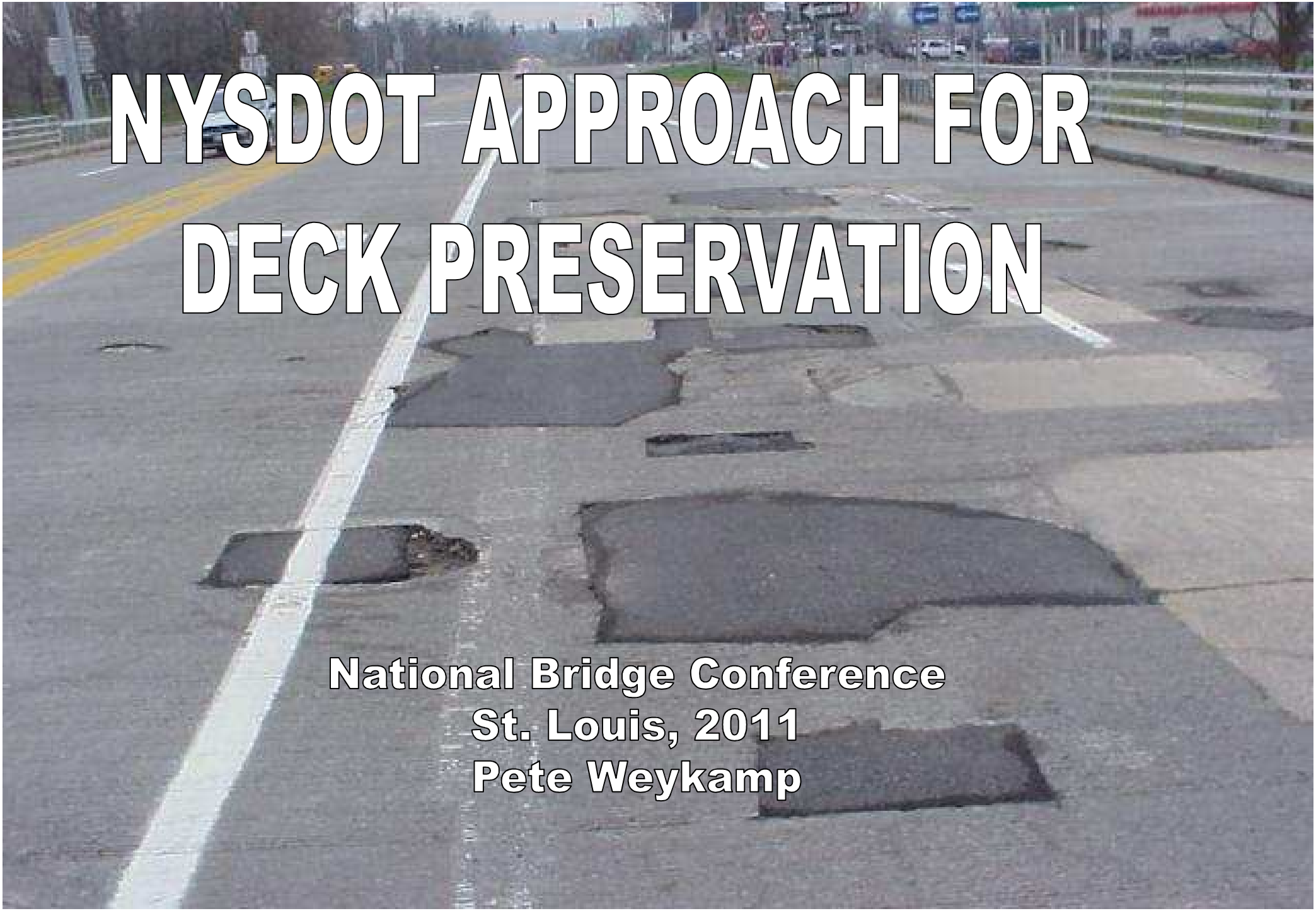


NYSDOT APPROACH FOR DECK PRESERVATION

National Bridge Conference
St. Louis, 2011
Pete Weykamp

BACKGROUND

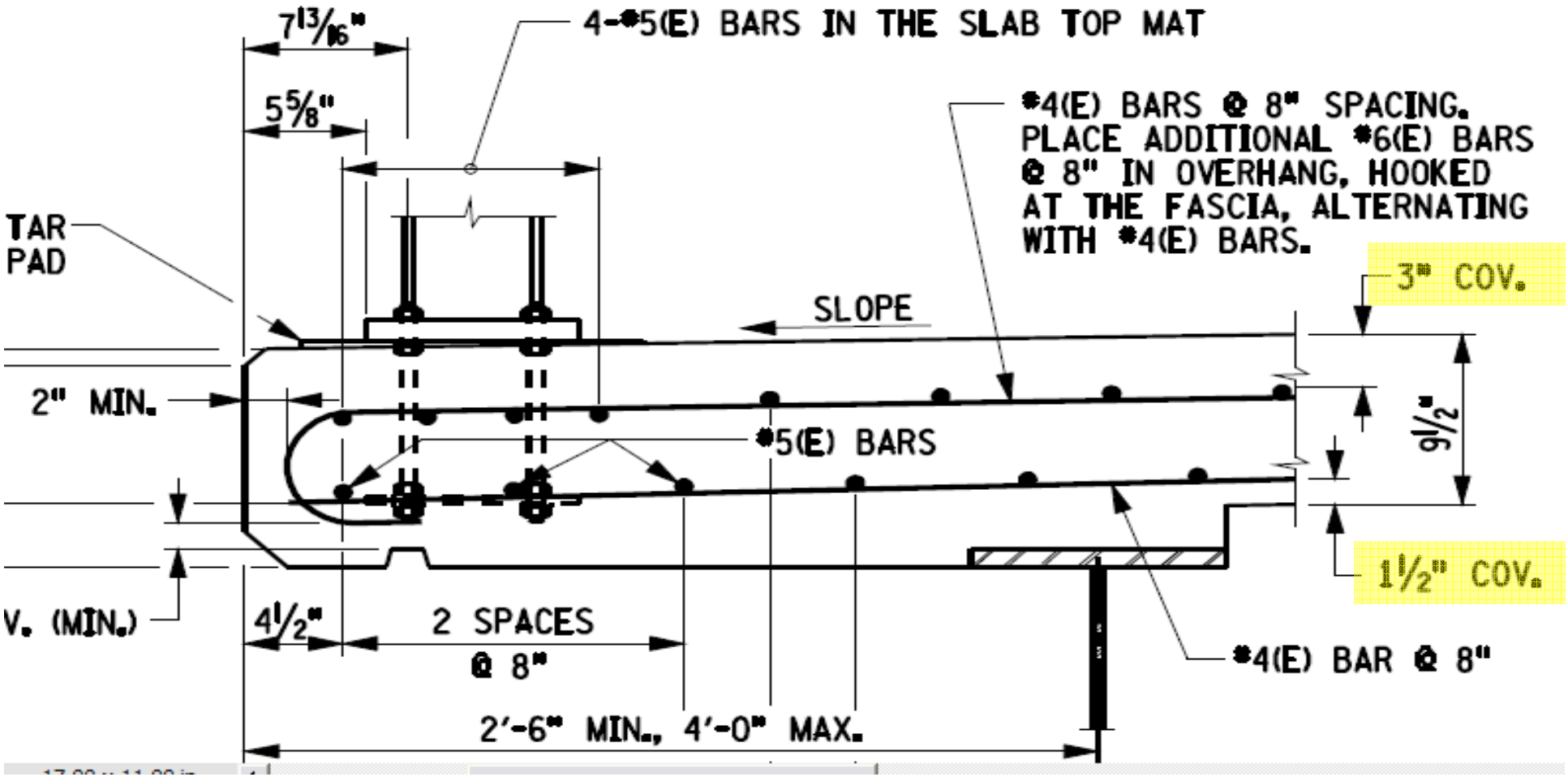
Count of Bridges:

- State – 7, 863
- Local – 11,898

Sq Ft of Deck

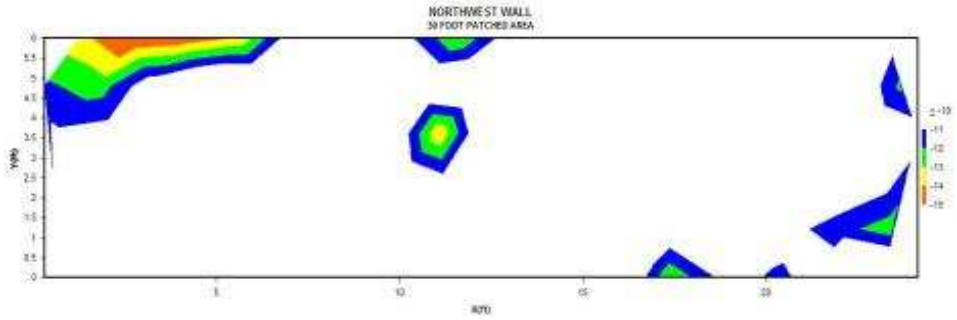
- State – $83.8M
- Local – $94.6M

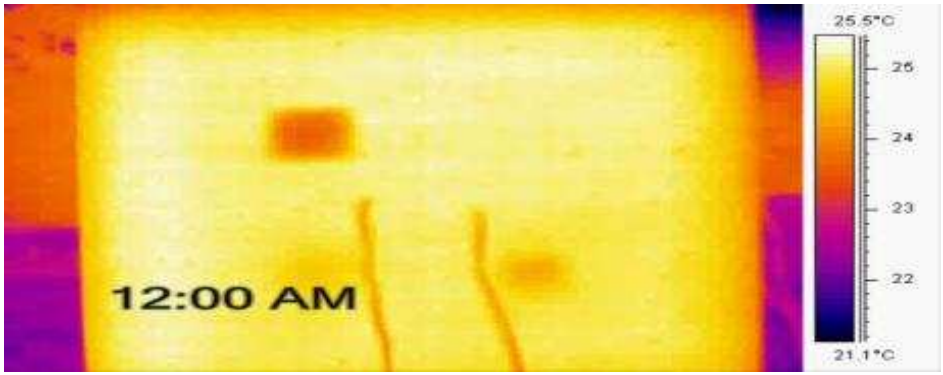
DESIGN

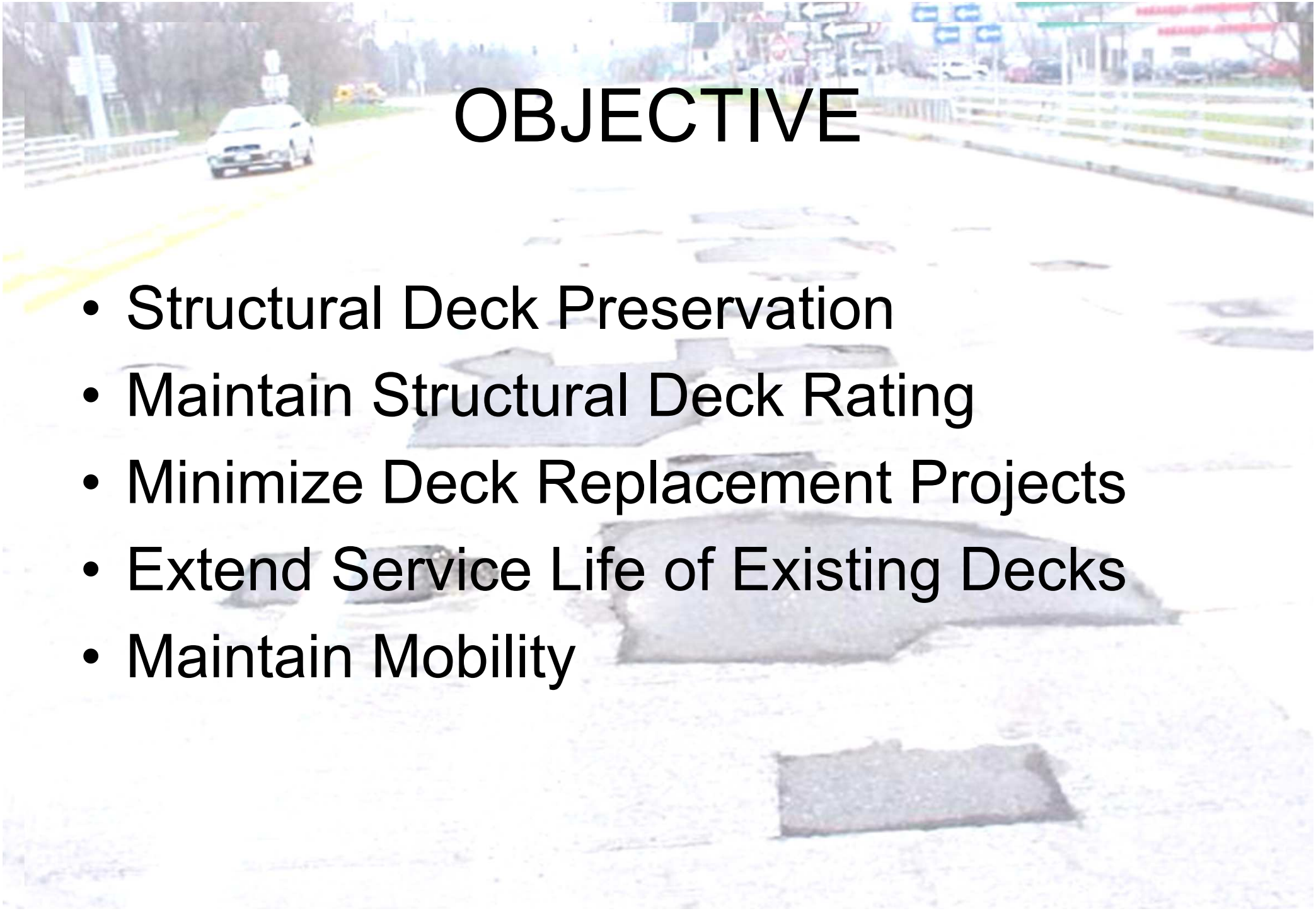

7 13/16"
5 5/8"
4-#5(E) BARS IN THE SLAB TOP MAT
#4(E) BARS @ 8" SPACING. PLACE ADDITIONAL #6(E) BARS @ 8" IN OVERHANG, HOOKED AT THE FASCIA, ALTERNATING WITH #4(E) BARS.
TAR PAD
SLOPE
3" COV.
2" MIN.
#5(E) BARS
9 1/2"
1 1/2" COV.
V. (MIN.)
4 1/2"
2 SPACES @ 8"
#4(E) BAR @ 8"
2'-6" MIN., 4'-0" MAX.

CONDITION ASSESSMENT

- Visual
- Sounding
- Ground Penetrating Radar
- Thermographic Inspection

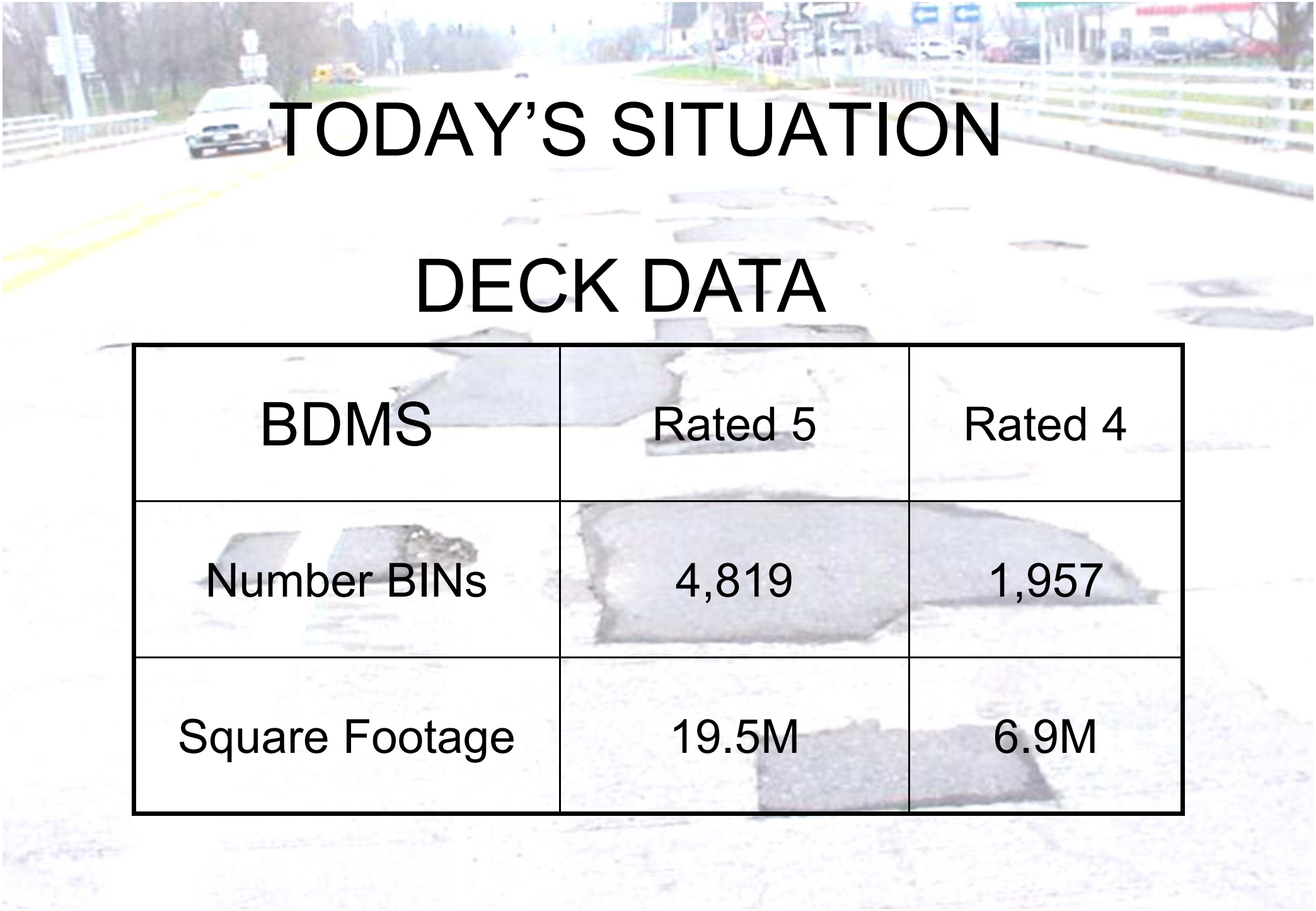






OBJECTIVE

- Structural Deck Preservation
- Maintain Structural Deck Rating
- Minimize Deck Replacement Projects
- Extend Service Life of Existing Decks
- Maintain Mobility



TODAY'S SITUATION

DECK DATA

BDMS	Rated 5	Rated 4
Number BINs	4,819	1,957
Square Footage	19.5M	6.9M

DECK CRACKING

BRIDGE MAINTENANCE CREDO

We, the bridge maintenance engineers of New York hold these truths to be self-evident: all joints leak, all concrete cracks, and rust never sleeps. We will strive to capitalize our way out of maintenance and maintain our way out of capital. It is our endeavor to educate others that a bridge is as important to a highway as a diamond is to a ring.

DECK PATCHING

- Minimal Bond
- Cold Joint
  - Not waterproof
- Temporary Fix
  - All material
  - All techniques
- Future Problems

OPTIONS

OPTIONS

CRACK FILLING

"Healer/Sealer"

- Ultra-low Viscosity Polymers
- Gravity Feed
- No Aggregates
- Sacrificial W S

WATERPROOFING MEMBRANES

- If They Work:
  - Block Salts from Bare Reinforcing Bars to Prevent
    - Expanding steel volume
    - Concrete pops
    - Concrete cracks
    - Accelerated corrosion
- If They Leak:
  - Trap Salts Near Bare Reinforcing Bars to Promote
    - Expanding steel volume
    - Concrete pops
    - Concrete cracks
    - Accelerated corrosion


TORCH APPLIED

CONDITION STATE				REPAIR OPTIONS (c)	POTENTIAL RESULT TO NBI		NEXT ANTICIPATED EVALUATION
Deck Surface NBI #58a	Deck Surface Deficiencies % (a)	Deck NBI #58	Deck Underside Deficiencies % (b)		Item # 58a Deck Surface Rating	Item # 58 Deck Rating	
N/A	N/A	N/A	N/A	CSM Activities	No Change (d)	No Change (d)	1 to 8 years
NBI = 5, 6, 7	2% to 5%	NBI > 5	N/A	Deck Patch / Seal Cracks	Up by 1 pt.	No Change (d)	3 to 10 years
				Epoxy Overlay	NBI now 8, 9	No Change	10 to 15 years
		NBI ≤ 5	N/A	Deck Patch	Up by 1 pt.	No Change	3 to 10 years
				Hold	No Change	No Change	1 to 8 years
NBI = 5	5% to 15%	N/A		Hold	No Change	No Change	1 to 8 years
				Deck Patch	Up by 1 pt.	No Change	3 to 10 years
NBI = 4 or 5	15% to 30%	NBI = 5,6	<10%	Deep Concrete Overlay	NBI now 8, 9	Up by 1 or 2 pts.	25 to 30 years
		NBI = 3 or 4	10% to 30%	Shallow Concrete Overlay	NBI now 8, 9	Up by 1 pt	10 to 15 years
		NBI = 2 or 3	>30%	HMA Overlay with waterproofing membrane(e)	NBI now 8, 9	No Change	8 to 10 years
NBI= ≤ 4	>30%	NBI = > 5	<5 %	Deep Concrete Overlay	NBI now 8, 9	Up by 1 or 2 pts.	20 to 25 years
		NBI = 3, 4, or 5	5% to 30%	Shallow Concrete Overlay	NBI now 8, 9	Up by 1 pt	10 years
				HMA Overlay with waterproofing membrane(e)	NBI now 8, 9	No Change	5 to 7 years
		NBI = 2 or 3	>30%	Replace Deck	NBI now 9	NBI now 9	40+ years
				HMA Cap (f)	NBI now 8, 9	No Change	1 to 3 years

POLYMERS IN MAINTENANCE

SHRP Task Force 34

Rapid Cure
Good Bond Strength
Flexural, Tensile Strength
Negligible Perm.
Good Freeze-Thaw
Low Dead Load
High Friction
Resistant to Salts

Bond Critical
Costly
Labor Intensive

DELIVERY

BROOM & SEED

SLURRY

NYSDOT W.S. AGGREGATE

- Gap Graded
- Hard
  - Mohrs >= 7
- Acid Insoluble Residue
  - >20%

Sieve Size	#4	#8	#16	#20	#30
Percent Passing	100	30-75	0-5	--	0-1

COMPARISONS

	DP	MEMBRANE	THIN POLY
"t" (in)	1.6	2	.375
Wt (lb/ft^2)	20	8	4
Cost ($/ft^2)	5	8	4
Delay (d)	21	2	2
Service (yr)	20	12	15

WHAT ELSE

BETTER
QUICKER
CHEAPER

ASPHALT RUBBER PAVER PLACED SURFACE TREATMENT?

PAVEMENT PLACED SURFACE TREATMENT

- **Benefits**
  - Rapid Placement
  - Minimal Surface Prep
  - Polymer Modified Emulsion Bond Coat
  - High Quality Gap Graded Mix
  - Less Labor
- **Unknowns**
  - Waterproofness
  - Performance on Bridge Decks
  - Service Life on Bridge Decks

ASPHALT RUBBER

Rubber contains polymers which…

- Raises softening point to above 140º F.
  - Resistance to rutting and shoving
  - Resistance to asphalt migration and drain-down
- Increases low temperature flexibility of residue.
  - Resistance to cracking
- Increases high temperature viscosity
  - Thicker film coatings on aggregate particles
  - Higher asphalt content mixes / applications
  - More asphalt = greater resistance to oxidation
  - Increased long term durability
  - Top PG Grading above 80
- Contains no water.

RUBBERIZED ASHALT PRODUCTS

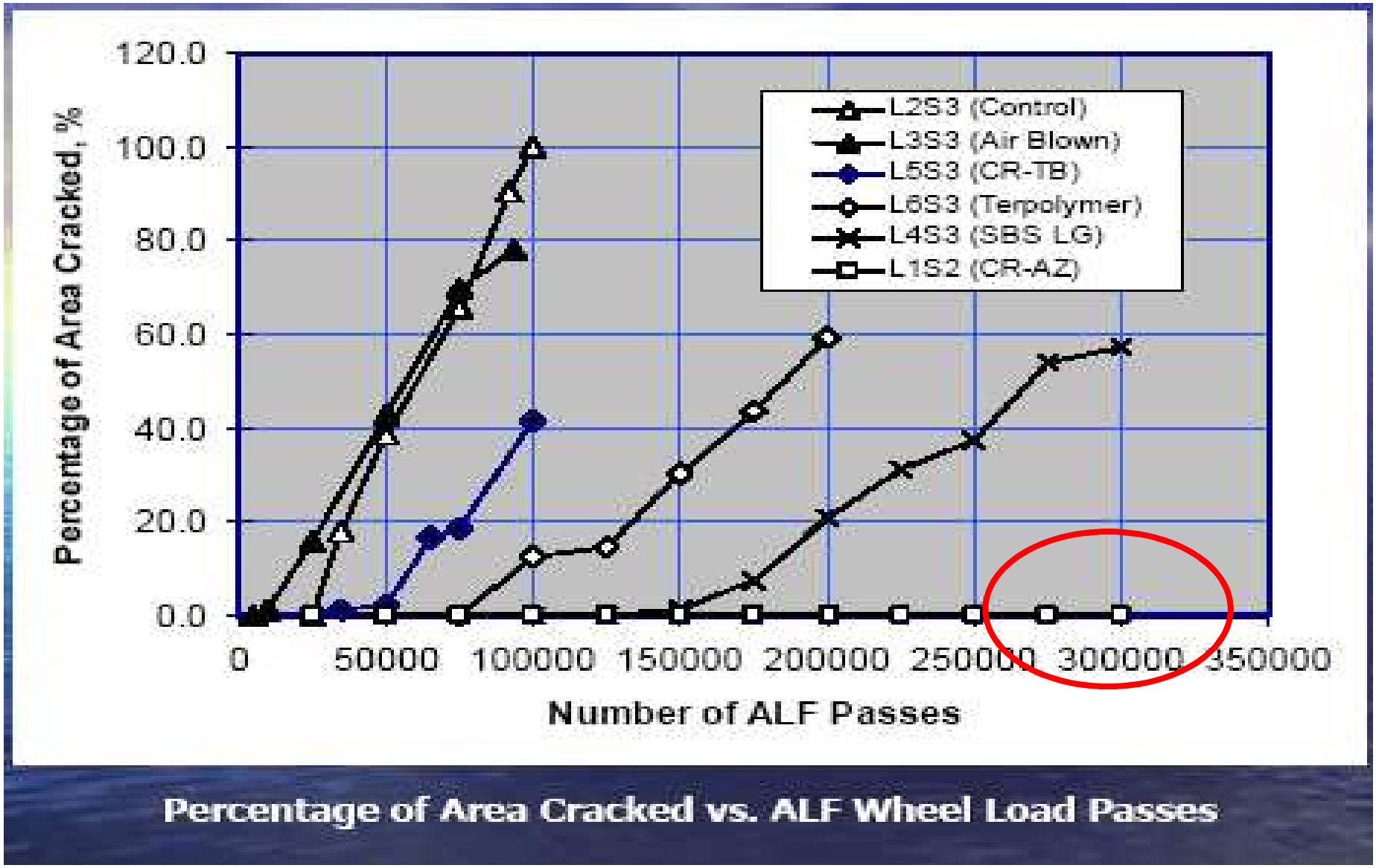
Asphalt-Rubber Binder

Terminal Blend Binder

ASPHALT COMPARISON

Criteria	AR	TB	PG
% Crumb Rubber	15+	NY: 12+/- 3 Others: 5-10	N/A
ASTM	D-6114		AASHTO
cP@375 F	1500-5000	500-	100-
Softening Pt. F	140+	130+	115- Typical
ALF Cycles	300,000+	100,000	100,000

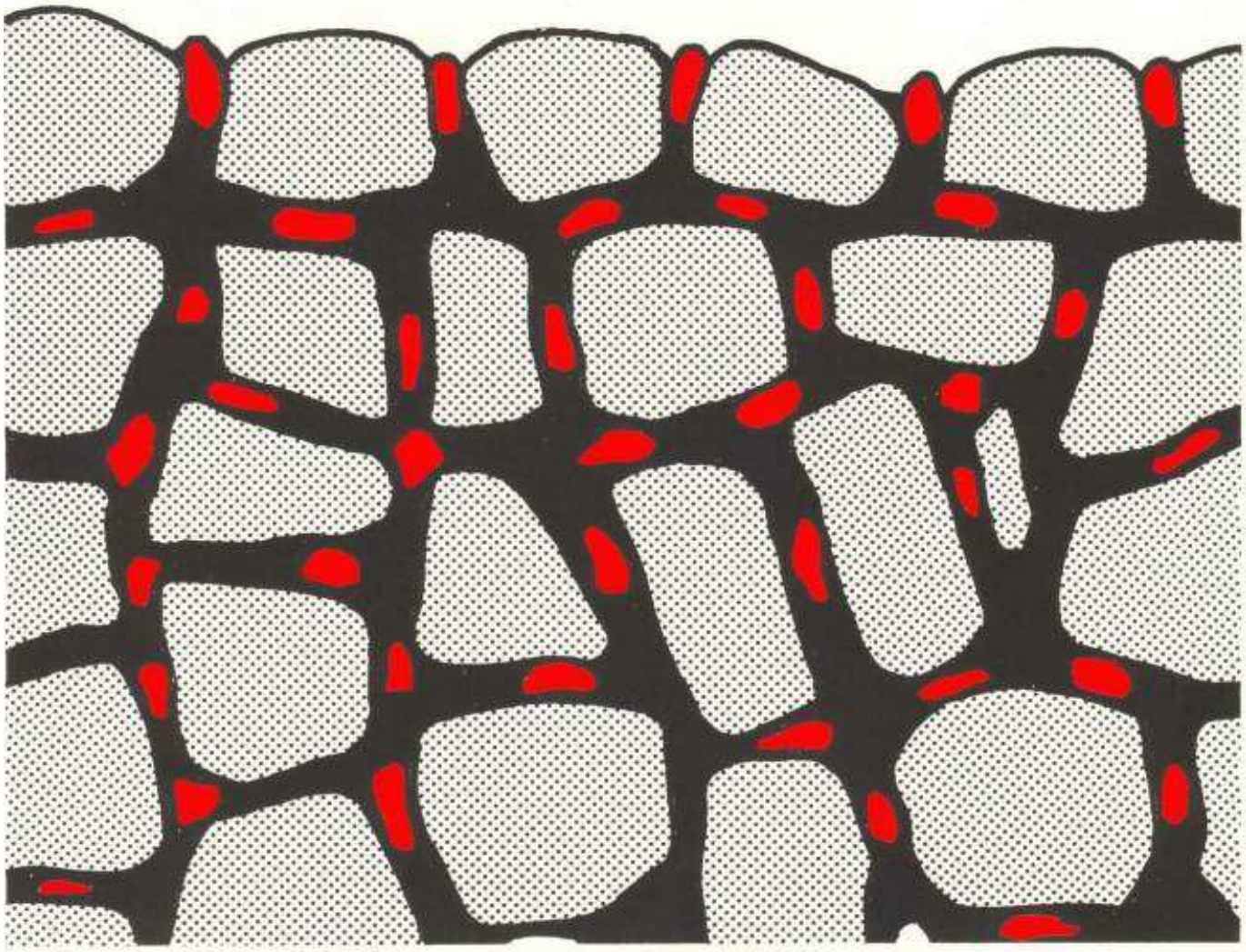
ALF PROJECT TEST RESULTS



Percentage of Area Cracked vs. ALF Wheel Load Passes

HOW IT WORKS

22,937,600 rubber particles per ton of mix helps fight cracking



www.rubberpavements.org

GREEN TECHNOLOGY

Turning this…

Into this…

MassDOT – AR PPST, I-295, August 2008

NYSDOT Project – D261765

PRE-EXISTING CONDITINS

AR PPST MIX PRODUCTION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

AR PPST APPLICATION

WATERPROOFING

- Reduce water intrusion
- Reduce chlorides
- Contaminated
  - Chlorides
  - Moisture
- Will the deterioration rate be reduced?

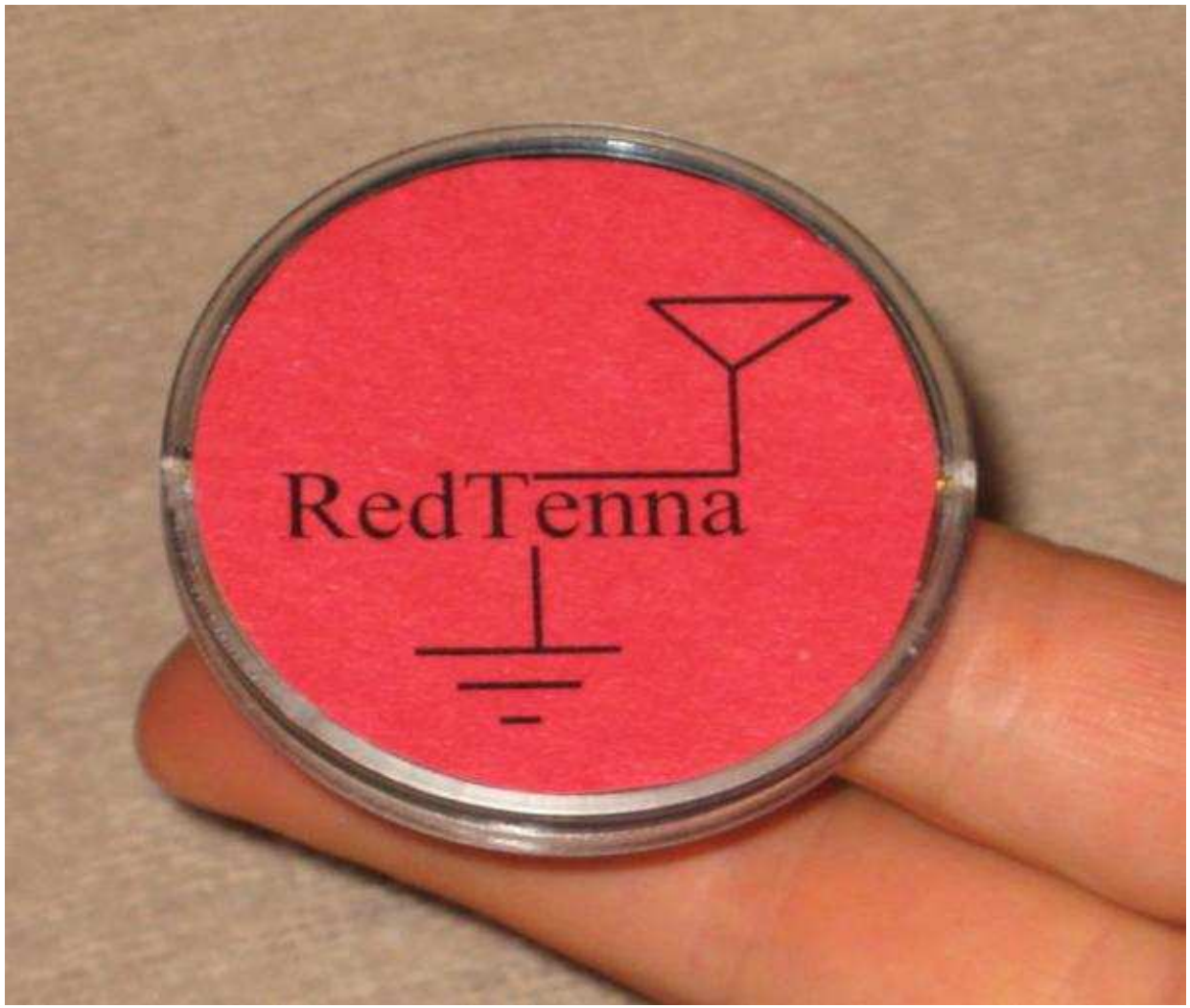
PROGRAM OBJECTIVES

- Verify the Effectiveness of Various Membranes
  - Various superstructure types
  - Various traffic conditions
  - Various Regional locations
- Determine Areas Most Prone to Failure
- Long-Term Monitoring
  - May be years for complete study: Failures reported immediately
- Correspond to Condition Rating

Conventional Moisture Measurement

- Probing Methods
  - test probes
  - surface
  - drill hole
- RF Field Methods
  - gross assessment
  - surface sensitive

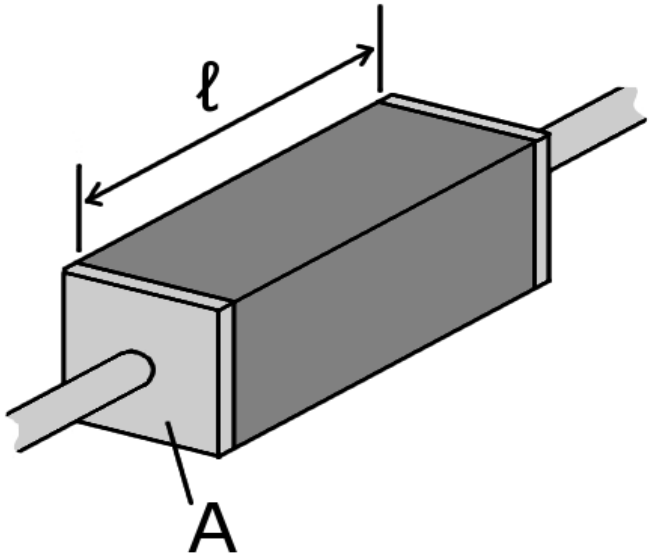
Wireless Sensor



How Long Will They Last?

- No Batteries
- No Moving Parts
- Stainless Steel Contacts
- Sensor Should Outlast the Structure

WHAT IS MEASURED

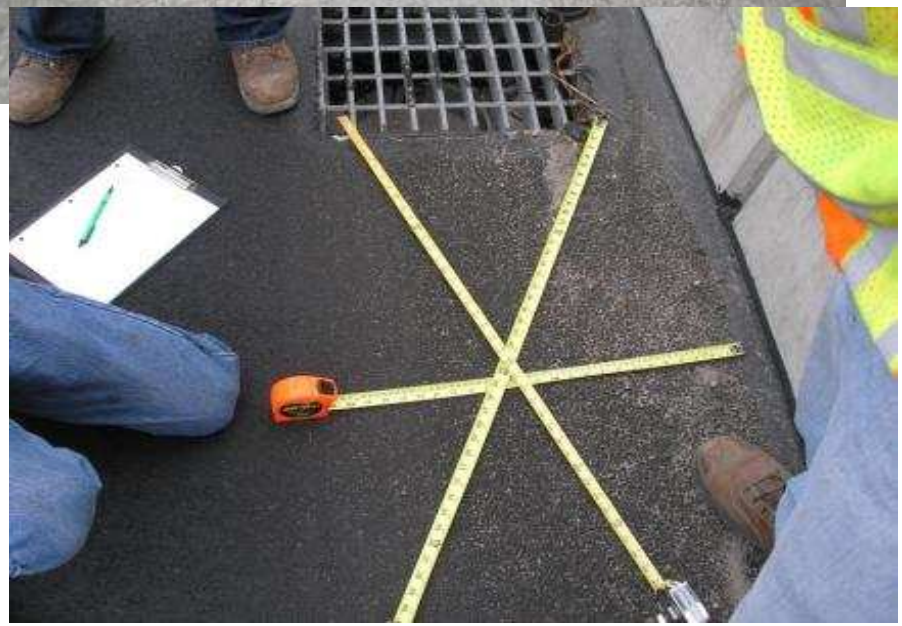


$$R = \frac{\rho L}{A}$$

ρ = resistivity
L = length
A = cross sectional area

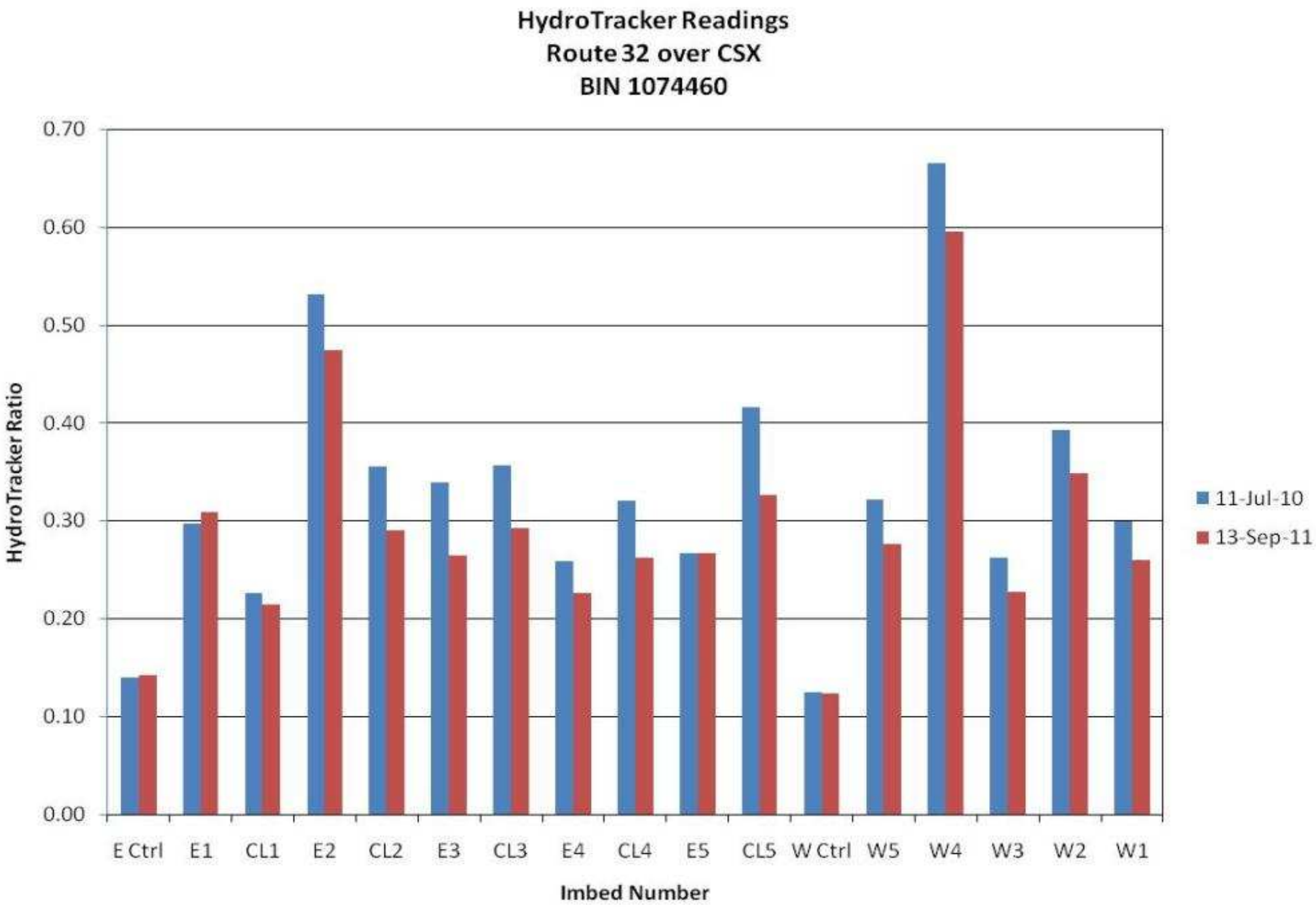
- Conductivity is $1/R$

PLACING, LOCATING,& INTERROGATING



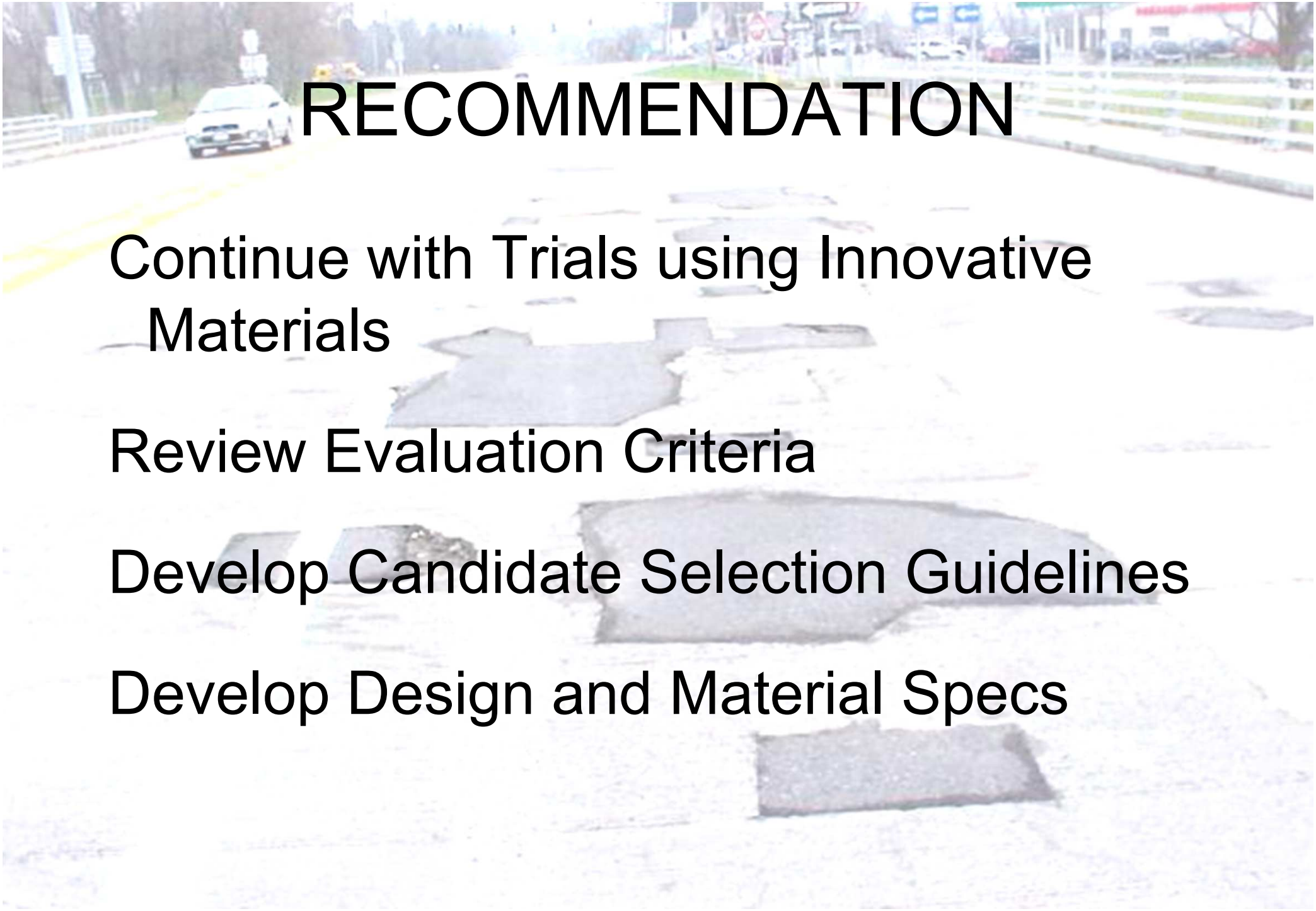
HYDRO TRACKER DATA

Rte 32 Oriskany NY									
J Foley		**13-Jul-10**				**13-Sep-11**			
Map	**Imbed**	**Test**	**Ref**	**Calc**	**% H2O**	**Test**	**Ref**	**Calc**	**% H2O**
E Ctrl	E Ctrl	140	1000	0.14	-0.2	143	1000	0.14	-0.1
E1	E1	297	1000	0.30	2.7	309	1000	0.31	3.0
CL1	E2	226	1000	0.23	1.4	215	1000	0.22	1.2
E2	E3	532	1000	0.53	7.1	474	1000	0.47	6.0
CL2	E4	356	1000	0.36	3.8	290	1000	0.29	2.6
E3	E5	339	1000	0.34	3.5	265	1000	0.27	2.1
CL3	E6	357	1000	0.36	3.9	293	1000	0.29	2.7
E4	E7	259	1000	0.26	2.0	226	1000	0.23	1.4
CL4	E8	321	1000	0.32	3.2	263	1000	0.26	2.1
E5	E9	267	1000	0.27	2.2	267	1000	0.27	2.2
CL5	E10	257	618	0.42	4.9	327	1000	0.33	3.3
W Ctrl	W Ctrl	125	1000	0.13	-0.5	124	1000	0.12	-0.5
W5	W5	211	656	0.32	3.2	276	1000	0.28	2.3
W4	W4	149	224	0.67	9.6	140	235	0.60	8.3
W3	W3	262	1000	0.26	2.1	228	1000	0.23	1.5
W2	W2	393	1000	0.39	4.5	349	1000	0.35	3.7
W1	W1	300	1000	0.30	2.8	260	1000	0.26	2.0


HydroTracker Readings
Route 32 over CSX
BIN 1074460
HydroTracker Ratio
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
E Ctrl
E1
CL1
E2
CL2
E3
CL3
E4
CL4
E5
CL5
W Ctrl
W5
W4
W3
W2
W1
Imbed Number
11-Jul-10
13-Sep-11

ANTICIPATED RESULTS

- Various Types of Membranes Evaluated
- Measure Effectiveness of Waterproofing
  - Moisture Sensors
  - GPR Surveys
  - Inspection Ratings
- Mainstream Use of Alternative Systems
  - Develop/Modify Specifications
  - Increase the Overlay Program



RECOMMENDATION

Continue with Trials using Innovative Materials

Review Evaluation Criteria

Develop Candidate Selection Guidelines

Develop Design and Material Specs


THANK YOU