RIDOT

Pavement Preservation Program (P^3)

2003

From the June 2003 Issue of:

Better Roads

For The Government/Contractor Project Team

road manager by Ruth W. Steiger, Editor-in-Chief

Prevention versus Repair — Managing Your Budget

Ideally, we'd all use preventive road maintenance. In the real world, budgets may only allow lowest-initial-cost expenditures unless other answers can be found.

How can you find the money to make the switch from repeated repairs to scheduled preventive maintenance? And how do you convince the head of the agency and the taxpayers that it's the right thing to do?

Every dollar spent on preventive maintenance saves three to four dollars in future road repairs according to the conservative estimate from the National Cooperative Highway Research Program.

Michigan, a leader in pavement preservation, reports that it saves up to $10 for each preventive maintenance dollar spent.

Even so, some states still use very little preventive work. Florida, Hawaii, Kentucky, North Carolina, Ohio, Rhode Island, and Tennessee lag behind the other states according to a study conducted by the American Association of State Highway and Transportation Officials' Pavement Preservation Lead States Team.

The study found that pavement preservation maintenance programs were most often integrated with pavement management systems, letting the state departments of transportation and their engineers make optimal use of computerization.

Of the states responding to the questionnaire for the study, 85% had PPM programs. Half of those had been in use for more than 10 years.

Practices used vary widely, with some states leaving PPM-versus-repair decisions to district managers and engineers. Other DOTs

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From a potential problem…

… to a problem waiting to happen…

…that becomes a problem for everyone.

Rhode Island Department of Transportation Mission Statement

"…to provide a safe, effective and environmentally responsible intermodal transportation system that supports economic development and improves the quality of life for all Rhode Islanders."

RIDOT Annual Report 1999

Status of National Highway System (NHS)

- Interstate Era 1950-1980
  - Federally funded national highway network
  - 46k miles of Interstate in 4M mile of national paved roads
  - RI: 272 miles of NHS roads — Interstate 70 miles; State maintained roads ~700 miles; **C**ity and Town roads ~6000 miles
- Late 1980s, network largely complete, but
  - Increasing traffic demands
  - Aging infrastructure
- In 1991, Congress passed ISTEA, recognizing a comprehensive need for highway maintenance and pavement preservation

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 billion dollar investment
  - WE MUST PROTECT THEM!

PHILOSOPHY 101

PHILOSOPHY of MAINTENANCE

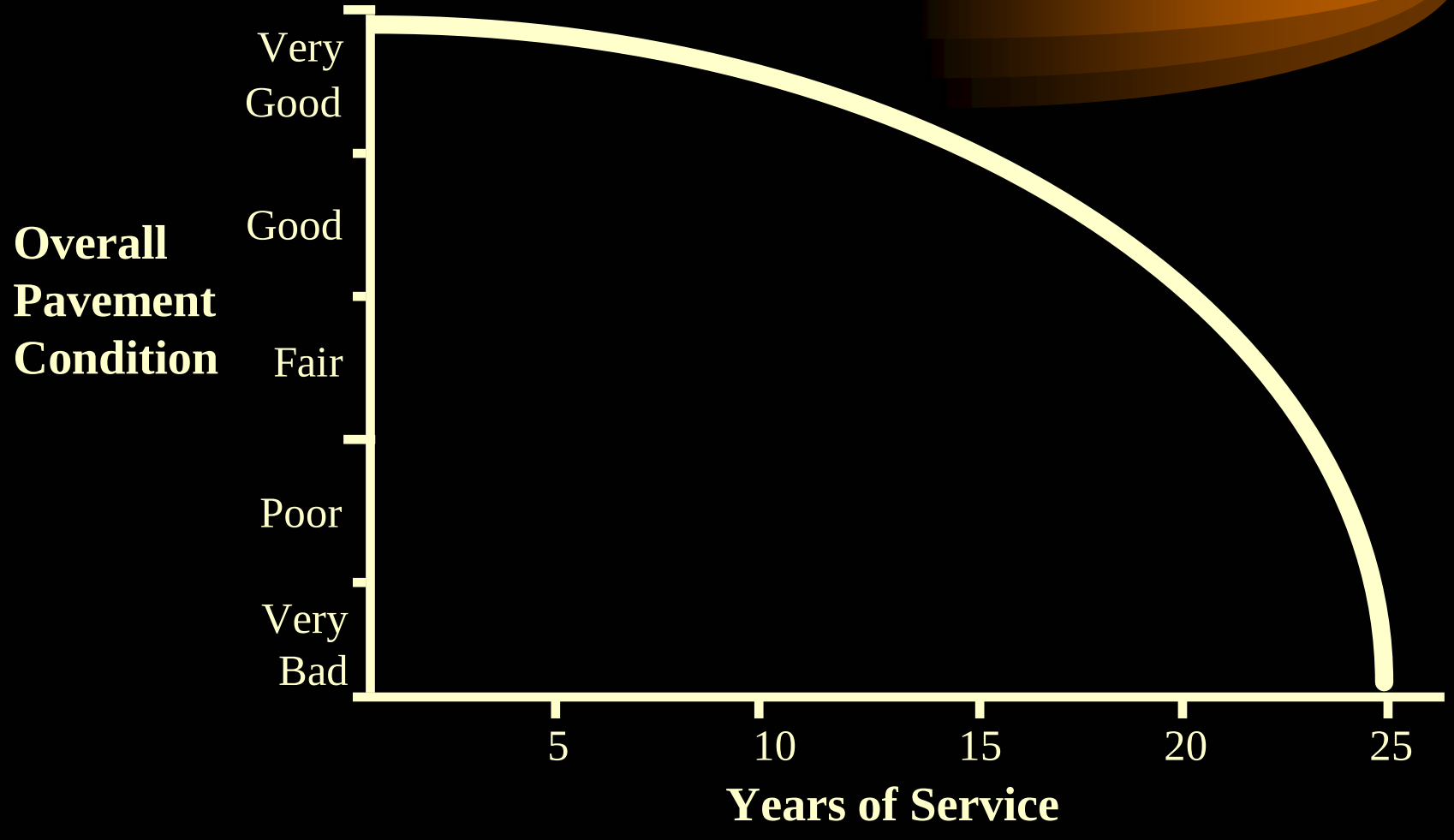
Timing of Maintenance

- 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

Deterioration Curves

- Studies show a correlation between pavement condition and age. This
  - Varies by pavement type and structure
  - Is generic in nature
    - Actual performance can vary depending upon many factors (traffic, environment, pavement structure, etc.)

Generic Deterioration Curve



Maintenance Strategies

Maintenance Strategies can be grouped into:

- Routine Maintenance
- Preventive Maintenance
- Defer Maintenance
  - Rehabilitation
  - Reconstruction
- Do nothing

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 Report for Five Year Old Roads

Highway Assessment Committee — 1997

- Study Focus: Ten year old roads
- Updated databases
- Researched use of Geographical Information Systems (GIS)
- Researched use of Pavement. Management Systems (PMS)

Pavement Preservation Program (P^3) — 1998

- Program initiation with statewide crack seal contracts
- Created extensive databases on highway/highway conditions
- Effected Integrated Geographical Information System with database
  - 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
  - Rubberized chip seal
- 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 paver-placed surface treatment to preventive maintenance arsenal
- Experimental test sections utilizing combination of surface treatments
- 6 contracts awarded: 3 crack seal, 3 surface treatments (Total funds $3.3M)

Pavement Preservation Program — 2001

- Rubberized asphalt mix added to preventive maintenance arsenal
- More 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 rubberized asphalt with fibers
- Surface Treatments
  - Asphalt rubber chip seal
  - 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
  - Elastomeric overlay using chemically modified crumb rubber
- 4 contracts valued at $3.2M
- Whitetopping valued at $1.1M

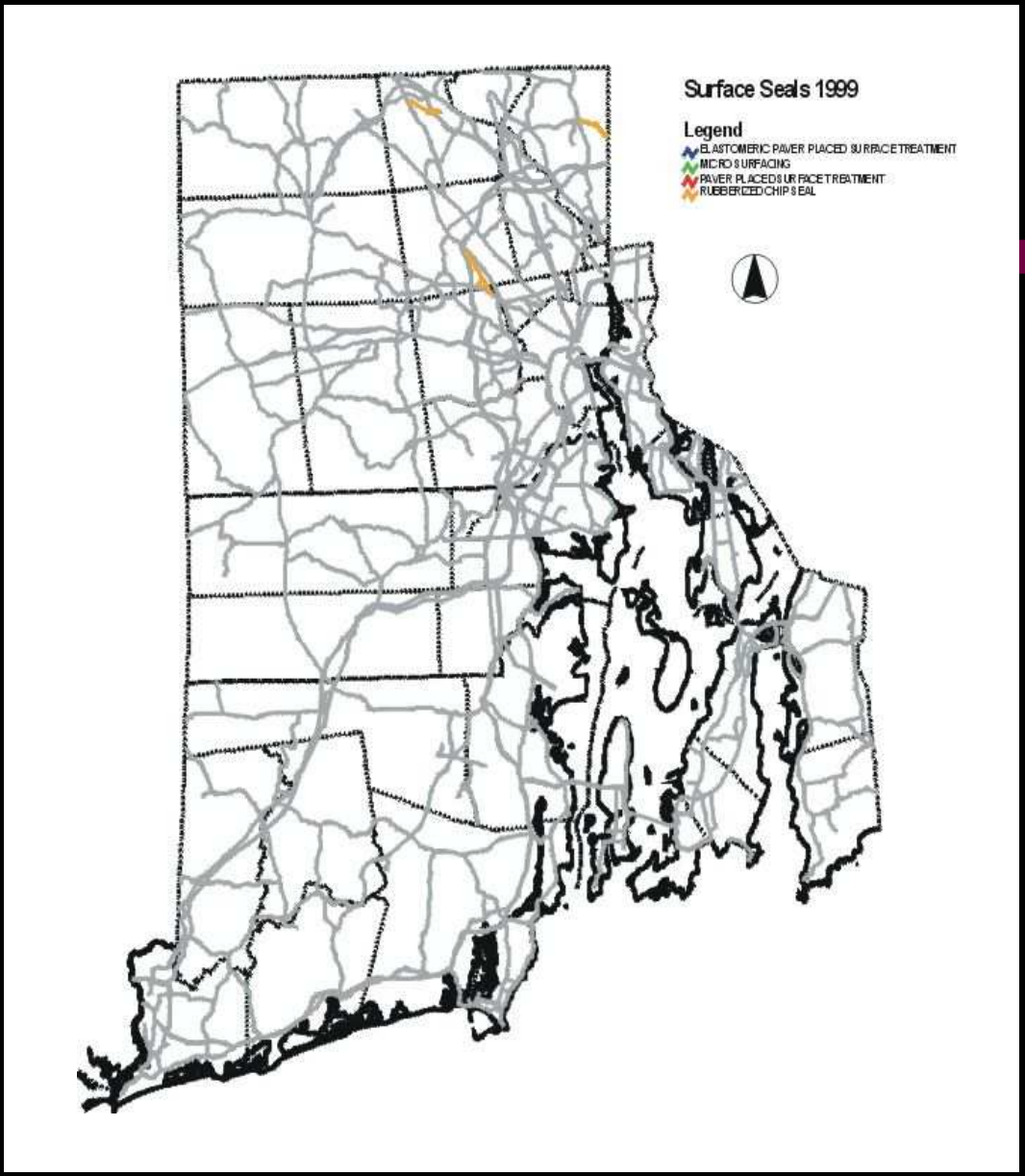
Pavement Preservation Treatments

- Rhode Island experience to date
  - Crack Seal/Rout and Seal
  - Microsurfacing
  - Rubberized Chip Seal
  - Paver-Placed Surface Treatment
  - Elastomeric Mix (new)
  - Combination Cape Seal/SAMI

Decision Matrix

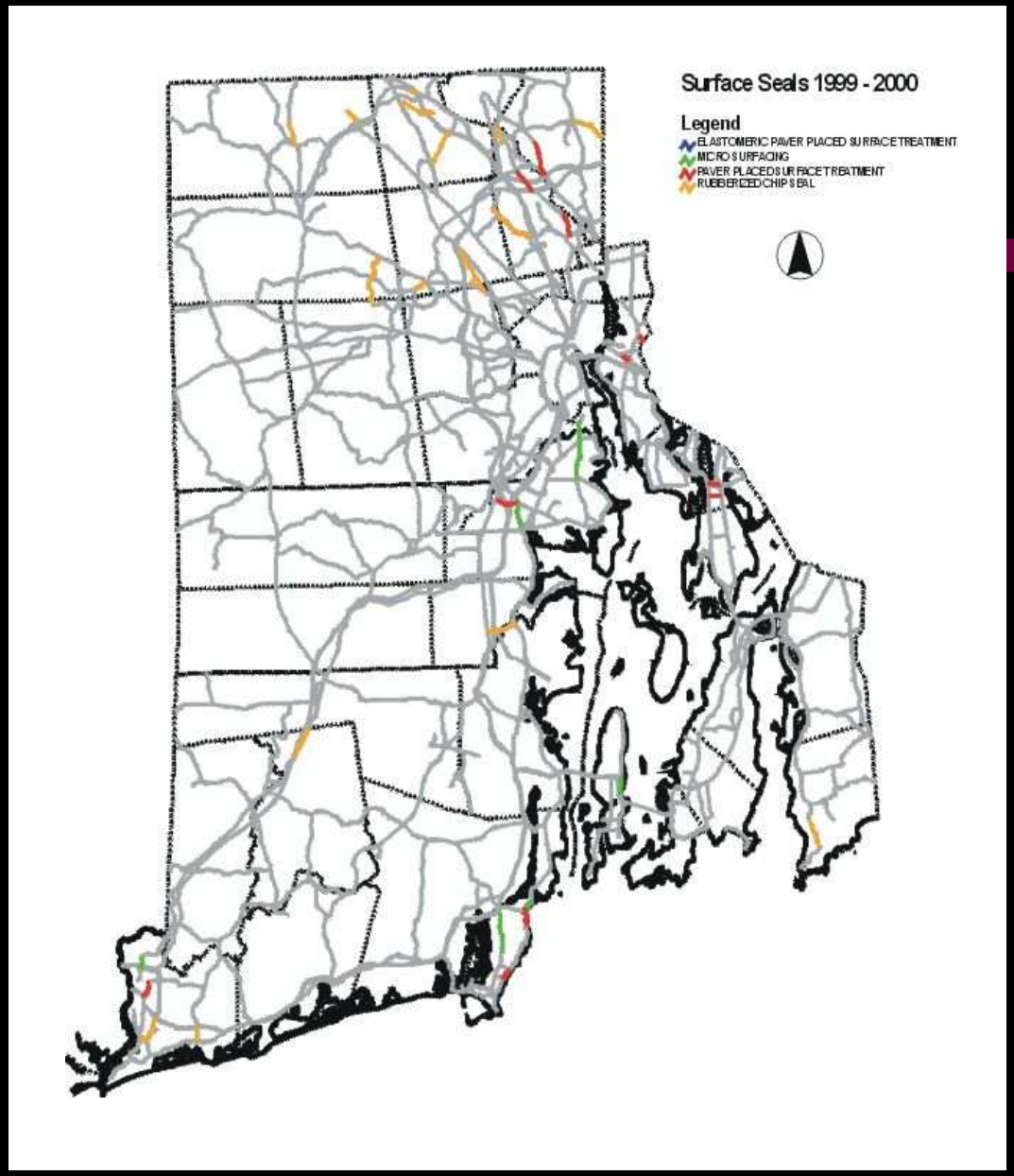
Factors	MICROSURFACING	RUBBERIZED ASPHALT CHIP SEAL	NOVACHIP	ELASTOMERIC THIN OVERLAY
Age of Road	7 (+) Years	7 (+) Years	7 (+) Years	7 (+) Years
Road Type	C2,C3	C2,C4	C2,C3	C2,C3
Traffic Volume	High Car / Low Truck	High Car / (Medium/High) Truck	High Car / High Truck	High Car / High Truck
Pavement Structure	>5 inches	>5 inches	>5 inches	>5 inches
Land Use	All Types	Non Residential, Rural, Farm, Non City, Industrial	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 with shim course	OK with shim course	OK with shim course or patching	OK with shim course or patching
crack density	Light	Medium/Heavy	Light/Medium	Light/Medium
base failure alligator cracks	No	yes with shim course	yes with shim course	yes with shim course
pothole / raveling	No	Yes with patching	Yes with patching	Yes with patching
Location	City, Urban, Suburban, non commercial	Suburban, Rural, Commercial, Industrial	City, Urban	City, Urban
Restrictions				
Thetmoplastic striping	No (must be removed)	No (must be removed)	Yes	Yes
Rigid Base	No	Yes	No	No
Intersections	Yes	No	Yes	Yes

1999 Surface Seals



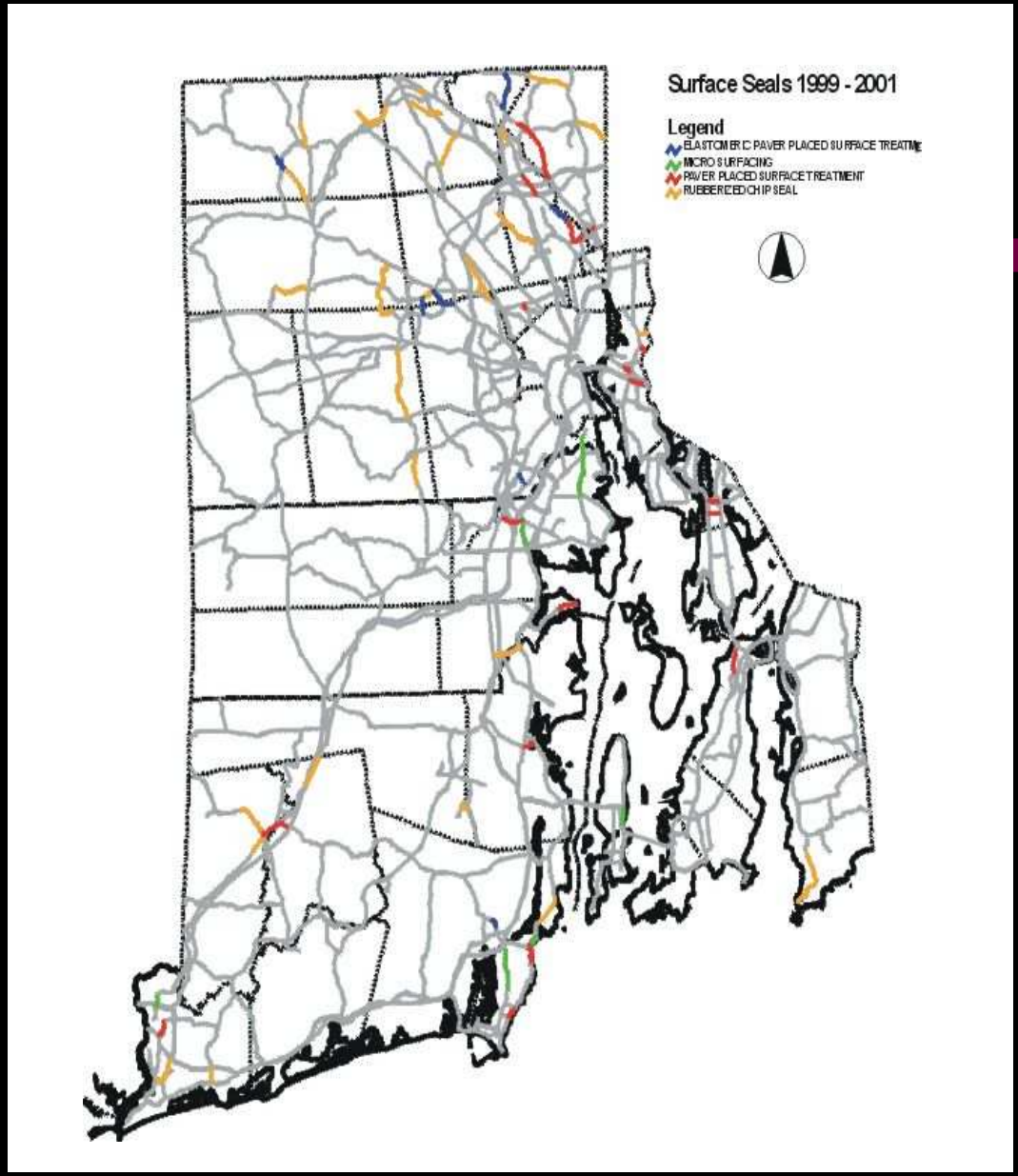
14.4 Miles Total

1999-2000 Surface Seals



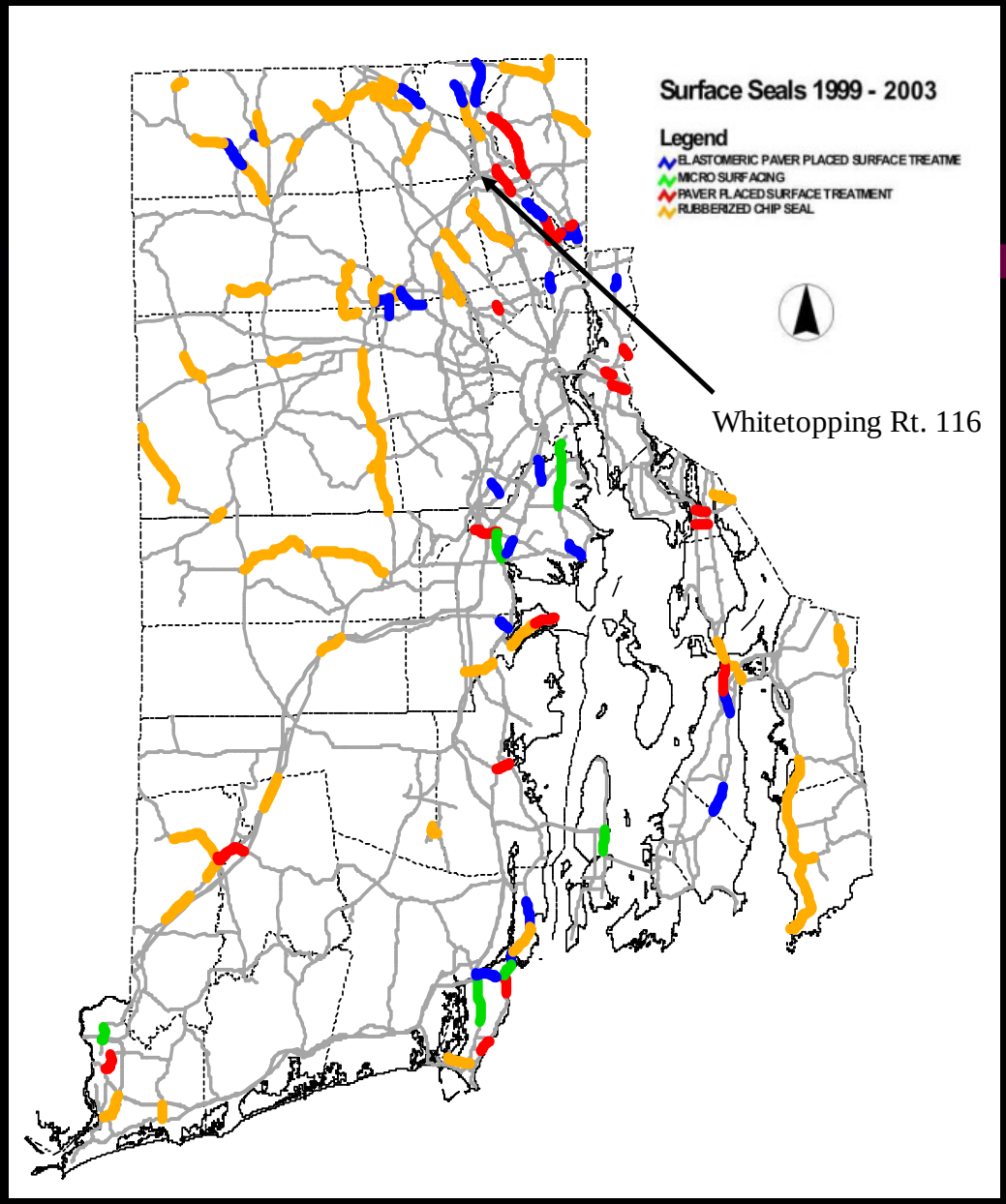
53.4 Miles Total

2000-2001 Surface Seals



91 Miles Total

1999-2003 Surface Seals



143.9 Miles Total

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 Sealing — Heating Kettle

Crack Sealing — Preparation (Hot Air Lance)

Crack Sealing — Sealing Operation

Crack Sealing — Sealing Operation

Crack Sealing — Sealing Operation

Crack Sealing — Failure

Crack Sealing — Procedure Video

Microsurfacing — Definition

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
- Prone to cold weather cracking
- Mitigates aging of underlying HMA layer

Microsurfacing

Microsurfacing — Before

Microsurfacing — After

Microsurfacing — Equipment

Microsurfacing Issues — *Cracking Around Heads*

Microsurfacing Issues — *Cracking Propensity*

Microsurfacing Issues — *Rumble Finish*

Microsurfacing — Washboarding

Microsurfacing — Scalloping

Microsurfacing — Delam at Heads

Microsurfacing — Delam at Gutter Line

Microsurfacing Issues — *Traffic Density*

Microsurfacing Issues

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

Rubberized Asphalt Chip Seal (RACS) — Description

The RACS is a blend of 20% crumb rubber and asphalt. RACS is hot spray-applied at the rate of 0.6 gallons per square yard. Then covered with 3/8" or 1/2" precoated stone, followed by rolling.

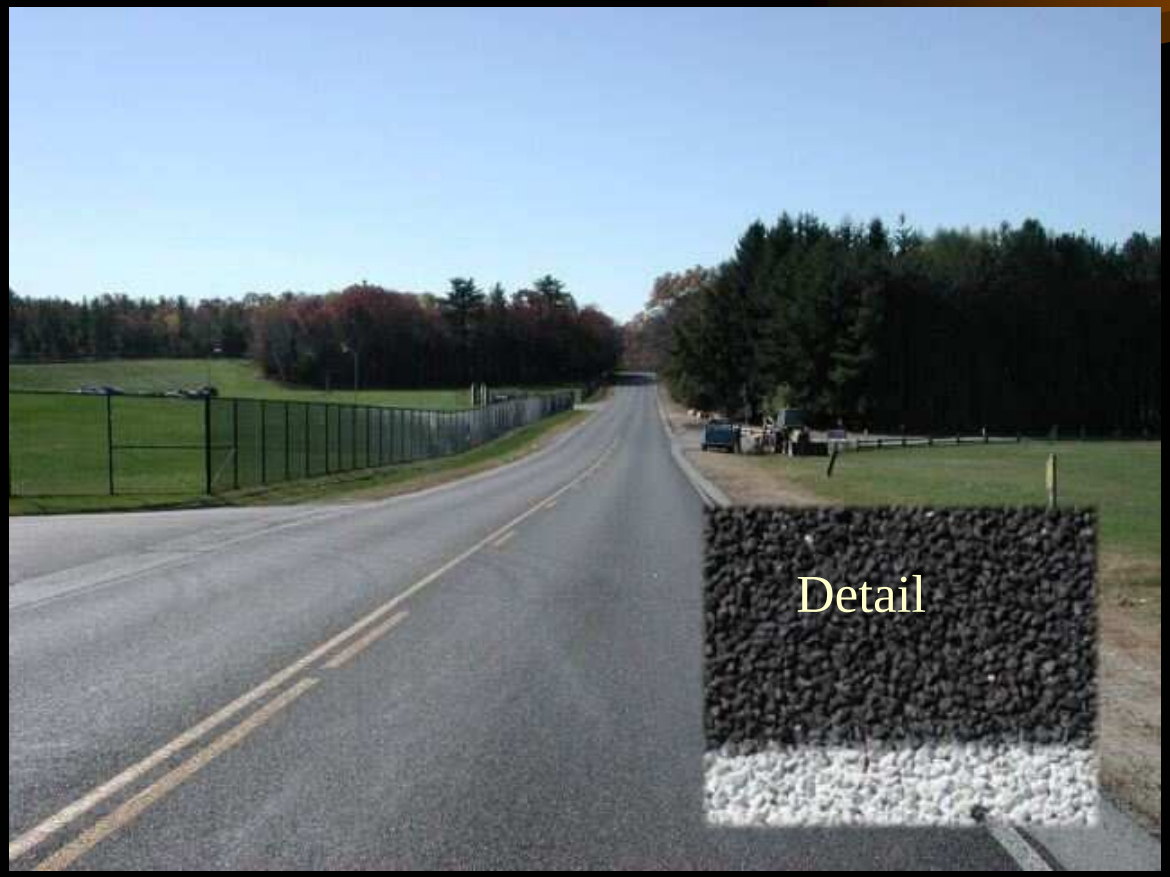
- Flexible - Good for moderately cracked roads.
- Relatively easy/fast to apply
- Ideal for cold wet climates
- Other unique applications

Rubberized Asphalt Chip Seal

Rubberized Asphalt Chip Seal — Prep/Shimming

Rubberized Asphalt Chip Seal — Before

Rubberized Asphalt Chip Seal — After



Rubberized Asphalt Chip Seal — Sprayer

Rubberized Asphalt Chip Seal — Chip Spreader

Rubberized Asphalt Chip Seal — Rolling

Rubberized Asphalt Chip Seal Issues — Bleeding @ Intersection

Rubberized Asphalt Chip Seal Issues — Improper Roller

Rubberized Asphalt Chip Seal Issues — Adhesion Failure

Rubberized Asphalt Chip Seal Issues — Streaking

Rubberized Asphalt Chip Seal Issues — Stone Kick Out

Rubberized Asphalt Chip Seal Issues — Delam due to Thermoplastic

Rubberized Asphalt Chip Seal Issues — Delam due to Thermoplastic

Rubberized Asphalt Chip Seal — Unique Applications

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Rubberized Asphalt Chip Seal — Unique Applications

Concrete Pavement

Paver-Placed Surface Treatment (PPST) - Description

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 Issues — Roller

Paver-Placed Surface Treatment Issues — Cracking

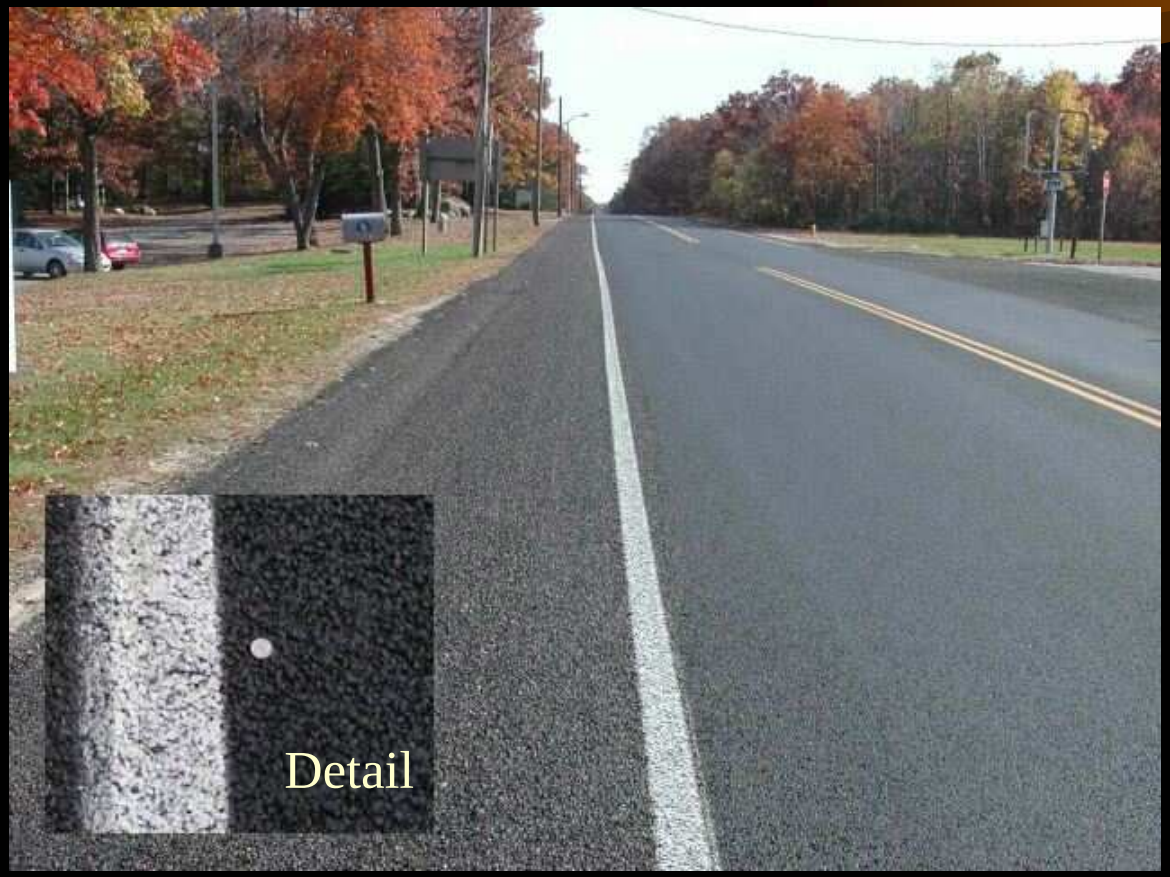
Paver-Placed Surface Treatment Issues — Bleeding

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

Sakonnet River Bridge

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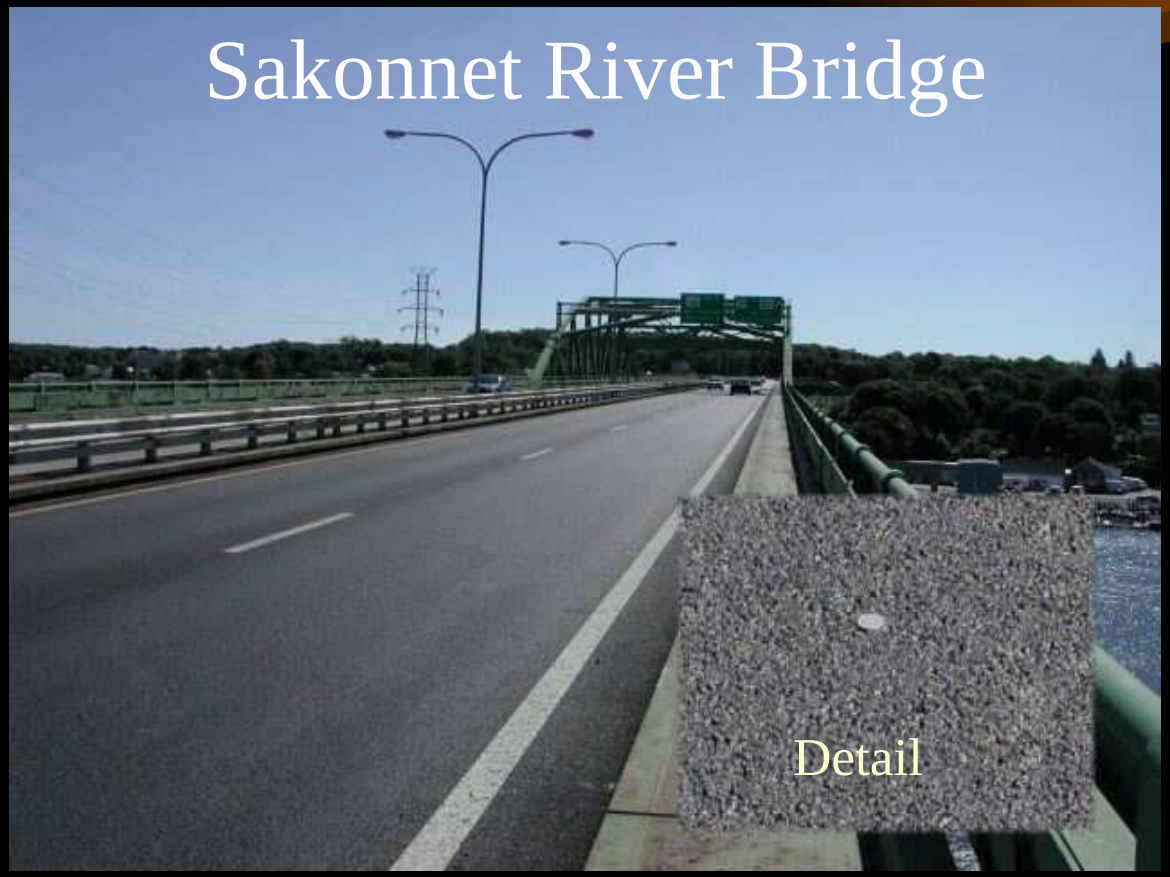
Paver-Placed Surface Treatment — Unique Applications



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 (CMCR) asphalt binder. The binder is PG 70-40 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

Paver-Placed Elastomeric Surface Treatment — Before

Paver-Placed Elastomeric Surface Treatment — After

Paver-Placed Elastomeric Surface Treatment — Train

Paver-Placed Elastomeric Surface Treatment — Spreader and Mix

Paver-Placed Elastomeric Surface Treatment — Roller

Paver-Placed Elastomeric Surface Treatment — Proper Tacking

Paver-Placed Elastomeric Surface Treatment — Pavement Joint

Paver-Placed Elastomeric Surface Treatment — Open Texture

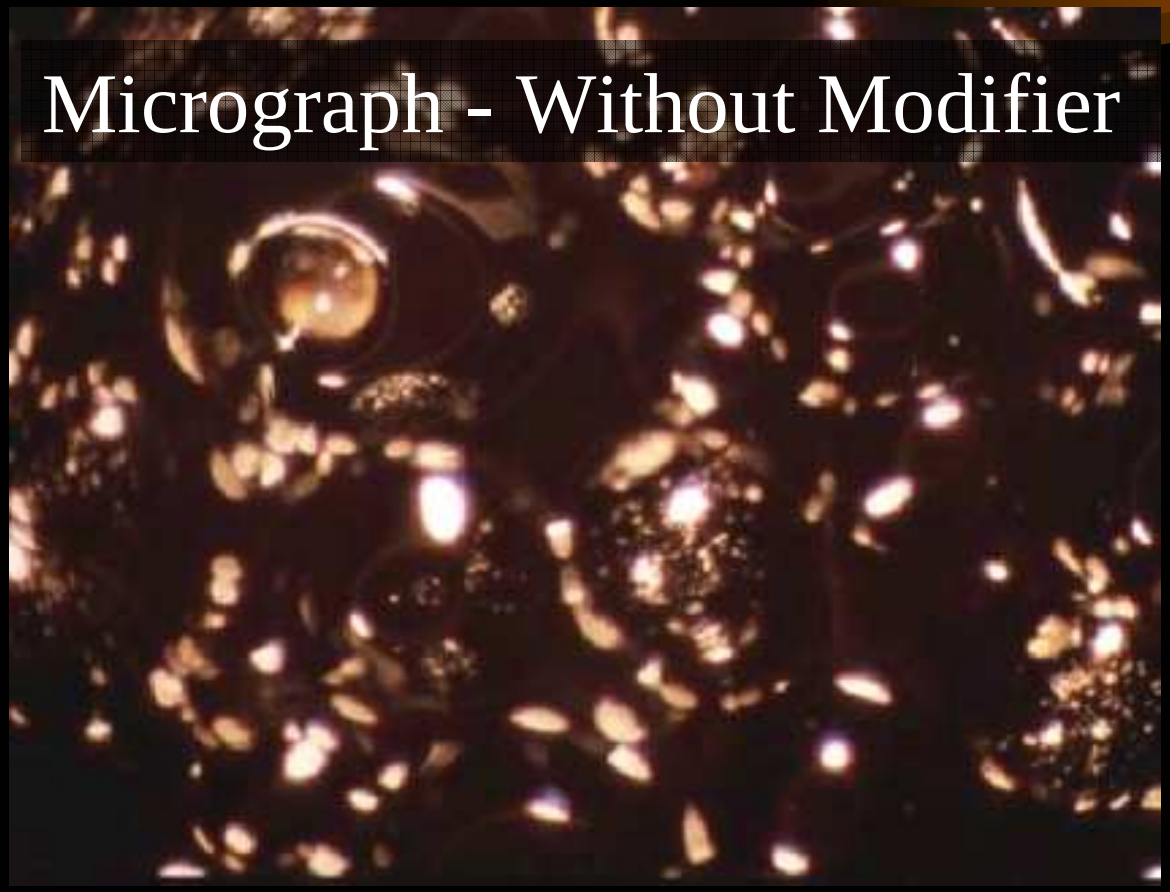
Paver-Placed Elastomeric Surface Treatment — Tack Streaking

Paver-Placed Elastomeric Surface Treatment — Tearing

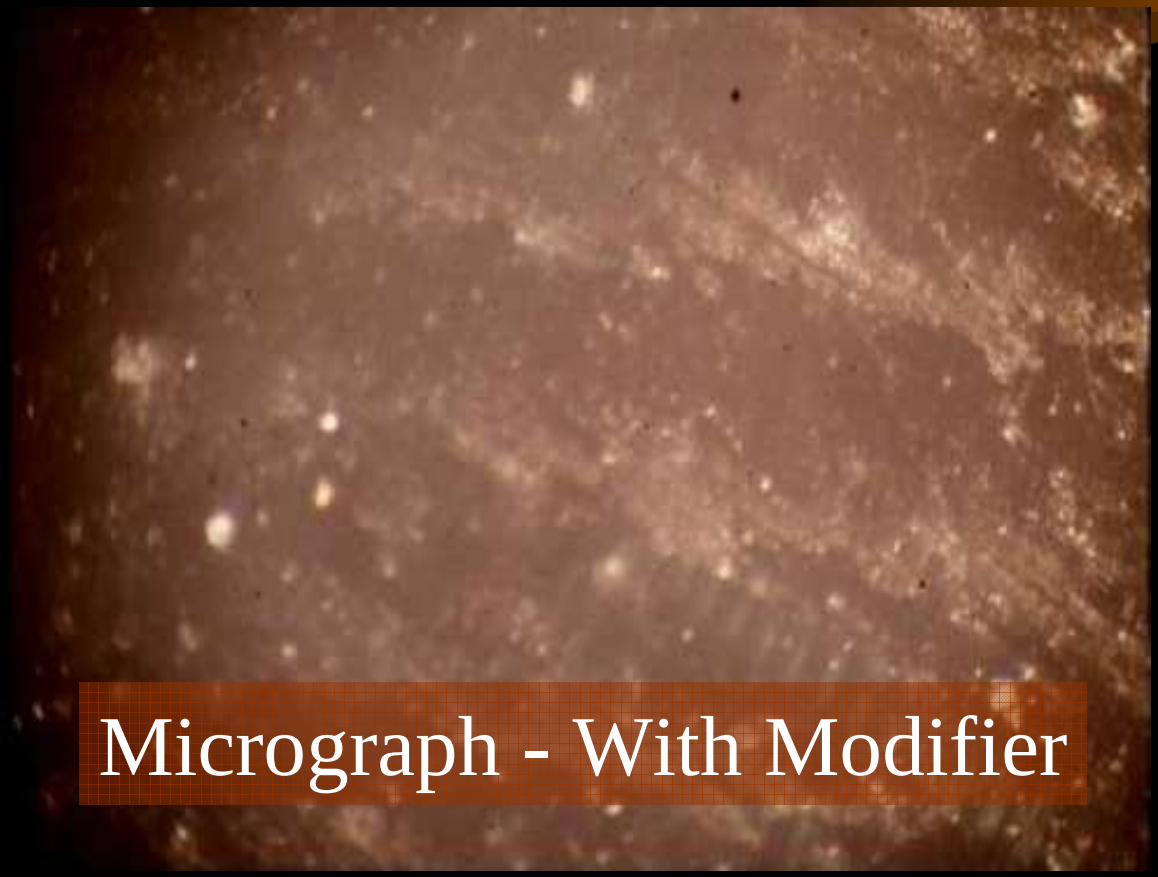
New Generation of Crumb Rubber Modified Asphalt (CRMA)

- Improved low temperature properties
- Increasing the binder PG grade
- Enhanced chemical bond between the asphalt and crumb rubber molecules due to the modifier

Paver-Placed Elastomeric Surface Treatment — New Technology



Paver-Placed Elastomeric Surface Treatment — New Technology



Micrograph - With Modifier

Whitetopping

- 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 - Placement

Whitetopping - Screeding

Whitetopping - Finishing

Whitetopping - Handfinishing

Whitetopping - Sawcutting

Whitetopping Stages

P³ Lessons Learned - Databases

- Use of Pavement Management techniques
- Extensive highway databases created
- Need for continually updated information/data
- Monitoring of surface treatment for efficacy and cost/benefit analysis

P³ Lessons Learned - GIS

- GIS has been incorporated into the P³ and is an indispensable tool for:
  - Project selection
  - Contract documentation and preparation
  - Monitoring/tracking of pavement treatments

Final Thoughts on the RIDOT P³

- The program is growing in scope and sophistication with more resources needed in the future
- Continuing support and encouragement from the Director and top management is critical
- Learning experience is essential to the future of the program
- In depth assessment (fiscal/technical) over the next 3 years is crucial to the direction of the program
- Dedicated funding with consistent $ amounts will ensure survival and growth of this essential program

The End…

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

… never-ending!

Pavement Preservation Program Development – Data Management

- Road segments given HPM ID with beginning/end points
- Entered into MS Access Database with all pertinent information
- Arcview (GIS) used to graphically display layers of 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 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/selection matrix
- Final list is culled after coordination with RIDOT sections, cities/towns and utilities

Pavement Preservation Program– Monitoring

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

Pavement Preservation Program– Monitored Treatments

- Crack seal
- Microsurfacing (MS)
- Novachip (NC)
- Rubberized chip seal (RCS)
- Elastomeric thin overlay (TO)
- Compound seals: SAMI – RCS w/NC
  Cape Seal – RCS w/MS

Pavement Preservation Program– Distress Monitoring

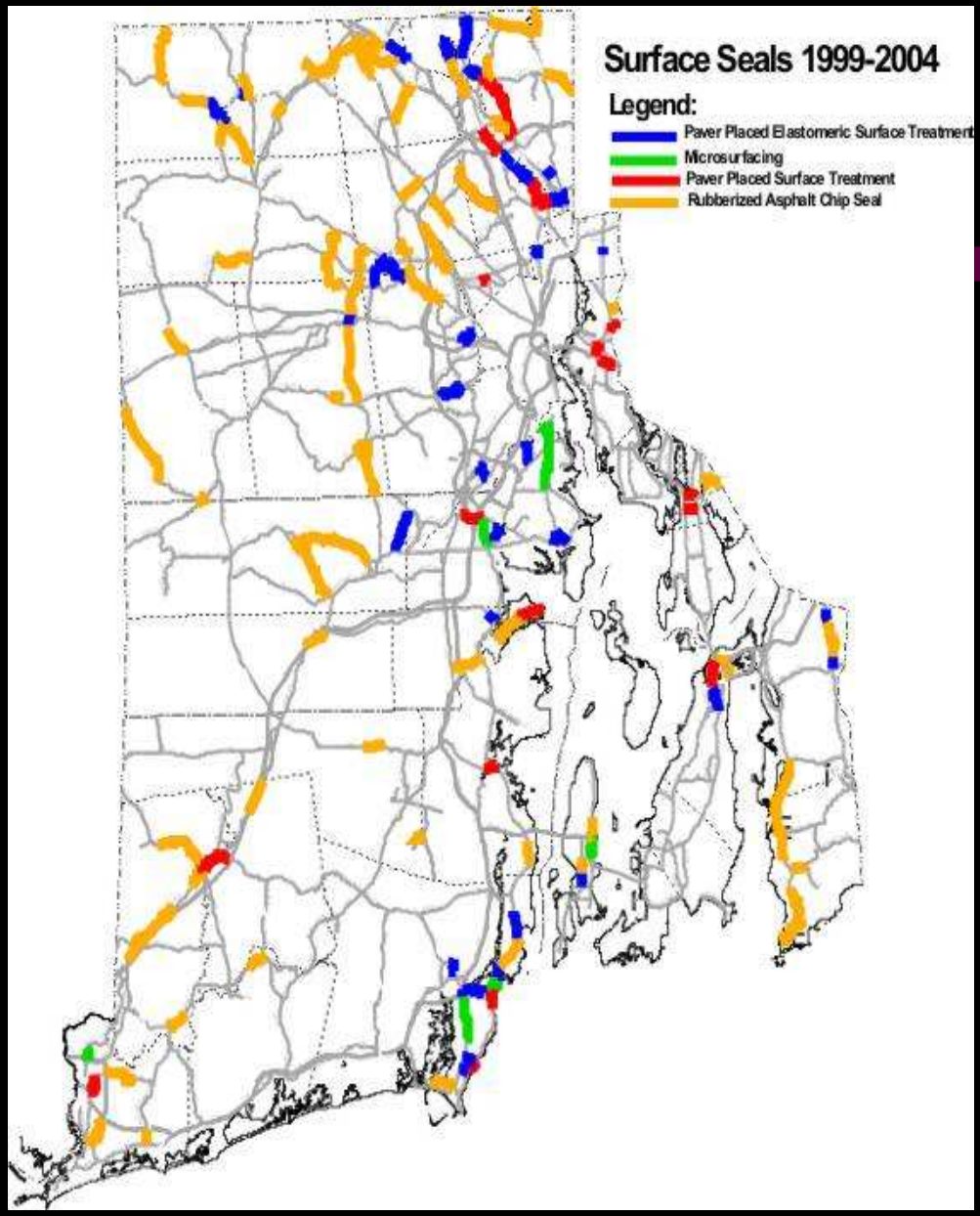
- Crack mapping
- Rutting/raveling/bleeding
- Skid numbers/IRI

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

Pavement Preservation Program–Monitoring Goals

- Evaluate the efficacy and cost efficiency of the program
- Determine the surface treatments that are superior performing
- Validate new methods and materials in Pavement Preservation

1999-2004 Surface Seals



178.3 Miles Total

Deterioration Curve w/ Strategies & Costs