

# Concrete Overlay Lessons Learned

County Engineers' Workshop  
February 10, 2022



  @Washtenawroads



# Introduction

- Matt MacDonell, P.E.
  - Washtenaw County Road Commission
  - Director of Engineering & County Highway Engineer



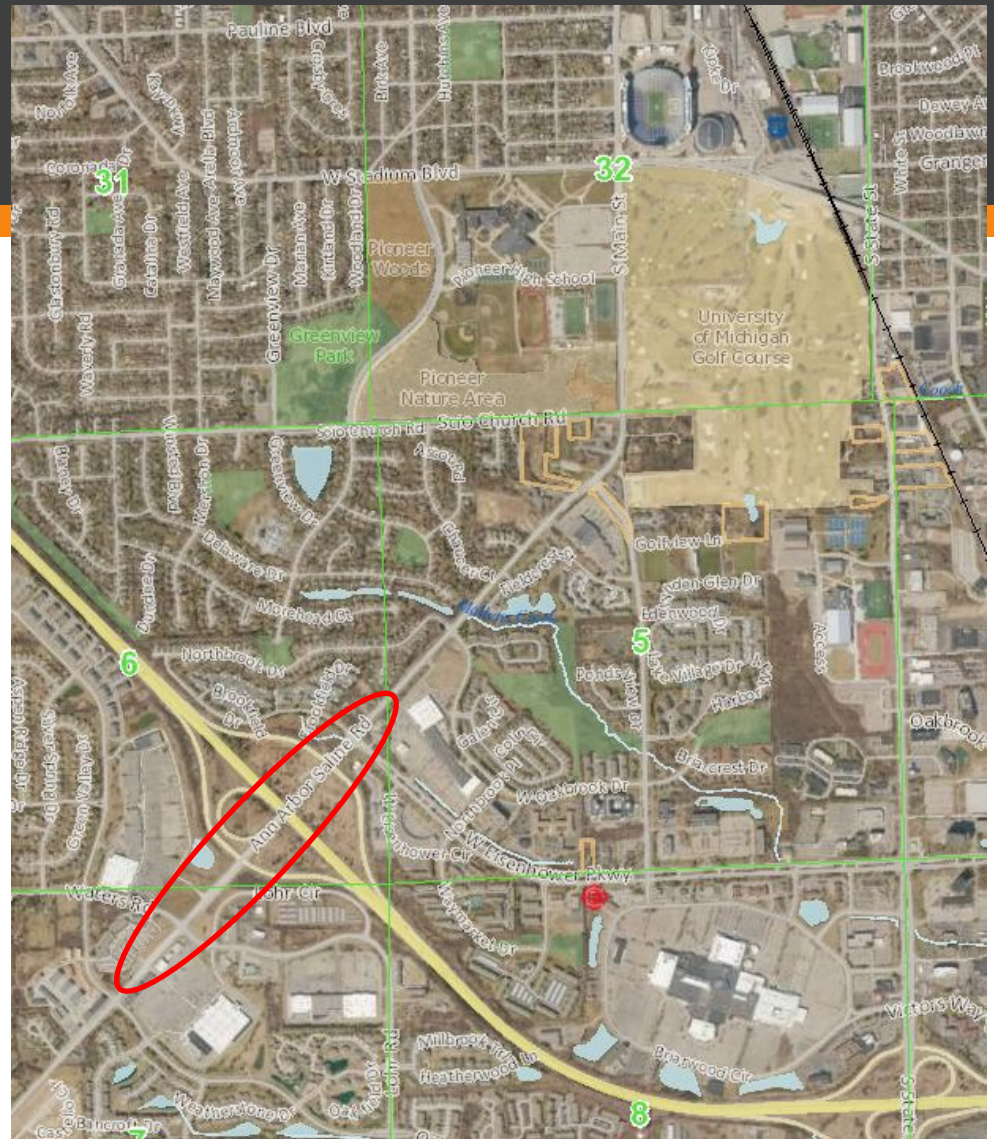
# ANN ARBOR-SALINE RD PROJECT





# Project Area

- I-94 Interchange
- City of Ann Arbor
- U of M Campus
- Pittsfield Township





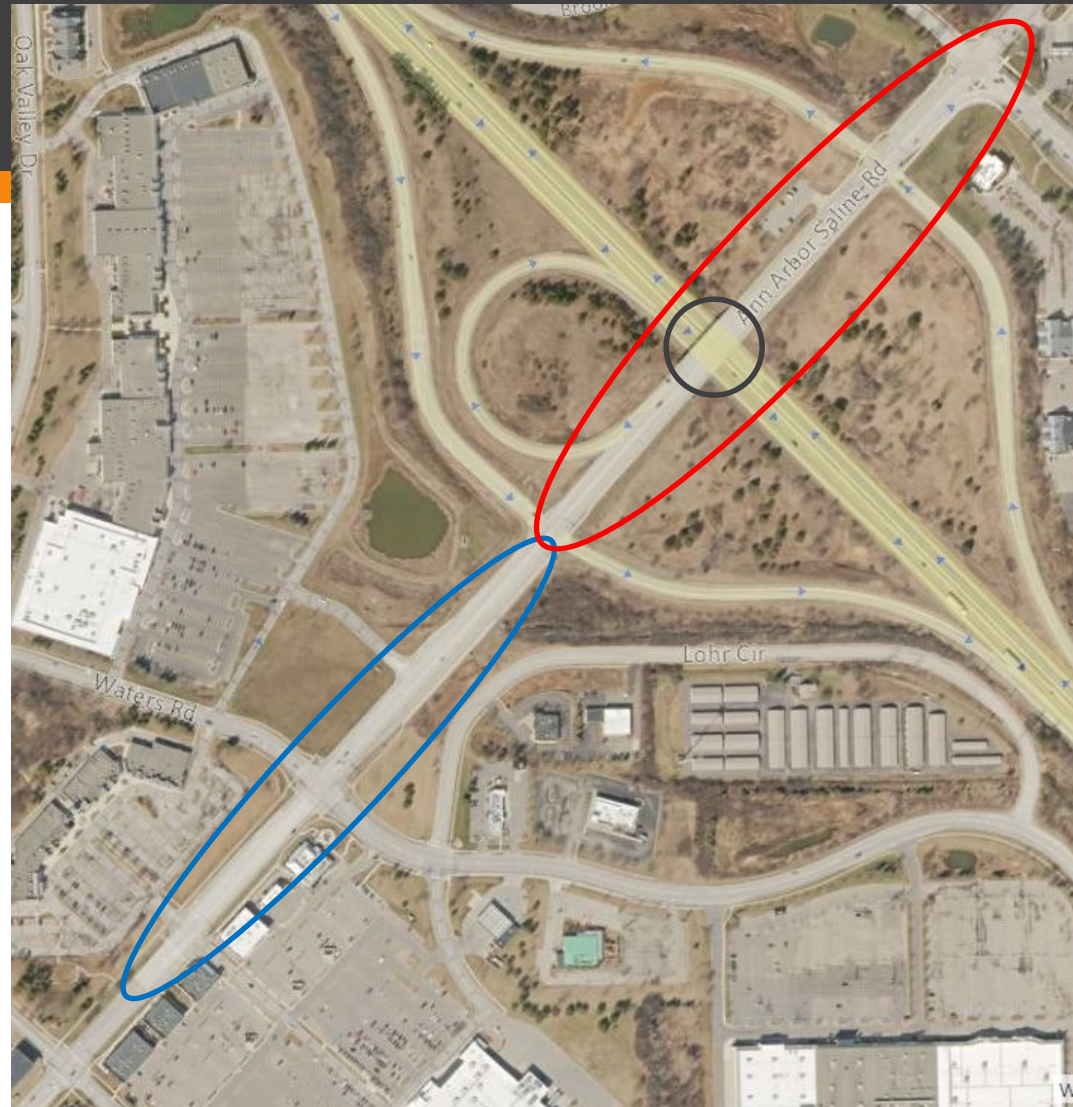


# THE PLAN



# Project Scope

- Full Depth Conc Pavt
- Bridge Deck over I-94
- Conc Overlay





# Existing Conditions for Full Depth Conc Pavement





# Existing Conditions for Conc Overlay





**AND THEN IT  
GOES TO BID...**



# MDOT Bid Letting

- February 2014
  - Low bid of \$2,686,819.63
  - **17.5%** over the engineer's estimate
- Other projects in the region
  - I-96 reconstruct in Livonia



# Bid Analysis

- Conc Pavt, Overlay (1,985 CYD)
  - Estimated \$85 per CYD
  - **Low Bid \$247.31 per CYD**
- Conc Pavt, Nonreinf, 9 inch (13,850 SYD)
  - Estimated \$35 per SYD
  - **Low Bid \$38 per SYD**



# NOW WHAT?



# Managing Project Changes

- Can we delay? NO
  - Project stakeholders
  - Schedule
  - MDOT contract
    - Major item of work
  - Project budget & WCRC budget

**=Work Order #1**



# Work Order #1



# Work Order #1

		OTHER			
STATION Sta 76+28		TO STATION 92+37	CHANGE +++	* EXTRA ***	
ITEM CODE NO.	ITEM OF WORK	QUANTITY	UNIT	UNIT PRICE	COST
+++3027031	Aggregate Base, Modified	1,055	Ton	8.00	8,440.00
+++6020015	Conc Base Cse, Nonreinf, 6 inch	(180)	Syd	32.00	(5,760.00)
+++6020106	Conc Pavt, Nonreinf, 9 inch	3,330	Syd	38.00	126,540.00
+++6020200	Joint, Contraction, Cp	2,120	Ft	1.00	2,120.00
+++6027011	Conc Pavt, Ovly, Finishing and Curing, Modified	(3,330)	Syd	1.00	(3,330.00)
***6027011	Conc Pavt, Ovly, Finish and Curing, Mod, Price Adj	10,925	Syd	1.15	12,563.75
+++6027021	Conc Pavt, Ovly, Furnishing and Placing, Modified	(718)	Cyd	\$247.31	(177,568.58)
***6030030	Lane Tie, Epoxy Anchored	350	Ea	5.12	1,792.00
				EXT COST	(35,202.83)



# Conc Overlay Construction





# Conc Overlay Construction



# Conc Overlay Construction







# HOW'D THAT WORK OUT?



# ...Not Great

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By 2019, thinned concrete overlay failed in traveled lanes.

# Failed Thinned Conc Overlay





# 2019 Concrete Repair Project

- Determination made to replace with full depth concrete pavement.
- Conc Pavt, Nonreinf, 9 inch
  - 4,490 SYD at \$51.50 per SYD
  - Approximately \$400,000 fix for a 20-year pavement

# Full Depth Conc Repair



# WCRC Lessons Learned

- 5" minimum thickness for a concrete overlay.
- Should have negotiated to eliminate the concrete overlay major item of work from the original contract.







# Fog Seal Lessons Learned

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Road  
Commission  
of Kalamazoo  
County



# Getting out of a sticky situation

A fog seal story

Ryan Minkus, County Engineer



Road  
Commission  
of Kalamazoo  
County





## 2018 Chip Seal Summary

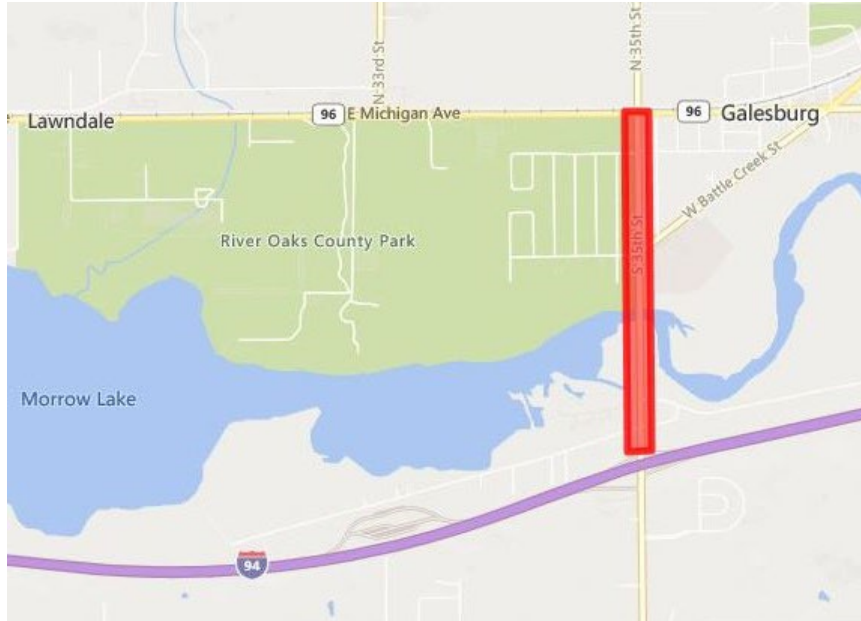
Primary Road: 56 miles

Local Road: 47 miles

Total: 103 miles

- All Primary routes to have fog seal application
- RCKC staff to perform all work

# 35<sup>th</sup> Street



- Connects M-96 & I-94
- 14,000 vehicles daily
- 5-lanes
- Residential north of river
- Planned Chip Seal & Fog Seal project



# Chip Seal Application

- First, two outside lanes
- Then shift to three inside lanes
- Everything going according to plan...  
...so far





# Fog Seal Prep

- After sweeping, Chip Seal set for minimum of 12 hours
- Vendor supplied Cationic Rapid Set Fog Seal Emulsion (CSS-1H Dilute) ready to be applied



## And then the trouble begins...

- RCKC crews apply fog seal material to 3 lanes
- They notice the dry time is taking longer than normal
  - Clearly there is a problem
  - Supervisors called to site
- After an investigation and phone calls, it is determined that Cationic Asphalt Emulsion (CRS-2M) has been applied over the chip seal and not the CSS-1H.



# Temporary Solution

- Road must re-open
- Use chip spreader to sand the road
- Road can open to traffic as permanent solution is sought

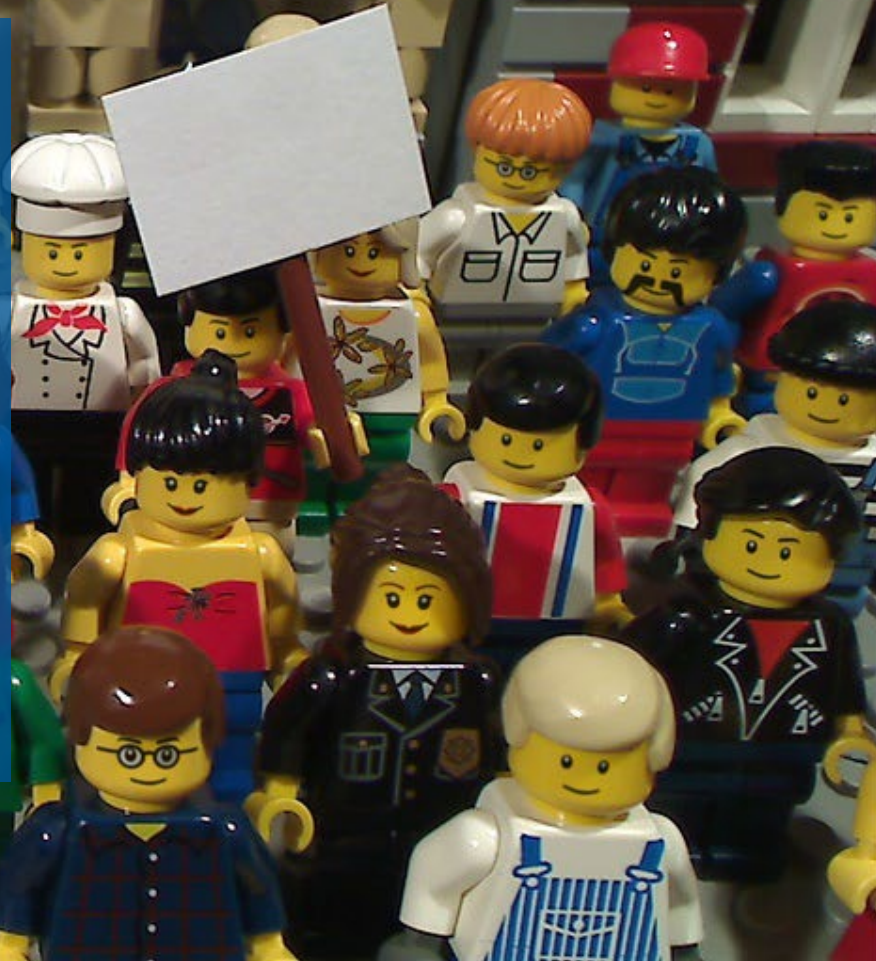


# Nobody noticed

...well, not exactly.

- Residents
- Residents
- Residents

*"The angry mob" by Oblong is licensed under CC BY-NC-SA 2.0*



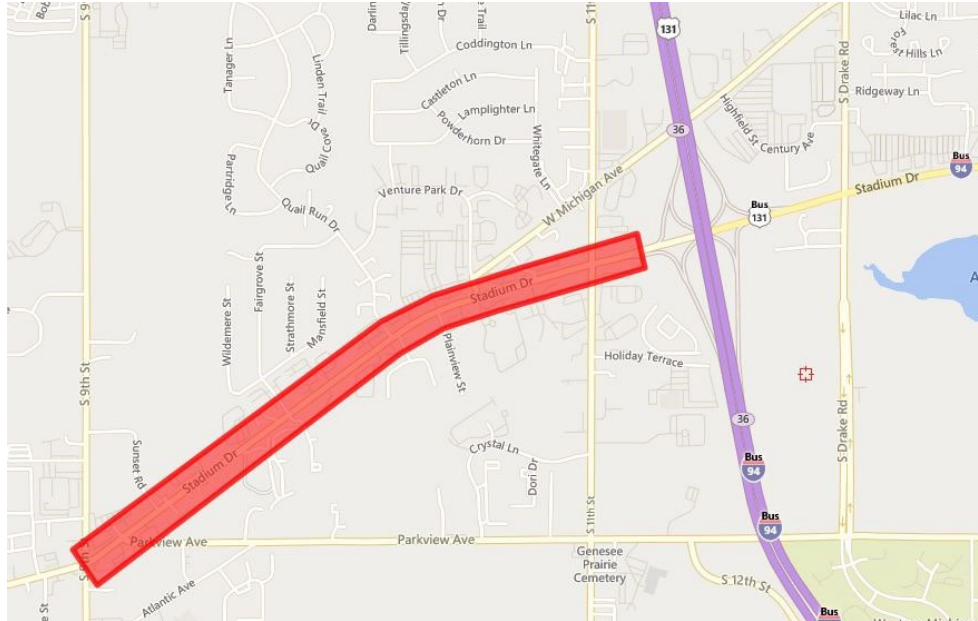




# Other Impacts

- Property damage
- Chip Seal perception
- RCKC Budget

# Stadium Drive



- Connection from I-94 to US-131
- 20,000 vehicles daily
- 5-lanes
- I-94 Emergency Route
- Commercial corridor
- Planned Chip Seal & Fog Seal project



# I'm sure everything will be fine

- Chip seal successfully applied to road
- RCKC crews start apply fog seal material to 3 lanes
- An employee notices something doesn't look right
  - Work is stopped before the 3 lanes are complete
  - Supervisor is called to site
- Staff quickly identify that CRS-2M has again been applied over the chip seal.



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# Temporary Solution

- Road must re-open
- Use dump trucks to sand the road
- Road can open to traffic as permanent solution is sought



# Options?

For RCKC:

1. Chip Seal
- or-
2. New Asphalt





# Chip Seal Application

- Stadium Drive – 2018
- Materials
- Impacts to public
- \$46k





The background image shows a construction site on a sunny day with a blue sky and white clouds. A white dump truck is parked on a dirt road, and a red and white striped traffic cone is in the foreground. A blue semi-transparent overlay covers the right side of the image, containing the title and a list of bullet points.

# New Asphalt

- 35<sup>th</sup> Street – 2019
- Too much delamination
- Costly (\$330k)
- Impacts to public



# Moving forward

- What steps are needed to prevent this in the future
- Sampling?
- Tracking?





# Mr. Vendor...

- Acknowledged for both applications they pulled material from the wrong tanker and shipped to RCKC
- Worked with RCKC to find solutions and prevent future errors



The background of the slide features a close-up photograph of numerous wooden sticks, possibly popsicle sticks, bundled together. A diagonal yellow line runs from the top left towards the bottom right. In the top right corner, there is a black graphic element resembling a road with white dashed lines receding into the distance.

## RCKC Staff

- Education
- Awareness
- Sampling

*"27/365 Stir it up" by Mykl Roventine is licensed under CC BY-NC-SA 2.0*



# Vendor Staff

- Material Identification
- Paperwork
- Communication



# Takeaways....

- Verify materials before application
  - Quick test methods
- Communication with Vendors
- Empower field staff
  - Was key to Stadium Drive application
- Do not recommend using chip spreader for sand
  - Now use additional stone for issues

# Thank you!



Road  
Commission  
of Kalamazoo  
County





Lessons Learned:

D Dr. N Culvert



# Existing Structure

- Original series of culverts
  - 1 x 48" CMP & 2 x 36" RCP
- Approximately 100 years old
- Open holes in pavement led to road closure in 2017





# Lesson #1 – Regular Inspection

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- Not a bridge, but would be replaced with one
- No inspection required
- County did not regularly inspect culverts





## Lesson #2 –

### Beware of Power Lines

- Consultant surveyed utilities, including power poles
- Power lines were not included on plans
- While poles had enough clearance, lines were too close to the crane, creating a risk of arcing





## Lesson #3 – Consider the Logistics

- Sheet piling had to be cut down to ground level
- At the time, water levels were high, so ground level was 18" underwater
- Had to hire a diver to cut sheets underwater (in December!)





## Lesson # 3 –

### Consider the Logistics

- Three-sided box culvert required lots of heavy riprap
- Riprap was placed after sheet piling was cut and bridge was nearly completed
- Because of the low clearance between the deck & the water, all 125 SYD of riprap had to be hand placed



## In the End...

- Project was nearly \$65K overbudget
- Utility issues due to relocation led to 6 month delay in schedule
- Major public disruption & political backlash
- But the culvert looks great & works well!





## Lesson #4 – Drainage is Key

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- West end of existing crossing involves short, steep approach slope
- Intense rains in summer 2021 led to major washouts and undermining of new pavement & guardrail
- While slopes were riprapped, there were no spillways, which had to be paved in when repairs were made







# When Good Intentions Go Bad



Dickinson County Road Commission









**Don McMillan**

**BETCAST**

***Emojis for Engineers***

# TYPICAL PROJECT



Planning,  
design,  
construction

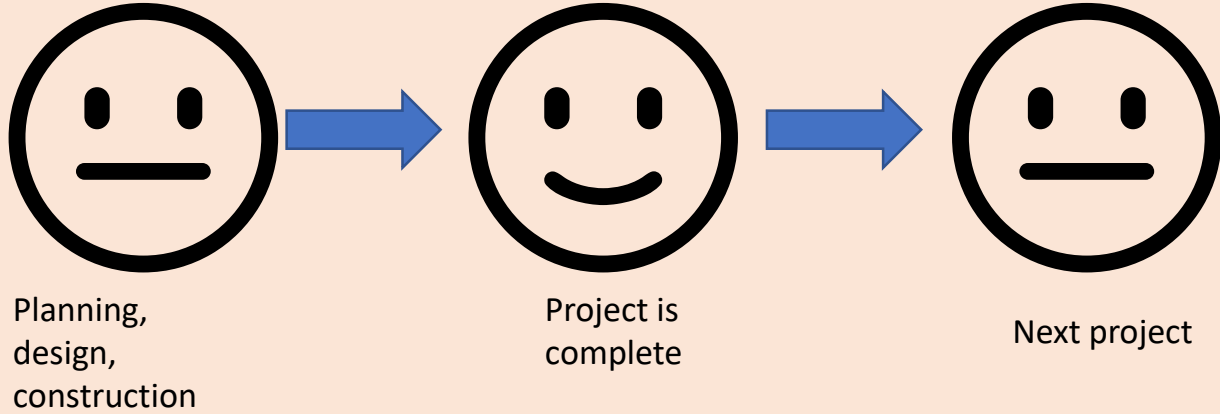


Project is  
complete

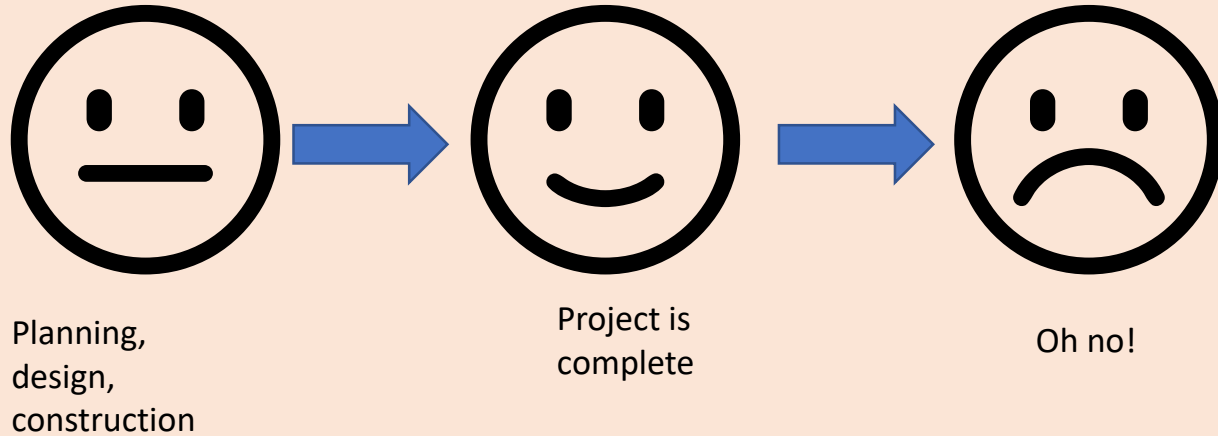


Next project

## TYPICAL PROJECT

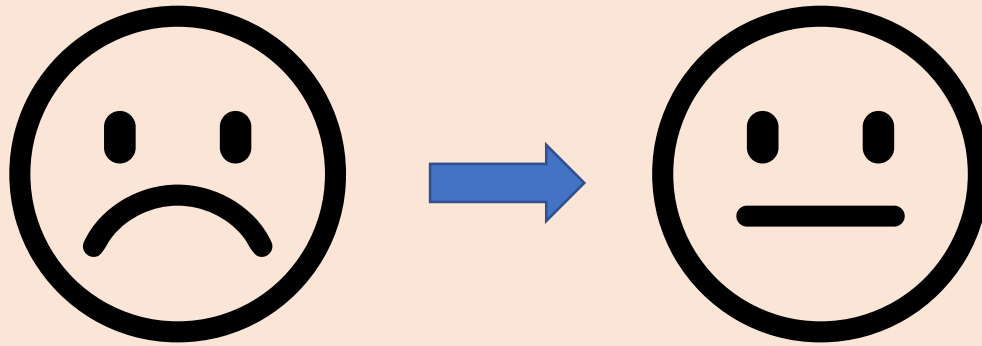


## NOT TYPICAL





What we are going to talk about



# THE SITUATION

- Its 2013. Pine Mountain Road has failed, cracking, rutting, pothole patches everywhere.
- It the Board's number 1 priority to rebuild this main truck route.

## TYPICAL EXISTING CONDITIONS





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# THE SITUATION

- Its 2013. Pine Mountain Road has failed, cracking, rutting, pothole patches everywhere.
- It the Board's number 1 priority to rebuild this main truck route.
- No money available.
  - Road in the small urban area, so can't move RTF money here.
  - Small urban money already programmed for the next 2 cycles. Next possible fund cycle would be 6 years out.





# THE SOLUTION

- Engineering searched out non-traditional funding. Found the AID program.
  - AID = Accelerated Innovation Deployment program.
    - One part of the FHWA Technology and Innovation Deployment Program (TIDP) approach, which provides funding and other resources to offset the risk of trying an innovation.
    - Projects eligible for funding shall include proven innovative practices or technologies such as those included in the EDC initiative.
    - FHWA encourages the use of AID Demonstration to promote the deployment of the Everyday Counts (EDC) innovations



- Pine Mountain Road/Westwood Avenue from US-2 / US-141 to Brookfield Street.
- A joint venture between the Dickinson County Road Commission and the City of Kingsford.
- 4.2 miles long
- It used the innovations of Hot in place asphalt recycling (HIPR) for base pavement and a warm mix asphalt (WMA) surface course
- Mostly rated 3-4 with some areas of 2.
- Construction was in August 2015



## HOT IN PLACE RECYCLING



# WARM MIX ASPHALT

















45.5°N, 88.08°W

# Kingsford, MI Weather Calendar

27° FORD AIRPORT STATION | CHANGE

TODAY

HOURLY

10-DAY

CALENDAR

HISTORY

WUNDERMAP

January

2016

View

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
27 Cloudy Actual: 32°   15° 0 in	28 Cloudy Actual: 20°   16° 0 in	29 Cloudy Actual: 26°   17° 0.23 in	30 Cloudy Actual: 27°   17° 0 in	31 Cloudy Actual: 24°   16° 0 in	1 Cloudy Actual: 24°   16° 0 in	2 Mostly Sunny Actual: 37°   10° 0 in
3 Cloudy Actual: 26°   21° 0 in	4 Cloudy Actual: 23°   10° 0 in	5 Mostly Sunny Actual: 30°   9° 0 in	6 Cloudy Actual: 31°   17° 0 in	7 Foggy Actual: 33°   26° 0 in	8 Snow Actual: 35°   32° 0.01 in	9 Snow Actual: 34°   15° 0.02 in
10 Snow Actual: 16°   0° 0 in	11 Snow Actual: 10°   -5° 0 in	12 Foggy Actual: 8°   -3° 0 in	13 Cloudy Actual: 10°   -5° 0 in	14 Cloudy Actual: 22°   6° 0 in	15 Cloudy Actual: 25°   16° 0 in	16 Cloudy Actual: 18°   -2° 0 in
17 Cloudy Actual: 7°   -5° 0 in	18 Cloudy Actual: 9°   -2° 0 in	19 Cloudy Actual: 17°   -13° 0 in	20 Cloudy Actual: 22°   -1° 0 in	21 Snow Actual: 24°   17° 0 in	22 Cloudy Actual: 27°   2° 0 in	23 Cloudy Actual: 29°   -6° 0 in
24 Cloudy Actual: 28°   23° 0 in	25 Foggy Actual: 28°   23° 0 in	26 Snow Actual: 28°   23° 0.04 in	27 Cloudy Actual: 36°   20° 0 in	28 Cloudy Actual: 37°   10° 0 in	29 Cloudy Actual: 21°   -7° 0 in	30 Cloudy Actual: 43°   19° 0.01 in
31 Cloudy Actual: 39°   23° 0 in	1 Cloudy Actual: 32°   19° 0 in	2 Snow Actual: 32°   24° 0 in	3 Snow Actual: 30°   20° 0.06 in	4 Cloudy Actual: 26°   14° 0 in	5 Cloudy Actual: 27°   5° 0 in	6 Foggy Actual: 30°   23° 0 in

# THE CALL

- February 2, 2016 – during CEW

“ the road is falling apart.” .....

“it’s under control” .....

”Don’t need to rush back” .....

“we need to make a plan ASAP” .....

“ski Jumps are next week” .....

.....” what are we going to tell the board?”

(Board meeting was scheduled for the next week)





# WHAT WE FOUND

- Road not breaking up. Actually it was pretty good.
- No heaving or rutting
- Crowns and super elevations true
- Uniform spaced transverse cracks in areas.
  - Most road at about 110-120 ft
  - but 40-50 ft spacing in some areas
- Other random transverse cracks elsewhere in the project.

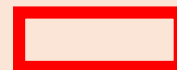
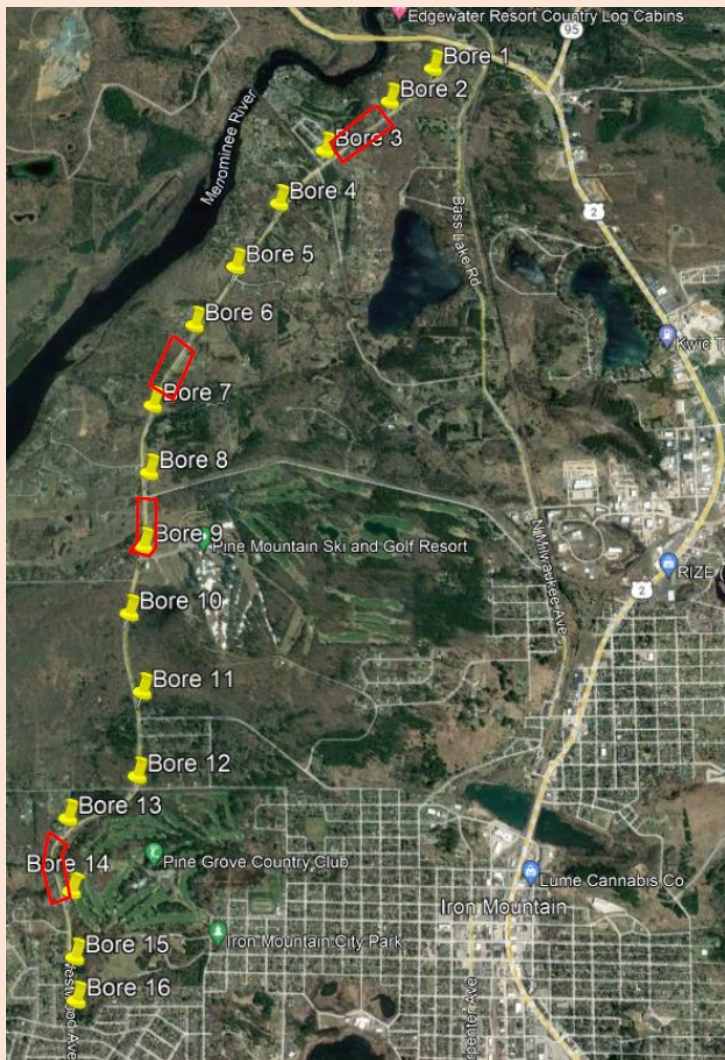












=BAD CRACK AREA



= Pre-design road bore  
(approximately 1500 Ft  
spacing)





# INVESTIGATIONS

- Conducted pavement cores and soil boring in the affected areas
  - Original soil borings showed 3 inch existing HMA, but really was much thicker in areas between some of the borings







# INVESTIGATIONS

- Talked to long term and retired DCRC employees - when the road was last paved years ago, they did a lift. It was “uneven and tippy” in a few areas, and they had issues with “slope” and the ride was “bumpy” with deep lines partway across the lane. So they put “another spot paving” in places and then topped it.
  - The crown wasn’t true.
  - The ride wasn’t acceptable as the pavement did not meet smoothness requirements.
  - It also had deep roller marks from improper parking of the roller on the hot mat.
  - They did some overlays in select areas to correct the problems prior to topping the whole road.

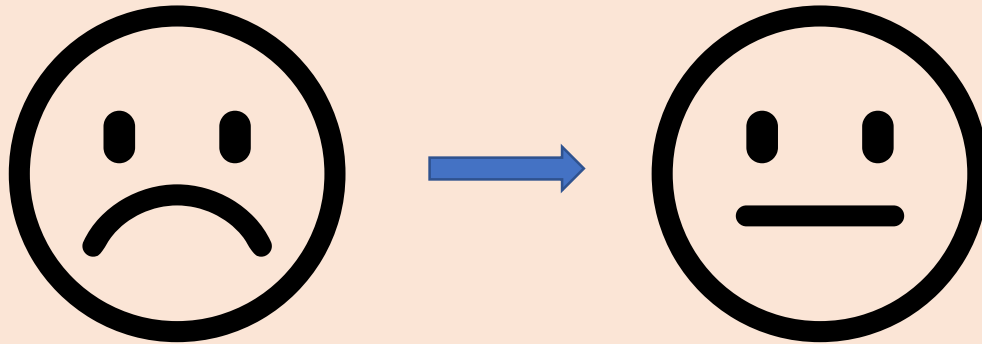
# INVESTIGATIONS

- Talked to the contactor's lab, they used "Michigan Oil" as the rejuvenation fluid. They have done other jobs in Michigan, and this was the same as they used elsewhere in the state in last couple of years.
  - The "Michigan Oil" is an emulsion, so it had no performance grade.
  - It's properties were based on the Detroit area.
  - It was recently successfully used in Lansing.
  - They never did a job this far north.





# HOW WE FIXED IT



# WHAT WE LEARNED / DOING DIFFERENT

- Closer soil borings
- Emulsions don't have PG. Use proper penetration / viscosity.
- Interview maintenance workers & old people who were there





# CLOSING THOUGHTS

## FOR MORE INFORMATION

Lance Malburg, P.E., Engineer

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Dickinson County Road  
Commission

Main: (906)774-1588

Engineering: (906)774-1162



Yeah! Its over!

# Questions?

