# *Cement Stabilized Base & Chipseal*

## *County Road 54… The Saga Continues*

MCEA Annual Conference

January 23, 2020

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McLEOD COUNTY

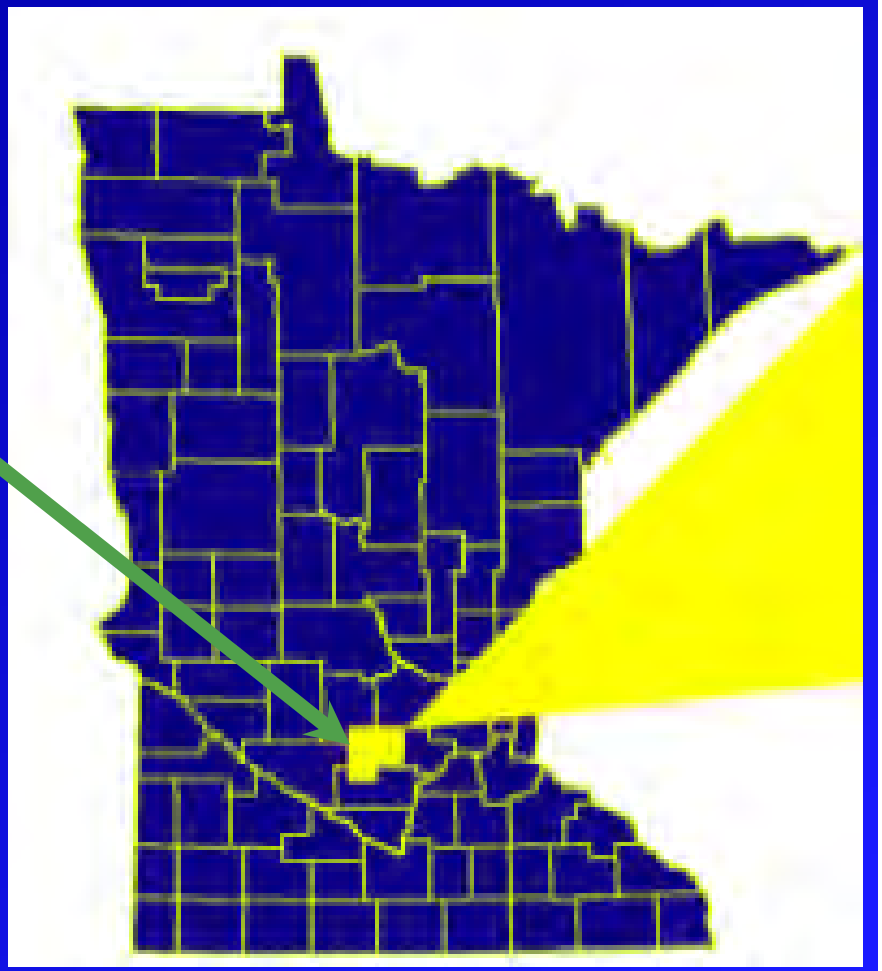
AMERICAN ENGINEERING TESTING, INC.

# Topics

1. Background
2. Project History
3. Construction Highlights
4. Construction and Performance Testing
5. Costs
6. Lessons Learned
7. Next Steps

# Where is McLeod County?

About 3.5 hours SE of Fargo, ND



Located approximately 60 miles west of the Twin Cities

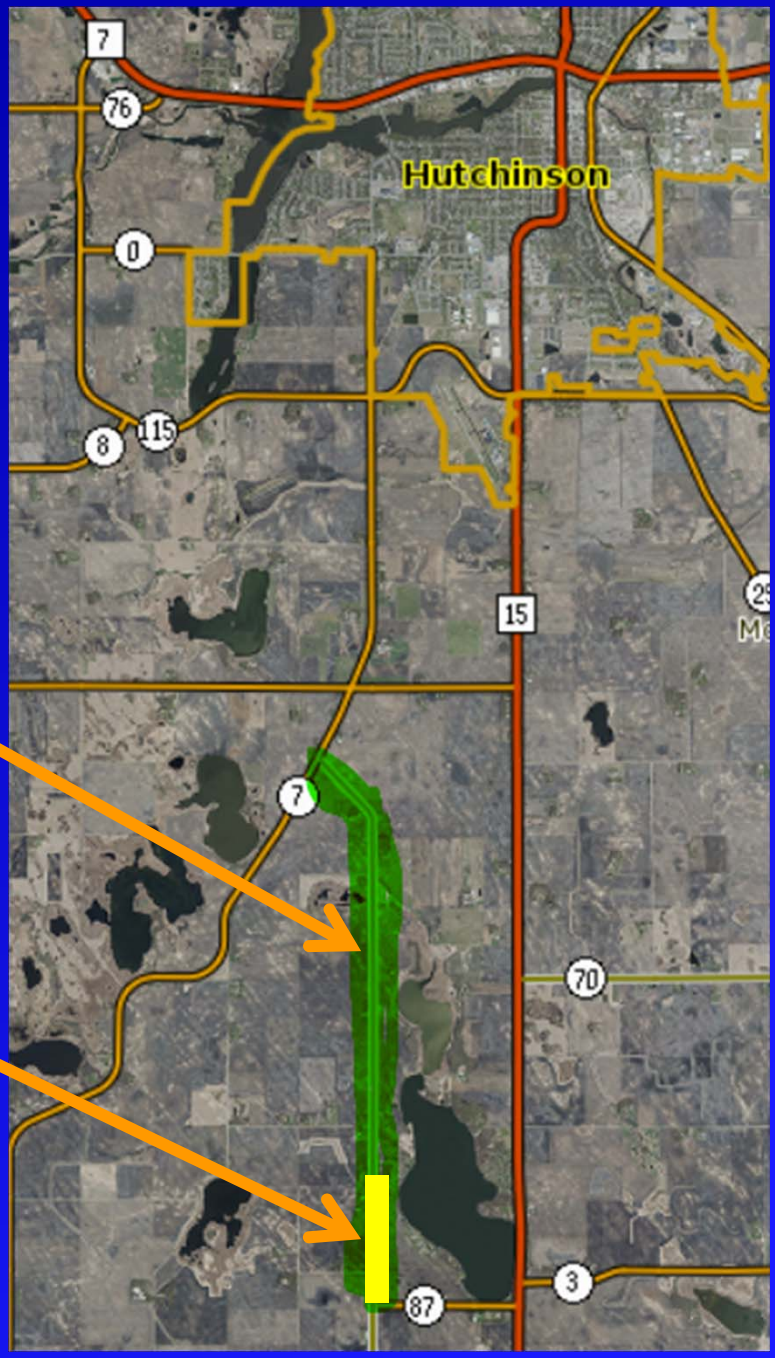
# Where is Project ?

## County Road 54 (CR 54)

~ 6 miles South of Hutchinson, MN

**Entire Corridor**
**~4 miles**
**CR 87 to CSAH 7**

**Initial Project**
**~1 mile**



# BACKGROUND

## CR 54 Issues

- ~200 ADT
- ~$5,000 Annually for Dust Control ($CaCl_2$)
- Washboards (due to speed/braking)
- Frequent Blading Required
- No Funding for traditional base and surfacing
- County Funded (non State Aid route)

**2013 - Neighborhood meeting**
**- Frustrated with condition of CR 54**

## GOALS FOR CR 54 & other higher volume gravel roads

- Dust Free Road
- Washboard Free
- Stand up to Agricultural Traffic
- ***Cost Effective***

# Project History

## 2014 Prime/Seal Project

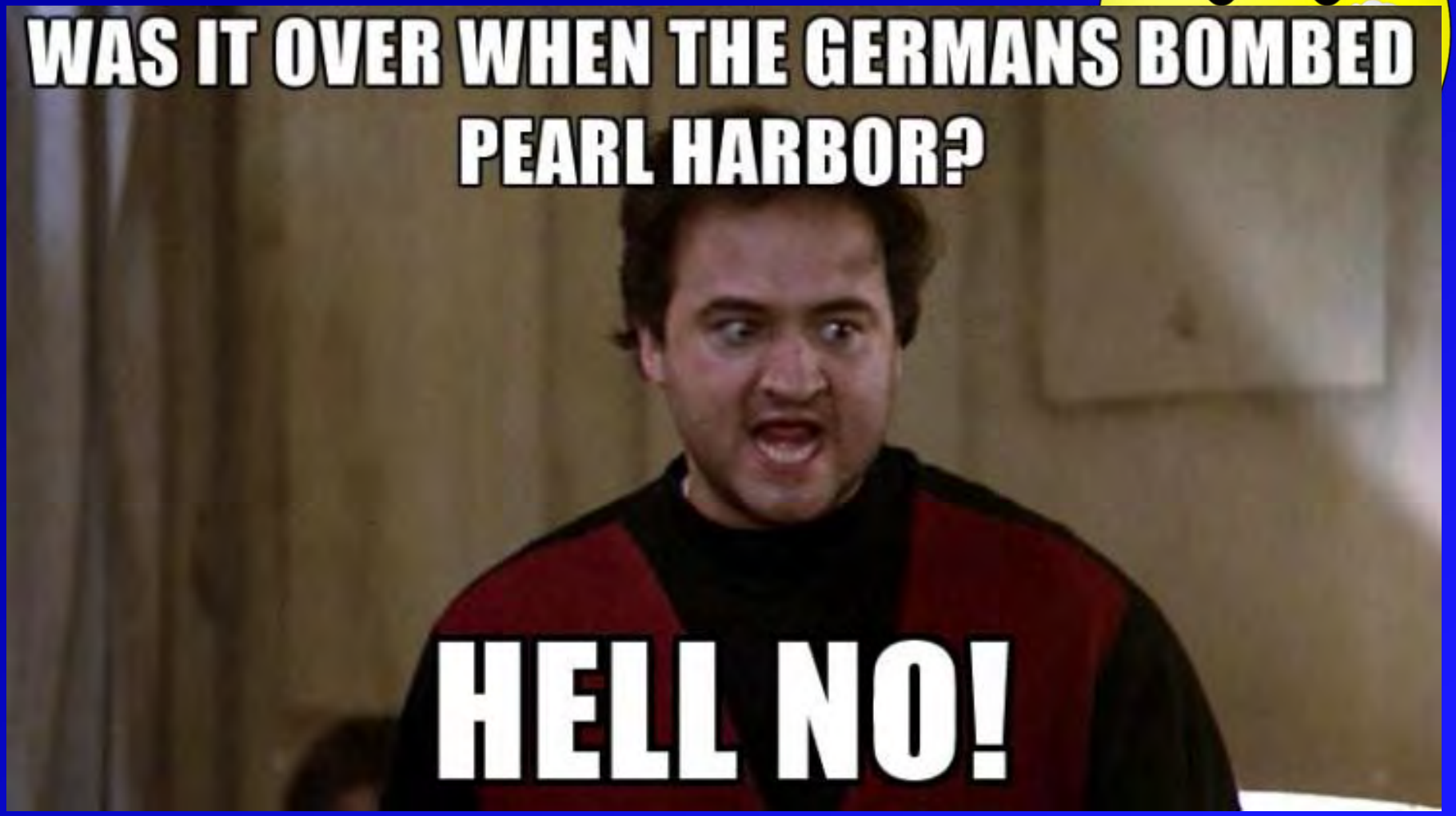
- Emulsified Prime Coat
- Single Chip Seal
- Fog

- ***Portions began to break up in fall***

# Project History

## 2015 Tiling and Reclamation Project

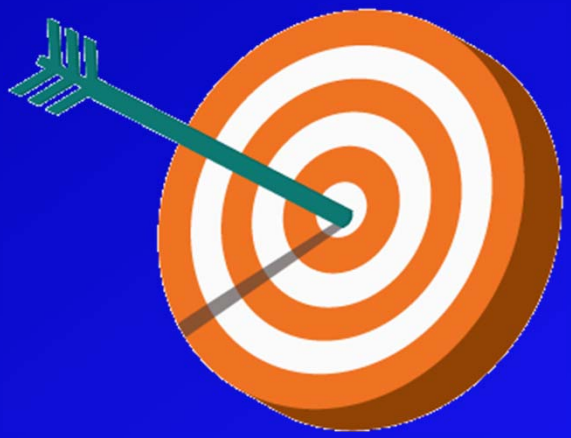
## NOW WHAT?



# Project History

**2016 Cement Stabilized Full Depth Reclamation, Seal Coat & Fog**

*Project Goal – Find the most cost effective optimal cement content and stabilization depth.*



- 4 Test Sections
- Varying Cement Contents
- Varying Stabilization Depths
- Short Section of Single Chip Seal
- 4% Cross Slope

# PROJECT OVERVIEW

| | Section 1 | Section 2 | Section 3 | Section 4 |
|---|---|---|---|---|
| Cement Content | 8 % | 7 % | 6 % | 5 % |
| Stabilization Depth | 10” | 10” | 8” | 8” |
| Tack Coat | 1300’ | 1300’ | 1300’ | 1300’ |
| Double Chip Seal | 1300’ | 1300’ | 1300’ | 1200’ |
| Single Chip Seal | - | - | - | 100’ |
| Fog Seal | 1300’ | 1300’ | 1300’ | 1300’ |

# CONSTRUCTION

## Spreading Cement

# CONSTRUCTION

## Cement Incorporation

# CONSTRUCTION

## Breakdown Rolling

# CONSTRUCTION

## Breakdown Rolling

# CONSTRUCTION

## Initial Blading

# CONSTRUCTION

Finish Rolling

# CONSTRUCTION


Finish Rolling & Final Trimming

# CONSTRUCTION

Final Trimming

# CONSTRUCTION

## Finished CSFDR

# CONSTRUCTION

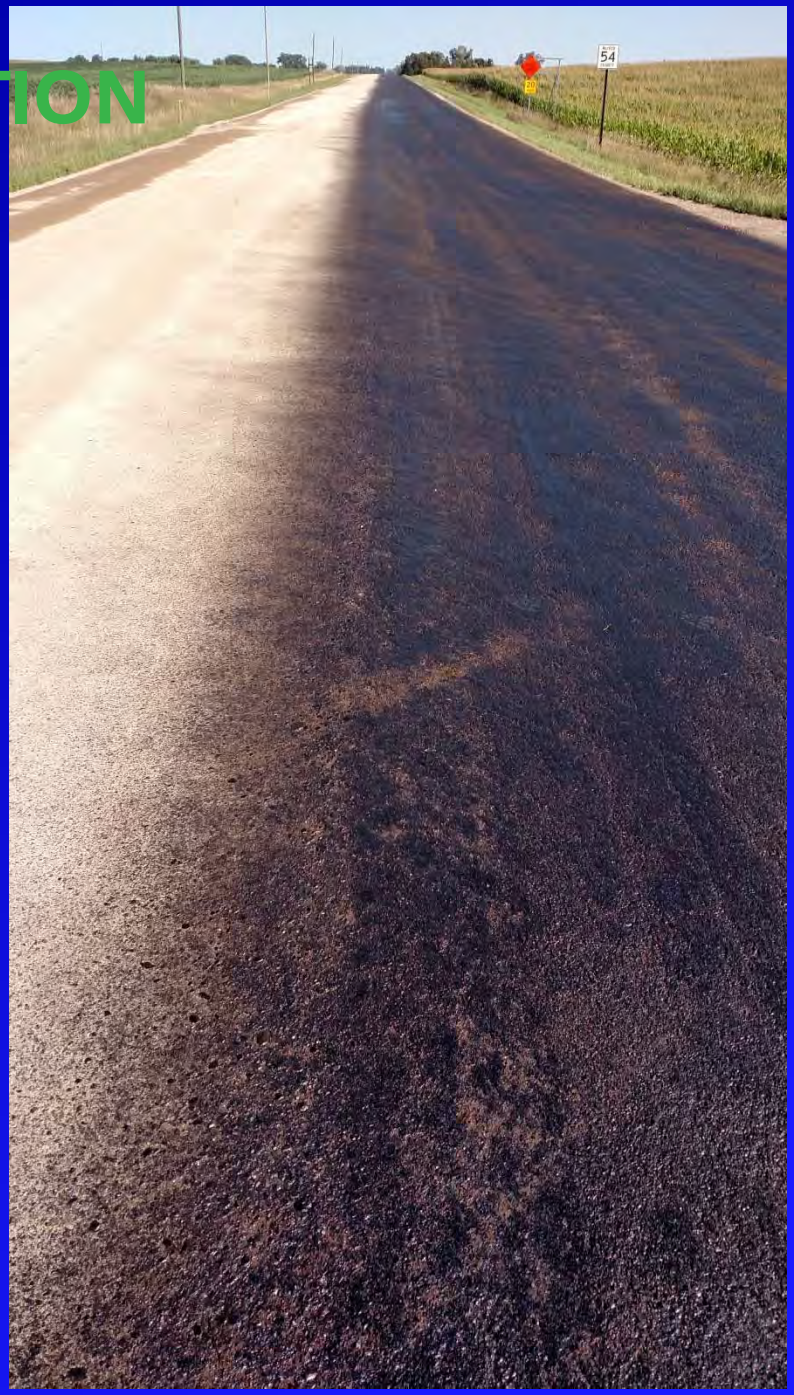
Finished CSFDR

# CONSTRUCTION

Seal Coat – Broom prep

# CONSTRUCTION

Tack Coat



# CONSTRUCTION

## Seal Coat – First Layer

# CONSTRUCTION

## Seal Coat – Second Layer

# CONSTRUCTION

## Seal Coat – Second Layer

# CONSTRUCTION

Fog Seal

8/23/16

# LESSONS LEARNED

## 2016 Project

### Ride

- Finish longer sections
- Tough to correct after project
- Likely include Ride Spec in Future

# LESSONS LEARNED

## 2016 Project

### Subgrade

- Need Good Drainage
- Continue Centerline Tile

### Residential Driveways

- Figure out Transition
- Potential Plowing Damage

### Future Projects

- No County Operators, One Contract
- Ensure Samples Match Existing Conditions
- 2nd Seal – Year 2 or later

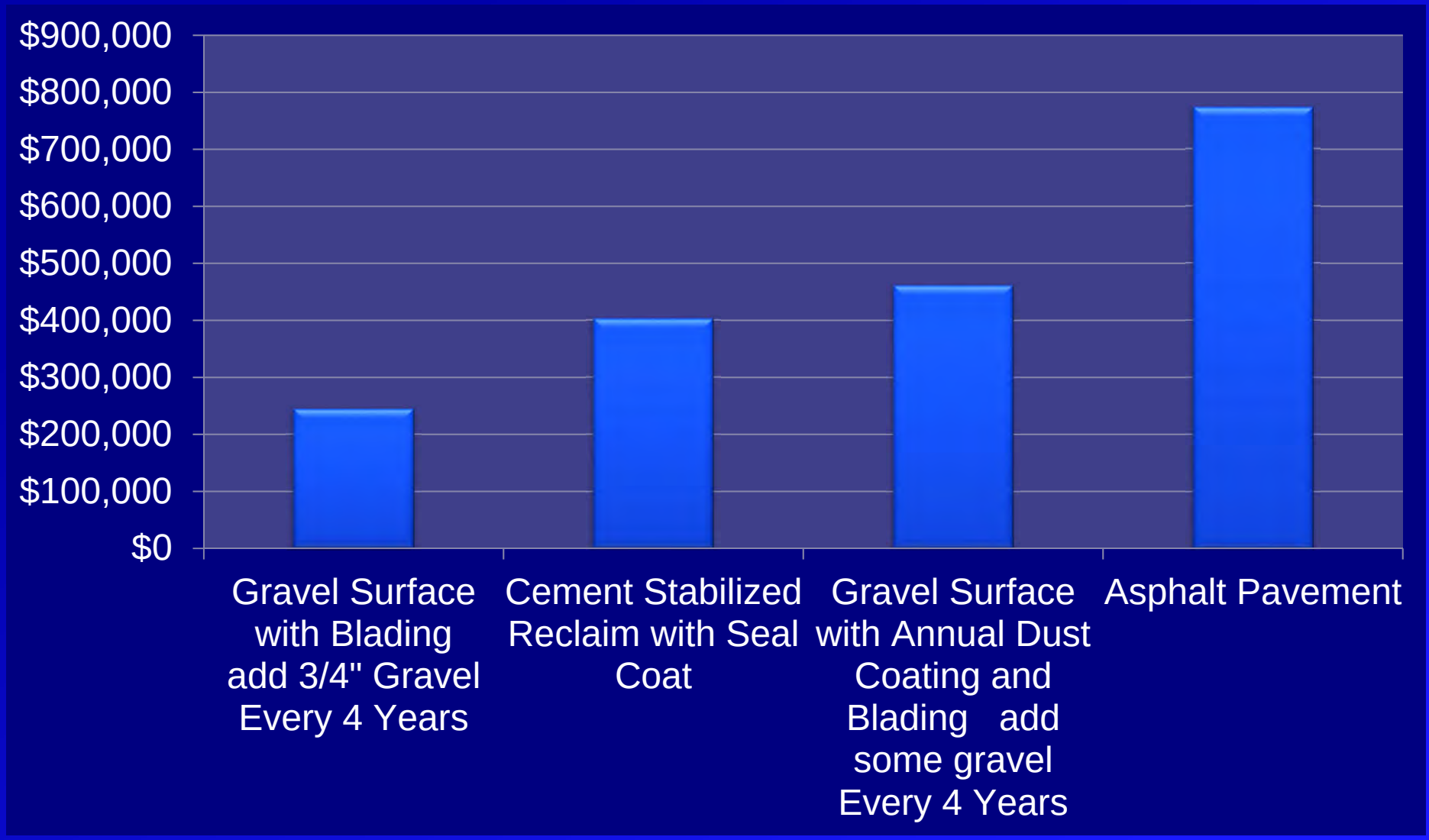
# 2016 PROJECT COSTS

| CSFDR | Cost/Mile | Cost/SY |
|---|---|---|
| • Cement | $ 51,300 | $ 3.12 |
| • Stabilization | $ 16,300 | $ 0.99 |
| • Laydown/Compaction * | $ 15,000 | $ 0.93 |
| **CHIP SEAL** | | |
| • Tack Coat | $ 3,100 | $ 0.19 |
| • 3/8” Seal | $ 22,900 | $ 1.40 |
| • 1/4” Seal | $ 20,000 | $ 1.22 |
| • Fog Seal | $ 3,300 | $ 0.20 |
| **TOTAL** | **~$ 132,000** | **~$ 8** |

** County Roller Operators*

# 50 YEAR LIFE CYCLE COSTS per mile

# COMPARISONS



# NEXT STEPS

**Finish CR 54**

**Continue to Monitor**

**More Planned**

- ~14 Miles in 5-Year Plan

**Good Tool in Tool Box for Right Road**

- $140,000/mile vs. Traditional Paving ~$450,000+

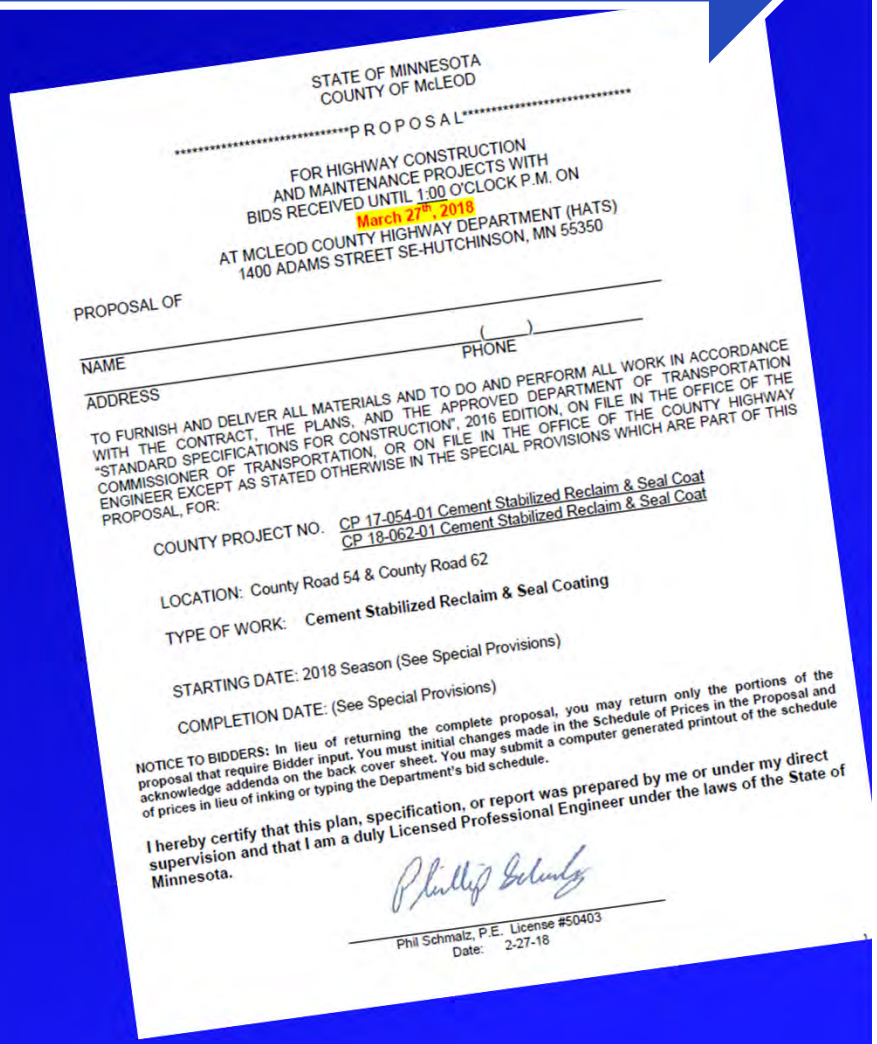
# 2018 Project

## 2018 Cement Stabilized Full Depth Reclamation, Seal Coat & Fog

- Finish Remaining 3 Miles
- Micro Mill south 1 mile
- Traditional Design/Bid/Build
- Micro Mill south 1 mile
- Hybrid Specifications from

  MnDOT/NDDOT/Consultant

  - Contractor Mix Design
  - Ride spec - Straightedge
  - Cross slope spec



STATE OF MINNESOTA
COUNTY OF McLEOD

**********PROPOSAL**********

FOR HIGHWAY CONSTRUCTION
AND MAINTENANCE PROJECTS WITH
BIDS RECEIVED UNTIL 1:00 O'CLOCK P.M. ON
March 27th, 2018
AT MCLEOD COUNTY HIGHWAY DEPARTMENT (HATS)
1400 ADAMS STREET SE-HUTCHINSON, MN 55350

PROPOSAL OF

NAME PHONE ( )

ADDRESS

TO FURNISH AND DELIVER ALL MATERIALS AND TO DO AND PERFORM ALL WORK IN ACCORDANCE WITH THE CONTRACT, THE PLANS, AND THE APPROVED DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR CONSTRUCTION", 2016 EDITION, ON FILE IN THE OFFICE OF THE COMMISSIONER OF TRANSPORTATION, OR ON FILE IN THE OFFICE OF THE COUNTY HIGHWAY ENGINEER EXCEPT AS STATED OTHERWISE IN THE SPECIAL PROVISIONS WHICH ARE PART OF THIS PROPOSAL, FOR:

COUNTY PROJECT NO. CP 17-054-01 Cement Stabilized Reclaim & Seal Coat
CP 18-062-01 Cement Stabilized Reclaim & Seal Coat

LOCATION: County Road 54 & County Road 62

TYPE OF WORK: **Cement Stabilized Reclaim & Seal Coating**

STARTING DATE: 2018 Season (See Special Provisions)

COMPLETION DATE: (See Special Provisions)

**NOTICE TO BIDDERS:** In lieu of returning the complete proposal, you may return only the portions of the proposal that require Bidder input. You must initial changes made in the Schedule of Prices in the Proposal and acknowledge addenda on the back cover sheet. You may submit a computer generated printout of the schedule of prices in lieu of inking or typing the Department's bid schedule.

**I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.**

Phil Schmaltz, P.E. License #50403
Date: 2-27-18

# 2018 Project

**2018 Cement Stabilized Full Depth Reclamation, Seal Coat & Fog**

Contract Awarded to Allstates Pavement Recycling & Stabilization on May 8, 2018

County Road 54 – stand alone – Engineers Estimate: $496,243.50

| Contractor | 54 Bid |
|---|---|
| Allstates Pavement Recycling/Stab, Rogers, MN | $395,497.86 |
| Astech Corporation, St. Cloud, MN | $426,778.98 |
| Duininck, Inc., Prinsburg, MN | $432,211.76 |

# How did it go?

## Early Concerns with Cement Laydown

# How did it go?

## Sealcoat Debonding

# Now What?

***County Didn't Get What They Want***

***Vs.***

***Contractor "Met Spec"***

## Received OPERA Funds to Test and Tell Story

# 2018 - Testing & Findings

# Spring 2019

## Chipseal Continued Debonding over the Winter/Spring

# 2018 - Testing & Findings

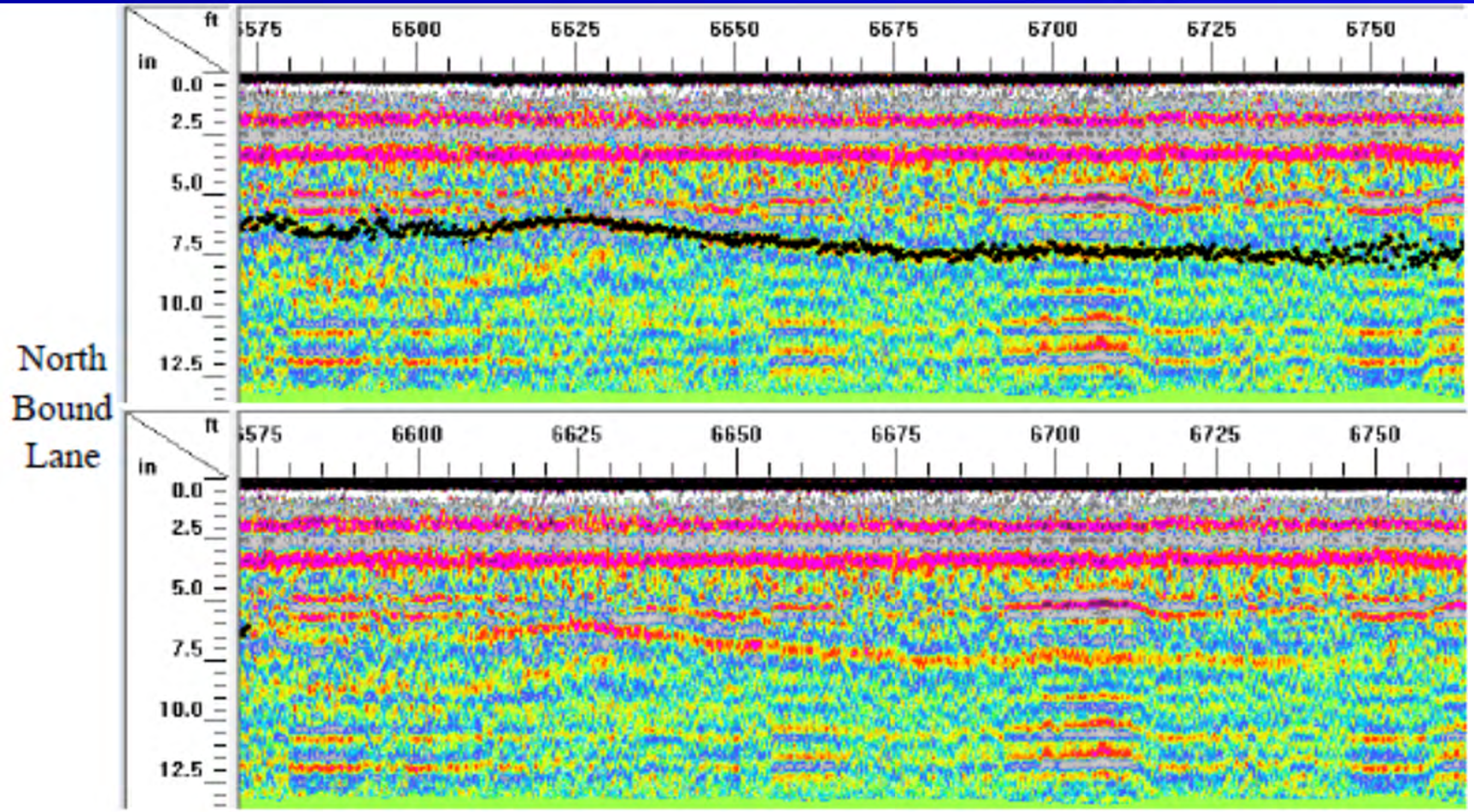
## Work Plan

- Evaluate all construction testing data and inspector diaries
- Ground Penetrating Radar to Determine Depth of Stabilization
- Falling Weight Deflectometer Testing to Determine Current Strength of Roadway
- DCP Testing to Determine Strength of Cement Stabilized Base by Depth and Confirm Depth of Stabilization (and aid with GPR analysis)
- Coring (if possible) to Evaluate the Quality of the Stabilized Material
- Unconfined Compressive Strength Testing (if possible) to compare to Mix Design
- Report with findings

# Construction Data

- Long Stretches of Cement Stabilization were done at one time.
  - Goal is to be mixed graded and compacted within 1 hour in the summer
- Unclear how well final compaction was completed after blade work and timing of final compaction
- Unclear how well surface was swept after micro-milling – might have affected bonding of chipseal

# Ground Penetrating Radar



# FWD Testing

- Definite Strength Difference Between Northern and Southern Portions of Roadway
- Combination of Differences in Subgrade and Stabilized Layer Strength

| | Northern 7,500 Feet | | | Southern 8,000 Feet | | |
|---|---|---|---|---|---|---|
| | Spring Load Capacity (tons) | Effective GE (Inches) | Effective R Value | Spring Load Capacity (tons) | Effective GE (Inches) | Effective R Value |
| Average | 10.4 | 29.4 | 7.4 | 6.1 | 19.1 | 5.6 |
| Std. Dev. | 3.3 | 6.9 | 1.9 | 2.0 | 6.6 | 1.7 |
| Design | 7.1 | 22.6 | 5.5 | 4.0 | 12.5 | 3.9 |

# DCP Testing

- Most DCP Tests Showed Significant Differences in Strength with Depth

**Dynamic Cone Penetrometer Testing (ASTM: D6951)**

| Number of Blows | DCP Readings (mm) | Difference (mm) | Depth (in) | DCP Index (mm/blow) | CBR |
|---|---|---|---|---|---|
| | 52 | | | | |
| 3 | 80 | 28 | 1.1 | 9.3 | 23.9 |
| 3 | 98 | 18 | 1.8 | 6.0 | 39.3 |
| 3 | 112 | 14 | 2.4 | 4.7 | 52.0 |
| 3 | 124 | 12 | 2.8 | 4.0 | 61.8 |
| 3 | 133 | 9 | 3.2 | 3.0 | 85.3 |
| 3 | 148 | 15 | 3.8 | 5.0 | 48.1 |
| 3 | 160 | 12 | 4.3 | 4.0 | 61.8 |
| 3 | 174 | 14 | 4.8 | 4.7 | 52.0 |
| 3 | 187 | 13 | 5.3 | 4.3 | 56.5 |
| 3 | 203 | 16 | 5.9 | 5.3 | 44.8 |
| 3 | 220 | 17 | 6.6 | 5.7 | 41.8 |
| 3 | 240 | 20 | 7.4 | 6.7 | 34.9 |
| 3 | 265 | 25 | 8.4 | 8.3 | 27.2 |
| | | | | | |
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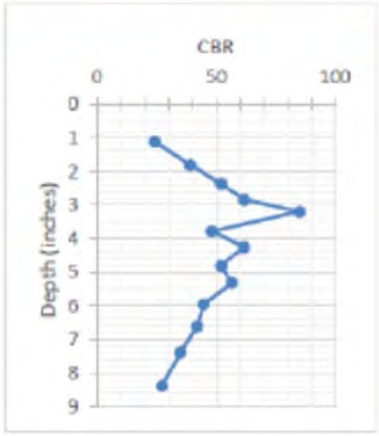



| Average CBR: | 48.4 |
|---|---|

**Comments**

For all soils except CL<10 CBR and CH soils, CBR=292/(DPI^1.12). For CL<10, CBR=1/((0.017019*DPI)^2. For CH soils CBR=1/(0.002871*DPI).

# Coring


AET No. 27-20035
County Road 54
C-1

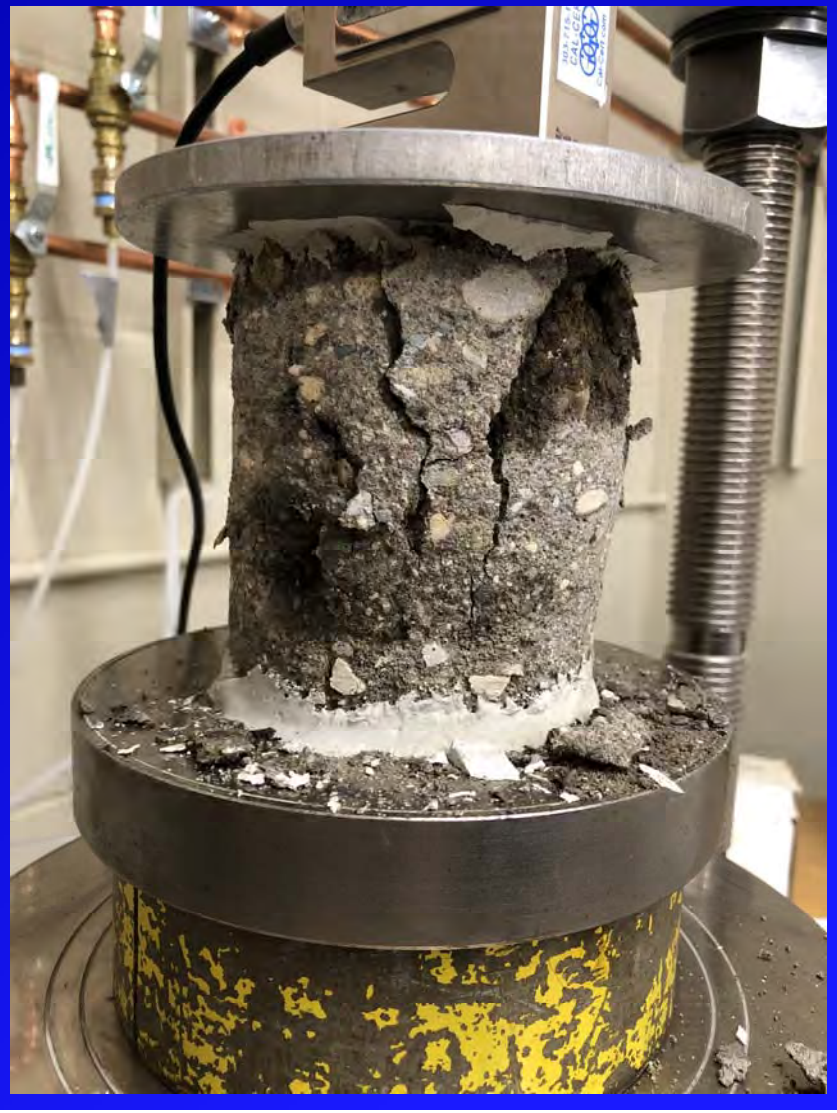

AET No. 27-20035
County Road 54
C-3


AET No. 27-20035
County Road 54
C-6

# Unconfined Compressive Strength

Cores that were Removed Intact were at or Near Design Strength (250 psi)

| Core | UCS (psi) |
|---|---|
| C-1 | 274 |
| C-3 | 193 |
| C-4 | 158 |
| C-5 | 98 |
| C-7 | 297 |
| C-8 | 338 |
| C-9 | 225 |



# Findings

- It Appears that the Time Between the Start of Mixing and Final Compaction was too Long. Stretches Being Worked were too Long to be Completed in One Hour.
- Divots in Road Surface were from Poorly Compacted Material Filling Padfoot Roller Depressions – Related to Time to Finish
- Variability in Strength both at Surface and at Depth – Possibly Due to too Much Time from Start of Mixing Until Final Compaction
- Design Strength was Achieved in Many Locations
- Often only 6 inches of Stabilization Met Strength
- Dirty Surface of Roadway After Micro-milling Might have Hurt Bonding of Chipseal

# Next Steps/Alternatives

1. Work with Contractor for Resolution
2. Identify Appropriate Fix for Current Conditions
    a. Do Nothing
    b. Add gravel to current surface
    c. Reclaim entire road back to gravel
    d. Pave entire road (CR 87 to CR 7)
    e. Pave 1st mile only (CR 87 to 1 mile N)

# QUESTIONS?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