

Compacting trench floor properly for widening

Handling material shortages and overages at the hopper

Keeping the train moving

Haul time for hot asphalt oil from Bay City

Returning liquid AC if not used

Ending the tanker in uphill stretches

Learning the equipment and wear parts (e.g., a belt adjustment problem shut us down for a week - simple issue but we didn't know)

Keeping the crew informed and having good communication

Proper training for hose connections with hot AC liquid (protocols and safety valves are in place, but fear still exists)

Fuel deliveries

Rental of a truck for cement blowing

Finding buried metal structures ahead of machine

Learning mix designs and getting our lab up and running fully

Construction logistics and project management

Getting contractors to pave in a timely fashion

Utilities that were mismarked and/or too shallow

Preparing and finishing of project sites

Availability of hot AC oil from suppliers on a consistent schedule

More...





Teamwork is critical...



# Overview

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What is Our “Why?”

What is Recycling, and How Are We Doing It?

Things to Know

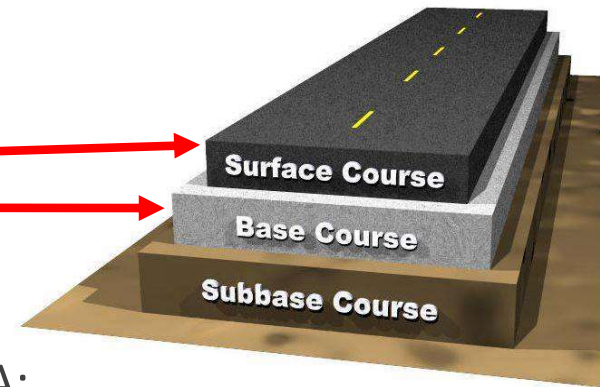
**The Case for Recycling**



# Road Design 101: Crush, Shape, & Compact (8" + 3.5")

Calculate the Structural Number:

- Hot-Mix Asphalt (HMA): 0.43/inch
- Aggregate Base: 0.13/inch



For a Crush, Shape, and Compact with 3.5" of HMA:

$$(8'' \text{ Agg. Base}) \times (0.13) + (3.5'' \text{ HMA}) \times (0.43) = ?$$

$$1.04 \quad + \quad 1.51 \quad = \quad \mathbf{2.55}$$

**IMPORTANT: Assumes dry conditions with no cracks in the pavement**

- Base is wet and soft every freeze/thaw cycle; cracks form too soon



# Revisiting Our Why...

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## Traditional CSC builds *good* roads...

Roads are currently built:

- **Strong** – best when new, from the top down (SN ~2.55).
  - Cracks and moisture compromise the intended structural number
  - 40% or less of the strength is from the base
- **Durable** – climate change is accelerating deterioration.
  - Strength is lost as it ages and during wet/freeze-thaw cycles
- **Cost** –\$300,000 to \$400,000 per mile; approaching \$500,000 per mile for thicker pavement to add strength (SN ~3.4).
  - Heavily dependent on HMA prices (certainly not going down)
- **GREEN** – reuses the existing road material, but requires much more new HMA to achieve strength. More aggregate, fuel, trucking, and resources.

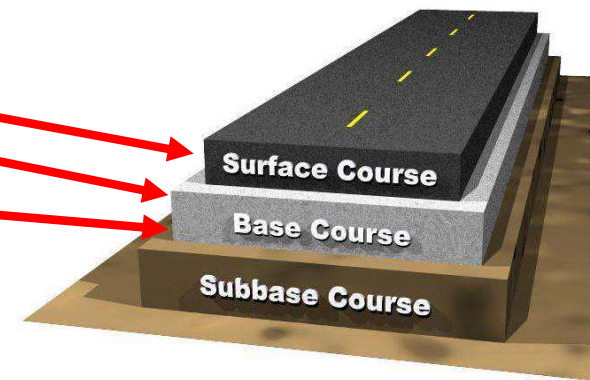


# Road Design 101:

## Cold-in-Place Recycled/FDR (8"+3.5")

Calculate the Structural Number

- Hot-Mix Asphalt (HMA): 0.43/inch
- Bound Aggregate Base (BAB): 0.35/inch+
- Aggregate Base: 0.13/inch



For a CIR/FDR with 8" of BAB and 3.5" of HMA:

$$(8'' \text{ BAB}) \times (0.35) + (3.5'' \text{ HMA}) \times (0.43) = ?$$

$$2.80 + 1.51 = 4.31+$$

**IMPORTANT: Retains strength in wet conditions, and less likely to crack**

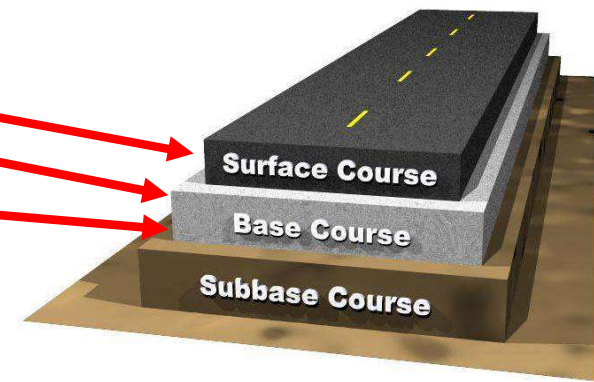


# Road Design 101:

## Cold-in-Place Recycled/FDR (7"+2")

Calculate the Structural Number

- Hot-Mix Asphalt (HMA): 0.43/inch
- Bound Aggregate Base (BAB): 0.35/inch+
- Aggregate Base: 0.13/inch



For a CIR/FDR with 7" of BAB and 2" of HMA:

$$(7'' \text{ BAB}) \times (0.35) + (2.0'' \text{ HMA}) \times (0.43) = ?$$

$$2.45 + 0.86 = \mathbf{3.31+}$$

**IMPORTANT: Retains strength in wet conditions, and less likely to crack**



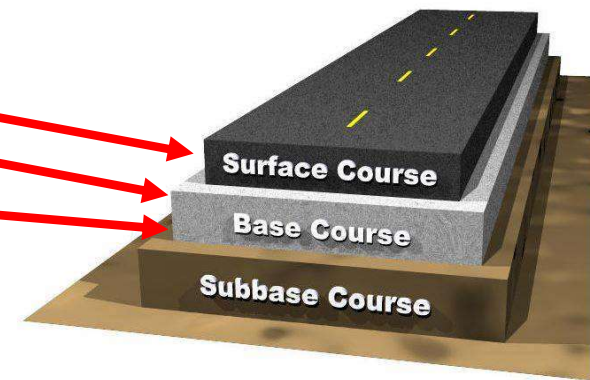


# Road Design 101:

## Cold-in-Place Recycled/FDR (6.5"+2")

Calculate the Structural Number

- Hot-Mix Asphalt (HMA): 0.43/inch
- Bound Aggregate Base (BAB): 0.35/inch+
- Aggregate Base: 0.13/inch



For a CIR/FDR with 6.5" of BAB and 2" of HMA:

$$(6.5'' \text{ BAB}) \times (0.35) + (2.0'' \text{ HMA}) \times (0.43) = ?$$

$$2.28 \quad + \quad 0.86 \quad = \quad \mathbf{3.14+}$$

**IMPORTANT: Retains strength in wet conditions, and less likely to crack**



# Building our roads to last...starting today!

LEGO block philosophy, building from the ground up, mile by mile

This sample is something typically seen from a state highway...but, it's a local road!

How can we have a base like this on our roads?



# Our “Why” ...more details

## Build GREAT roads!

Roads that are built with a Structural Number of **between 3.0 and 4+**:

- **Strong** – from the bottom up.
  - 65-75% of the strength from the **base**
- **Durable** – in all seasons.
  - 70-80% Indirect Tensile Strength (ITS) retained while **wet**
  - Cracking is significantly reduced
- At the **same cost** – or **less**.
  - Generally 30%+ savings, especially for an equivalent strength
- While being **GREEN** – Reducing, Reusing, Recycling, and minimizing environmental impacts.
  - 70% reduction in greenhouse gas emissions
  - Less use of virgin aggregates for HMA



# The Long View...

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- This is a long-term, sustainable road improvement plan
  - 50 to 80 miles per year over the next 20-30 years (1,600 miles)
  - Rural townships benefit in the long run (e.g., the “Alaska method”)
- Maintenance costs will likely decline over time
  - Potholes will become more and more rare
- Employee morale and engagement benefits will continue to grow
  - Important for retention and recruitment
- Our focus can shift towards other priorities in our community:

*Making the Jackson County community safe, and helping it to thrive as a great place to work, live, and play!*



# Road Recycling & Improvement Plan

## 2018 Project List

Name	P.O.B	P.O.E	Length	Funding Source	Notes
Rosehill Rd	Cooper Rd	N. Elm Ave	1.05	JCDOT	Class A
Maple Dale Rd	Kimmel Rd	Vrooman Rd	2	Summit	Bond Program
Thorne Rd	Kimmel Rd	Sears Rd	0.5	Summit	Bond Program
Riegel Rd	King Rd	McCain Rd	1.01	Spring Arbor	Bond Program
S. Harrington Rd	McCain Rd	N. Spring Arbor Twp Line	1.19	Spring Arbor	Bond Program
Kimmel Rd	Thorne Rd	S. Jackson Rd	2.71	Summit	Bond Program
Reynolds Rd	Horton Rd	Kibby Rd	2.09	Spring Arbor	Bond Program
Mathews Rd	Hammond Rd	M-60	0.71	Spring Arbor	Bond Program
Total			11.26		

## 2019 Project List

Mathews Rd	Hammond Rd	Teft Rd	1.11	Spring Arbor	Existing Dirt Road/Bond Program
Cox Rd	Mathews Rd	Teft Rd	0.51	Spring Arbor	Existing Dirt Road/Bond Program
Teft Rd	Mathews Rd	M-60	2.28	Spring Arbor	Bond Program
Vrooman Rd	Moscow Rd	Horton Rd	2.01	Summit/Spring Arbor	Bond Program
Whispering Wood Sub	Off Kibby Rd	Road End	0.69	Summit	Bond Program
Rimers Dr	Off Reynolds Rd	Road End	0.4	Spring Arbor	Bond Program
Meadowbrook Ln	Springbrooke Rd	Road End	0.21	Summit	Bond Program
Pioneer Dr	Off McCain	Arbor Hills Rd	0.95	Summit	Bond Program
Arbor Hills Rd	Off McCain	Pioneer	0.47	Summit/Spring Arbor	Bond Program
Remington	Off Dearing Rd	Road End	0.22	Spring Arbor	Bond Program
Fairground					
Bailey Rd	County Farm Rd	Springport Rd	1.61	Sandstone	Township program
Falahee Rd	Flansburg Rd	Page Ave	1.39	JCDOT	Class A
Holibaugh Rd	Village of Springport	County line	2.59	JCDOT	
Voy St	Glasgow Rd	Oakview Trl	0.09	Assessment	Private Dr in Sandstone Twp
Oakview Trl	Voy St	Woodlane Trl	0.36	Assesment	Private Dr in Sandstone Twp
Woodlane Trl	Oakview Trl	Leora Ln	0.12	Assesment	Private Dr in Sandstone Twp
Sandstone Creek Dr	N. Sandstone Rd	Road End	0.29	Assesment	Private Dr in Sandstone Twp
Old Silo Dr	Hankerd Rd	Road End	0.52	Assesment	Private Dr in Henrietta Twp
Total			15.82		



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 **Things to Know**

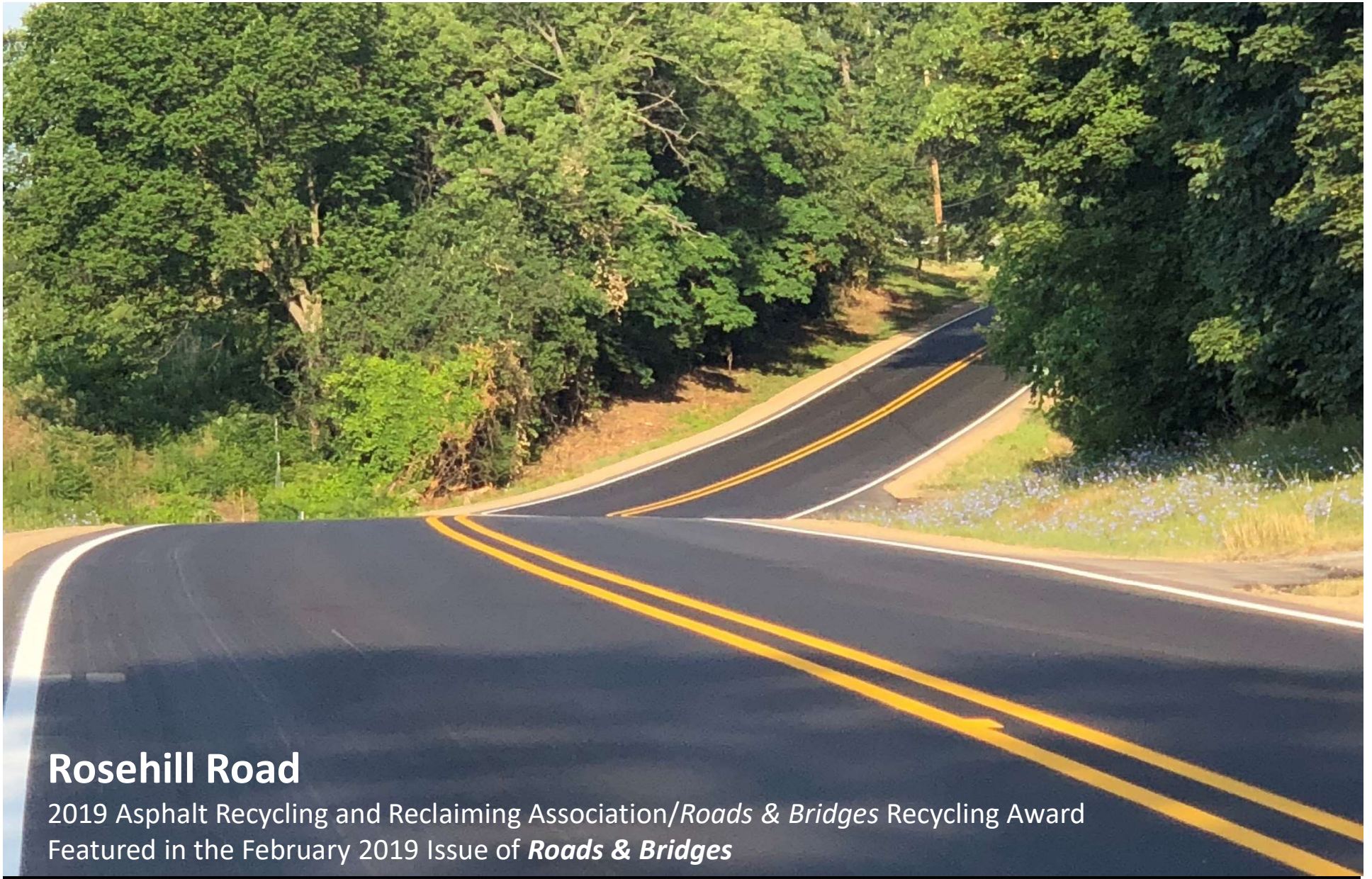
 **The Case for Recycling**





Rosehill  
Road





## Rosehill Road

2019 Asphalt Recycling and Reclaiming Association/*Roads & Bridges* Recycling Award  
Featured in the February 2019 Issue of *Roads & Bridges*





# Thank You to Many Partners!

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JCDOT wholeheartedly acknowledges and thanks the following partners for their support and contributions towards a successful first year of road recycling:

- The entire JCDOT Team and Crews
- The Jackson County Board of Commissioners
- County Administrator/Controller, Mike Overton, MPA
- Mike Marshall, Jeff Johnson, Loyd Amos, and the entire team at Wirtgen America, Inc.
- Jeff Ely, Pat Kane, and the entire team at AIS Construction Equipment
- EJD Transport, Inc.
- St. Marys Cement
- Bit-Mat Products of Michigan, Inc.



Research & Innovation Continues...

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*Thank  
you!*



# Appendix

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# Imagine...

A 5-6 year-old road that looks like this...

...not one crack or defect. Anywhere.



# Highway 23 in Ontario, Canada



# Imagine...

A 20 year-old road that looks like this...in Minnesota. How can this be?



# Comparison of Two Road Segments Constructed in 1999

Detroit Lakes, Minnesota

Photos from 2012

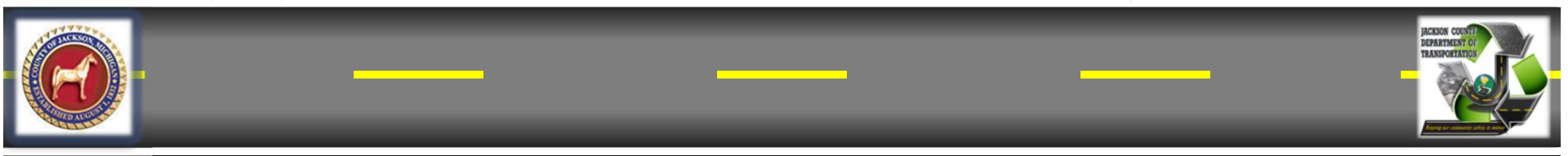
4" COLD-IN-PLACE RECYCLING WITH 3" HMA

TRADITIONAL 3" MILL AND OVERLAY WITH  
3.5" HMA



Only modest distress with crack sealing recently completed per expected, routine maintenance measures

Substantial surface deterioration, with heavy spray patching and other surface repair work evident



# Minnesota Control Section

## US-59 in 2012 – 2-inch mill and 3.5-inch HMA overlay constructed in 1999





# What we see today...

This road is not even 20 years old.

