Cement Stabilized Base & Chipseal

"County Road 54"

NRRA Pavement Conference

May 24, 2017

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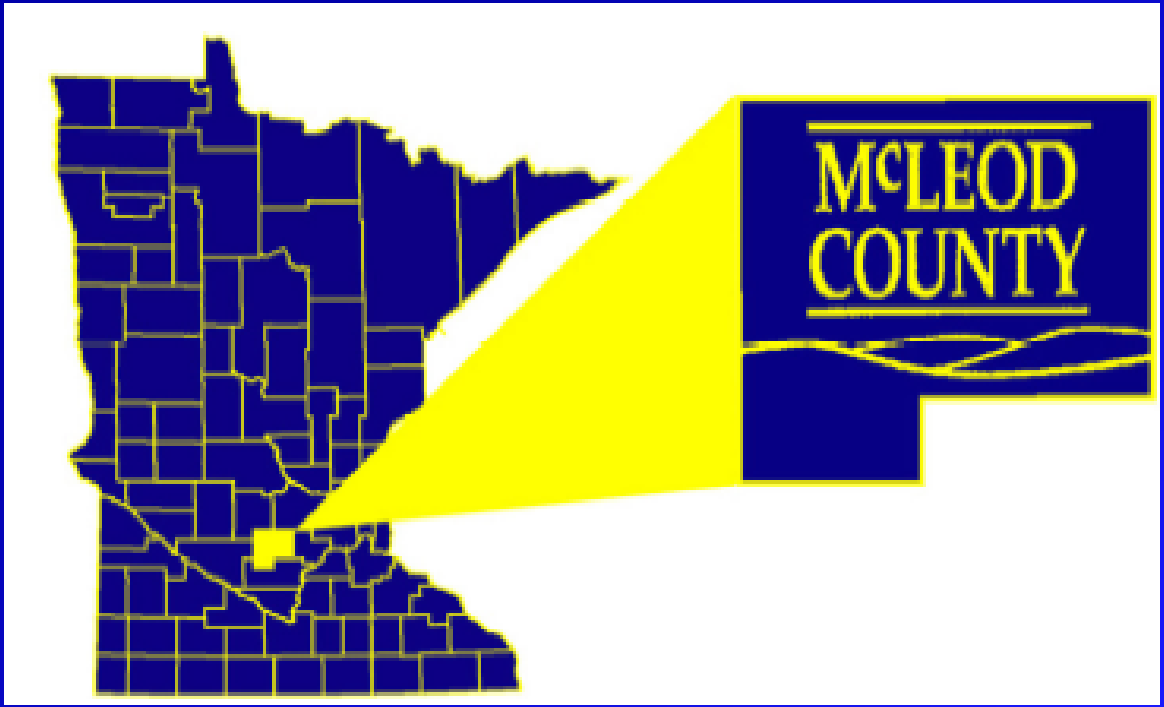
Topics

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

Where is McLeod County?

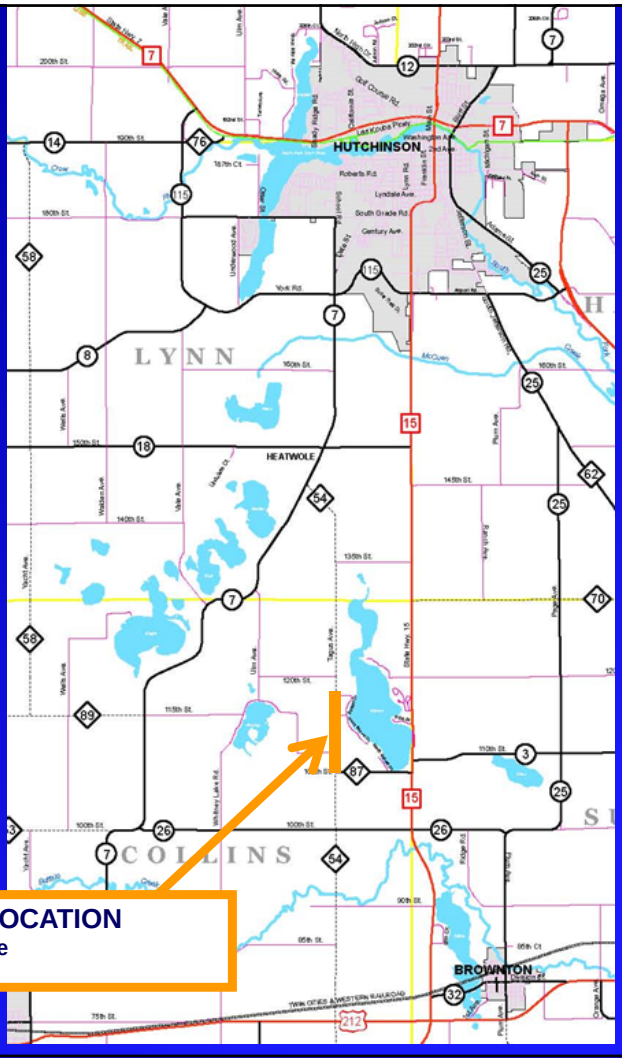


Located approximately 60 miles west of the Twin Cities

Where is Project?

County Road 54 (CR 54)

~ 6 miles South of Hutchinson, MN



BACKGROUND

County Road 54

- Gravel Road
- Primarily serves rural housing development
- Seasonal agricultural traffic
- ~ 200 ADT
- County Funded (non State Aid route)

BACKGROUND

CR 54 Issues

- ~$5,000 Annually for Dust Control ($CaCl_2$)
- Washboards (due to speed/braking)
- Frequent Blading Required
- No Funding for traditional base and surfacing

Goals for CR 54

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

BACKGROUND – Past Efforts

2014 Prime/Seal Project

- CR 54
- Township Housing Development
- Nearby County Park
- *Portions of CR 54 began to break up in fall*

2015 Reclamation & Tiling Project

- CR 54

NOW WHAT?

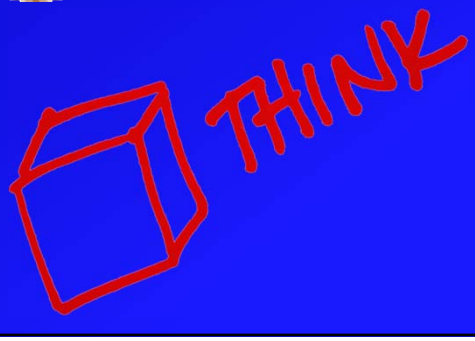
2016

Cement Stabilized Full Depth Reclamation (CSFDR)

Double Chip Seal & Fog Seal

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

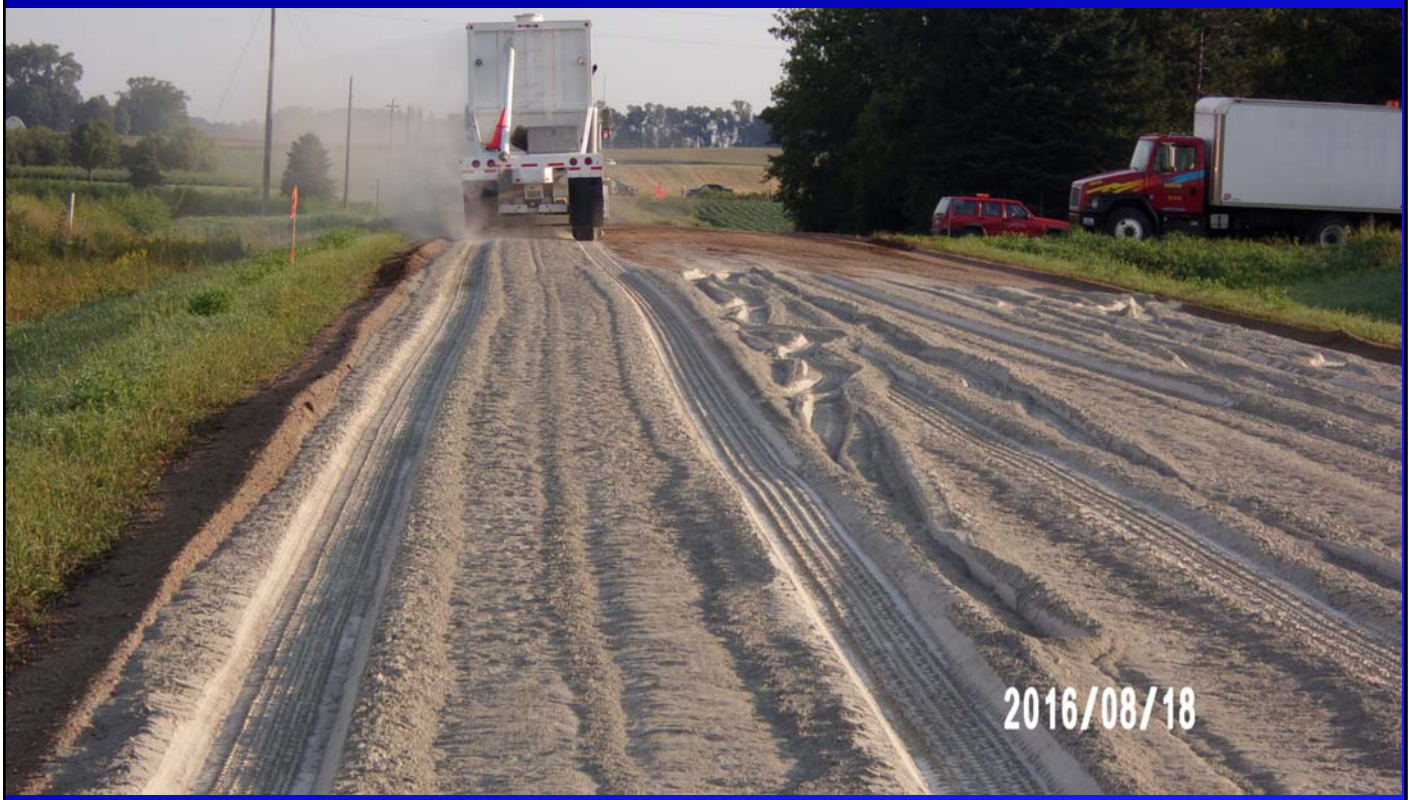


PROJECT OVERVIEW

	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

Spreading Cement

CONSTRUCTION

Cement Incorporation

CONSTRUCTION

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CONSTRUCTION
Cement Incorporation
FRIEDGES

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

CONSTRUCTION

Seal Coat – First Layer

CONSTRUCTION

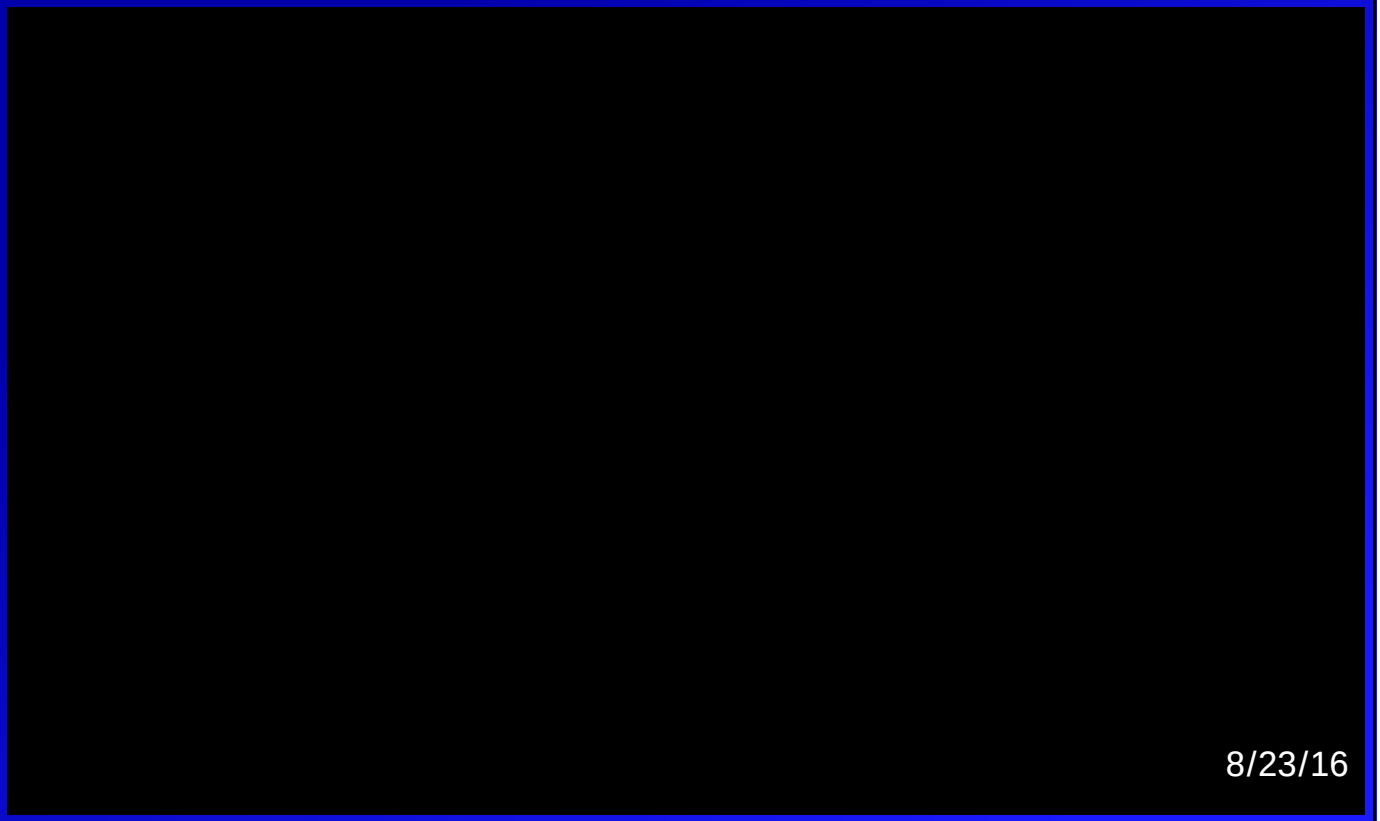
Seal Coat – Second Layer

CONSTRUCTION

Seal Coat – Second Layer

CONSTRUCTION

Fog Seal *(sorry no pics ☺)*



DESIGN PROCESS

- Two mix designs
  - One for 8 inch SFDR section, one for 10 inch SFDR section
  - Relative proportions of gravel to subgrade were different due to reclamation depths
    - 8” Section Proctor 127.3 pcf at 9.1% moisture
    - 10” Section Proctor 122.6 pcf at 10.5% moisture
  - Target Unconfined Compressive Strength of 250-300 psi at 14 days

DESIGN PROCESS

- Two mix designs
  - 8” Section
    - 5% Cement Content at OMC
      - 272 psi UCS
  - 10” Section
    - 7% Cement Content at OMC
      - 267 psi UCS

DESIGN PROCESS

- After lab work was completed the roadways were graveled and graded, so the roadway had more gravel than the mix designs contained.
- Likely result was going to be higher strength than the original mix design

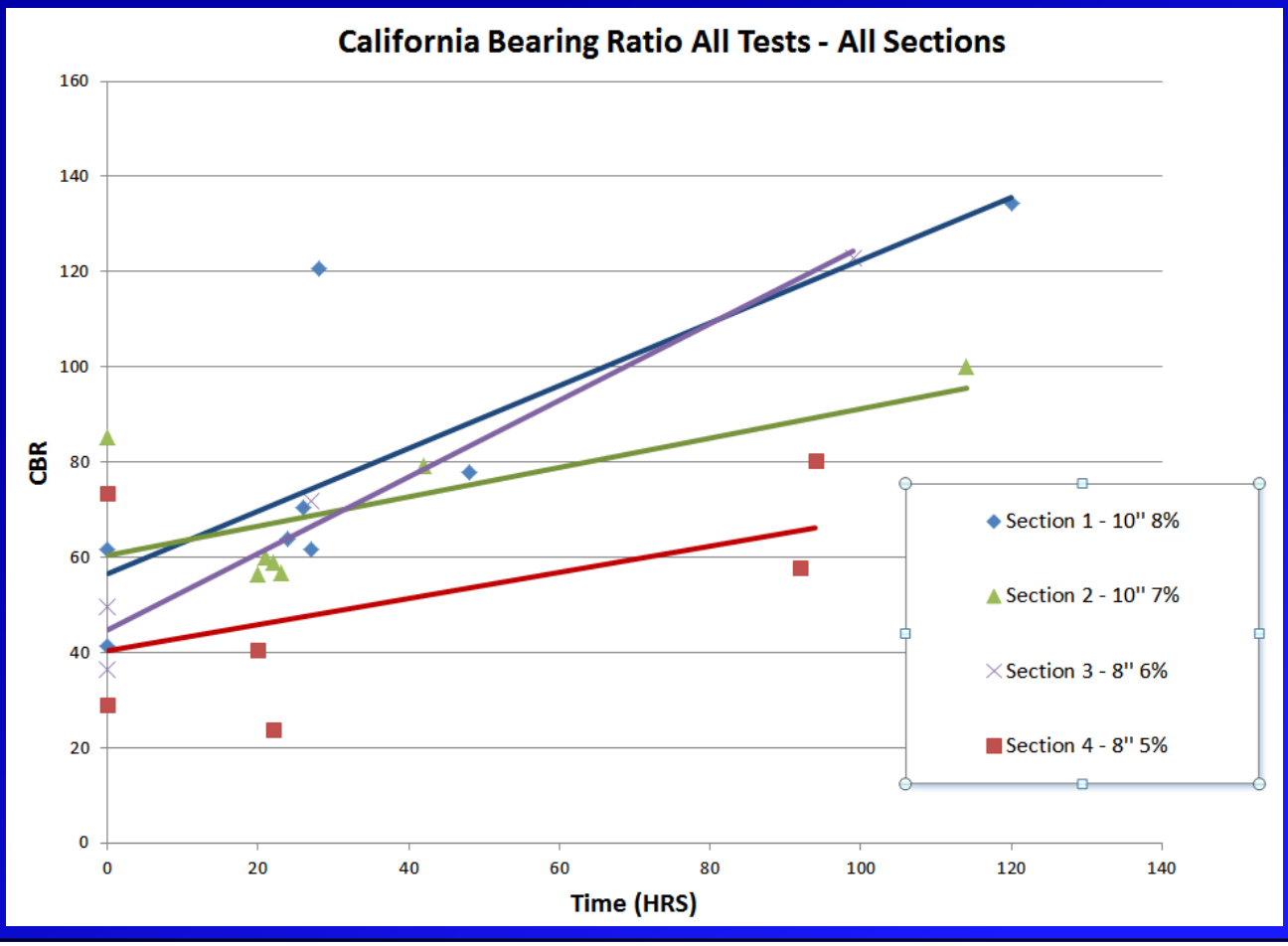
CONSTRUCTION & PERFORMANCE TESTING

- Field Testing
  - Nuclear Gauge for Moisture and Density
    - Water was added to soil as necessary to achieve (or approach) optimum moisture content
  - Rolling Patterns were performed
    - Several Each Day to account for variability in the roadway materials
  - Density and moisture was checked during compaction
    - Density was typically >98% of rolling pattern density

CONSTRUCTION & PERFORMANCE TESTING

- **Field Testing**
  - **DCP testing was performed post construction for strength verification**
  - **Target strengths (minimums)**
    - **CBR of 20 in 2 days**
    - **CBR of 50 in 7 days**
    - **Strengths measured greatly exceeded the targets**

CONSTRUCTION & PERFORMANCE TESTING



CONSTRUCTION & PERFORMANCE TESTING

- Performance Testing
  - Ground Penetrating Radar
  - Falling Weight Deflectometer
  - IRI
- Performed October, 2016

CONSTRUCTION & PERFORMANCE TESTING

- GPR - Sections were constructed thicker than plan
  - 10 inch sections
    - Section 1 – 14.5 inches
    - Section 2 – 14.6 inches
  - 8 inch Sections
    - Section 3 – 11.1 inches
    - Section 4 – 10.1 inches

CONSTRUCTION & PERFORMANCE TESTING

- **FWD Results**
  - **Significant strength increase over non-stabilized roadway – all stabilized sections > 10 tons**
  - **No direct correlation between cement content and strength**

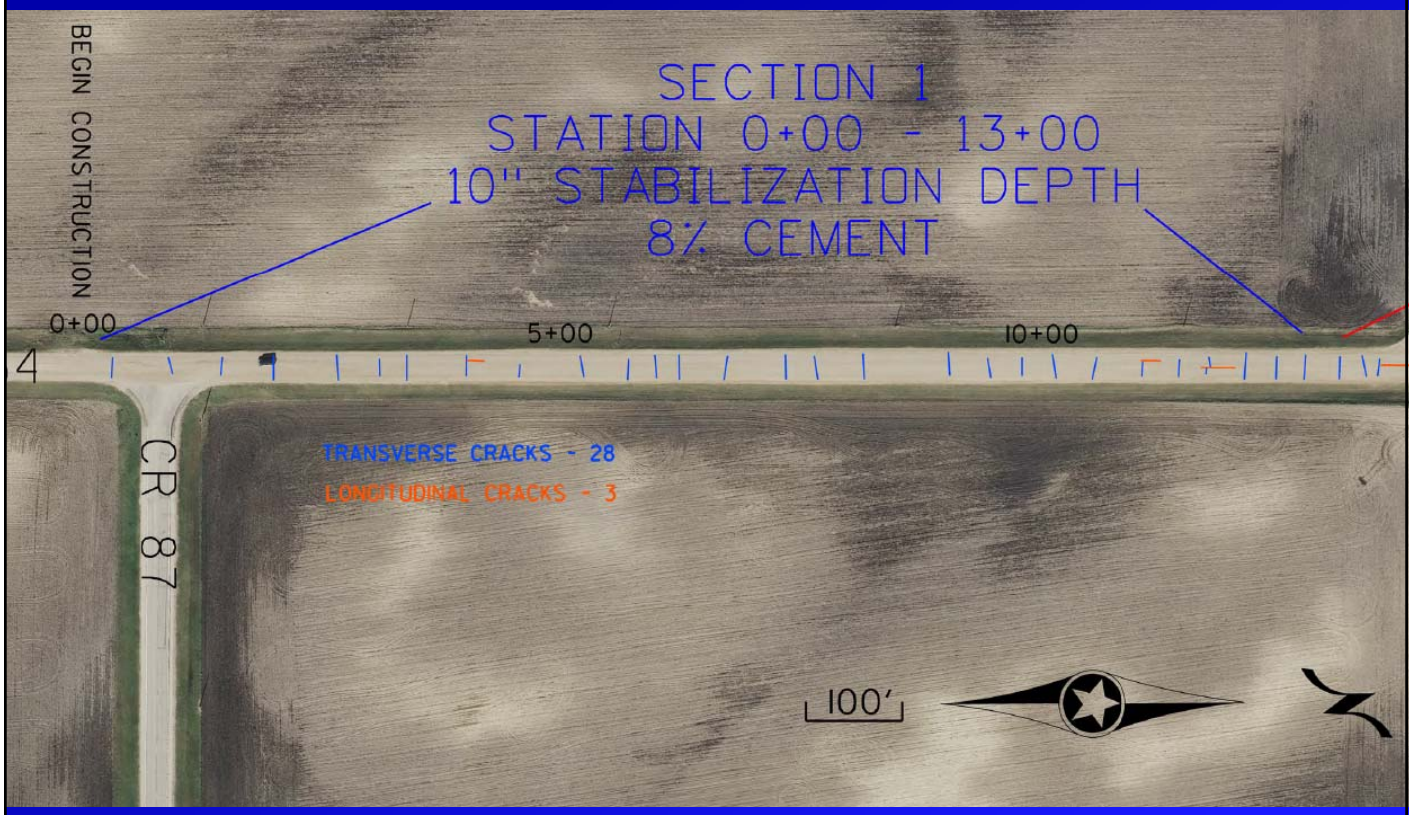
Section	Length	Thickness	Modulus	Load Capacity
	feet	in.	ksi	tons/axle
South Gravel	1300	4.8	16.7	4.8
1	1300	14.5	362.1	20.0
2	1300	14.6	560.9	21.8
3	1300	11.1	438.6	19.0
4	1300	10.1	280.4	10.8
North Gravel	1300	7.6	16.4	5.4

CONSTRUCTION & PERFORMANCE TESTING

- **Ride Quality Results**
  - **IRI of stabilized sections was significantly higher than the unstabilized gravel roadway on both ends of the project**

Section	Length	IRI
	feet	in./mi.
South Gravel	1300	84.8
1	1300	293.2
2	1300	237.4
3	1300	204.4
4	1300	210.9
North Gravel	1300	149.6

CRACK SURVEY - SPRING 2017



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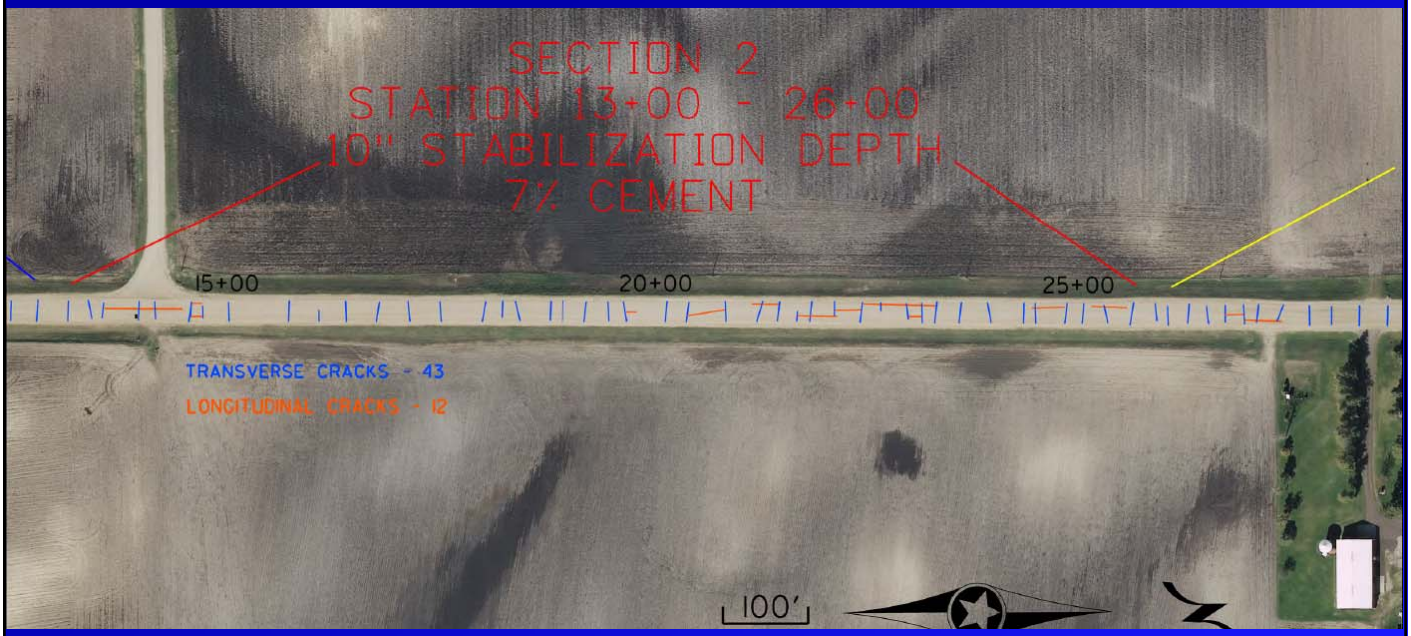

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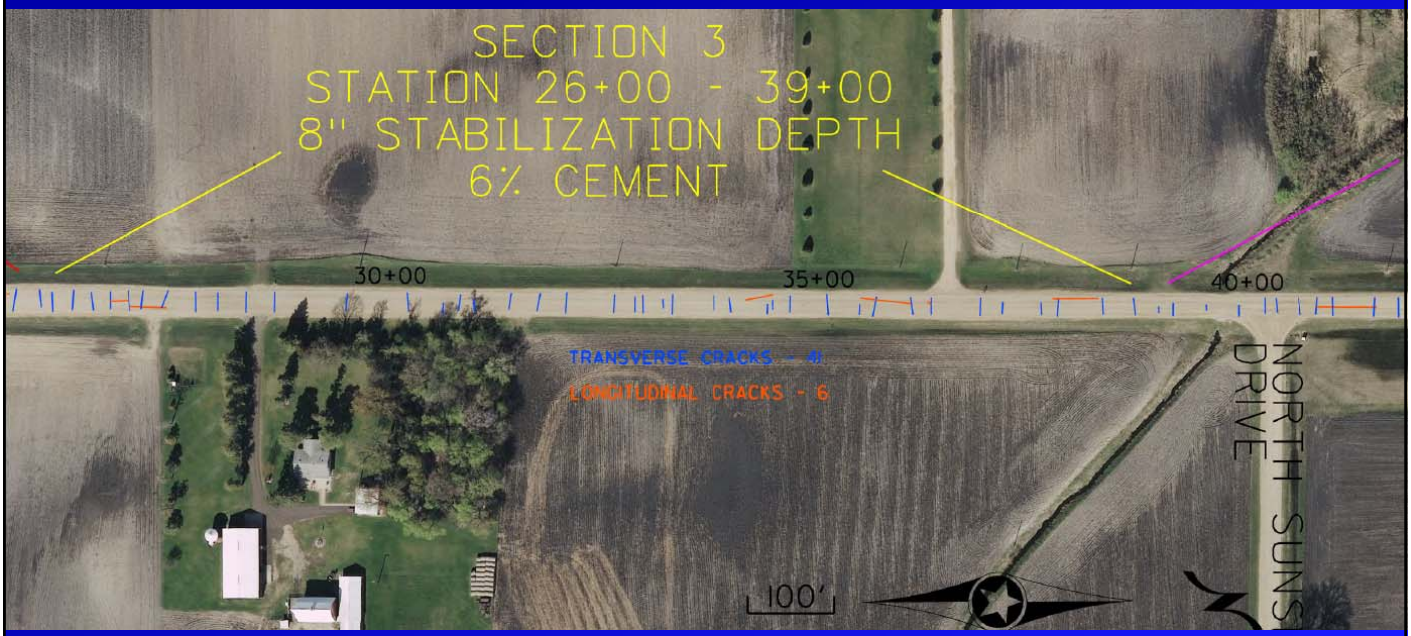

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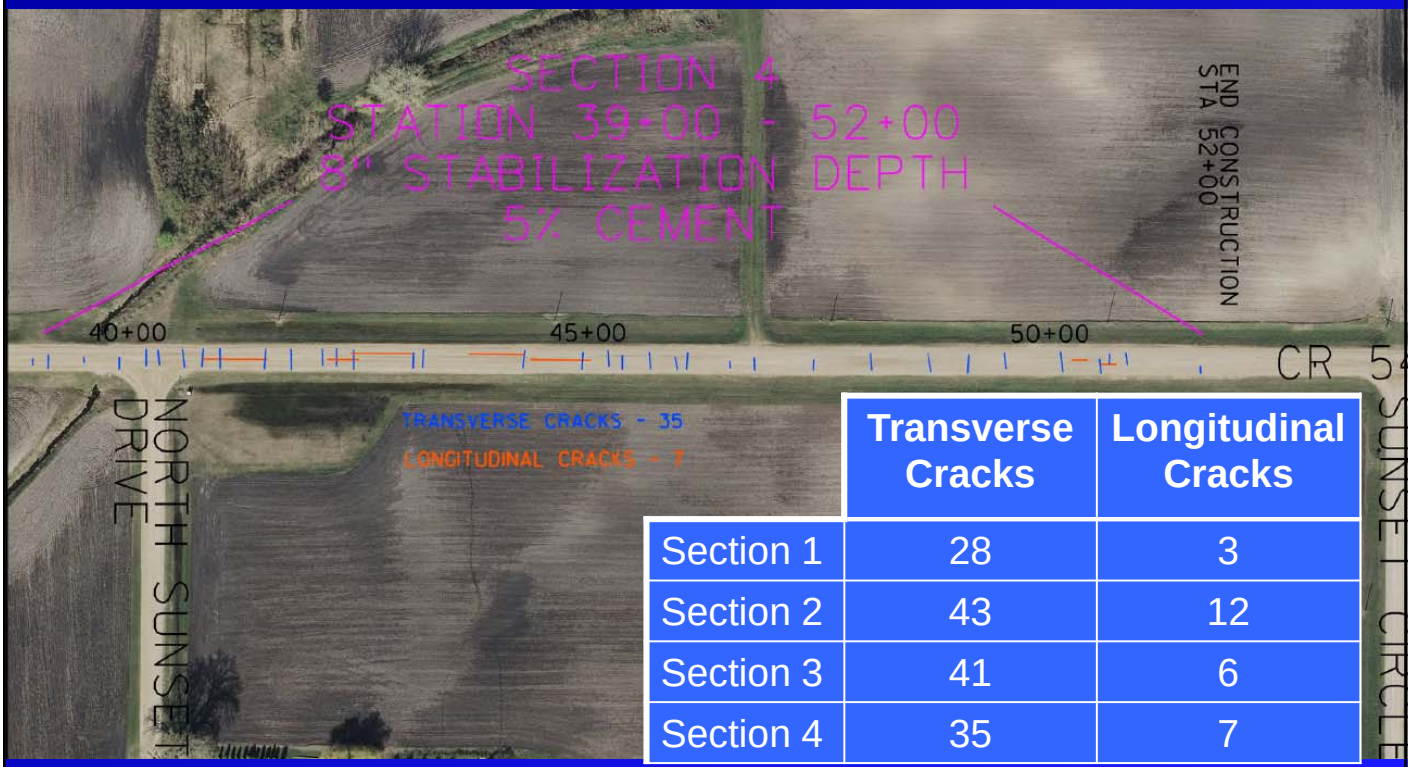


	Transverse Cracks	Longitudinal Cracks
Section 1	28	3
Section 2	43	12
Section 3	41	6
Section 4	35	7


SPRING 2017
1 Year Old

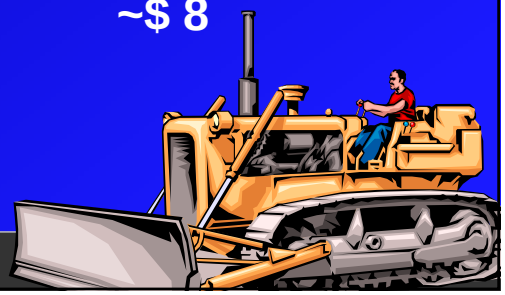

Taqus Ave
SPRING 2017
30
1 Year Old


SPRING 2017
1 Year Old

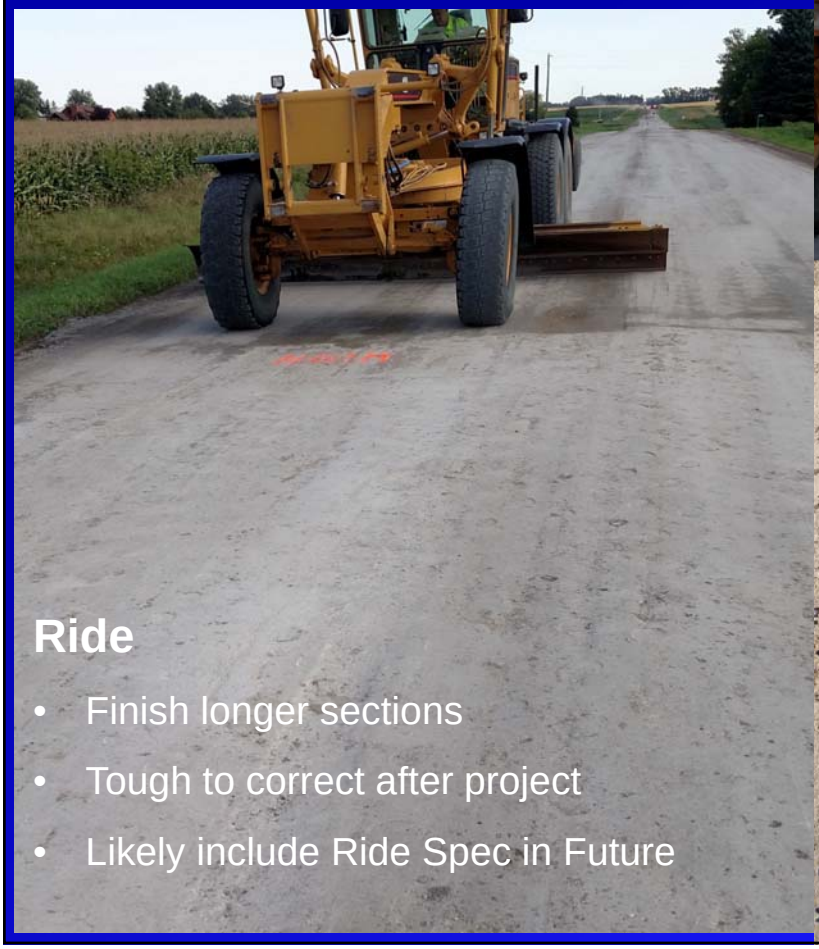
COSTS

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*



LESSONS LEARNED



Ride

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

LESSONS LEARNED

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

NEXT STEPS

Finish CR 54

- 1 mile 2017
- 2 miles 2018

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+

QUESTIONS?

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