RIDOT

Pavement Preservation Program (P³)

2003
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 repair costs according to the conservative estimates from the National Cooperative Highway Research Program.

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 Program.

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, 86% had PPM programs. Half of those had been in use for more than 10 years.

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

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.
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; City 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
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

Overall Pavement Condition

Very Good

Good

Fair

Poor

Very Bad

Years of Service

5 10 15 20 25
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 P²
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 (P³) — 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 P³
  - For monitoring of P³
- 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)
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)
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
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<th>Factors</th>
<th>MICROSURFACING</th>
<th>RUBBERIZED ASPHALT CHIP SEAL</th>
<th>NOVACHIP</th>
<th>ELASTOMERIC THIN OVERLAY</th>
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1999 Surface Seals

14.4 Miles Total
1999-2000 Surface Seals

53.4 Miles Total
2000-2001 Surface Seals

91 Miles Total
Surface Seals 1999-2003

Legend
- ELASTOMERIC PAVING PLACED SURFACE TREATMENT
- MICRO SURFACING
- RIVER PLACED SURFACE TREATMENT
- RUBBERIZED CHIP SEAL

Whitetopping Rt. 116

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

Detail
Microsurfacing
— Delam at Heads
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
Rubberized Asphalt Chip Seal — Unique Applications
Rubberized Asphalt Chip Seal — Unique Applications
Rubberized Asphalt Chip Seal — Unique Applications

Concrete Pavement

Before

After
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)

Detail
Paver-Placed Surface Treatment — Unique Applications

Sakonnet River Bridge
Paver-Placed Surface Treatment — Unique Applications

Sakonnet River Bridge
Paver-Placed Surface Treatment — Unique Applications

Sakonnet River Bridge
Paver-Placed Surface Treatment — Unique Applications

Sakonnet River Bridge
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 — 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

Micrograph - Without Modifier
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
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 Highway 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 comparator.
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

Design Life

Very Good
Good
Fair
Poor
Very Poor

Routine ($)
Preventive ($$)
Rehab ($$$)
Rebuild ($$$$$)