RIDOT

Rhode Island - The Great State of Pavement Preservation

2014

Providence, RI

From a potential problem…

… to a problem waiting to happen…

…that becomes a problem for everyone.

Rhode Island Department of Transportation Mission Statement

"…**maintain** and provide a **safe**, **efficient**, environmentally, aesthetically and culturally sensitive intermodal transportation network that offers a variety of convenient, cost-effective mobility opportunities for people and the movement of goods supporting economic development and improved quality of life."

Introduction

1) Introduction
2) Program Development
3) Program History
4) Pavement Preservation Tools/Treatments
   a) Crack Seal
   b) Microsurfacing
   c) Asphalt Rubber Chip Seal (ARCS)
   d) Bonded Wearing Course
   e) Thin Overlay (Paver-Placed Elastomeric Surface Treatment - PPEST)
   f) SAMI (ARCS + Hot mix Overlay)
5) Concrete – Whitetopping
6) Reclamataion with and without Emulsion
7) P^2 Monitoring Program
8) Final thoughts

Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991

- Provided federal funding to states for programmed preventive maintenance for the first time
- States could now utilize federal funding for pavement management systems

Concepts

- Pavement Preservation – All activities undertaken to provide and maintain a serviceable roadway
- Routine Maintenance – Refers to day-to-day highway maintenance operations
- Preventive Maintenance – Strategy and cost effective treatments that preserve the system

Welcome to Extending Pavement Life

Extending Pavement Life

- Why Extend Pavement Life?
  - Because it Maximizes the Return on the Taxpayers Investment
- Pavements represent a Trillion dollar investment
  - WE MUST PROTECT THEM!

PHILOSOPHY 101

PHILOSOPHY of MAINTENANCE

Timing of Preventive Maintenance

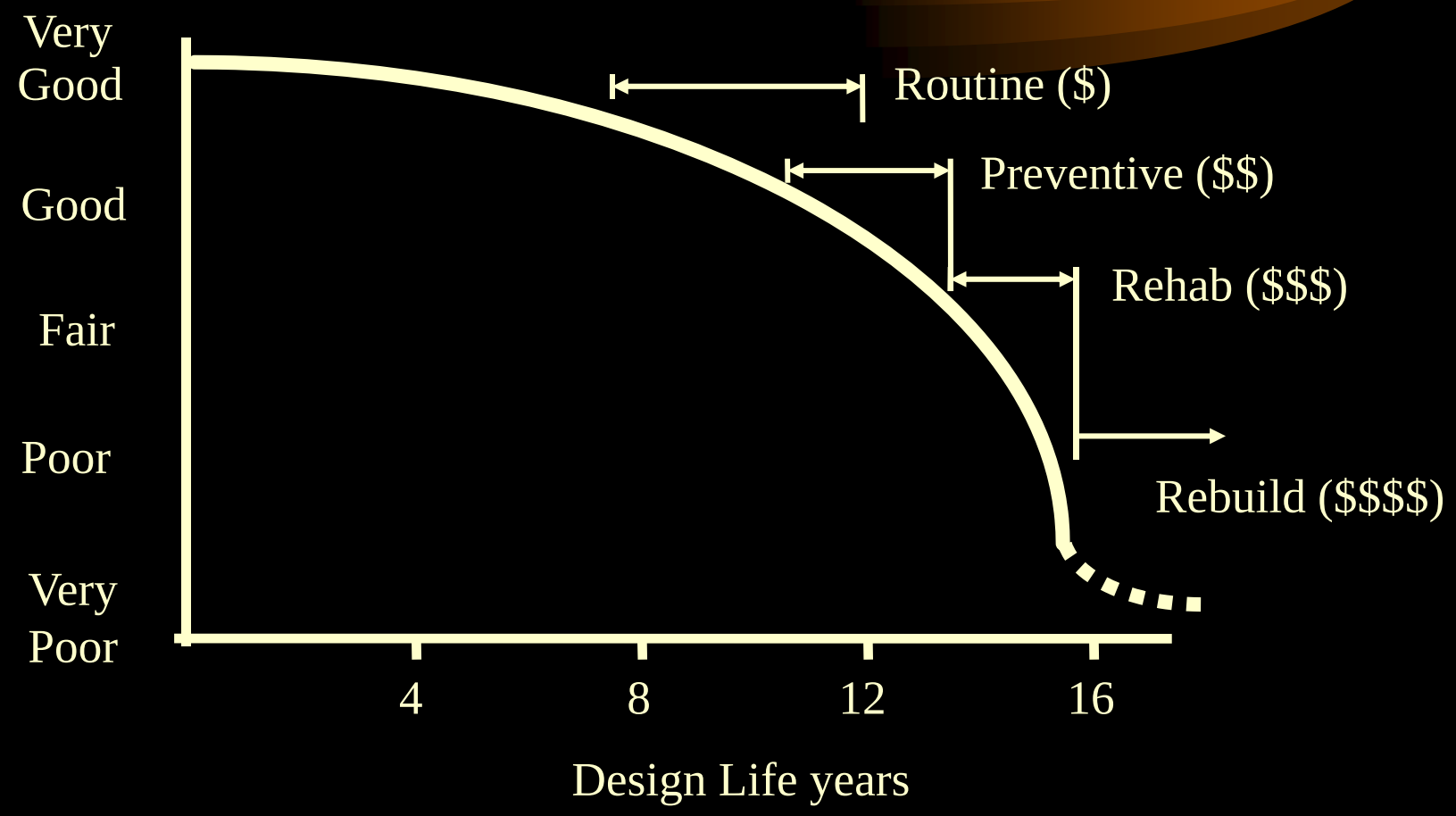
- Timing is Everything !!!!!
- Proper Maintenance is basically a timing issue
  - When should a road receive maintenance
  - Based upon the relationship between:
    - Deterioration Curves and,
    - Cost-Effectiveness of Maintenance Strategies

Maintenance Strategies

Maintenance Strategies can be grouped into:

- Routine Maintenance
- Preventive Maintenance
- Deferred Maintenance
  - Rehabilitation
  - Reconstruction
- Do nothing (Pay big $$$ later)

Deterioration Curve w/ Strategies & Costs



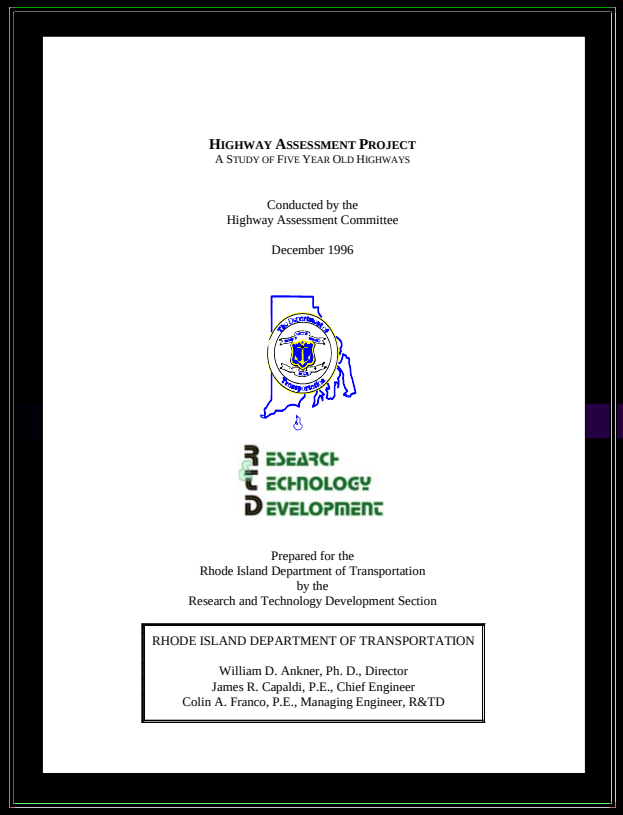
The RIDOT Journey into Pavement Preservation

Formation of the Highway Assessment Committee (HAC) — 1995

- HAC: Incorporate members from various engineering divisions in RIDOT
- Study Focus: Five year old roads
- Purpose: Determine the impact of design and construction practice on highway maintenance
  - Minimize need for maintenance
  - Identify practices that improve highway durability

Highway Assessment Committee — 1996

- Produced comprehensive report
- Created database with information on roadway element conditions
- Created methods for assessing highway conditions
- Formulated recommendations for improvement
- **Created a cadre of RIDOT Engineers/ Technicians Familiar with P^2**



HIGHWAY ASSESSMENT PROJECT
A STUDY OF FIVE YEAR OLD HIGHWAYS

Conducted by the
Highway Assessment Committee

December 1996

RESEARCH
TECHNOLOGY
DEVELOPMENT

Prepared for the
Rhode Island Department of Transportation
by the
Research and Technology Development Section

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

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Highway Assessment Report for Five Year Old Roads

Pavement Preservation Program Development Initiated 1998

Pavement Preservation Program Development – Data Management

- Road segments given LRS ID with beginning/end points
- Entered into Arcview (GIS) database with all pertinent information
- Arcview is used to graphically display layered information

Pavement Preservation Program Development – Road Selection Criteria

- Roads that are 5-15 years old are actively reviewed for P^2 treatment
- Roads that are in poor condition are forwarded to Higway Design for 3R/Reconstruction
- List of potential roads are solicited from Maintenance and other sections and reviewed against the database

Pavement Preservation Program Development – Road Selection Process

- Teams from the Department independently review and rate candidates (~150 roads)
- Short list obtained from field review/decision matrix
- Final list is culled after thorough coordination with RIDOT sections, cities/towns and utilities

Decision Matrix

Factors	CRACK SEAL	RUBBERIZED ASPHALT CHIP SEAL	BONDED WEARING SURFACE	ELASTOMERIC THIN OVERLAY
Age of Road	5 (+) Years	7 (+) Years	7 (+) Years	7 (+) Years
Road Type	C2,C3	C2,C4	C2,C3	C2,C3
Traffic Volume	All Types	High Car / (Medium/High) Truck	High Car / High Truck	High Car / High Truck
Pavement Structure	All Types	All Types	All Types	All Types
Land Use	All Types	Non Residential, Rural, Farm, Non City	City, Urban Upscale	City, Urban Upscale
Pedestrian / Children	OK to use	Do not use	OK to use	OK to use
Road Features				
Curbing	OK	OK	OK	OK
Sidewalk	OK	OK	OK	OK
Distress Factors				
rutting > 3/4in.	OK with shim course	OK with shim course	OK with shim course	OK with shim course
utility trenches	OK	OK with shim course	OK with shim course or patching	OK with shim course or patching
crack density	Light to Heavy	Medium/Heavy	Light/Medium	Light/Medium
base failure alligator cracks	Some	yes with shim course	yes with shim course	yes with shim course
pothole / raveling	Some	Yes with patching	Yes with patching	Yes with patching
Location	All Types	Suburban, Rural, Commercial, Industrial	City, Urban	City, Urban
Restrictions				
Thetmoplastic/epoxy striping	N/A	No (must be removed)	No (must be removed)	No (must be removed)
Rigid Base	Yes	Yes	Yes	Yes
Intersections	Yes	No	Yes	Yes

RIDOT Pavement Preservation Program History: 1998-2014

Pavement Preservation Program (P^3) — 1998

- Program initiation with statewide crack seal contracts using block sealer ASTM D 6690
- Created extensive databases on highway/highway conditions
- Geographical Information System
  - For selection of roads for P^3
  - For monitoring of P^3
- 4 contracts (Total Funds: $460K)

Pavement Preservation Program — 1999

- Utilized Pavement Management Systems to enhance database
- Researched and initiated preventive maintenance surface treatments
  - Microsurfacing
  - Asphalt rubber chip seal (ARCS)
- 5 Contracts awarded: 3 crack seal, 2 surface treatments (Total funds: $1.3M)

Pavement Preservation Program — 2000

- Performance monitoring of pavement preservation treatments initiated
- Added Bonded Wearing Course treatment to preventive maintenance arsenal
- Experimental test sections utilizing combination of surface treatments (Cape Seal/SAMI)
- 6 contracts awarded: 3 crack seal, 3 surface treatments (Total funds $3.3M)

Pavement Preservation Program — 2001

- PPEST: Elastomeric Thin Overlay (TO) using chemically modified crumb rubber asphalt (CMCRA) added to preventive maintenance arsenal
- Surface Treatment experimental test sections added
- 7 contracts: 3 crack seal, 4 surface treatment (Total funds $2.8M)

Pavement Preservation Program - 2002

- Crack sealing using (CMCRA) with fibers
- Surface Treatments
  - Asphalt rubber chip seal (ARCS)
  - PPEST :Elastomeric overlay using chemically modified crumb rubber
- 4 contracts valued at $3.0M

Pavement Preservation Program - 2003

- Crack sealing using rubberized asphalt with fibers
- Surface Treatments
  - Asphalt rubber chip seal (ARCS)
  - Elastomeric overlay using chemically modified crumb rubber (PPEST)
- 4 contracts valued at $3.2M
- Whitetopping valued at $1.1M

Pavement Preservation Program - 2004

- Crack seal using rubber asphalt with fibers
- Crack seal (Rout) limited access highways
- Surface Treatments
  - ARCS
  - Elastomeric overlay using chemically modified crumb rubber
- 5 Contracts valued at $4.2M

Pavement Preservation Program - 2005

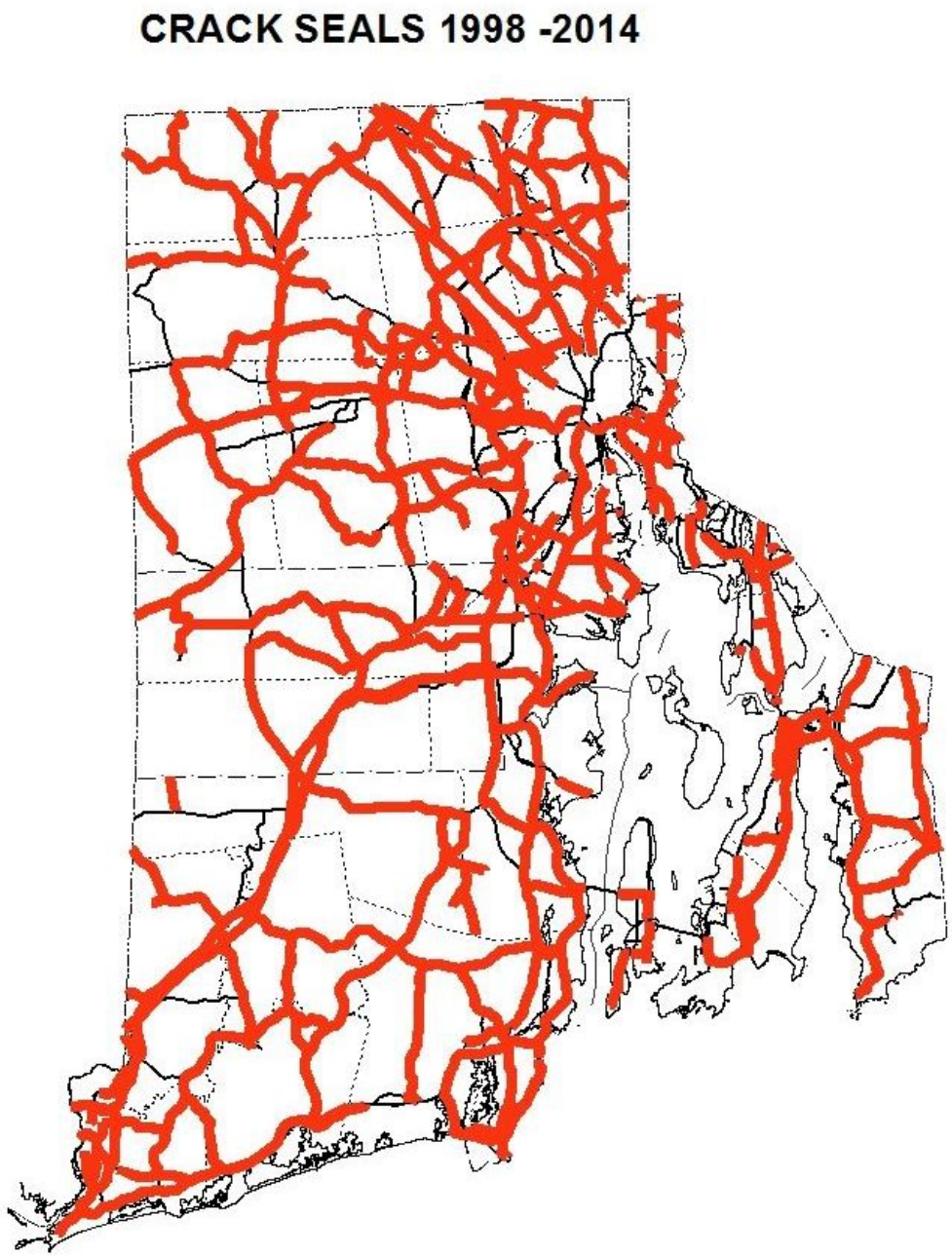
- Crack seal using rubber asphalt with fibers
- Surface Treatments
  - Asphalt rubber chip seal
  - Elastomeric overlay using chemically modified crumb rubber
  - Special project – SAMI chip seal with PPEST overlay
- 4 Contracts valued at $4.4M

Pavement Preservation Treatments to Date

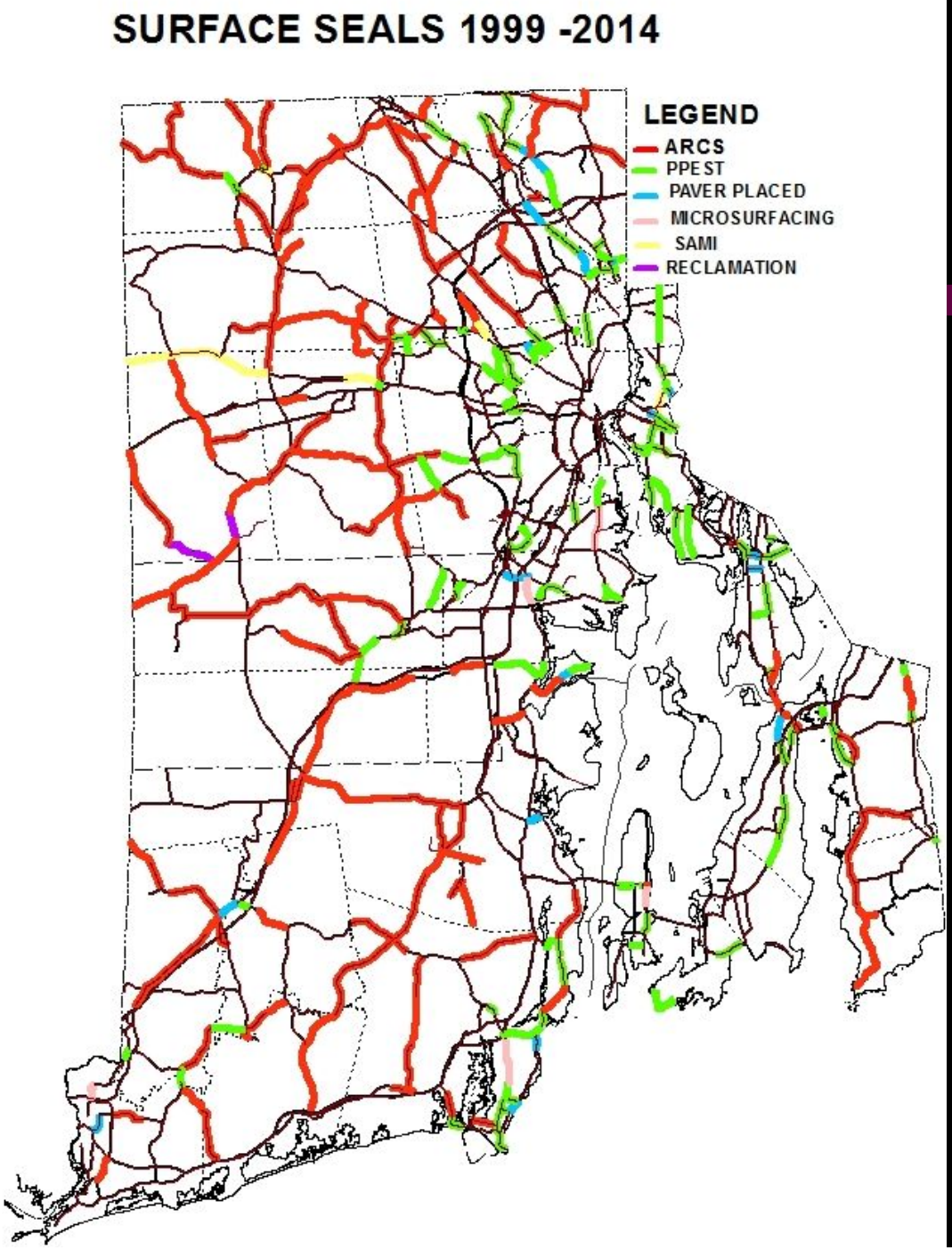
- Rhode Island experience to date
  - Crack Seal/Rout and Seal
  - Microsurfacing
  - ARCS-Asphalt Rubber Chip Seal
  - Bonded Surface Treatment
  - PPEST -Elastomeric Mix -Thin Overlay
  - Combination : Cape Seal/SAMI

Pavement Preservation Treatments to Date

- Rhode Island experience to date (CONT)
  - SAMI (ARCS + PPEST)
  - PPEST with 40 mesh asphalt rubber
  - PPEST with asphalt rubber + Warm Mix Additive
  - Reclamation with Emulsion Stabilizer
  - White Topping – Experimental Section



1998-2014 Crack Seal



1999-2014 Surface Seals

Pavement Preservation Tools/Treatment

Crack Sealing — Definition

- Crack Seal – Blow clean and heat crack; fill and overband with rubberized asphalt cover
- Rout and Seal – Grind out and heat crack; fill with rubberized asphalt

Crack Seal Material Composition

- Hot Applied Block Sealer– ASTM 6690 Type II
- Asphalt Rubber W/ Fibers:

  Neat Asphalt – PG 58 – XX

  Crumb Rubber – Minimum 5%, 80/40 mesh

  Blend AC – PG 70-34/64-34

  Blend Viscosity – 3 Pa · s @ 300°F

  Chemical Bonding Agent

  Fibers – 10 mm length polyester, 15 dpf

Crack Sealing — Heating Kettle

Crack Sealing — Preparation (Hot Air Lance)

Crack Sealing — Sealing Operation

Crack Sealing — Sealing/Blinding Operation

Crack Sealing — Failure

Crack Sealing — Failure

Surface seals

- All roads to be surface sealed are crack sealed
- Brought to profile and camber by shimming and milling
- Must be structurally sound

Microsurfacing

Microsurfacing — Definition/Properties

A polymer modified asphalt slurry consisting of emulsion, aggregate and Portland cement. Applied with specialized equipment and is a relatively fast operation.

- Does not require much surface preparation
- Good skid resistance values
- Good for rut filling
- Mitigates aging of underlying HMA layer
- Prone to cold weather reflective cracking

Microsurfacing

Microsurfacing — Before

Microsurfacing — After

Microsurfacing — Equipment

Microsurfacing Issues — *Cracking Around Heads*

Microsurfacing Issues — *Cracking Propensity*

Microsurfacing Issues — Washboarding

Microsurfacing Issues — Delam at Heads

Microsurfacing Issues — Delam at Gutter Line

Microsurfacing Issues

- **Noise** (for the first season)
- Rough pavement texture
- Scalloping of pavement (plows)
- Delamination

Asphalt Rubber Chip Seal (ARCS)

Asphalt Rubber Chip Seal (ARCS) — Definition/Properties

The ARCS is a blend of 20% crumb rubber and asphalt. ARCS is hot spray-applied at the rate of 0.6 gallons per square yard. Then covered with 1/4”- 1/2" precoated stone, followed by rolling.

- Flexible - Good for moderately cracked roads.
- Relatively easy/fast to apply
- Ideal for cold wet climates
- Other unique applications

Asphalt Rubber Chip Seal (ARCS) Material Composition

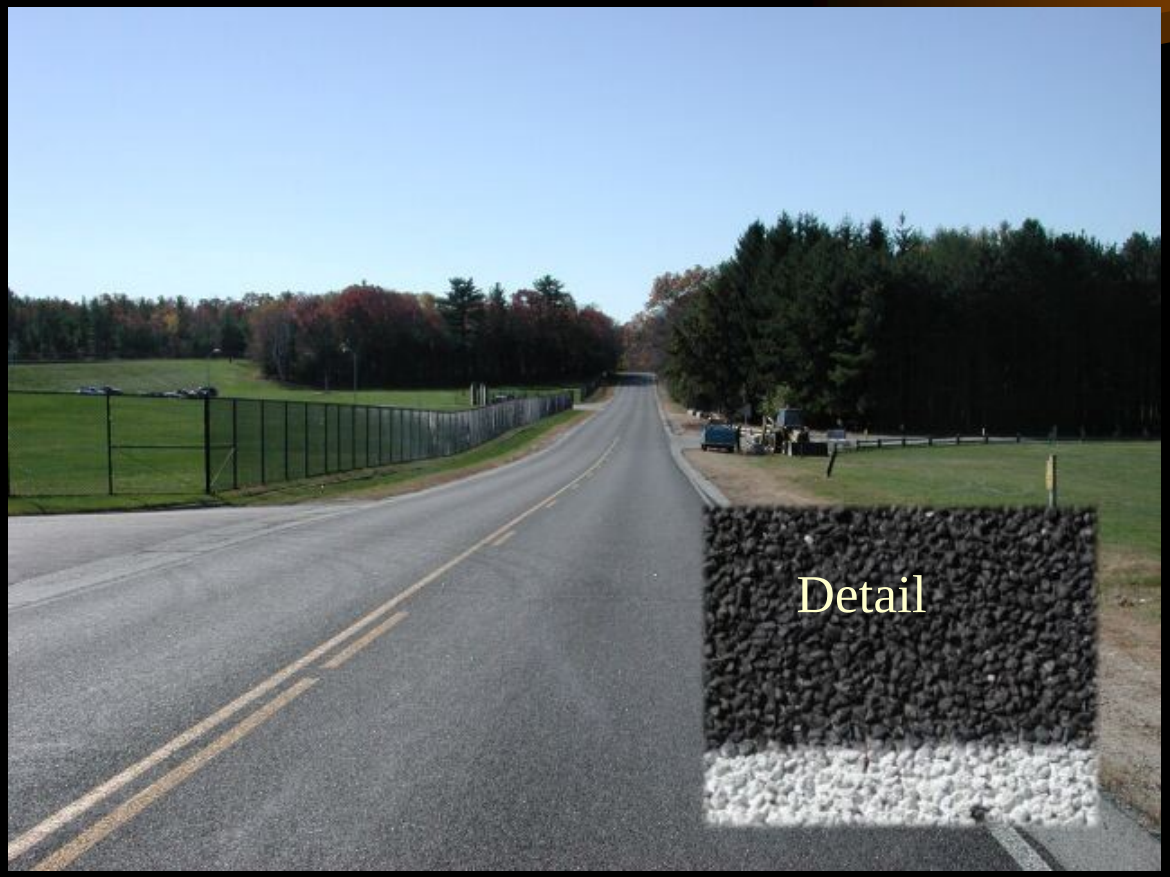
- PG 58 – 28
- Asphalt Rubber – Max size #10 sieve
- Rubber % - 20 ± 3
- Aggregate Size – ¼” to ½” (single size)
- Aggregate Coating – 100% coating w/PG 58 - 22

Asphalt Rubber Chip Seal

Asphalt Rubber Chip Seal Prep - Shim and Crack Seal

Asphalt Rubber Chip Seal — Before

Asphalt Rubber Chip Seal — After



Asphalt Rubber Chip Seal — Sprayer

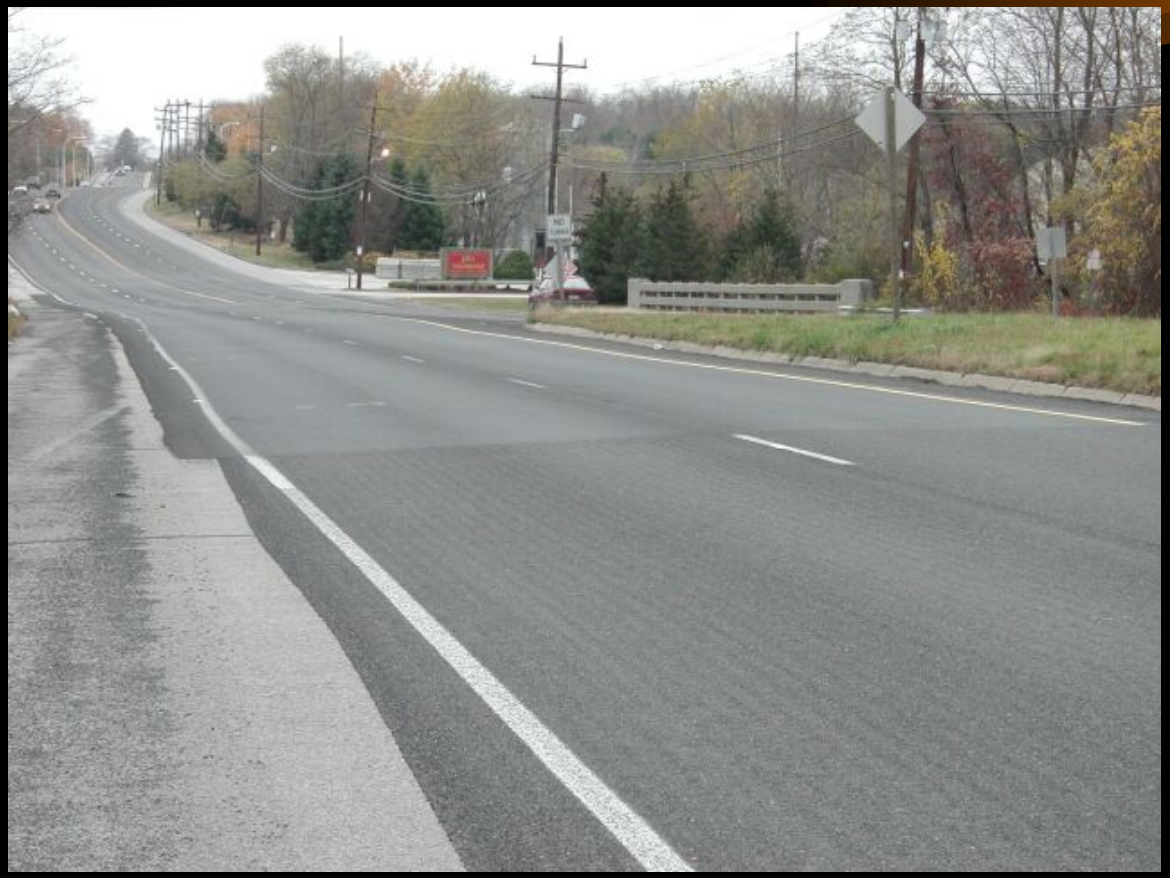
Asphalt Rubber Chip Seal — Chip Spreader

Asphalt Rubber Chip Seal — Rolling

Asphalt Rubber Chip Seal Issues — Bleeding @ Intersection

Asphalt Rubber Chip Seal Issues — Improper Roller

Asphalt Rubber Chip Seal Issues — Streaking



Asphalt Rubber Chip Seal Issues — Stone Kick Out

Asphalt Rubber Chip Seal Issues — Delam due to Thermoplastic

Asphalt Rubber Chip Seal Issues — Delam due to Thermoplastic

Asphalt Rubber Chip Seal — Unique Applications

Asphalt Rubber Chip Seal — Unique Applications

Asphalt Rubber Chip Seal — Unique Applications

Asphalt Rubber Chip Seal — Unique Applications

Concrete Pavement

Paver Placed Surface Treatment (Nova Chip)

Paver-Placed Surface Treatment (Nova Chip/PPST) - Definition

PPST is a polymer emulsion (applied at 0.25 gallons per square yard) sprayed immediately before placement of the hot mix overlay (3/4"). Followed by rolling.

- Efficient/fast operation
- Used on roads with sound foundation
- Good ride and aesthetically pleasing

Paver-Placed Surface Treatment

Paver-Placed Surface Treatment – Before

Paver-Placed Surface Treatment – After

Paver-Placed Surface Treatment — Train

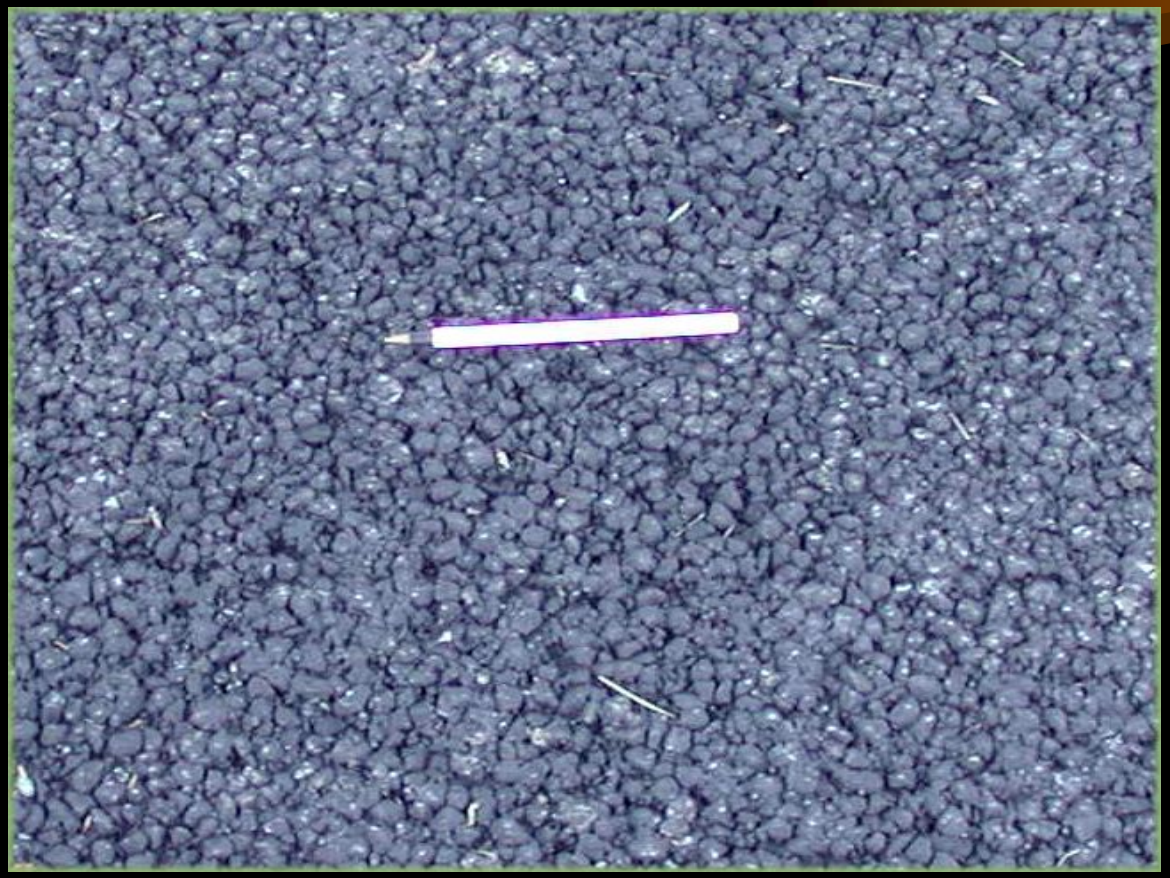
Paver-Placed Surface Treatment — Emulsion/Mix Application

Paver-Placed Surface Treatment — Roller Compaction

Paver-Placed Surface Treatment Issues — Cracking

Paver-Placed Surface Treatment Issues — Bleeding

Paver-Placed Surface Treatment Issues — Handwork (Open Mix)



Paver-Placed Surface Treatment Issues — Low Heads

Paver-Placed Surface Treatment Issues — Equipment Mobility

Paver-Placed Surface Treatment — Unique Applications (Shoulder)

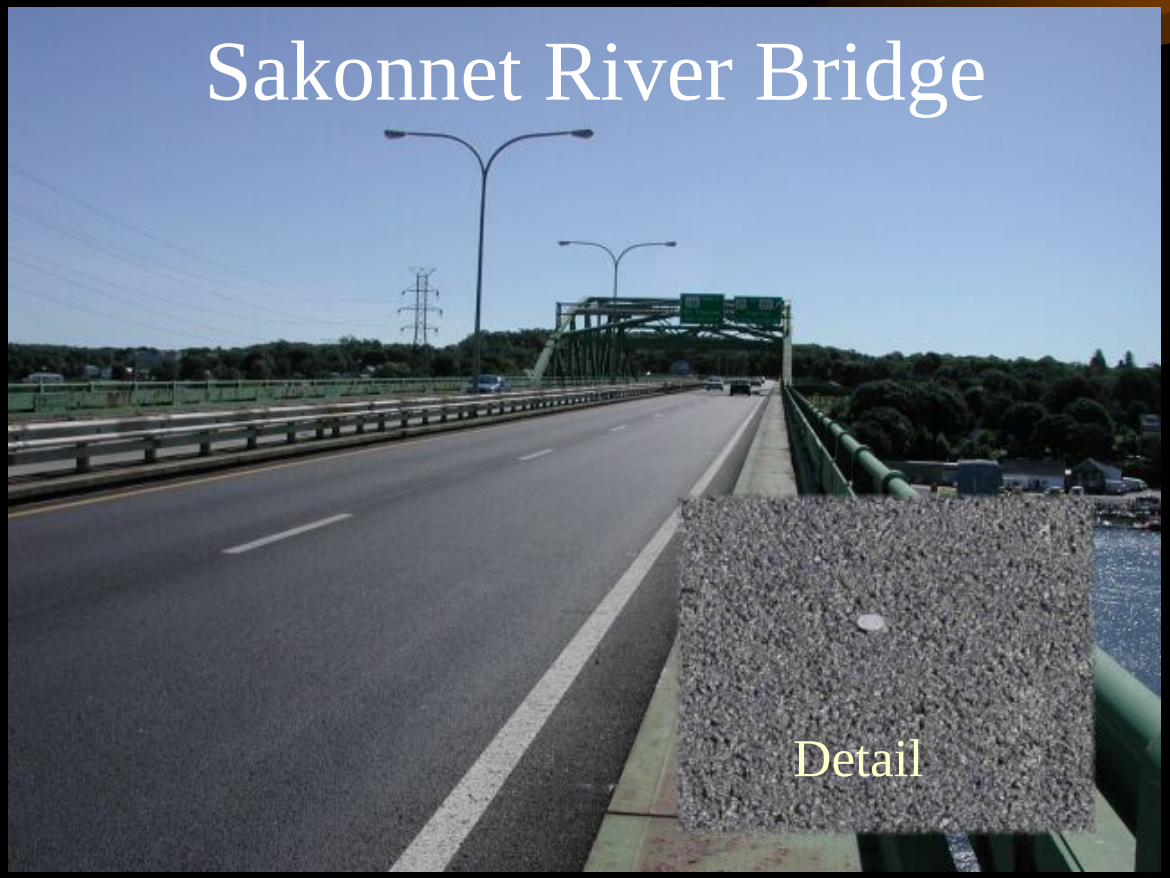
Paver-Placed Surface Treatment — Unique Applications

Paver-Placed Surface Treatment — Unique Applications

Sakonnet River Bridge

Paver-Placed Surface Treatment — Unique Applications

Paver-Placed Surface Treatment — Unique Applications



Paver-Placed Elastomeric Surface Treatment - Thin Overlay (PPEST)

Paver-Placed Elastomeric Surface Treatment (PPEST) — Definition

PPEST is a mixture of coarse-graded 3/8 inch crushed aggregate and a chemically modified crumb rubber asphalt (CMCRA) binder. The binder is PG 70-28 and contains a minimum 5% CMCR. The mix has a binder content of 6.0 to 7.5%. PPEST is:

- Produced in a Conventional hot mix plant
- Applied to a tack-coated surface
- Placed to a one-inch compacted thickness

PPEST Composition

CMCRA Binder:

- Neat Asphalt: PG 58 – XX
- Crumb Rubber: 7% with Chemical Bonding Agent
- Asphalt Blend: PG 76 – 34/PG 70 - 28

Separation < 5%

PAV < 5000 KPa @ 7 °C

El Rec ≥ 70% @ 4°C

Aggregate: Maximum size ½”

Marshall Mix Design: Stability 1000 lbs, Flow 8-16

PPEST — *Before*

PPEST — *After*

PPEST — *Train*

PPEST — *Roller*

PPEST Issues — *Proper Tacking*

PPEST — *Pavement Joint*

PPEST Issues —*Texture*

PPEST Issues — *Tack Streaking*

PPEST Issues — *Tearing*

Special Treatment PPEST/ARCS SAMI - Tack Coat

Special Treatment PPEST/ARCS SAMI - Paving

Whitetopping

Whitetopping - Definition

- Thin (~4”) concrete overlay over existing asphalt pavement
- Prevents rutting and shoving at intersections, particularly on downhill grades
- Useful in areas with traffic by heavy vehicles, such as truck stops

Whitetopping - Milled Surface

Whitetopping - Placement

Whitetopping - Screeding

Whitetopping - Finishing

Whitetopping - Handfinishing

Whitetopping - Sawcutting

Whitetopping - Traffic on Grade

Pavement Preservation Program Monitoring

Pavement Preservation Program – Monitoring

- Beginning in 2000, the P2 program has been monitored biannually by the Pavement Management section with 20 active sections to date

Pavement Preservation Program – Monitored Treatments

- Crack seal
- Microsurfacing (MS)
- Novachip (NC)
- Asphalt rubber chip seal (ARCS)
- Elastomeric thin overlay (TO)/CMCR
  - Asphalt rubber w/40 mesh
  - Asphalt rubber w/Warm Mix Additive
- Compound seals: SAMI – ARCS w/NC
  Cape Seal – ARCS w/MS

Pavement Preservation Program – Distress Monitoring

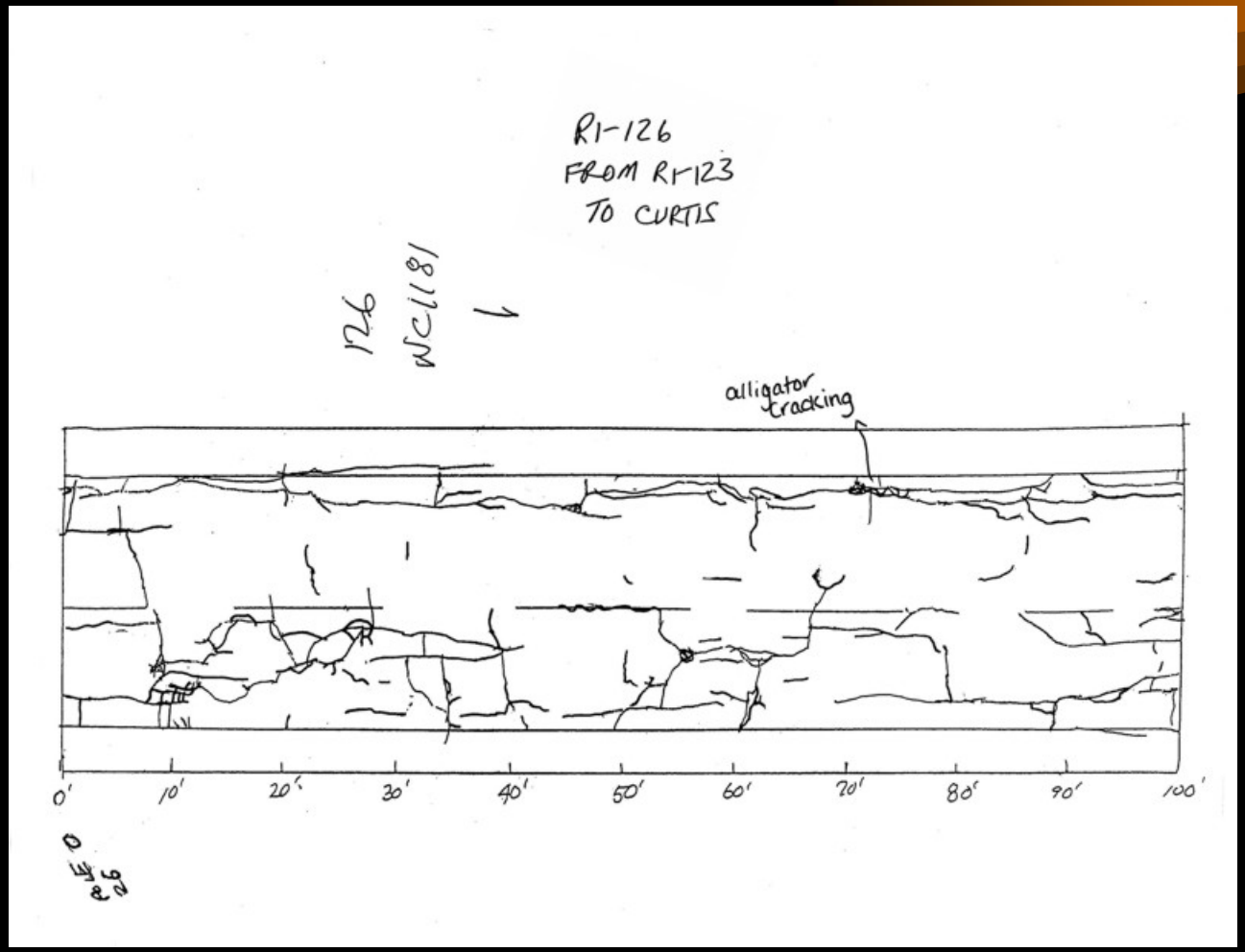
- Crack mapping
- Rutting/raveling/bleeding
- Skid numbers/IRI

Note: Cracking has been the most prevalent distress noted and is being used as a comparator

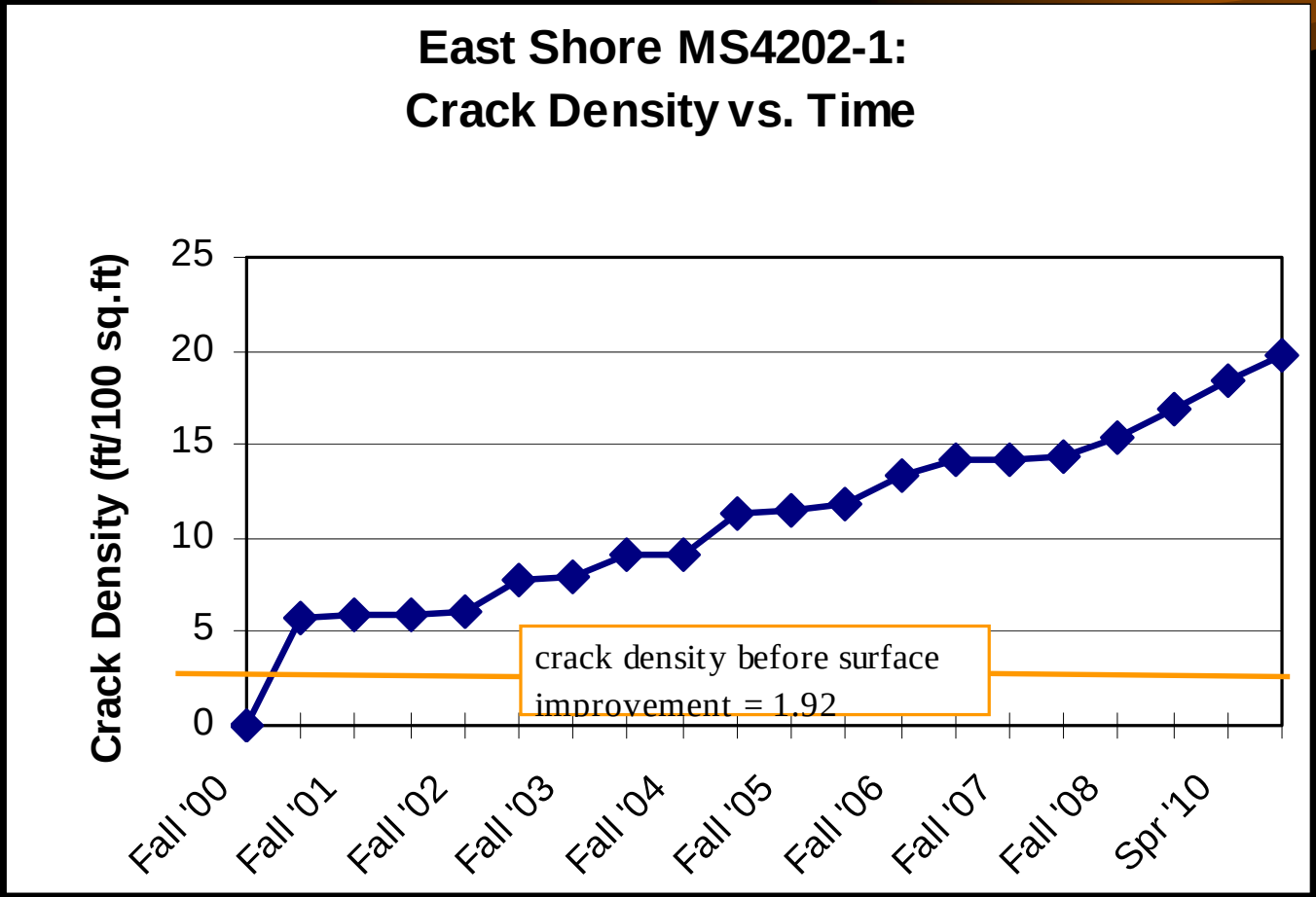
Pavement Preservation Program – Monitoring Goals

- Evaluate the efficacy and cost efficiency of the program
- Determine superior performing surface treatments
- Validate the methods and materials used

Pavement Preservation Program – Crack Distress Map



Pavement Preservation Program– Monitoring Examples



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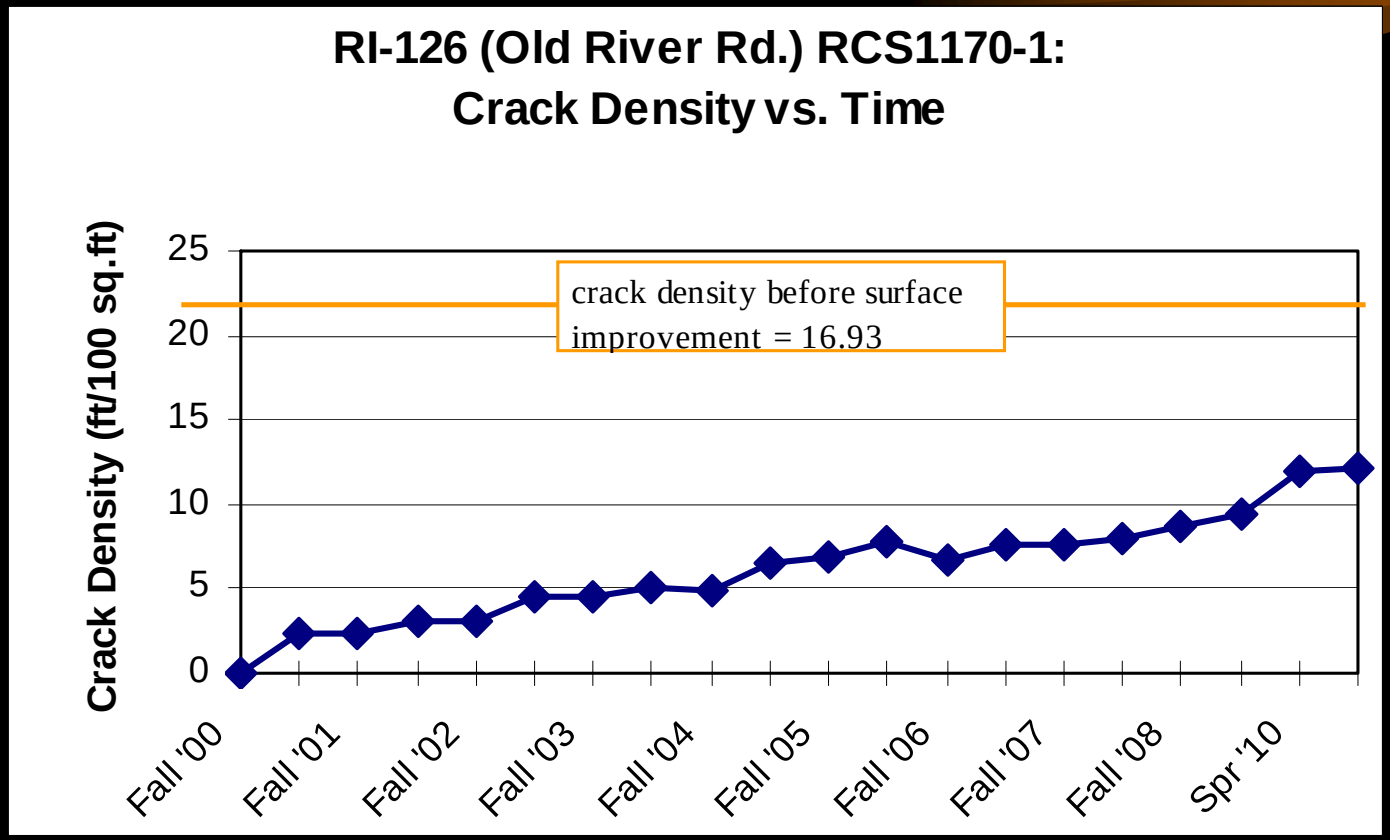

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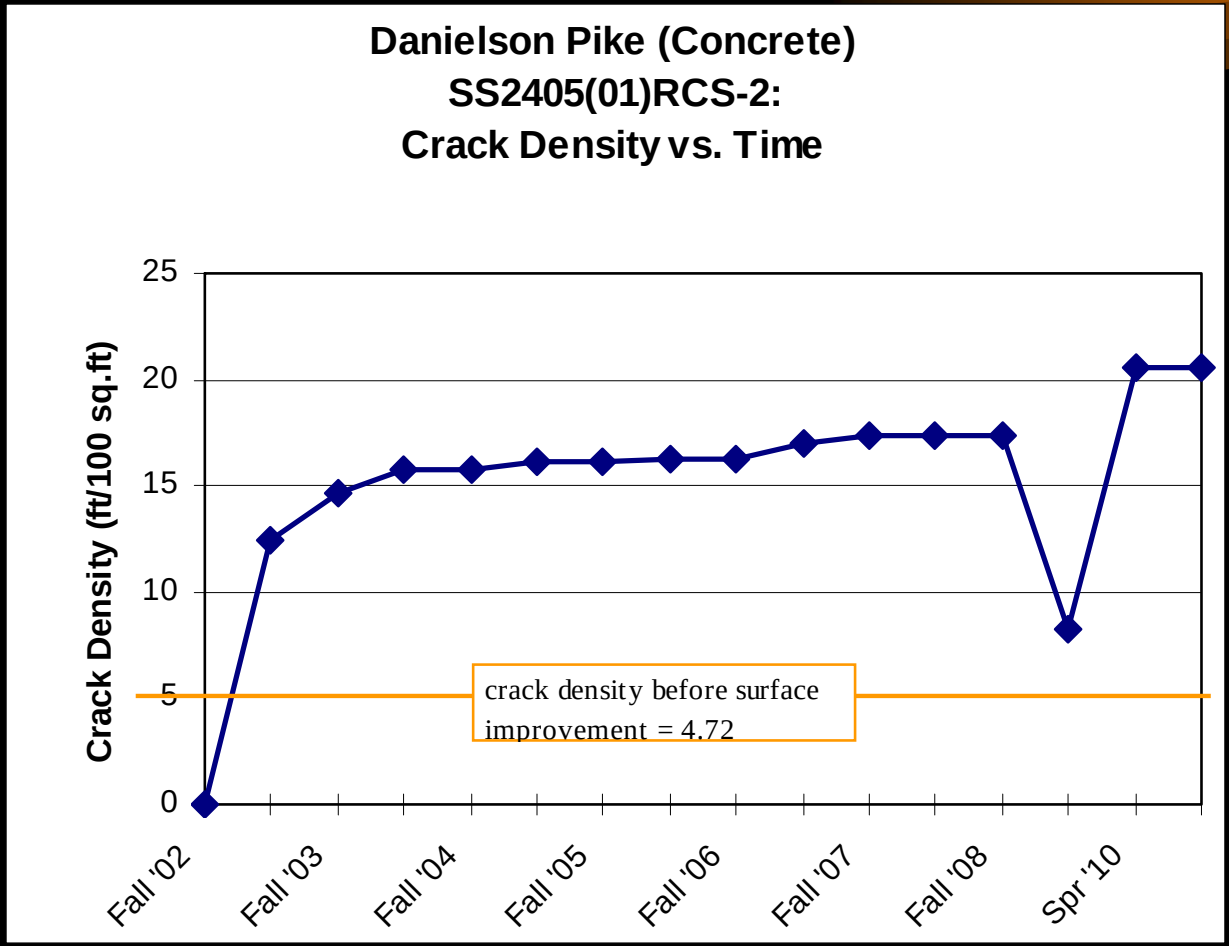

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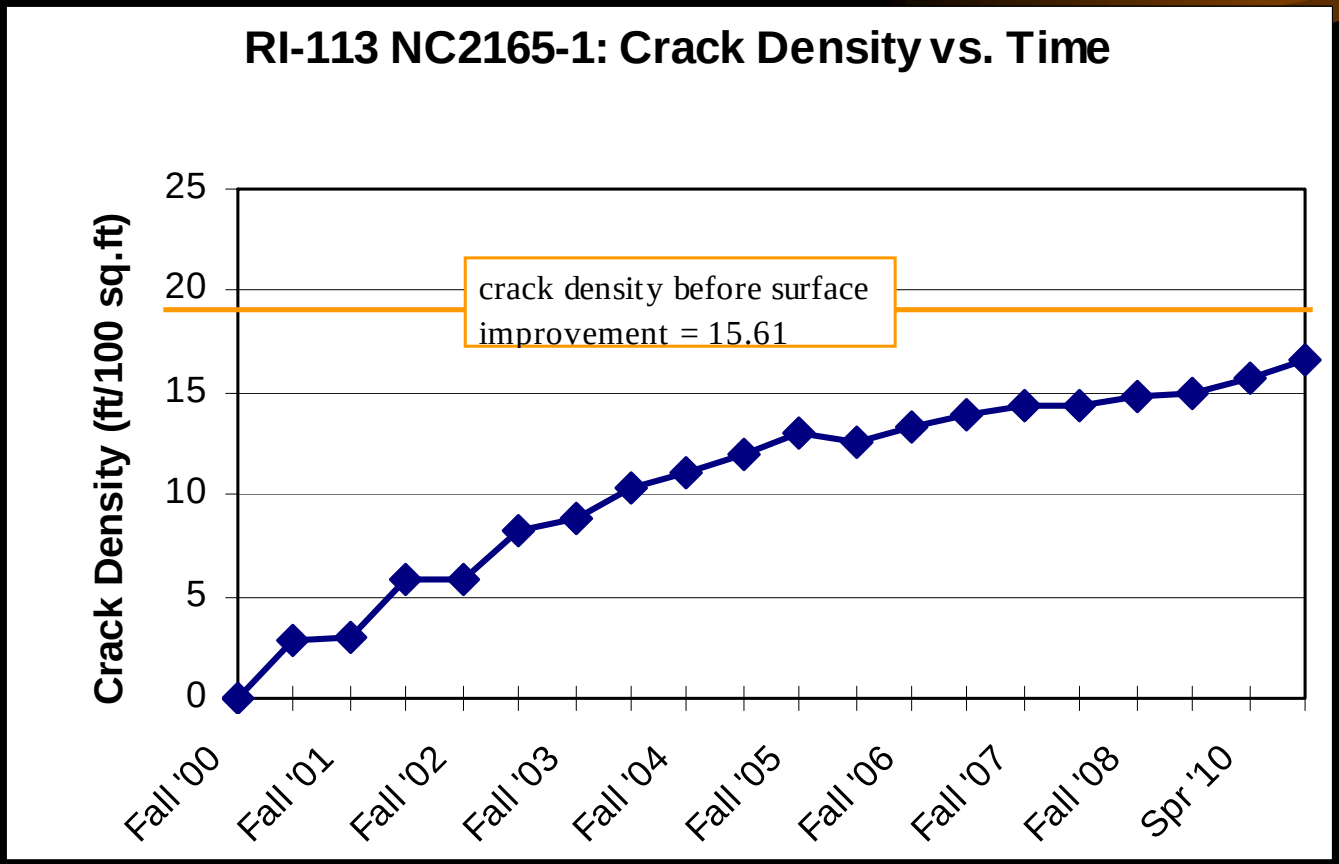

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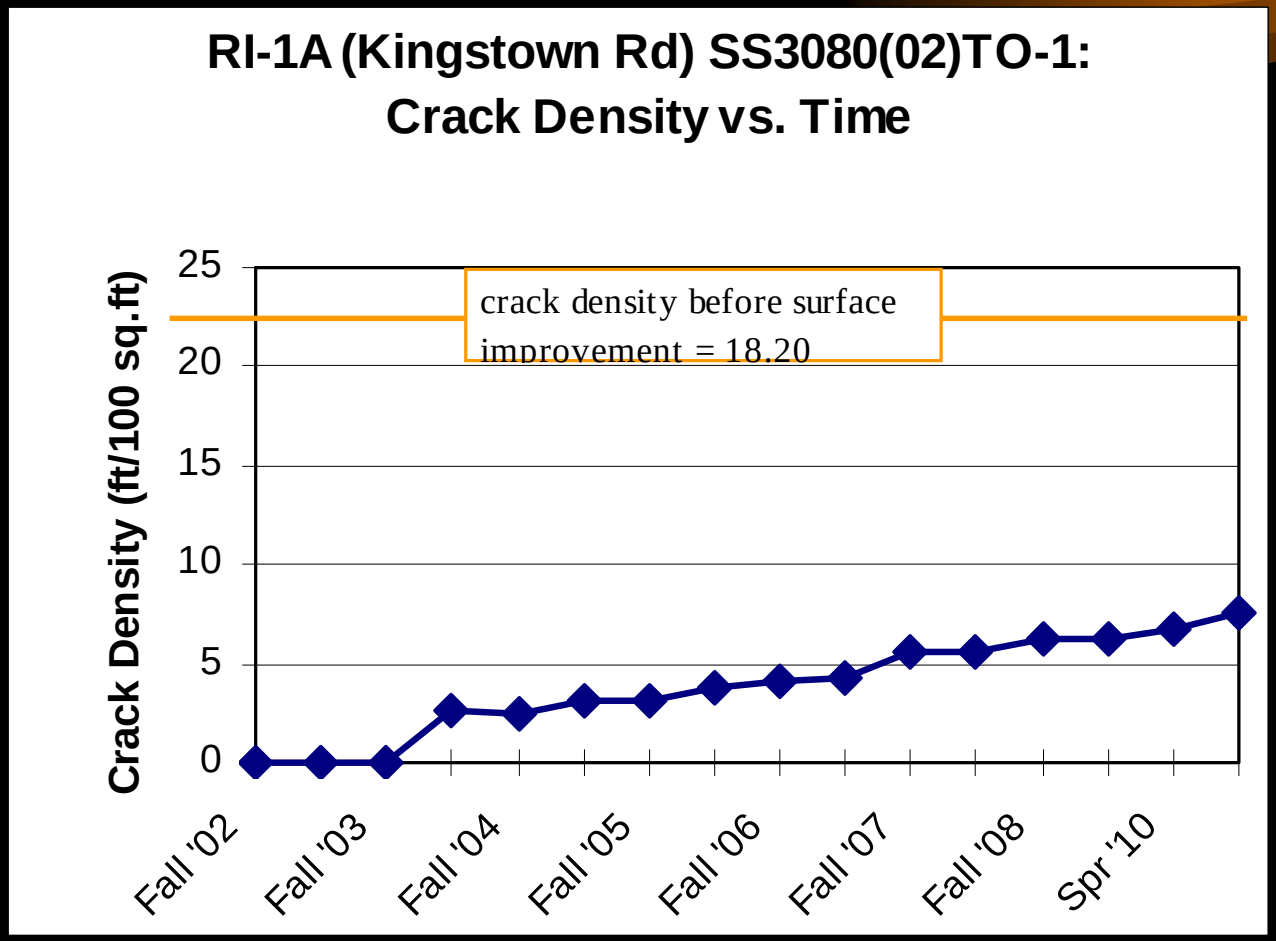
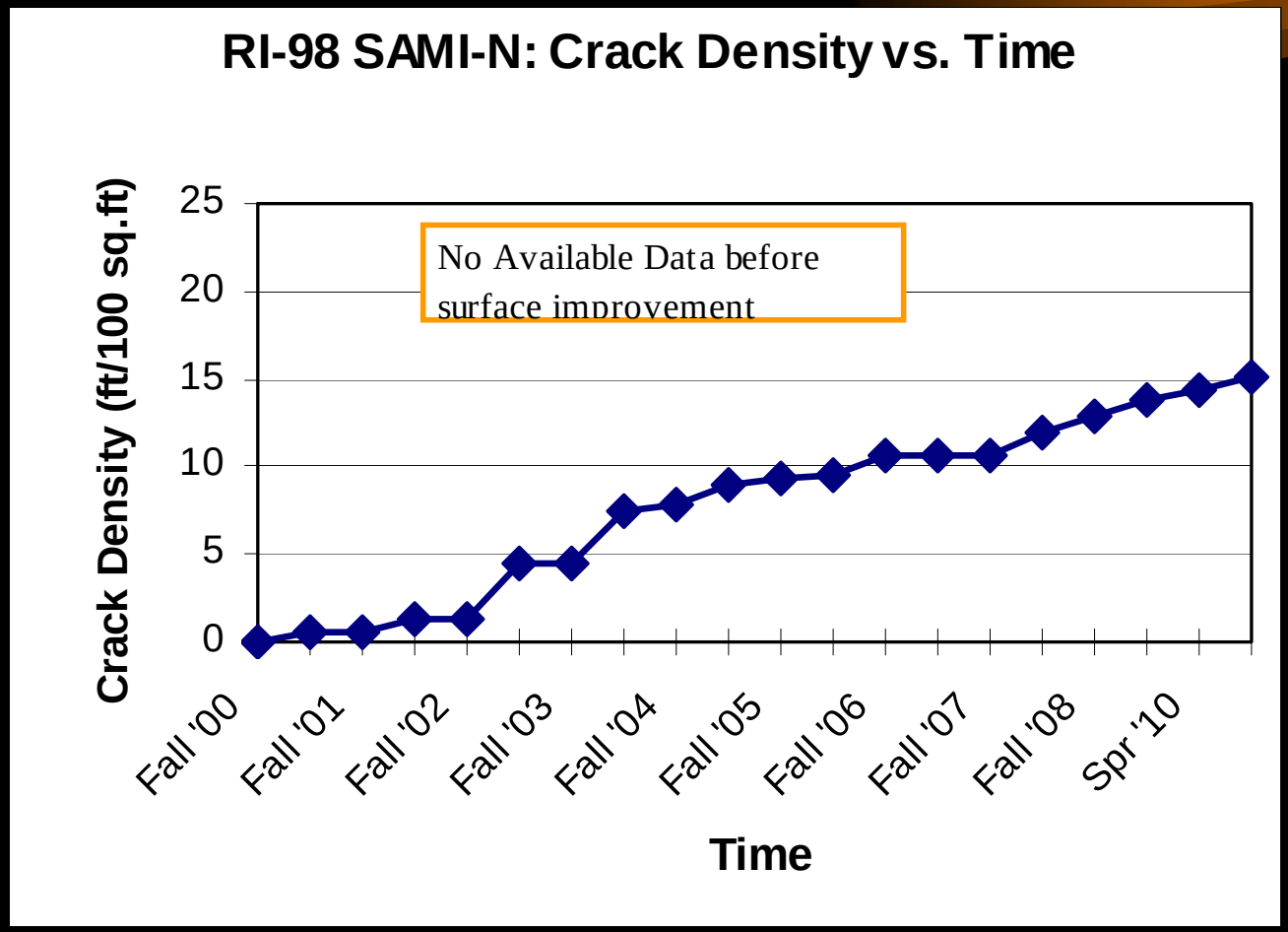


Pavement Preservation Program– Monitoring Examples



Lessons Learned

P^3 Lessons Learned - Databases

- Use Pavement Management techniques
- Use GIS /Create database for highway network
- Need for continually updated information/data
- Monitoring of surface treatment for efficacy and cost/benefit analysis

P^3 Lessons Learned - GIS

- GIS has been incorporated into the P^3 and is an indispensable tool for:
  - Project selection
  - Contract documentation and preparation
  - Monitoring/tracking of pavement treatments

Final Thoughts on the RIDOT P^3

- The program is growing in scope due to its effectiveness
- Continuing support from the Director and top management is critical to ensure dedicated funding
- Try new tools and technologies growth and experience are essential
- Periodic in depth assessments (fiscal/technical) are crucial to the health and direction of the program

The End…

…and yet, only the beginning, as the task of preserving our highways is

… never-ending!