Concrete Office Updates

2012 Spring MEO Meeting

Maria Masten

April 19, 2012

Concrete Mix Designs

- Do you still want to receive copies of MnDOT mix concrete mix designs?

MnDOT TP-02406-02 (4-09)

Minnesota Department of Transportation
Estimated Composition of Concrete Mixes

To: Clay Pitts S.P.: 1020-30

Address: P.O. Box 325, Mill City, Mn 55101

Material	Pit Number	Cement Manufacturer, Flyash Generating Plant, or Aggregate Source			Type or Class	Grad No.	SPG.	Absorp.	F.M.
Cement	-----	(Any Certified)			I/II	-----	3.15	----	----
Fly Ash	-----	(Any Certified)			C	-----	2.58	----	----
Fine Agg.	23456	Salinger, Lakeland			----	----	2.64	.008	2.80
Coarse Agg. No. 1	23456	Salinger, Lakeland	CA	70	C	3/4-	2.70	.014	----
Coarse Agg. No. 2	23456	Rock Island, Falls City	50	30	C	3/8-	2.65	.016	----
Coarse Agg. No. 3									----
Coarse Agg. No. 4									----

Admixtures: A. E. A. (Type 3 Concrete) Water Reducers or Retarder (M1 and M2)

										Estimated Batch Weights- Pounds (Dry)				
											Coarse Agg			
Ref	Mix	W/C Ratio	C/V Ratio	Slump Range without WR	Slump Range with WR	% Air	Port Cement	Fly Ash	Water	Fine Agg.	No.1	No.2	No.3	No.4
2.80	1A43	0.53		2-4	2-5	1.5	507	89	298	1347	1266	533		
	1C62	0.68		3-6	3-7	1.5	407	72	320	1268	1353	569		
	3Y43	0.45		2-4	2-5	6.5	557	98	292	1167	1241	522		
	3A22	0.45		1-2	1-3	6.5	468	83	247	1300	1267	533		
	3A32	0.45		1-3	1-4	6.5	489	86	259	1208	1297	546		
	3A32HE	0.45		1-3	1-4	6.5	749		284	1129	1212	510		
	3A34	0.45		1-3	1-4	6.5	501	88	265	1286	1221	513		

NOTICE:
ALL TESTS AND SAMPLE RATES MUST COMPLY WITH THE MATERIALS CONTROL SCHEDULE

Copy To:

Dist	M	Materials
	Extra:	4

Note: Adjust above dry weights for moisture contained in the aggregates
Ready-mix batches are based on 27.00 cubic feet +1%

Date: 9/18/2009

Mica Schist
Concrete Engineering Specialist

2012 Special Provisions – 2461.4D7

- Provides electronic platform scales for weighing all materials.
  - Measure to nearest 0.02 kg

Production of 3U18 Bag Mixes

- Currently produced only in Roberts, WI
- Certified Plant Program
  - Will allow manufacturer of 3U18 Pre-bagged mixes
  - Requires QC Plan and Quality Control Testing
  - Once a year visits by MnDOT personnel to "certify" the plant
- Expect to see 3U18 production in surrounding states for Minnesota projects
  - TCC added new production facilities in Iowa, South Dakota, North Dakota, Wisconsin, Minnesota and Nebraska

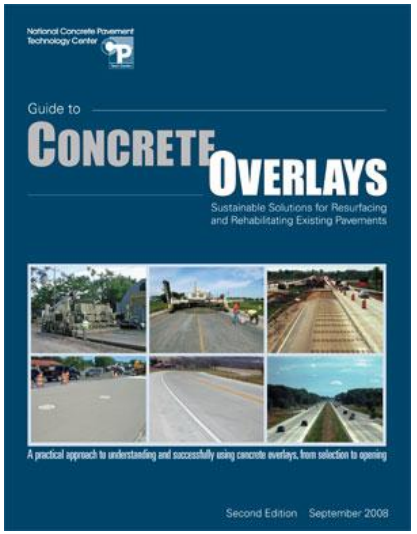
Current Concrete Research Projects

- Maturity Methods for Concrete Paving
- Concrete Delivery Time Specifications
- Practical Design Procedure for Whitetopping
- Evaluation of Geotextile Fabric Bondbreaker
- Evaluation of Current Carbonate and Absorption Aggregate Spec Limits for Paving and Bridge Superstructure
- Partial Depth Patching Repair Material Durability Project
- Durability of w/c ratio pavements
- Colored Concrete Specifications

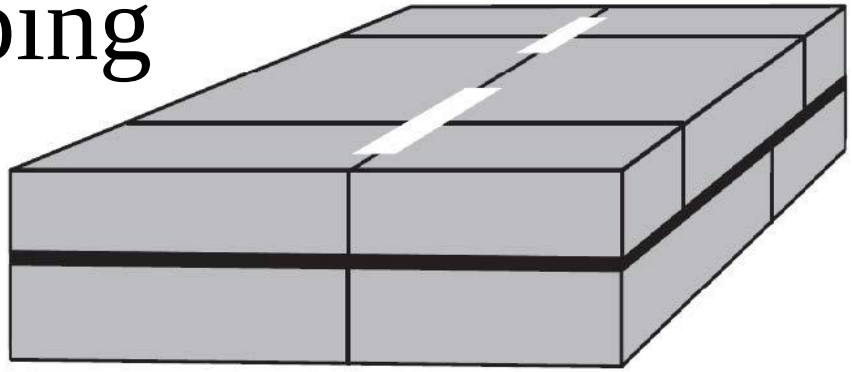
Measuring Sawcut Depths

- Seen some longitudinal cracking that does not appear to be subgrade related as is usually the case with longitudinal cracking.
- **Where we correct the cross slope in concrete – the centerline longitudinal joint is deeper than the transverse joint – it is important to ensure the Contractor is making adjustments in their sawing operation to adjust for this.**
- **In transverse joints where we correct the cross slope the t/3 measurement should be based on the minimum thickness of the pavement.**
- **For transverse joints in concrete overlays – the joint depth should be t/3 For all longitudinal joints – the joint depth should be t/3**
- A thin plastic ruler would be accurate enough to randomly take some saw cut depth measurements, another option would be the thin steel ruler that is used with the beam breakers. **I would suggest randomly checking the joints at least 1 time per day during paving.** Document the saw cut depths in your construction field diary.

Concrete Overlay Survey



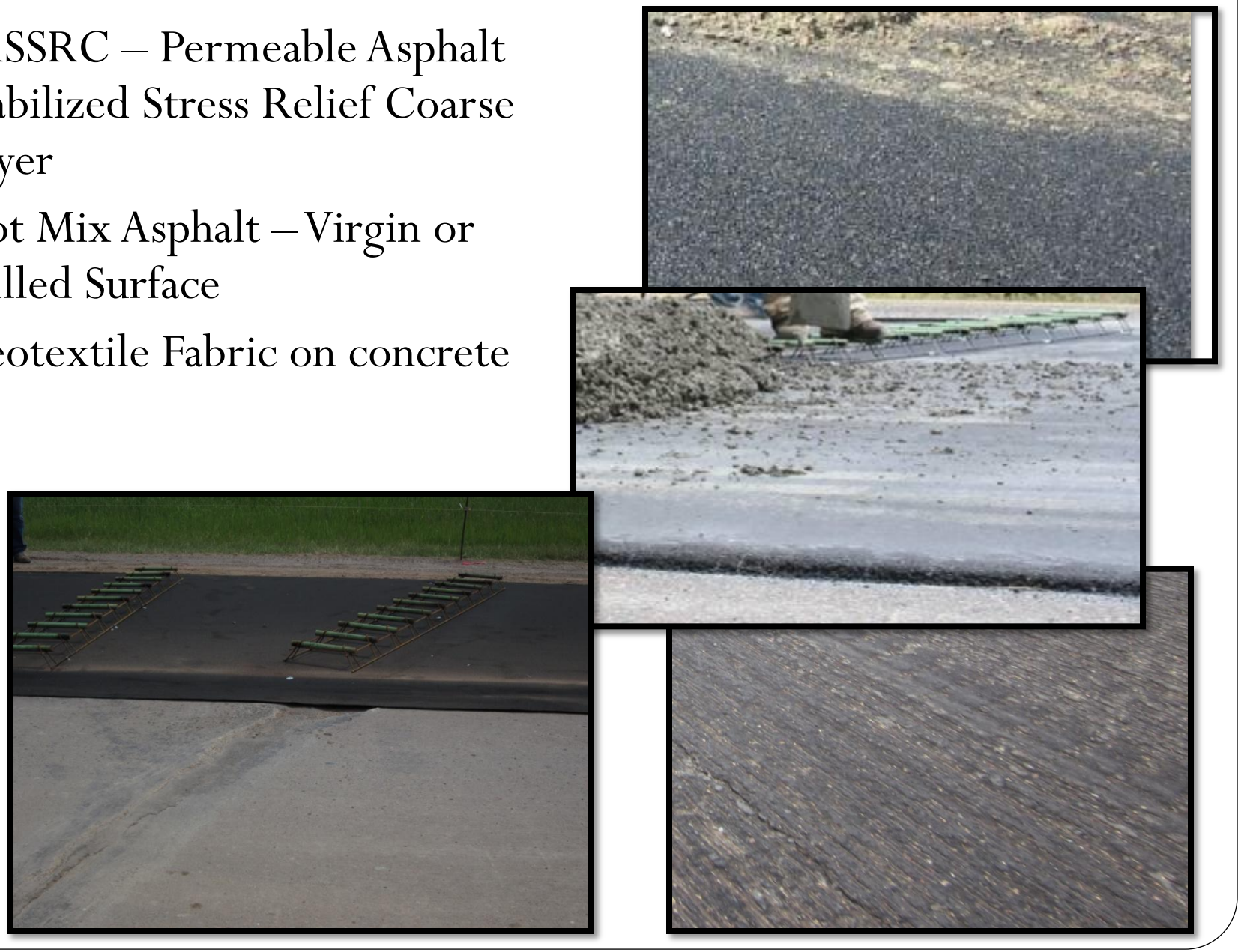
Whitetopping



Unbonded Concrete Overlay

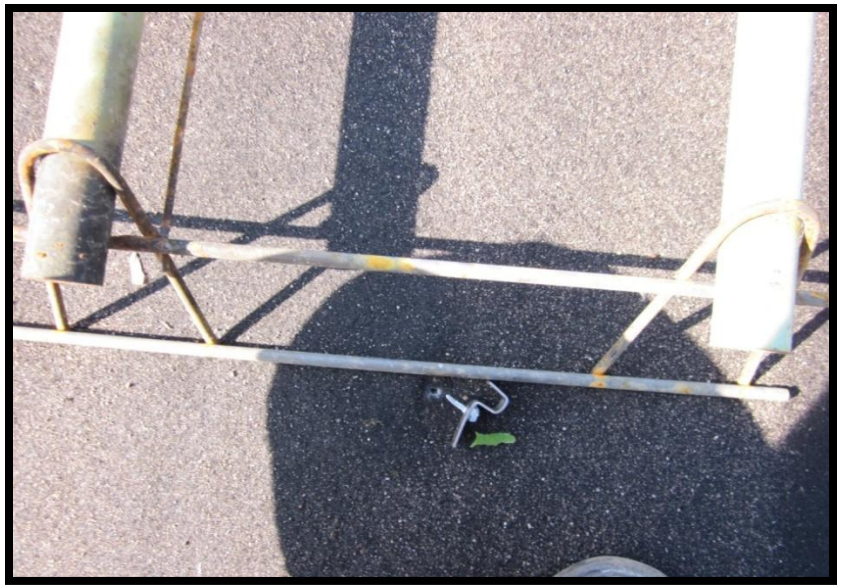
Bond Breaker Types Used in Minnesota

- PASSRC – Permeable Asphalt Stabilized Stress Relief Coarse Layer
- Hot Mix Asphalt – Virgin or Milled Surface
- Geotextile Fabric on concrete

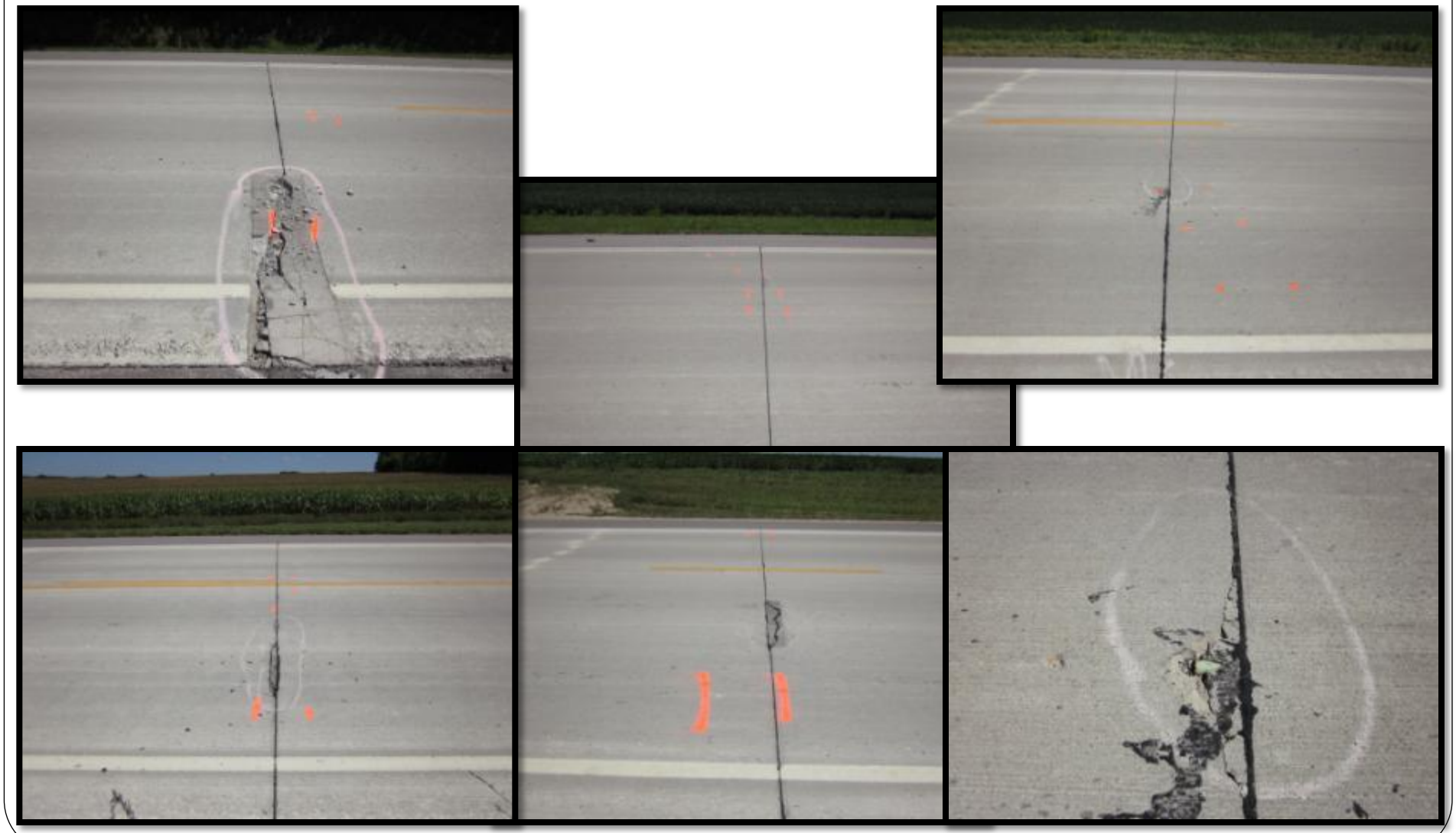


Anchoring Dowel Baskets

- On several projects, the Agency dedicated person to making sure baskets were anchored
- Anchor on the downstream side

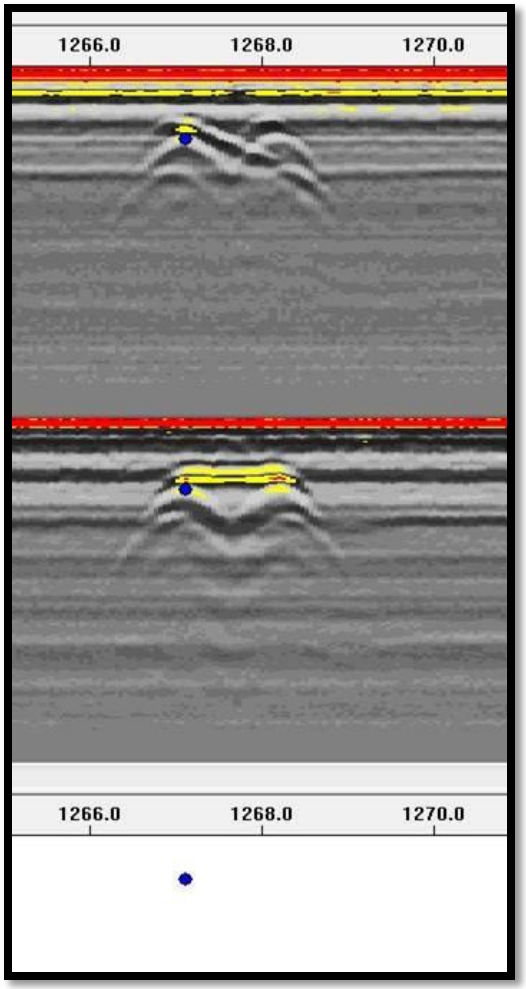


Misaligned Dowel Bars

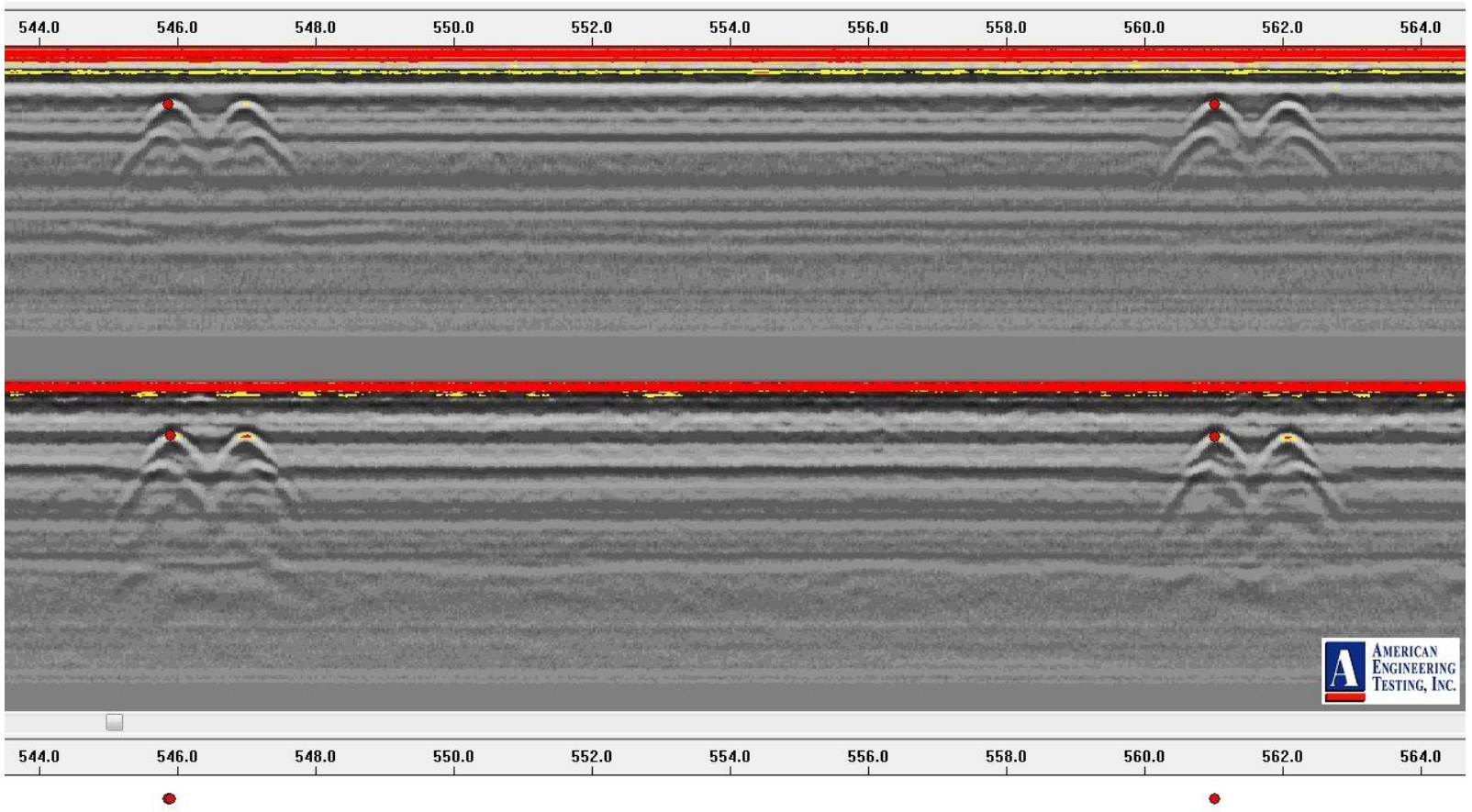


GPR Investigation

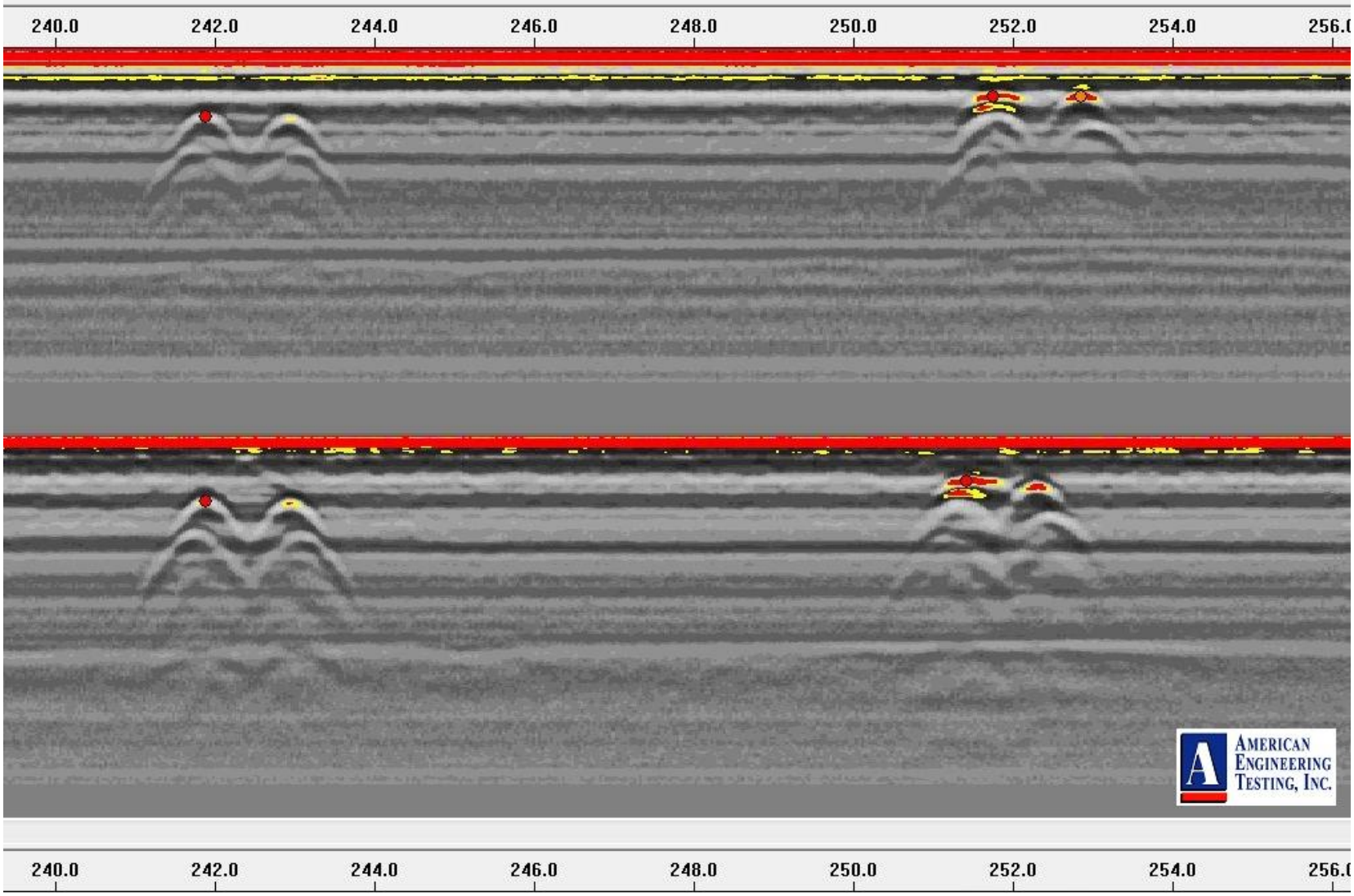
- Top scan shows a bar that has fallen into the basket
- Bottom scan shows a bar in its proper place.



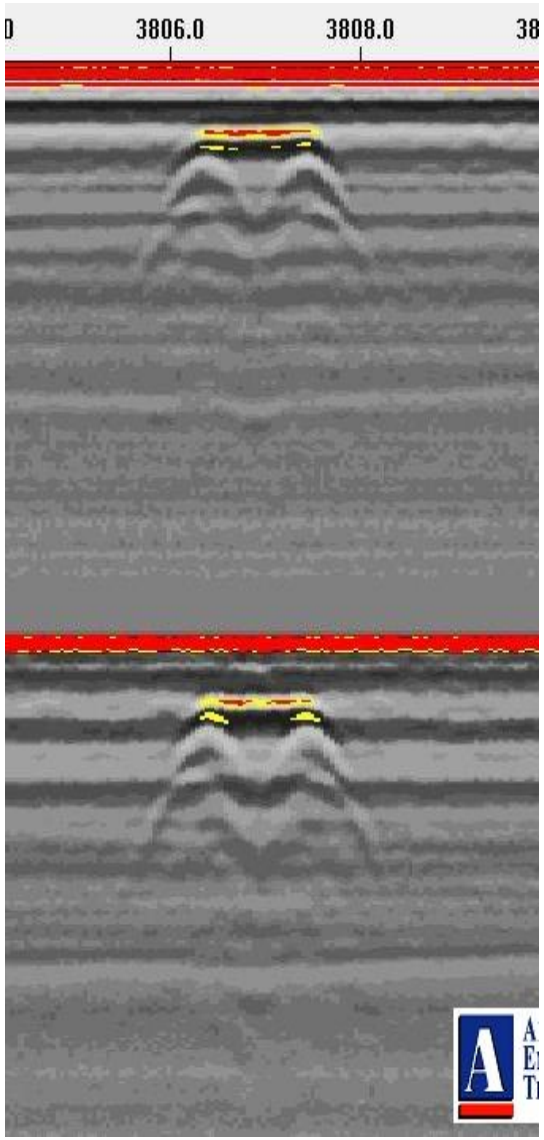
Normal Baskets



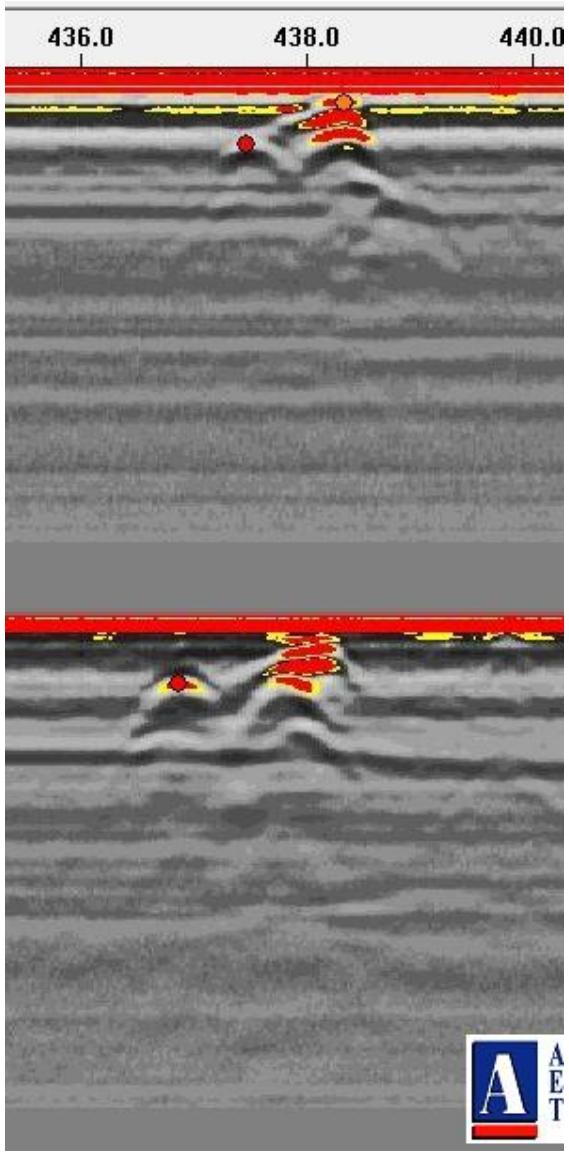
Moved Baskets



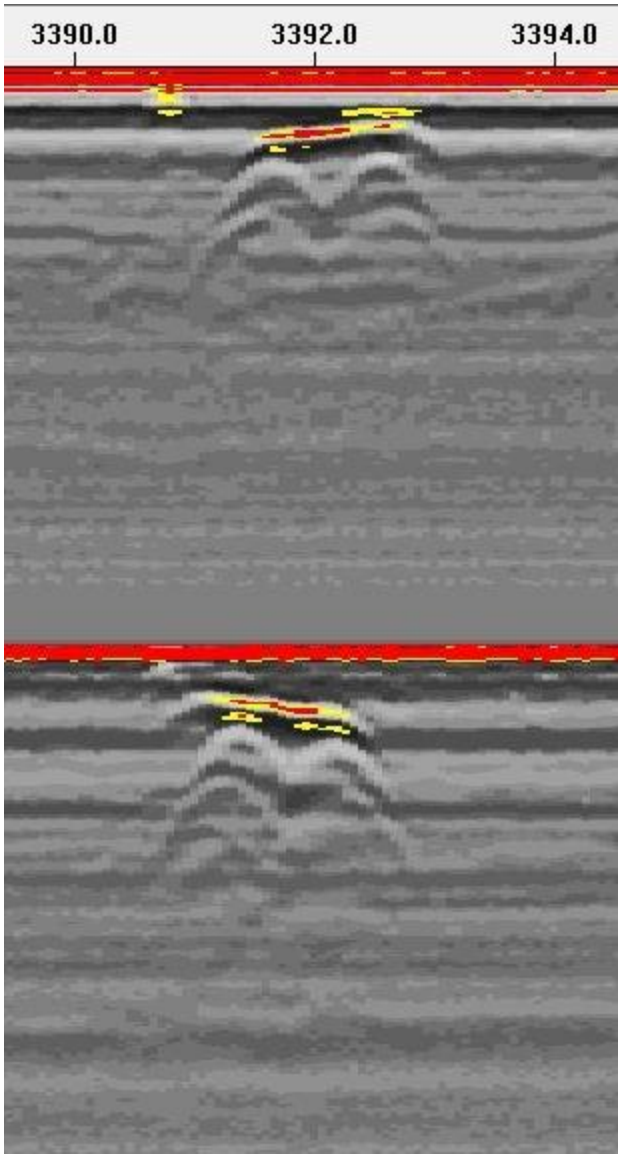
Normal Basket



Damaged Basket



Compressed Basket



Why is a QC Plan Needed?

MnDOT Requirements
QC Plan for Anchoring Baskets

- Provide a Quality Control Plan in writing to the Engineer for acceptance that provides a method for keeping the dowel basket assemblies anchored to the existing asphalt or bond breaker layer and into the underlying concrete.
- Contractor is required to demonstrate anchoring methods for overlays

MnDOT Requirements
QC Plan for Anchoring Baskets

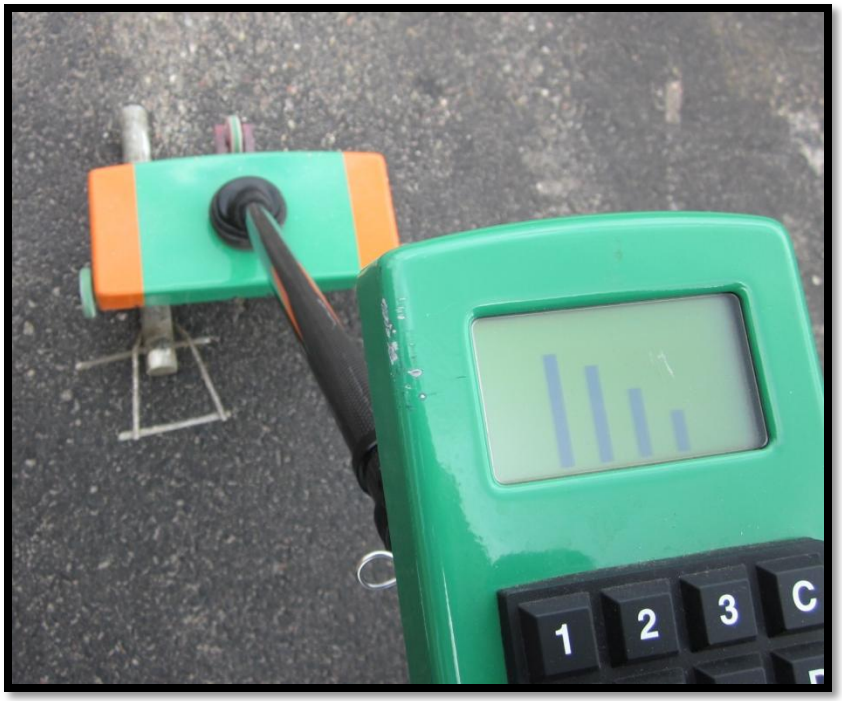
- The Quality Control Plan shall include the following at a minimum:
  - Proposed type and number of fasteners
  - Dowel basket assembly anchoring plan (ie. Anchored all basket assemblies prior to concrete placement, one lane at a time, anchor all basket assemblies during the concrete placement operation, etc.)
  - Procedure if assemblies do not hold with the proposed method (Plan B)
  - Sampling rate for locating basket assemblies with the MIT-SCAN T2

MIT-T2 Spec

- The Contractor shall furnish a MIT-SCAN T2 non-destructive testing device having the ability to measure the location of concrete reinforcement, dowel bars and concrete pavement thickness in a single device.
- Agency and Contractor personnel shall mutually use this non-destructive testing device several times a day during concrete pavement construction.

MIT-T2 Spec

- Agency observations do not relieve the Contractor of the requirement to properly place the concrete reinforcement and dowel bars as shown in the plans.
- In addition, the Department reserves the right to reject pavement in accordance "Conformity with Plans and Specifications" and 1512, "Unacceptable andd Unauthorized Work."

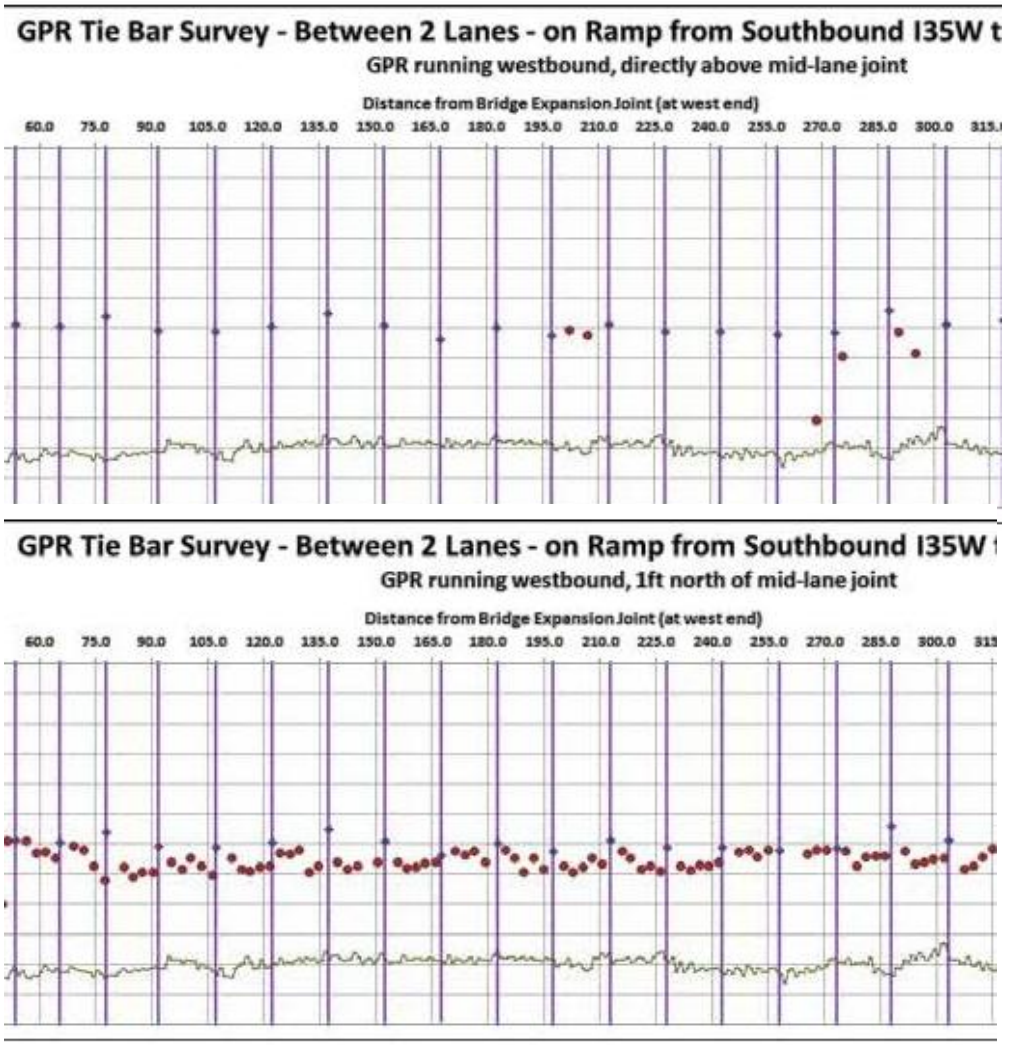


Coring/Probing Special Provisions

- Reduced coring by 50%
- Contractor Quality Control Probing (QCP),
- Probe Verification Core (PVC),
- Quality Assurance Core (QAC).

- Want additional thickness data with the MIT-SCAN T2
  - 5 projects were measured in 2010
  - Typical difference in any 2 types measurements is approximately 1.5 – 2%
  - Equates to 0.15 to 0.20 inch in pavement thickness (tolerance is 0.10 inch)

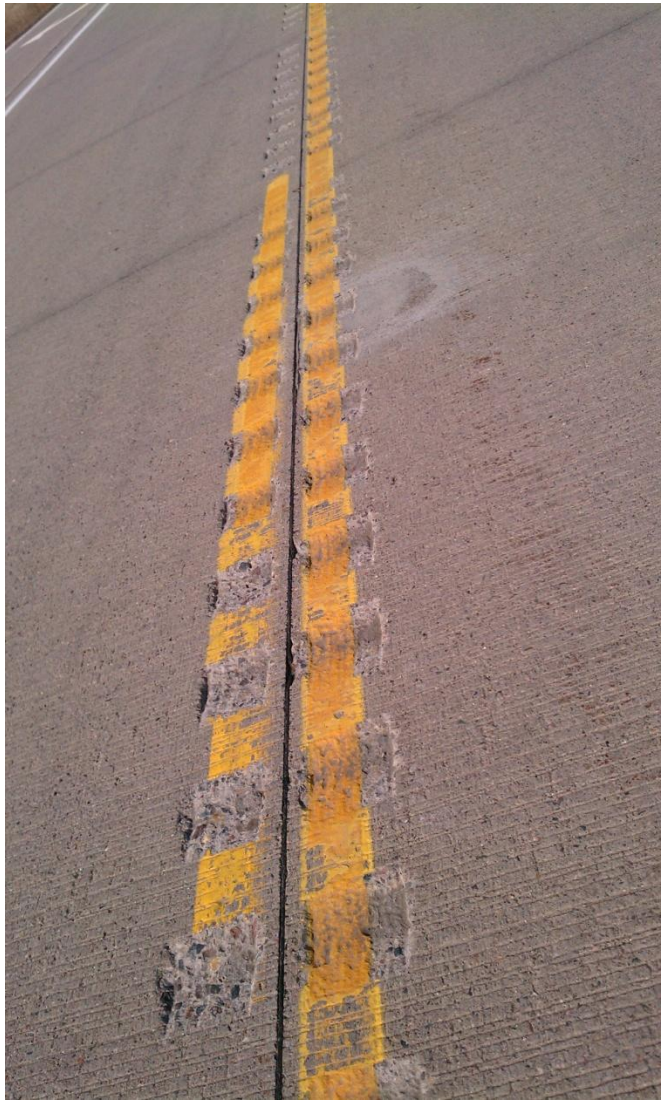
Misaligned Tie Bars



Technical Memorandum No. 11-02-T-02
Centerline Rumble StripEs

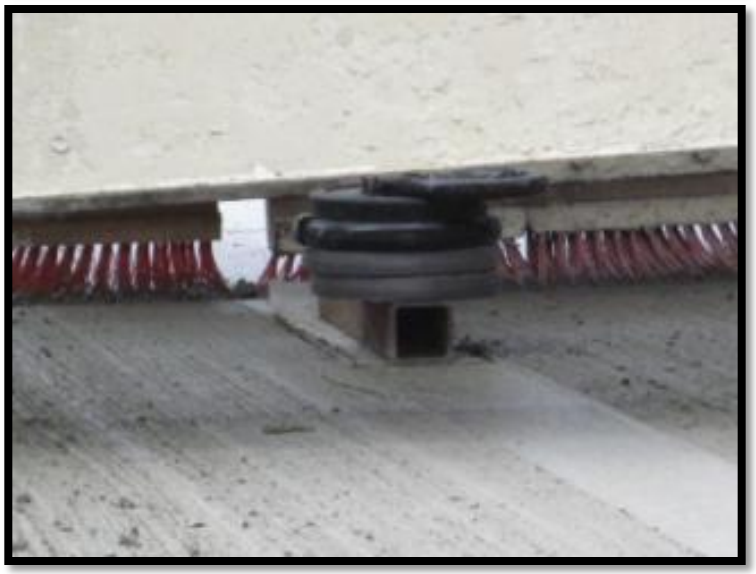
- Centerline rumble stripEs will not be required on concrete pavements until April 1, 2014 in order test out various installation methods; but if they are to be installed, the current recommended installation is two 8" wide rumbles on either side of the centerline joint (each 2" away from the joint).

Ground in Centerline Rumble Strips



Recessed Impression for Striping

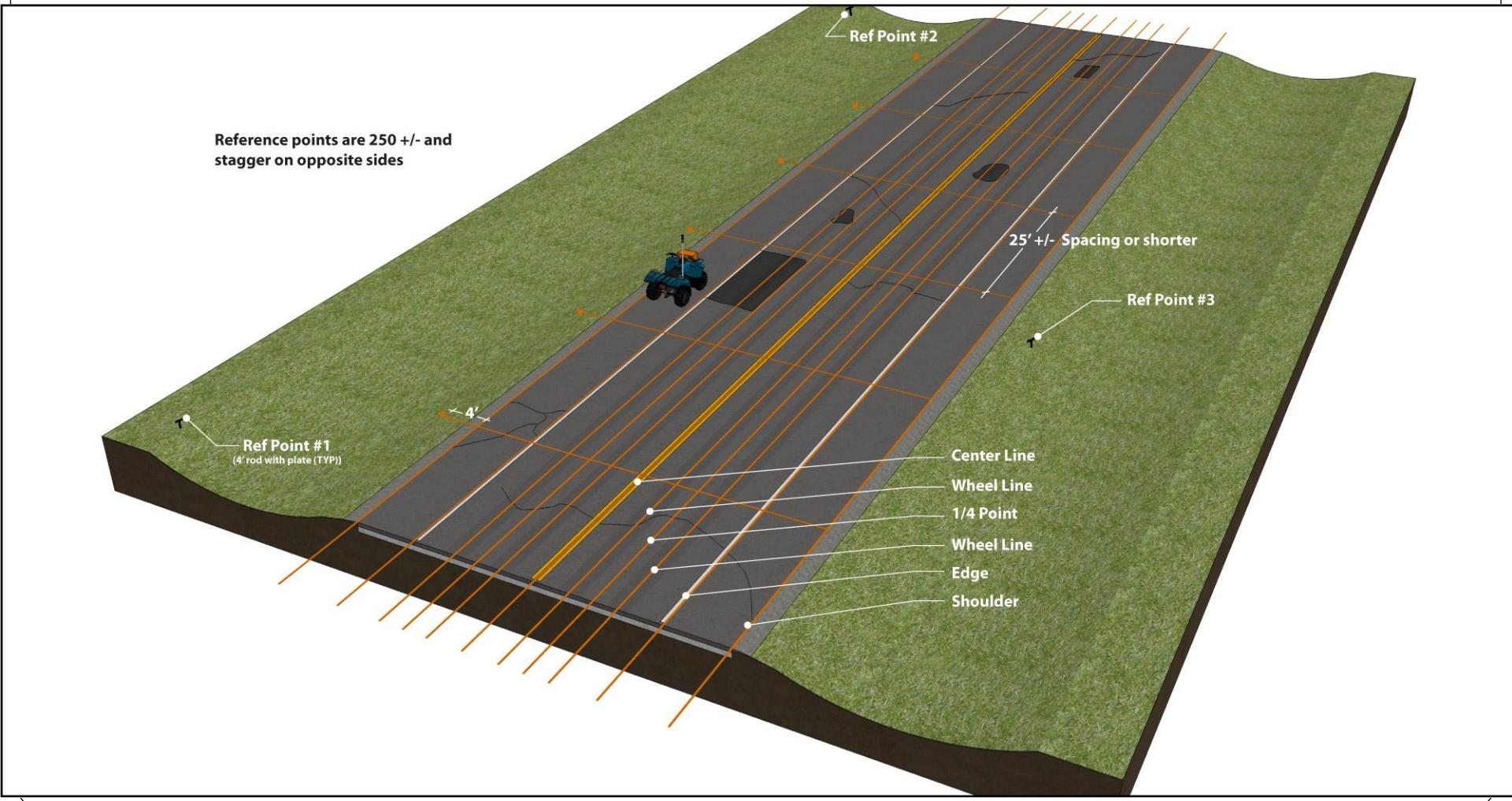
- Installed in plastic concrete
- Used in several counties
- Plan to use in D1 project in 2012
- Looking for other projects to try it on also



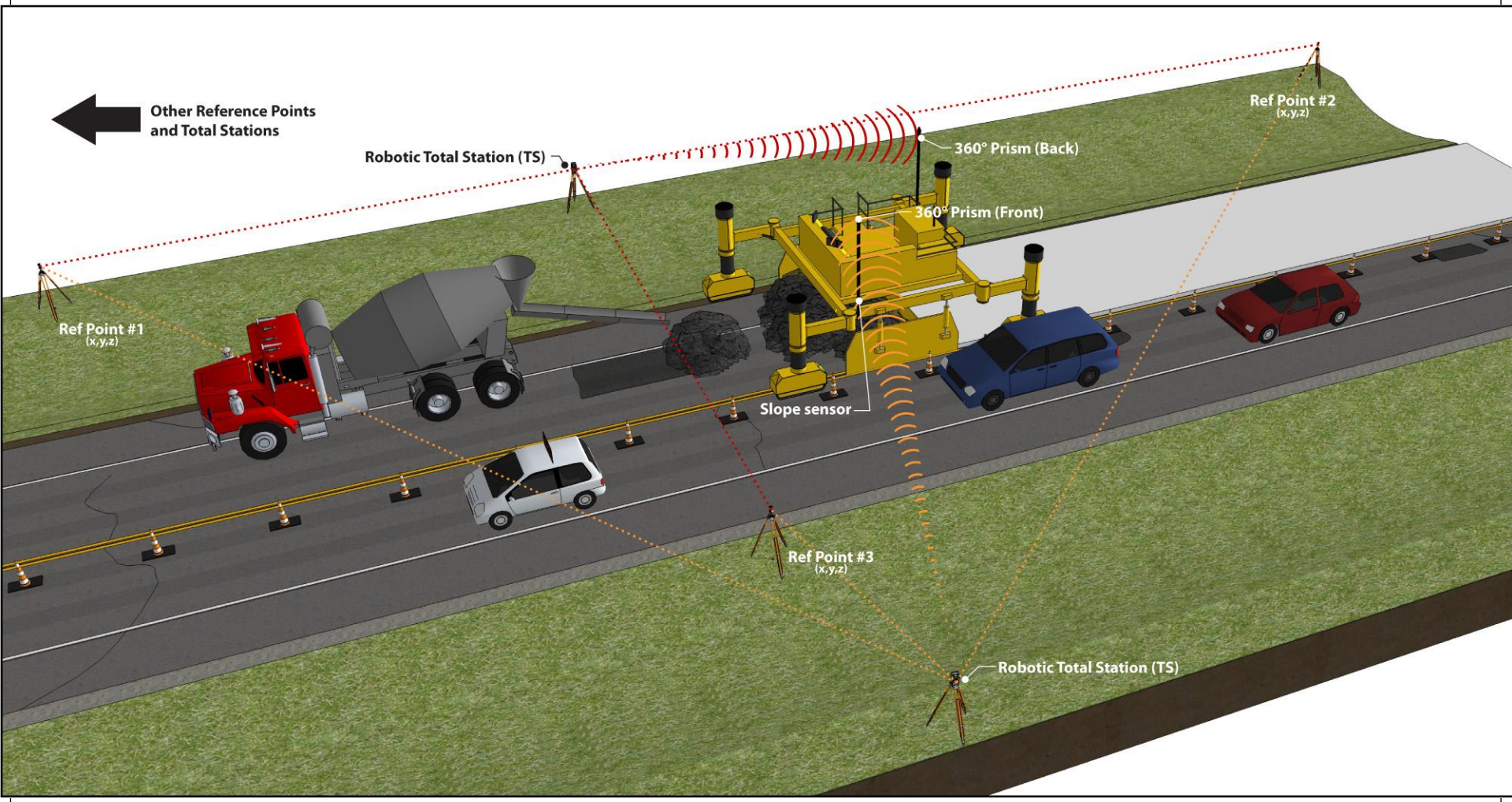
Recessed Impression for Striping

- Benefits
  - Longer striping life…
  - Potential for no joint damage from milling concrete to place striping

Stringless Paving Survey Grid



Stringless Paving



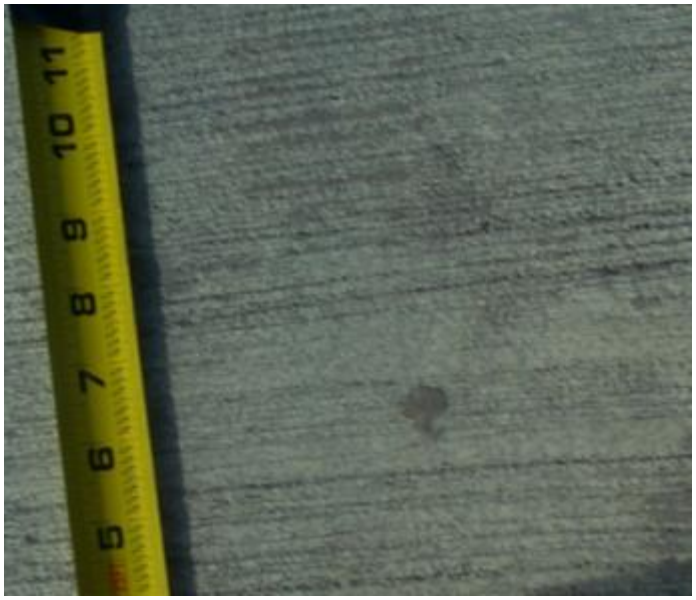
Drag Texture Direction Initiatives

2008

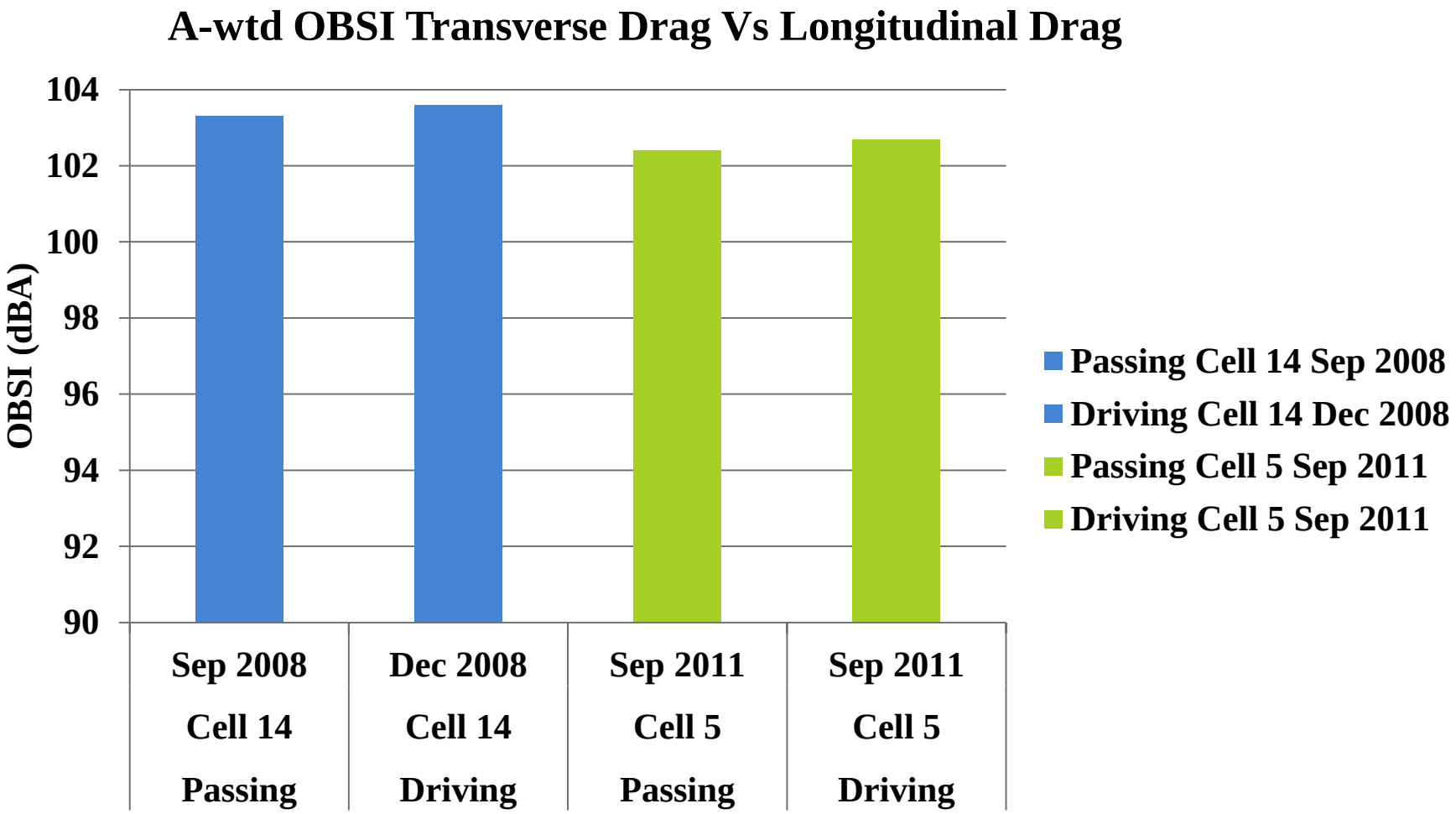
- Longitudinal Broom Drag and Turf Drag Cells 13 and 14
- Transverse Broom Drag Cell 53 MnROAD

2011

- Cell 5 (East End) Transverse Drag

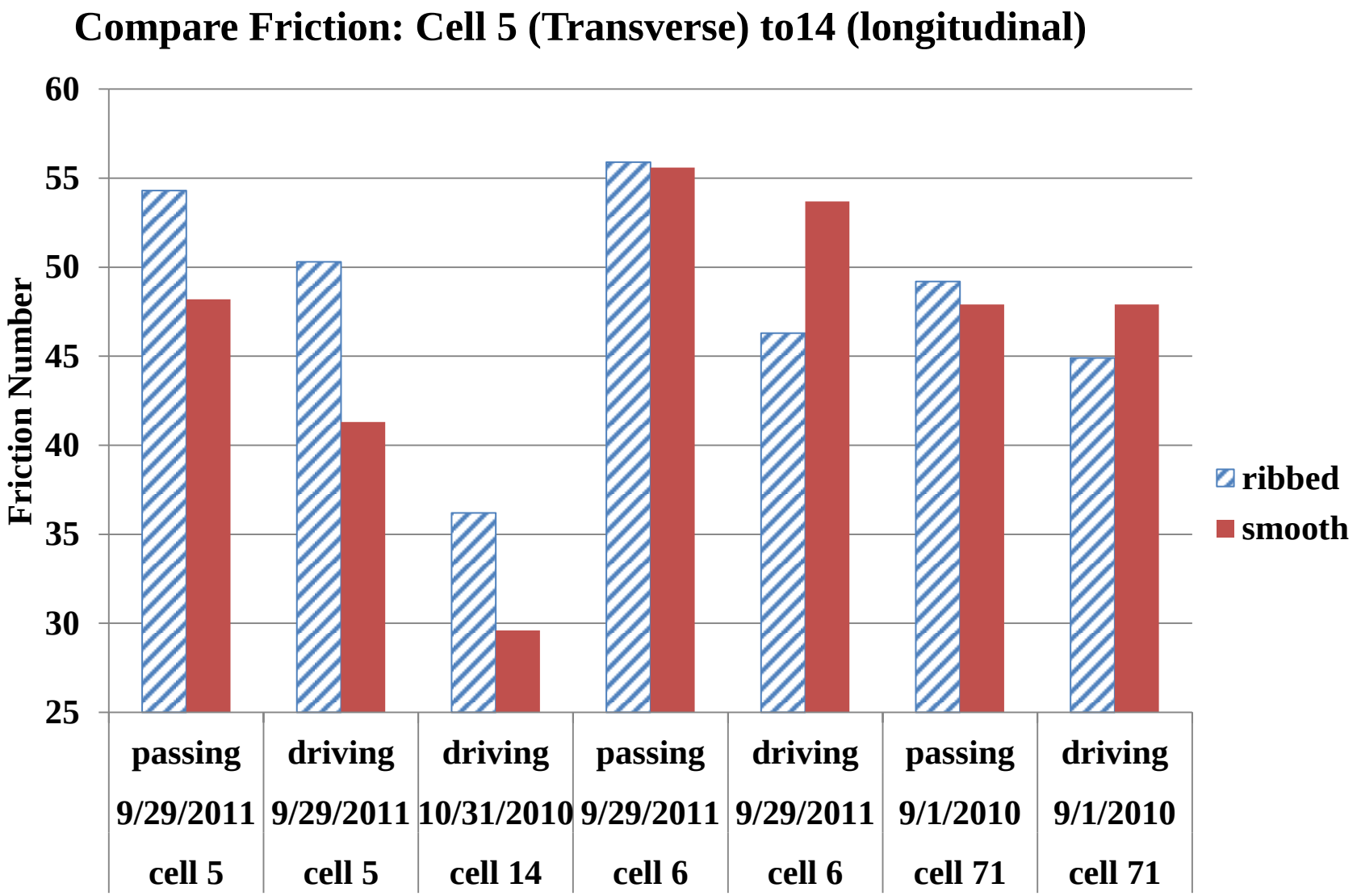


TRANSVERSE VS. LONGITUDINAL DRAG



Pop outs in cell 14 may have influenced increased OBSI

TRANSVERSE VS LONGITUDINAL TURF, UDG VS LONGITUDINAL TINE

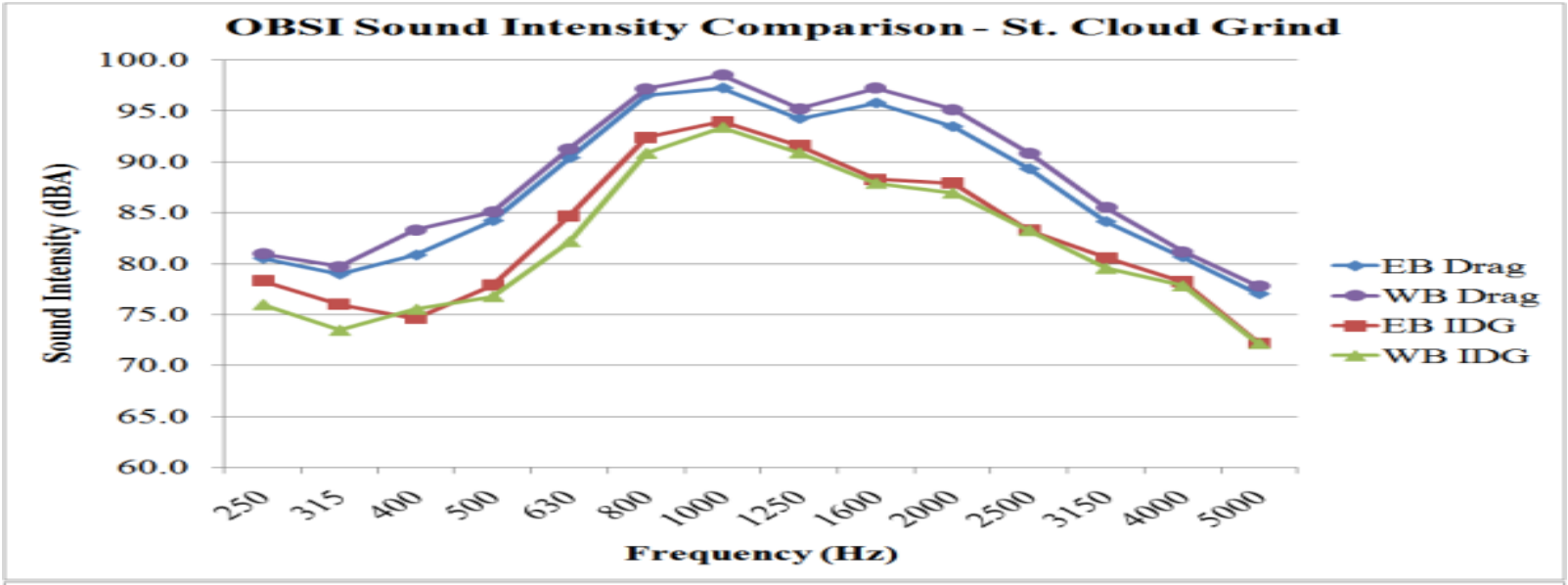


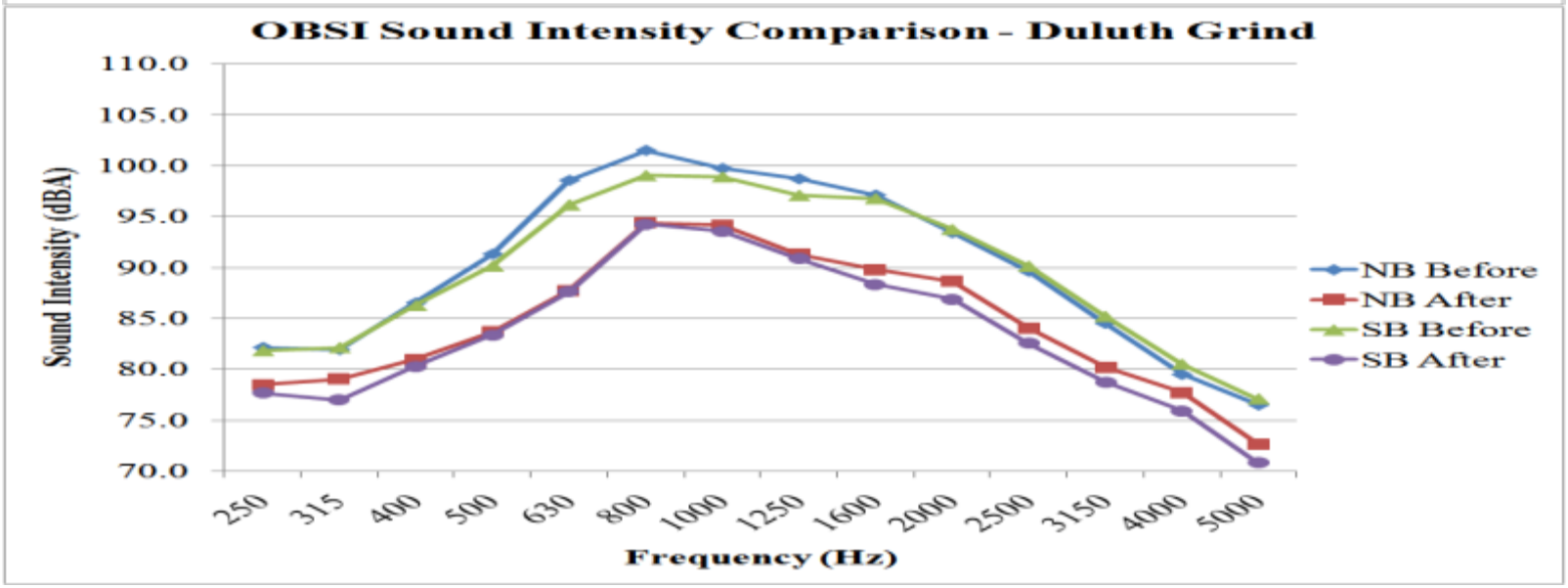
BEFORE AND AFTER INNOVATIVE GRINDING IN ST CLOUD 2009 & DULUTH 2010

2010 DULUTH INNOVATIVE GRIND / MnROAD CELL 71 QUIET PAVEMENT

PREVIOUS (TRANSVERSE TINE)

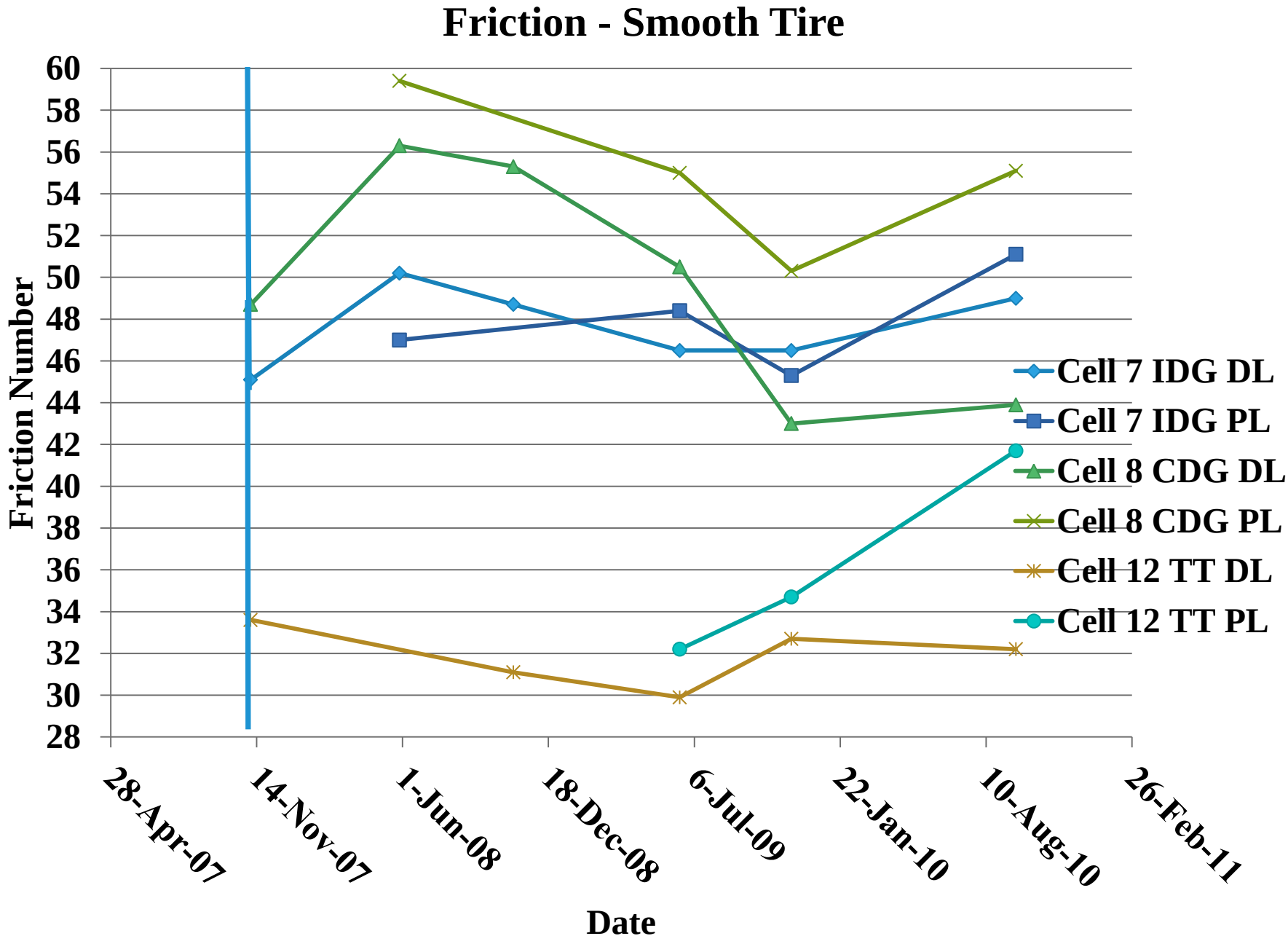
ACOUSTIC IMPROVEMENT:
St. Cloud & Duluth Project Texture Designs

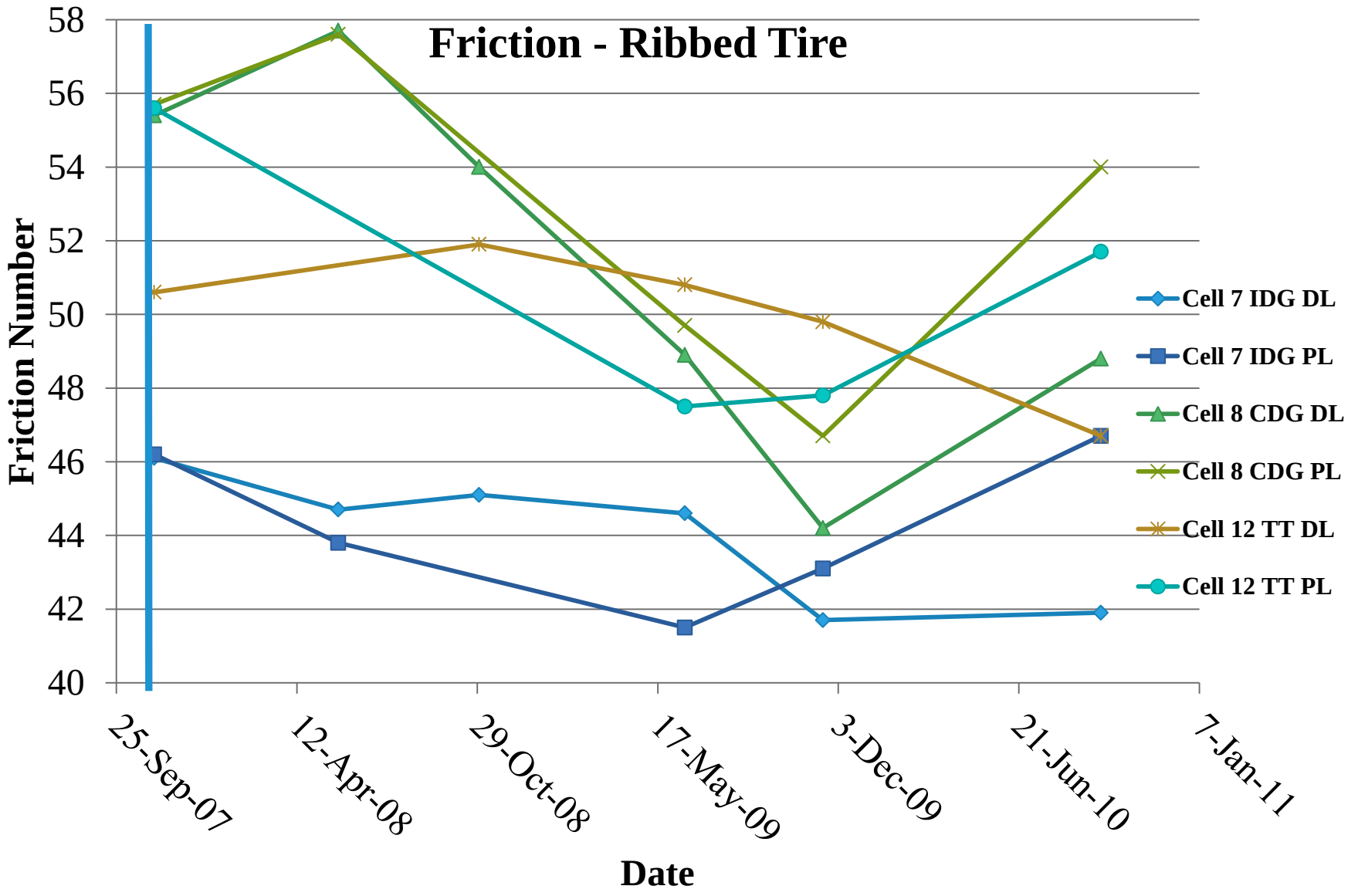




Acoustic improvement occurred in all 3rd Octave Frequencies

DIAMOND GRIND IMPROVEMENTS


Friction - Smooth Tire
Friction Number
60
58
56
54
52
50
48
46
44
42
40
38
36
34
32
30
28
28-Apr-07
14-Nov-07
1-Jun-08
18-Dec-08
6-Jul-09
22-Jan-10
10-Aug-10
26-Feb-11
Date
Cell 7 IDG DL
Cell 7 IDG PL
Cell 8 CDG DL
Cell 8 CDG PL
Cell 12 TT DL
Cell 12 TT PL


Friction - Ribbed Tire
Friction Number
58
56
54
52
50
48
46
44
42
40
25-Sep-07
12-Apr-08
29-Oct-08
17-May-09
3-Dec-09
21-Jun-10
7-Jan-11
Date
Cell 7 IDG DL
Cell 7 IDG PL
Cell 8 CDG DL
Cell 8 CDG PL
Cell 12 TT DL
Cell 12 TT PL

CONCLUSION

- Transverse Drag does not seem to produce significant acoustic difference from Longitudinal Drag. The benefits derivable from friction optimize both variables in Transverse Drag.
- Replication of Innovative diamond grind benefits with longitudinal tining still seems remote
- Each stage of the diamond grinding development process demonstrated improvement in acoustic properties steadily from concept to deployment.

Preliminary Results of the "Investigation of Benefits of the MNDOT w/cm Specification"

Gerard Moulzolf, PG
Vice President/Principal Petrographer
American Engineering Testing, Inc.
St. Paul, MN & Bonita Springs, FL

History

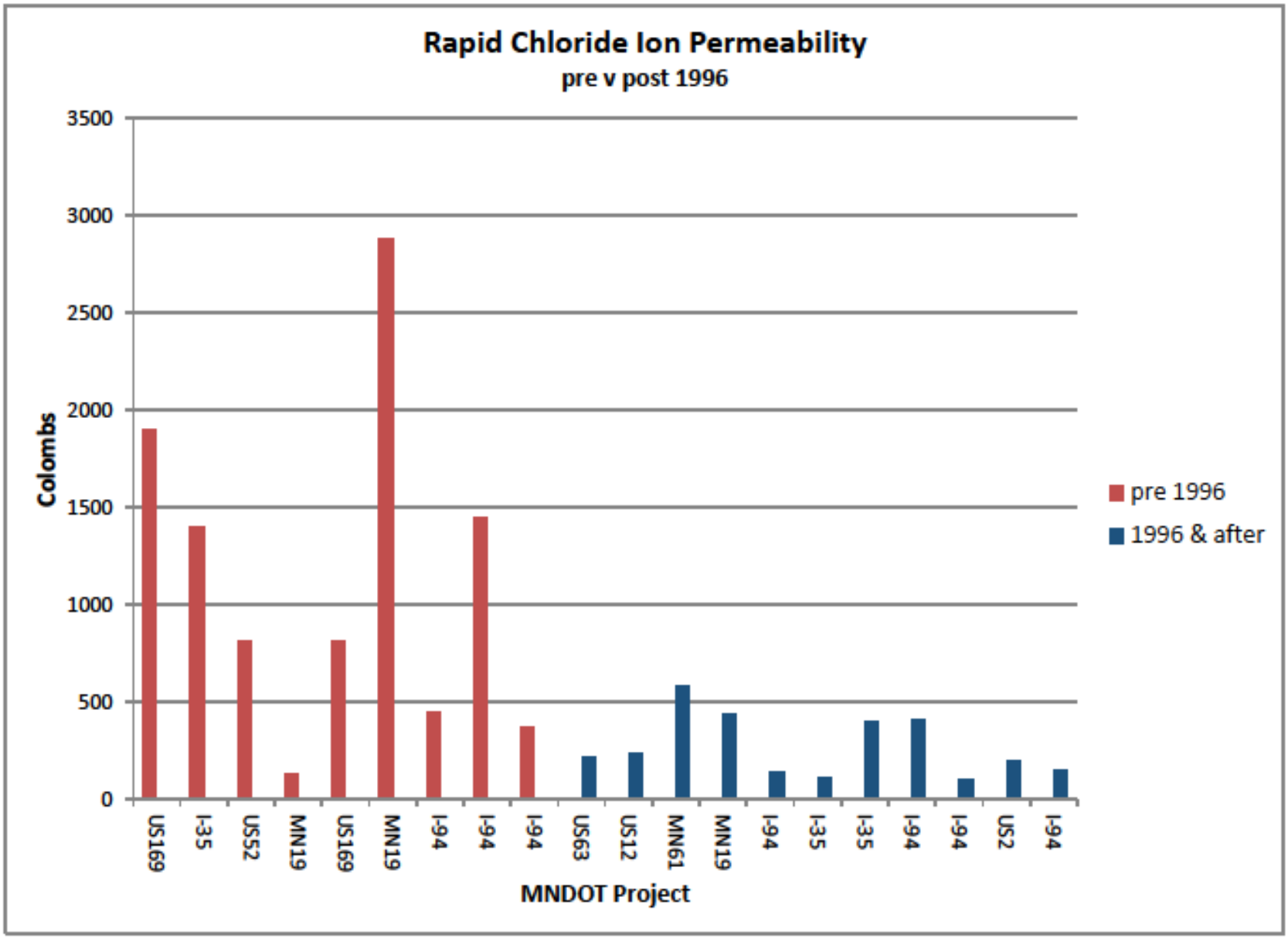
- **The ≤ 0.40 w/cm incentive began on the 4 largest paving projects let in the winter and spring of 1996.**

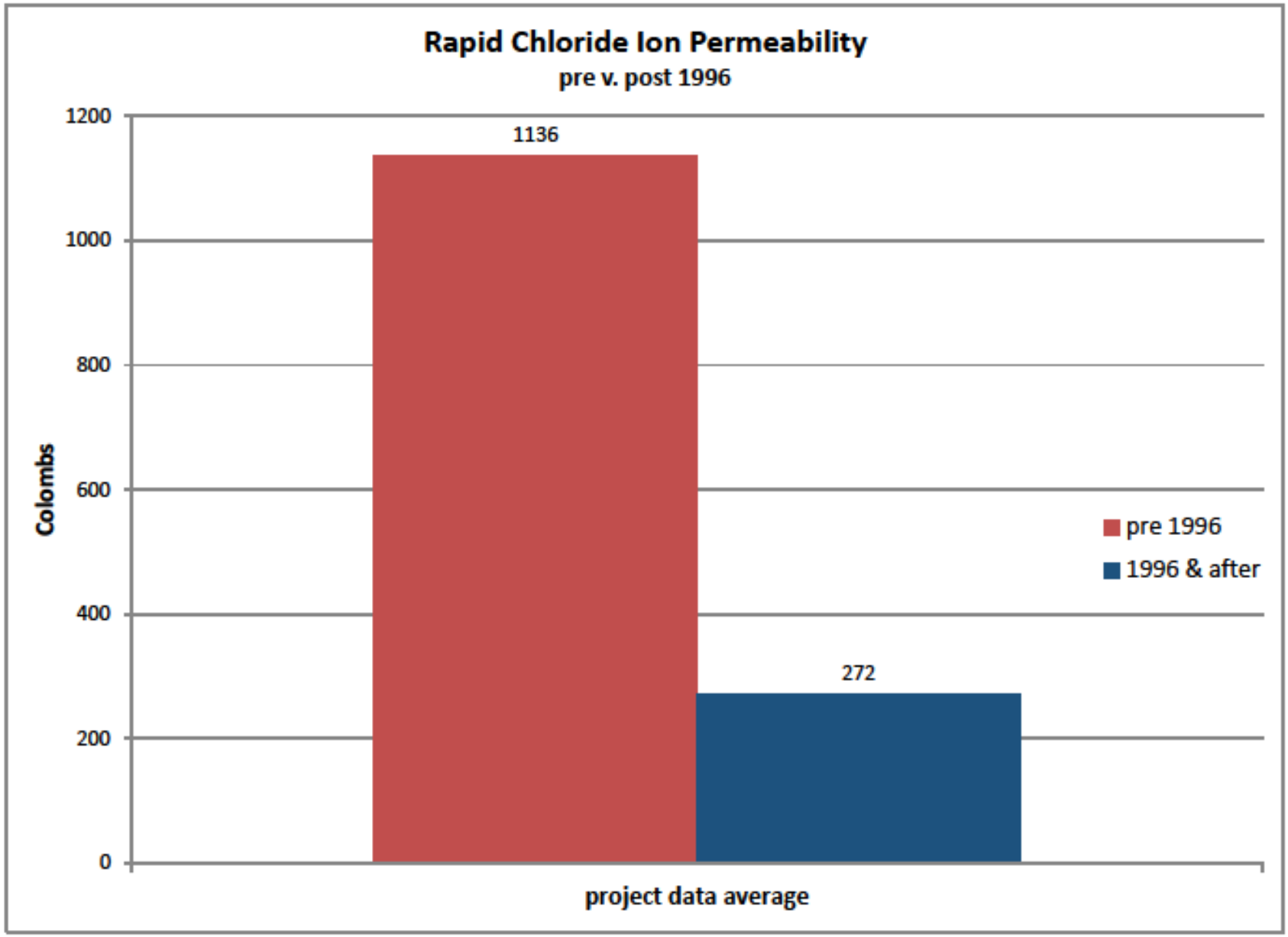
- **In 1997, all major paving projects included the w/cm incentives**

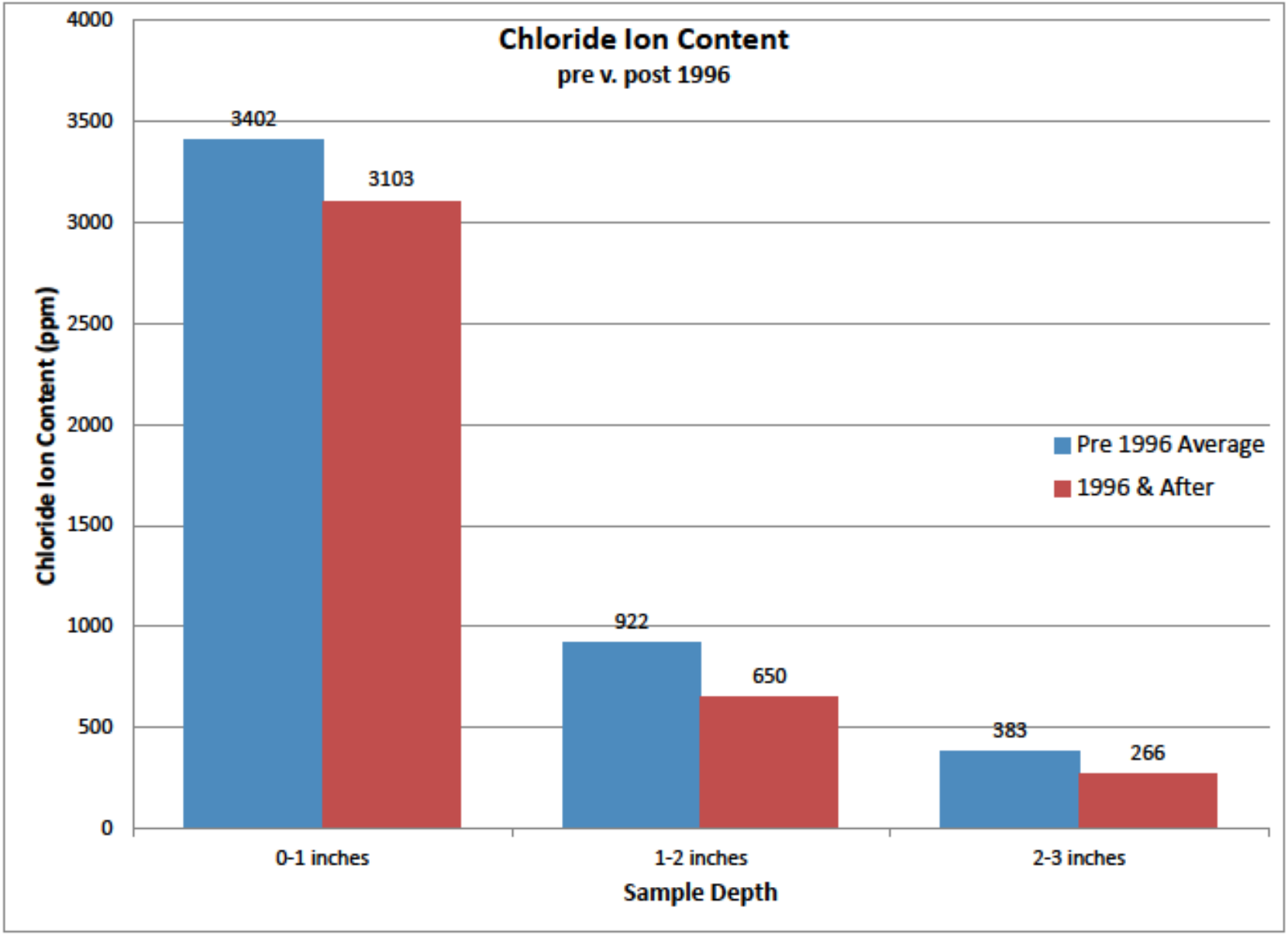
- **Reported previous w/cm's averaged 0.46-0.48 with approx 530lbs cementitous.**

Study

- Commissioned by MNDOT Office of Materials & Road Research
- “Phase 1” included select pavements from Districts 1, 2, 3, 6, 7, & 8
- “Phase 2” includes cores from select pavements in D4 and Metro
- Rapid Chloride Permeability – Mid panels
- Chloride Ion Penetration – Mid panels
- Petrography – Joints and Mid panels


Rapid Chloride Ion Permeability
pre v post 1996
Colombs
3500
3000
2500
2000
1500
1000
500
0
US169
I-35
US52
MN19
US169
MN19
I-94
I-94
I-94
US63
US12
MN61
MN19
I-94
I-35
I-35
I-94
I-94
US2
I-94
MNDOT Project
pre 1996
1996 & after


Rapid Chloride Ion Permeability
pre v. post 1996
1200
1000
800
600
400
200
0
Colombs
1136
272
pre 1996
1996 & after
project data average

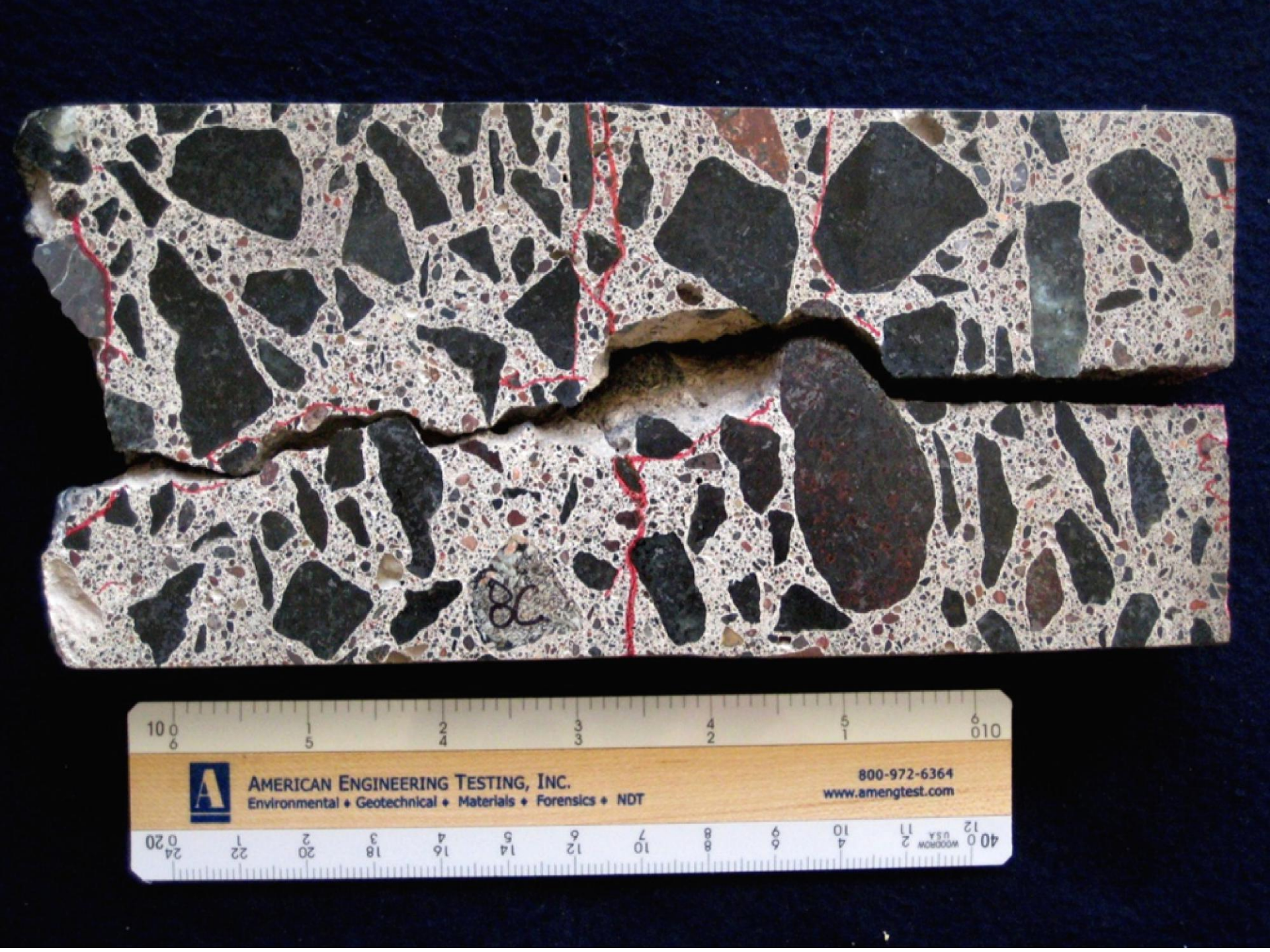

Chloride Ion Content
pre v. post 1996
Chloride Ion Content (ppm)
4000
3500
3000
2500
2000
1500
1000
500
0
3402
3103
922
650
383
266
Pre 1996 Average
1996 & After
0-1 inches
1-2 inches
2-3 inches
Sample Depth

D1 3805-67 (TH61)

1997

D1 3805-67 (TH61)

1997


AMERICAN ENGINEERING TESTING, INC.
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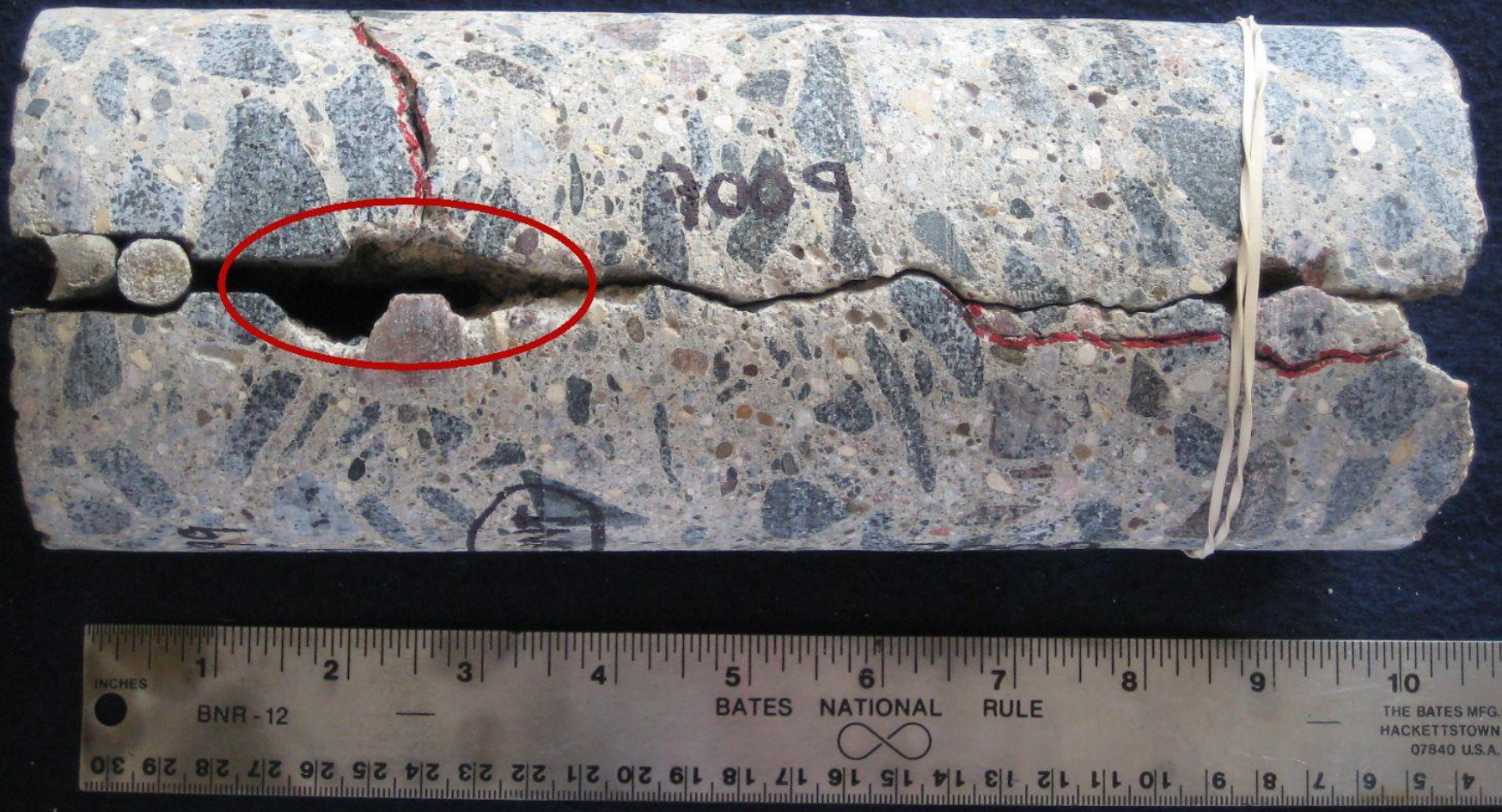
800-972-6364
www.amengtest.com

D3 7380-199

D3 7380-199



1997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D3 7380-199
Well bonded
1999

D3 7380-199

1999


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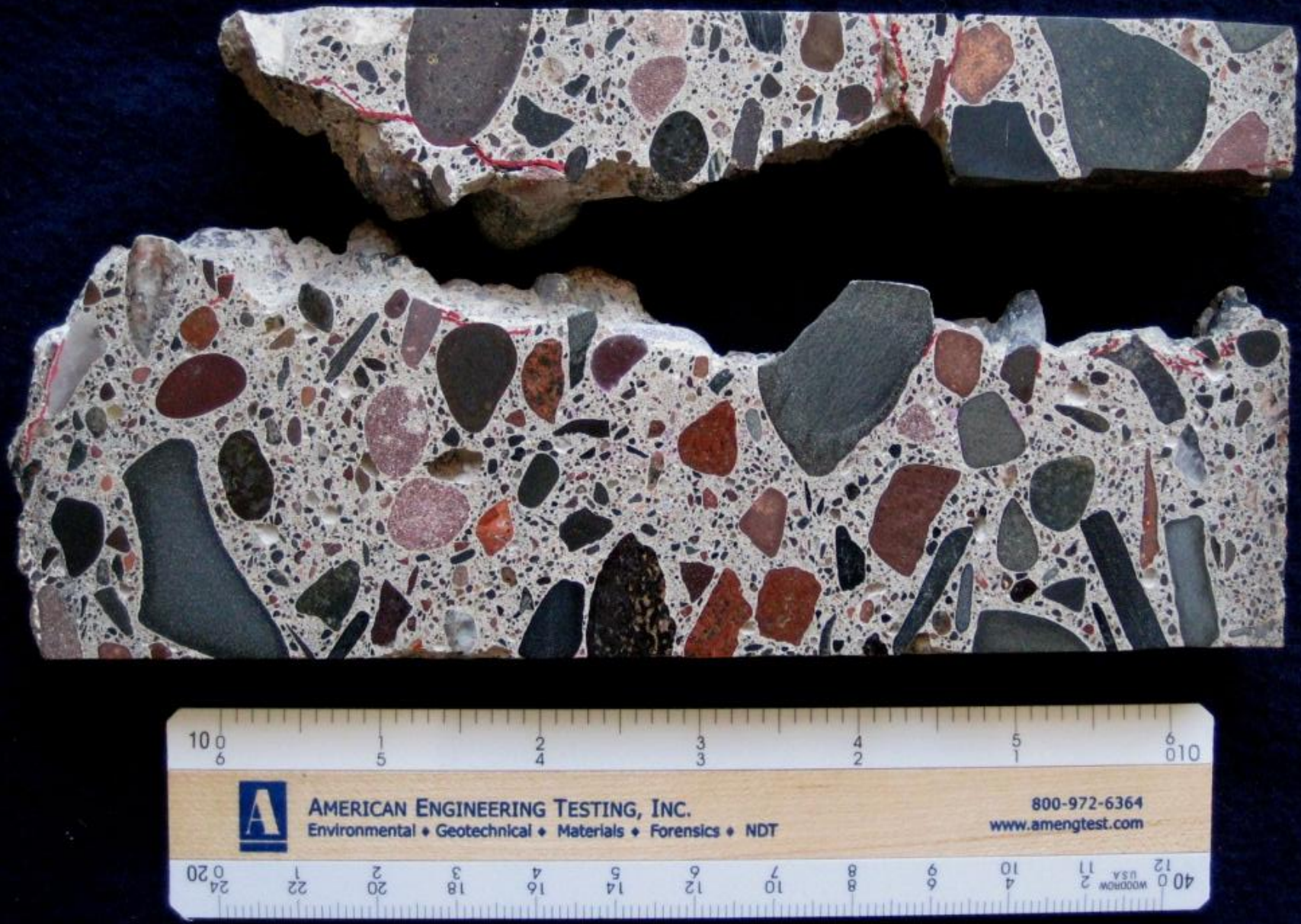
www.amengtest.com

D1 0980-127

1992


D1 0980-127
3B
INCHES
BNR-12
BATES NATIONAL RULE
THE BATES MFG.
HACKETTSTOWN
07840 U.S.A.
1992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Environmental • Geotechnical • Materials • Forensics • NDT
800-972-6364
www.amengtest.com

Initial Petrographic Conclusions

- All cores exhibited freeze-thaw resistant air void systems
- All concrete was devoid of obvious batching and placement deficiencies.
- Apart from 1992 US52 Dolostone, all aggregates were hard, sound, and durable.
- Intact Joint Sealant = No distress (certain 97, 99, 2000 projects)

Initial Petrographic Conclusions

- **A 1996, 1997, and 2000 concrete exhibited "later" joint activation (<shrinkage)**
- **Post w/cm cores exhibit less distress and thinner zones of ettringite-filled entrained-sized air voids.**

Future Work

- Start and Finish Phase 2 (D4 and Metro) petrography. I-94 and Hwy55
- Research and conclude on the effects of deicer types.
- Further research and conclude on joint sealant use/condition vs. concrete joint condition.

Minnesota County Experience in PCC Paving

Whitetopping, UBOL and New

CPAM Concrete Paving Workshop
March 8, 2012

Anoka – CSAH 18

Anoka - CSAH 22

McLeod – CSAH 2 (1)


2

McLeod – CSAH 2 (2)

Olmsted – CSAH 10

Scott – CR 66


X 475


SPEED
LIMIT
50

Questions?