Overview of Concrete Overlays

19th Annual TERRA Pavement Conference
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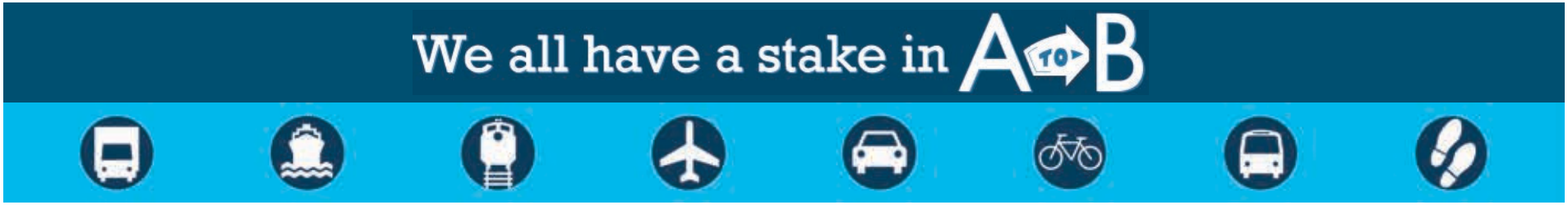

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- Matt Zeller, CPAM

Overview

- Types of Concrete Overlays
- Projects in MN
- Resources for Concrete Overlays
- TH 24 Successes and Challenges
- Current and Future Efforts

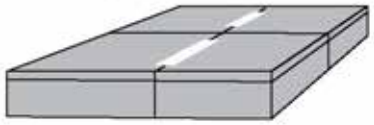
Bonded Overlay Systems
(Resurfacing/Minor Rehabilitation)

2” – 5”

In general, bonded overlays are used to add structural capacity and/or eliminate surface distress when the existing pavement is in good structural condition.

Bonding is essential, so thorough surface preparation is necessary before resurfacing.

Bonded Concrete Overlays of Concrete Pavements
–previously called bonded overlays–



Bonded Concrete Overlays of Asphalt Pavements
–previously called ultra-thin whitetopping–

Bonded Concrete Overlays of Composite Pavements

Unbonded Overlay Systems
(Minor/Major Rehabilitation)

4” – 11”

In general, unbonded overlays are used to rehabilitate pavements with some structural deterioration.

They are basically new pavements constructed on an existing, stable platform (the existing pavement).

Unbonded Concrete Overlays of Concrete Pavements
–previously called unbonded overlays–

Unbonded Concrete Overlays of Asphalt Pavements
–previously called conventional whitetopping–

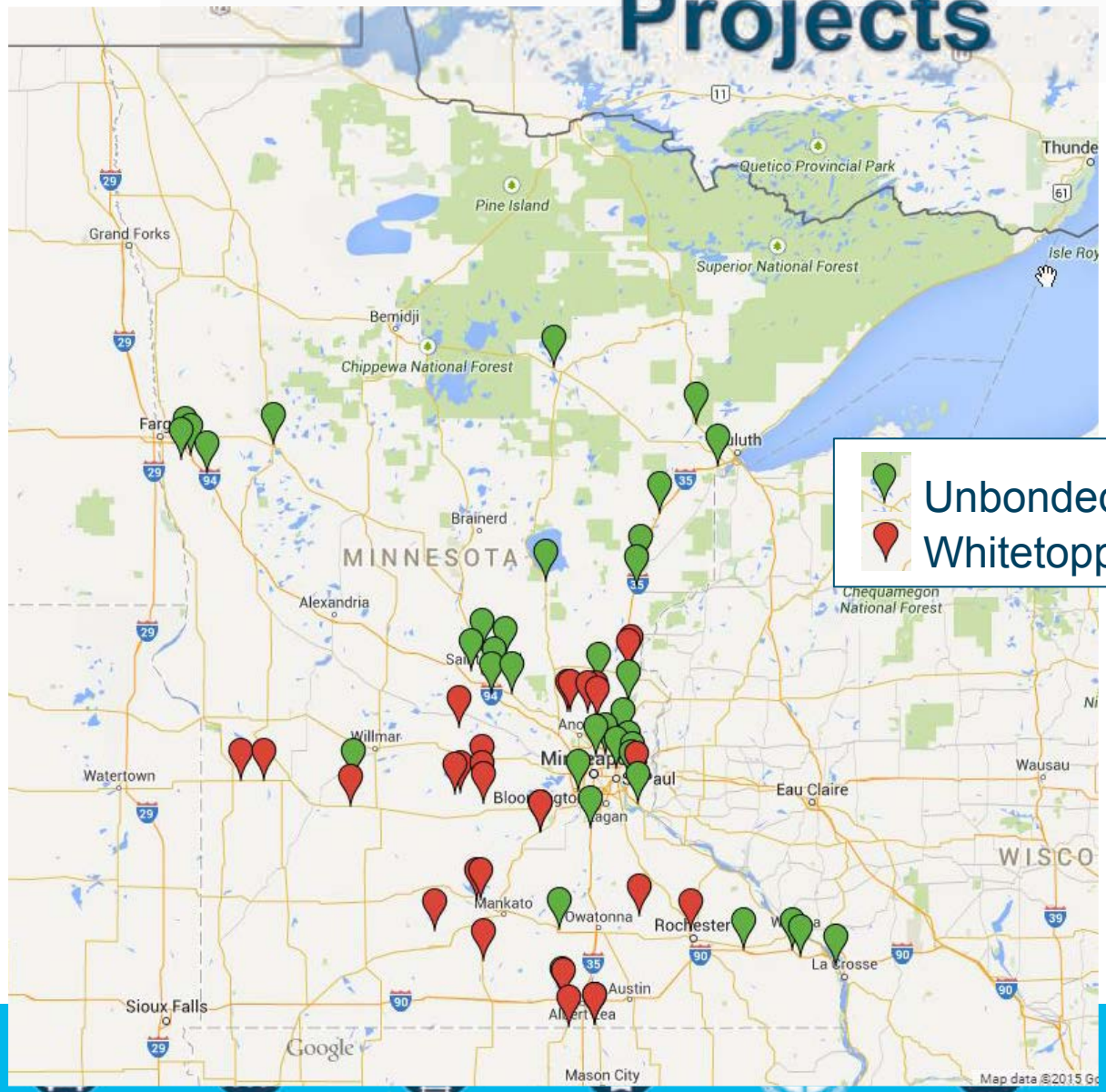
Unbonded Concrete Overlays of Composite Pavements

Figure 1. All concrete overlay systems can be categorized as either bonded or unbonded

Concrete Overlays Experience (Pre-2010)

- Thick Unbonded Overlays
- BCOA (Whitetopping)
  - MnROAD test sections
  - 6” – Olmsted Ct – 1 mile (1982)
  - 6” - TH 30 in District 7 (1993)
  - 6” - TH 35 in Metro (2009)
  - 6” – TH 56 in District 6 (2009)
- Thin Unbonded Overlays
  - 5” undoweled - TH 53 in District 1 (2008 and 2009)
  - 6” doweled on TH 169 in District 3 (2009)

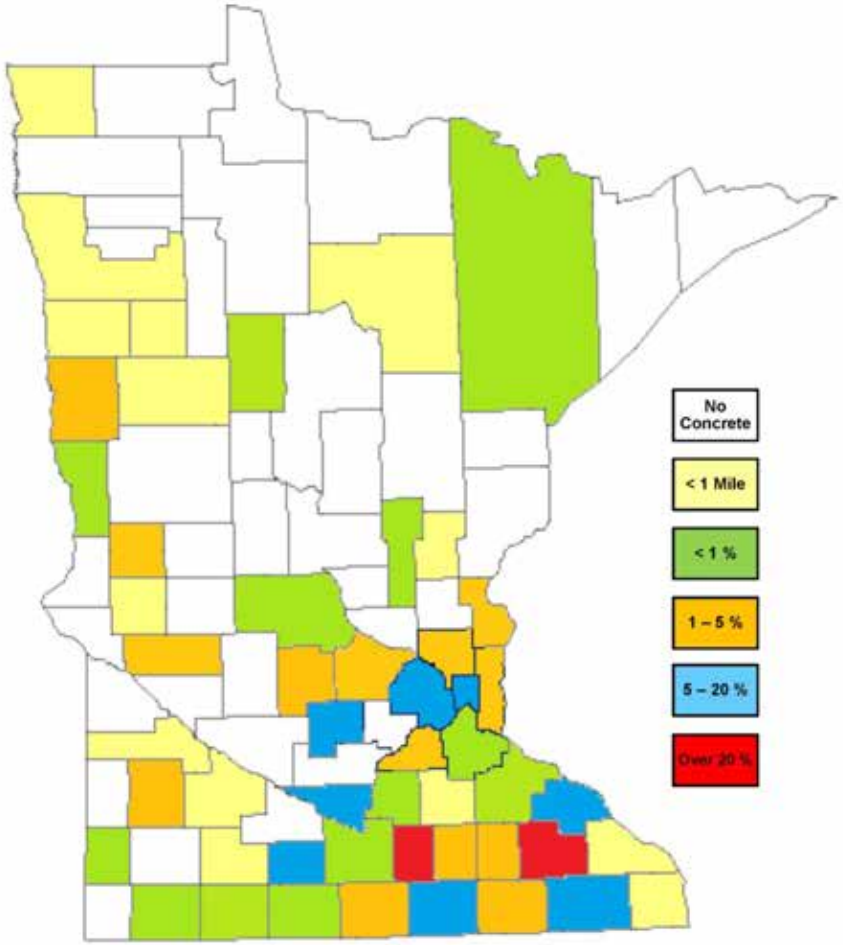
Minnesota BCOA and UBOL Projects

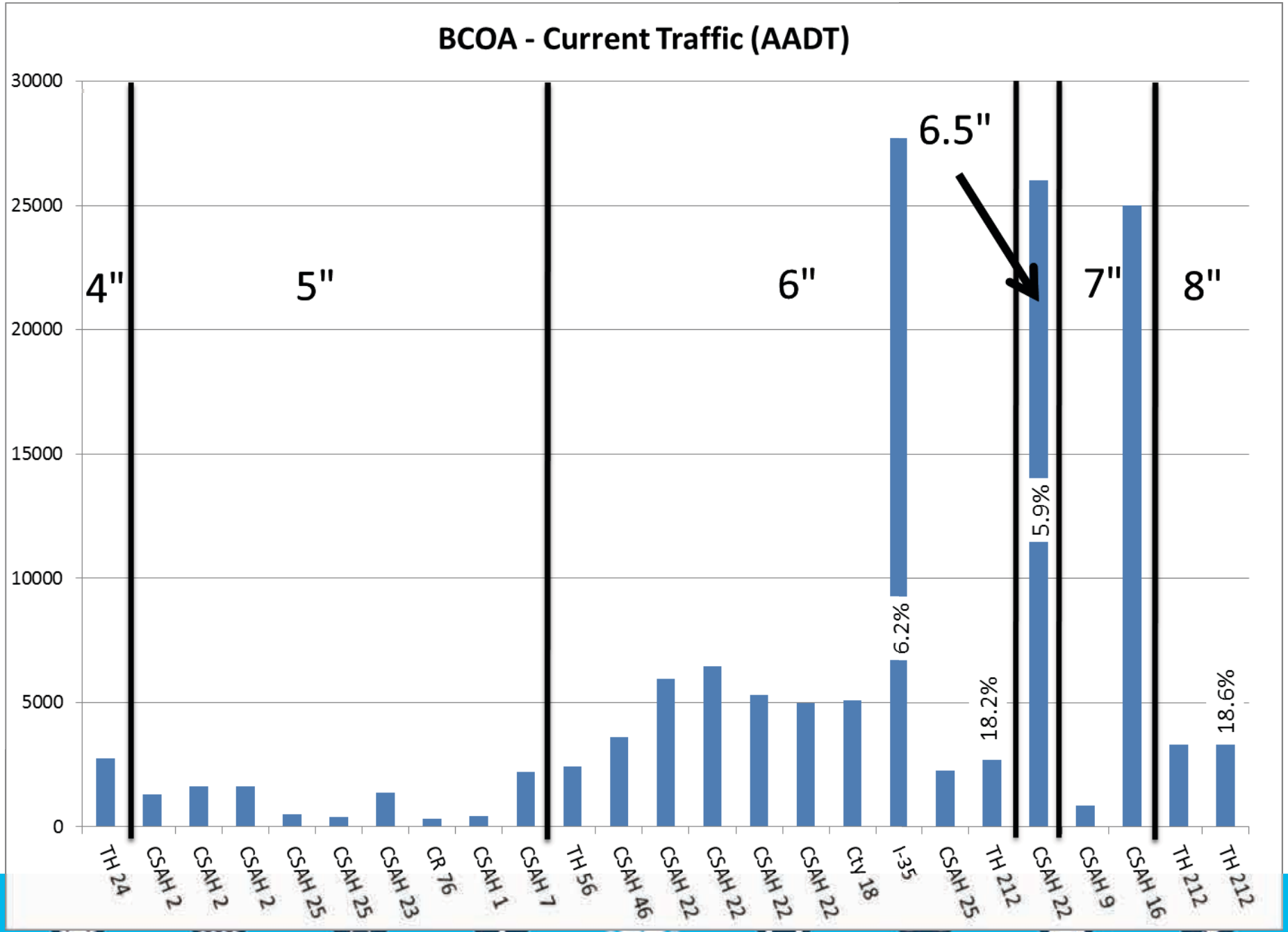


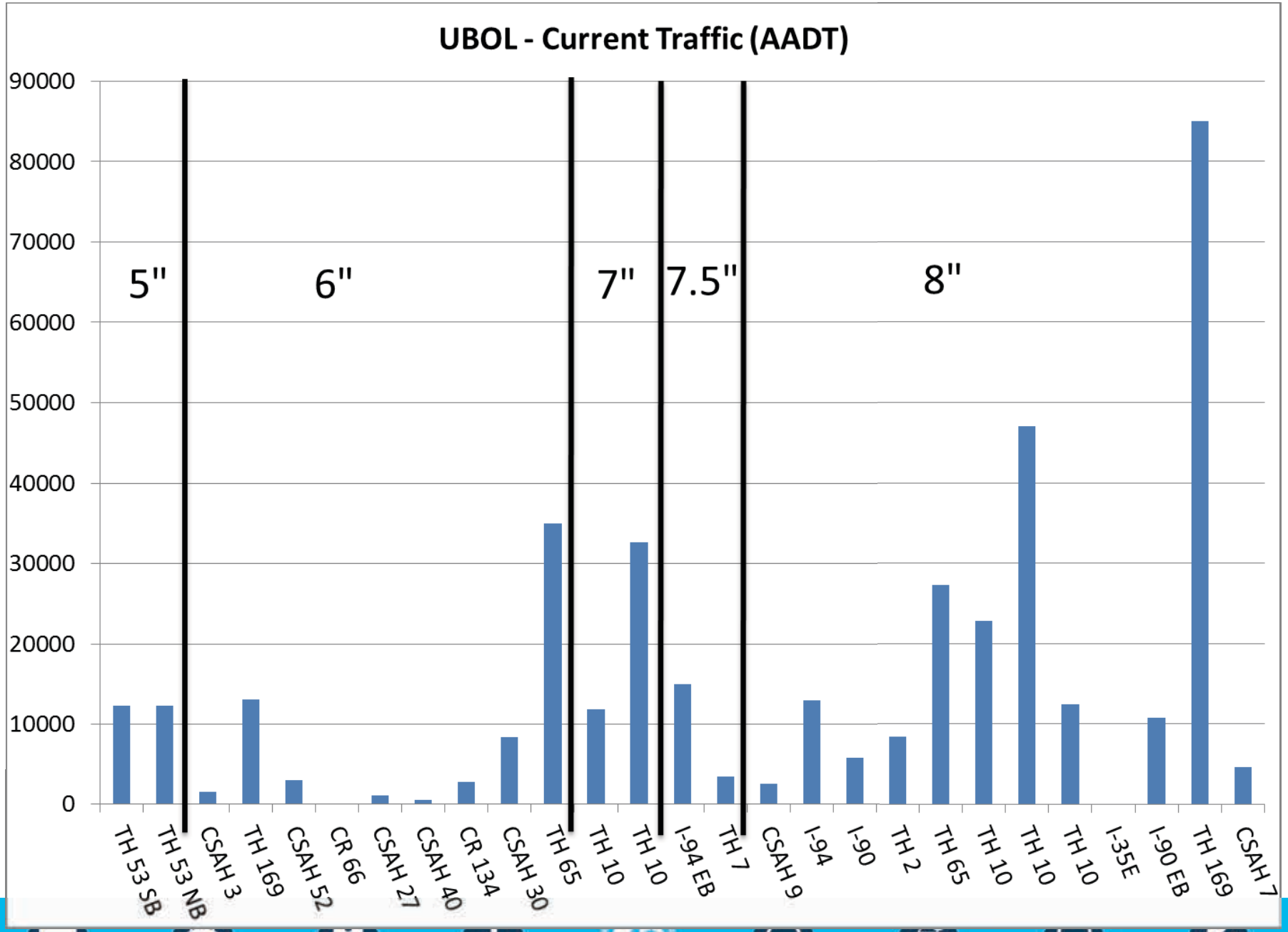
Unbonded Overlay (UBOL)
Whitetopping (BCOA)

CSAH Mileage
With Concrete Pavement

2014 Data

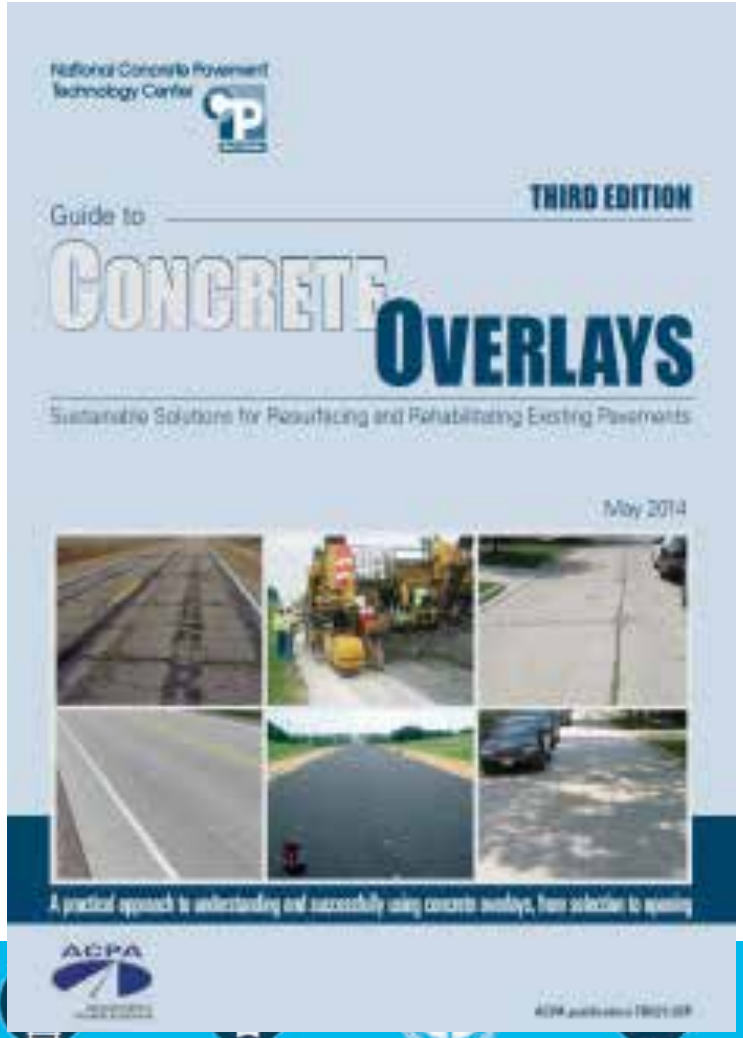



BCOA - Current Traffic (AADT)
30000
25000
20000
15000
10000
5000
0
4"
5"
6"
6.5"
7"
8"
6.2%
18.2%
5.9%
18.6%
TH 24
CSAH 2
CSAH 2
CSAH 2
CSAH 25
CSAH 25
CSAH 23
CR 76
CSAH 1
CSAH 7
TH 56
CSAH 46
CSAH 22
CSAH 22
CSAH 22
CSAH 22
Cty 18
I-35
CSAH 25
TH 212
CSAH 22
CSAH 9
CSAH 16
TH 212
TH 212


UBOL - Current Traffic (AADT)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
5"
6"
7"
7.5"
8"
TH 53 SB
TH 53 NB
CSAH 3
TH 169
CSAH 52
CR 66
CSAH 27
CSAH 40
CR 134
CSAH 30
TH 65
TH 10
TH 10
I-94 EB
TH 7
CSAH 9
I-94
I-90
TH 2
TH 65
TH 10
TH 10
TH 10
I-35E
I-90 EB
TH 169
CSAH 7

Concrete Overlay Resources

CP Tech Center Overlay Guide – 3rd Edition



Is the roadway a good candidate?

MNDOT PAVEMENT DESIGN MANUAL

Chapter 2 – Investigation

Chapter 2 - MnDOT Pavement Design Manual, Oct 31, 2014

10/31/2014

MnDOT Pavement Engineer Date

- Chapter 2 – Investigation
- Step-by-Step
- Recommend
  - GPR
  - Coring

Table 230.1 –Minimum Coring Intervals & for Use of GPR			
	Off-crack Cores	On-crack Cores	GPR
New/Reconstruction	1 per mile**	0	No
FDR/SFDR	1 per mile*	0	Yes
CIR	1 per mile*	1 per mile	Yes
PCC Overlay	1 per mile*	1 per mile	Yes
HMA Overlay	1 per mile	1 per mile	No

* Increase coring to two per mile if no GPR data will be collected.

What will the design look like?

- Chapter 5 – PCC
- Data Collection and Design Process
- Typical Sections

Table 510.1 – Program to Use for Whitetopping Design

Program	Design Life	BCOA-ME Candidate*	MnPAVE-Rigid Candidate**	Min. PCC Thickness
BCOA-ME	20	✓		4.0 Inches
MnPAVE-Rigid	20		✓	6.0 Inches
MnPAVE-Rigid	35	✓	✓	6.0 Inches

PCC Overlay design - Whitetopping

- Milling the asphalt is typical to reduce grade adjustments
  - Critical if <6” proposed concrete thickness
  - Mill to at least ½” below existing lift line
- Minimum of 3” good asphalt (No more than 15% of cores < 4”)
- Perform patching of working cracks and potholes prior to overlaying

PCC Overlay design – Unbonded OL

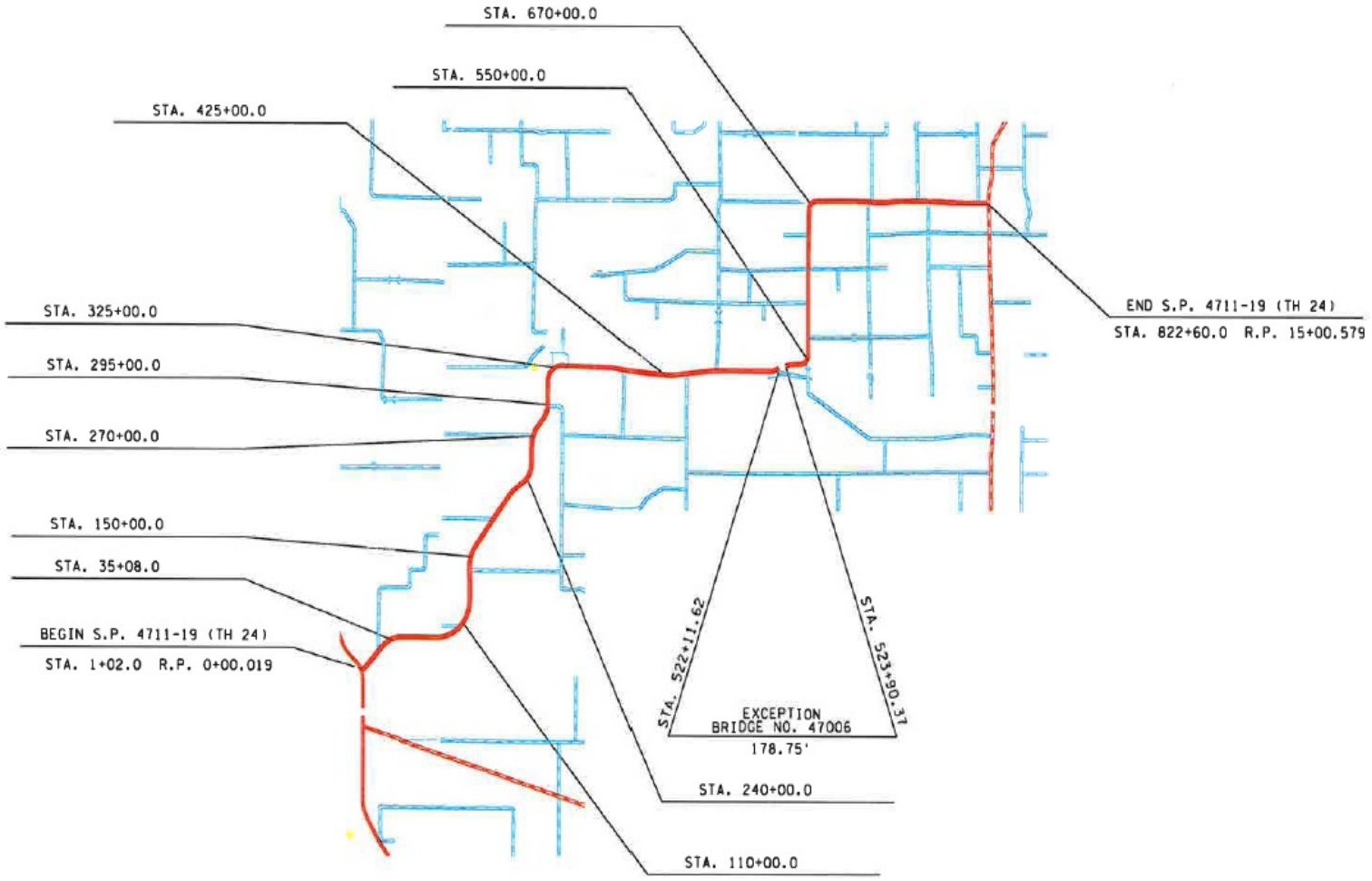
- Localized patching with HMA
- Correct superelevations with HMA
- Correct crown in concrete
- Bond Breaker layer options
  - PASSRC (1” – 2”) – dependent upon faulting
  - HMA (1” – 2”) – dependent upon faulting
  - Geotextile Fabric (1/4”) – not recommend for faulted concrete

Joint Spacing, Dowel Bars and Tie Bars

Table 530.1 – PCC Joint Spacing/Dowel Bars					
PCC Thickness	Joint Spacing		Dowel Bars		All Longitudinal Joints
	Longitudinal (Panel Width)	Transverse (Panel Length)	Size	Number (Per 12' Lane)	
≥ 10 ½ inches	12' – 14'	15'	1 ½" dia. Dowels	Full-Set (11 dowels)	No. 5 tie bars (36" long)
8-10 inches	12' – 14'	15'	1 ¼" dia. Dowels	Full-Set (11 dowels)***	No. 4 tie bars (30" long)
7 & 7.5 inches	12' – 14'	15'	1" dia. Dowels	Full-Set (11 dowels)***	No. 4 tie bars (30" long)
6 & 6.5 inches *	12' – 14'	12'	1" dia. Dowels	Full-Set (11 dowels)***	No. 4 tie bars (30" long)
6 & 6.5 inches *	6' – 8'	6'	Un-Doweled		No. 4 tie bars (30" long)**
4 -5.5 inches	6' – 8'	6'	Un-Doweled		See **Figure 510.4****

* 6.0 & 6.5-inch overlays may have either 12'-14'x 12' or 6'-8'x6' panels. Contact the MnDOT Pavement Design and Concrete Engineers to determine the best option.

TH 24 Bonded Concrete Overlay (Whitetopping)

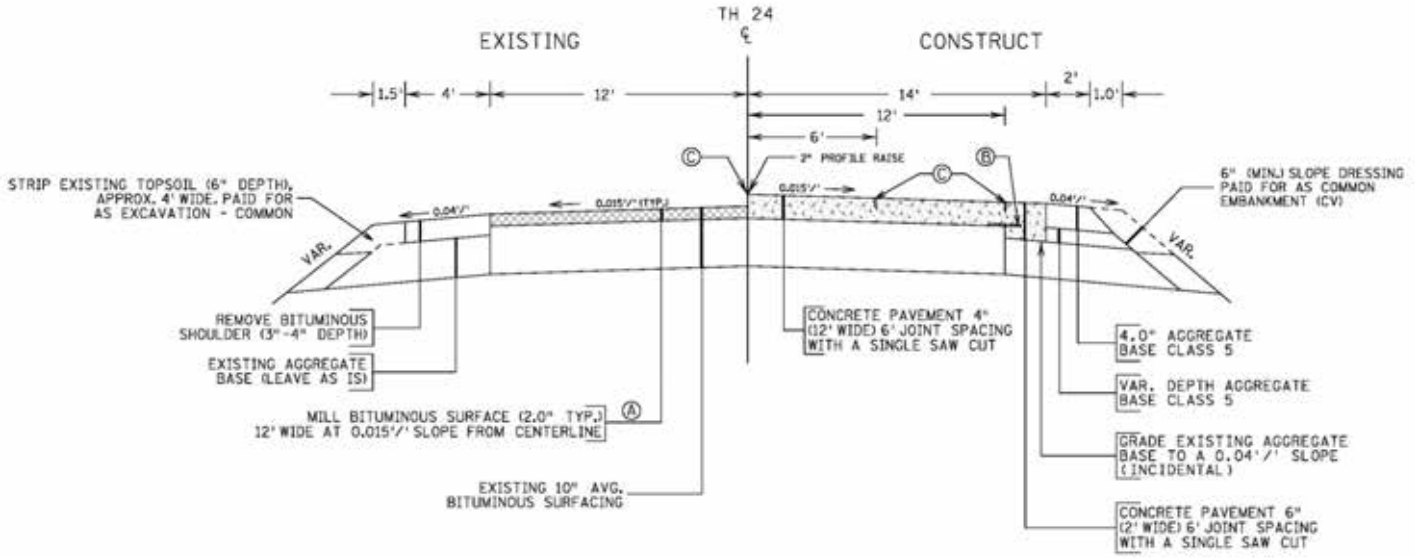


Pre-construction Training

- MnDOT Central Office gave District 8 $4 million to convert a 3” bituminous mill and overlay to a 4” concrete overlay
- CP Tech Center provided training for both MnDOT and Construction Personnel
  - Provided training for approximately 30 people
  - Requested contractor subs attend also (sawing key!)

TH24 Litchfield BCOA - Design

- Constructed Summer 2014
- Approx. 15 miles
- 4” Concrete overlay
- 6’ x 6’, 6’ x 8’ panels
- ½ of joints sealed, ½ unsealed



HMA condition - post milling

Edge broke off – removed some and bridge the rest with rebar

Challenge – Thickness Control

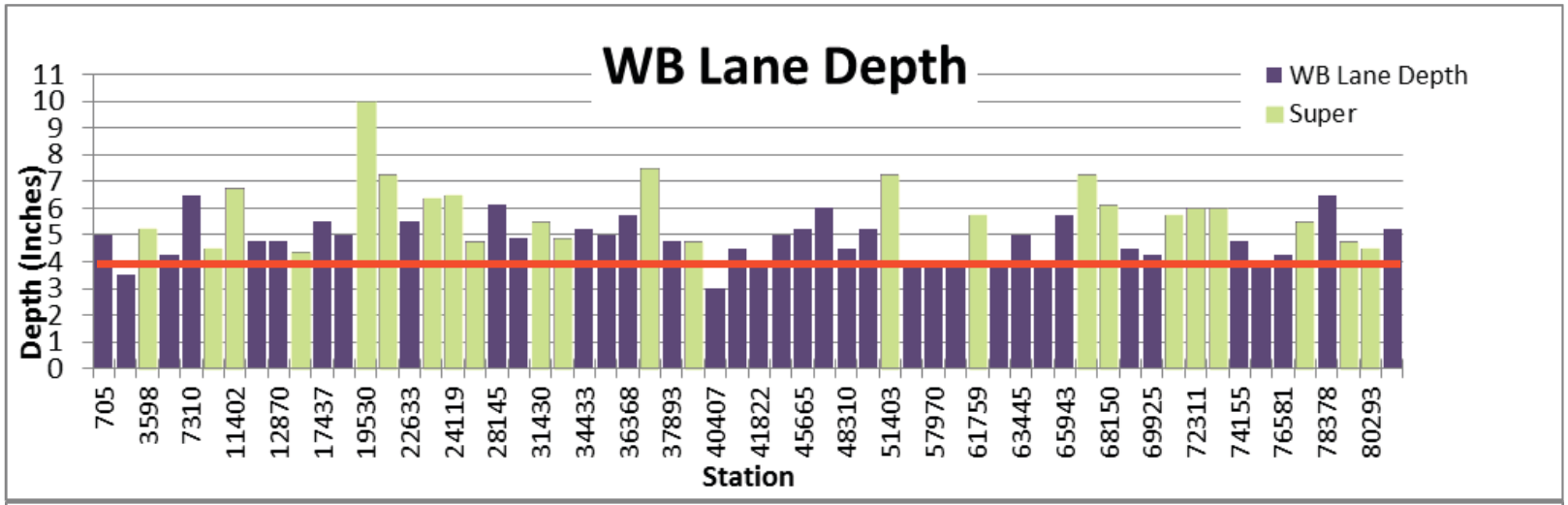
- The Contractor was told to maintain a minimum of 4” thickness.
- Milling to a string line and paving off the same string line profile would aid in controlling the thickness.
- The super elevated curves on this project were an extreme challenge.

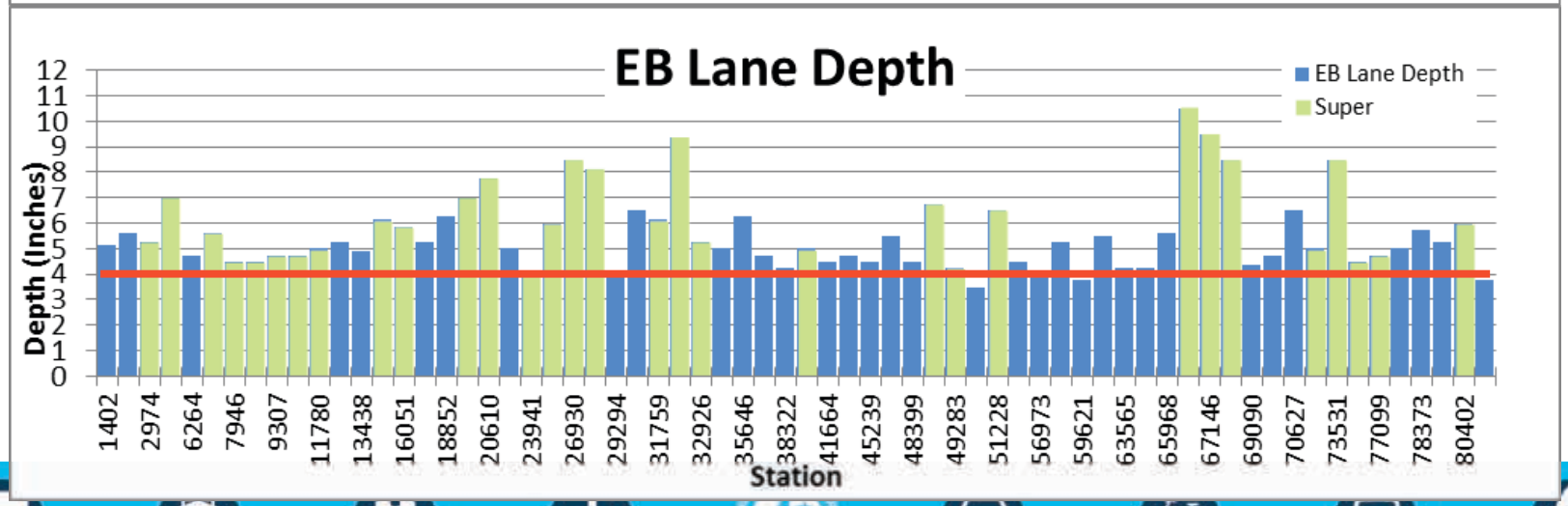
Challenge - Concrete Thickness Control

Success

- Concrete office used MIT-Scan-T2 to verify probe thickness
- Reduced the number of cores in the new pavement.

TH 24 MIT-Scan-T2 Thickness Measurements





Challenge - Thickness Overruns

- By looking at the probe data though, the overall average depth of the whole project is **5.42”, vs. 4”** a 30% difference.
- Project was paved to a profile rather than milled to a profile
- Plan was designed to the current super design

Challenge – Narrow Shoulders

Difficult to set string line for paving.

Challenge – Widening roadway

- Existing width 24 ft – Final width 28 ft
- Thickened edge was tied to the existing mat with 30” bars – Needed 36” bars in some areas
- Very labor intensive.

Success

- Anticipated paving one lane at a time
- Paved Full Width – Contractor used a shuttle system to move residents in and out of pavement curing areas.

Challenge

- Guardrail at the bridge
- Plan called for leaving guardrail in place and paving to bridge approach panel.
- Difficult survey situation and the ride quality at the bridge suffered.

Challenge

- Contractor Plant and production issues.
- Inconsistent supply of cement and fly ash
- Compatibility Issues between materials

Challenge – Concrete Curing

- With the 4 inch design and fear of shrinkage cracking, it was noted that more cure was needed to obtain the “white sheet of paper” finish. Instead of two barrels spaced out along project, three barrels were needed.

Success - Sawing

- Contractor built a system to deliver the water needed to operate all 7 saws at one time which allowed them to space water trucks out at intersections. (Project was paved full width)

Challenge – Pavement Removal

- Approximately 1000 ft section needed removal due to surface consolidation and finishing issues
- Proved difficult due to the fact that the concrete was bonded to the in-place asphalt.
- The Contractor chose to mill the 4+ inches of concrete for removal.

Challenge - Pavement Removal

- Milled the main 24’
- Jackhammered the transition area and the 6” widened area.
- Broomed, powerwashed and sandblasted
- New reinforcement placement.
- Prepped both headers and pour.
- Appeared very labor intensive and costly compared to just cutting it out and replacing it.

TH 24 Open House

Spring 2015: Lessons Learned Open House

- Hosted by MnDOT
- Presentations by MnDOT and CpTech Center

MnDOT BCOA "Whitetopping" Efforts

- Committed to building more BCOA projects
- MnDOT Technical Working Groups Priorities
  - Pavement Design
  - PCC
  - Pavement Management
- Further evaluation of existing projects
- Development of performance curve
- Standard process for evaluation of potential candidates

MnDOT Construction Efforts

- Standard Plan Sheets for Concrete Overlays
- Sample Plan for Whitetopping
- Stringless Paving Spec

Concrete Paving Class

- March 27-28, 2015
- MnDOT Training and Conference Center – Arden Hills
- 2-day class (very similar to 2014)
- Registration announcement coming soon

Questions?