#### Rubberized Asphalt in Pavement Preservation

#### Midwest Pavement Preservation Partnership

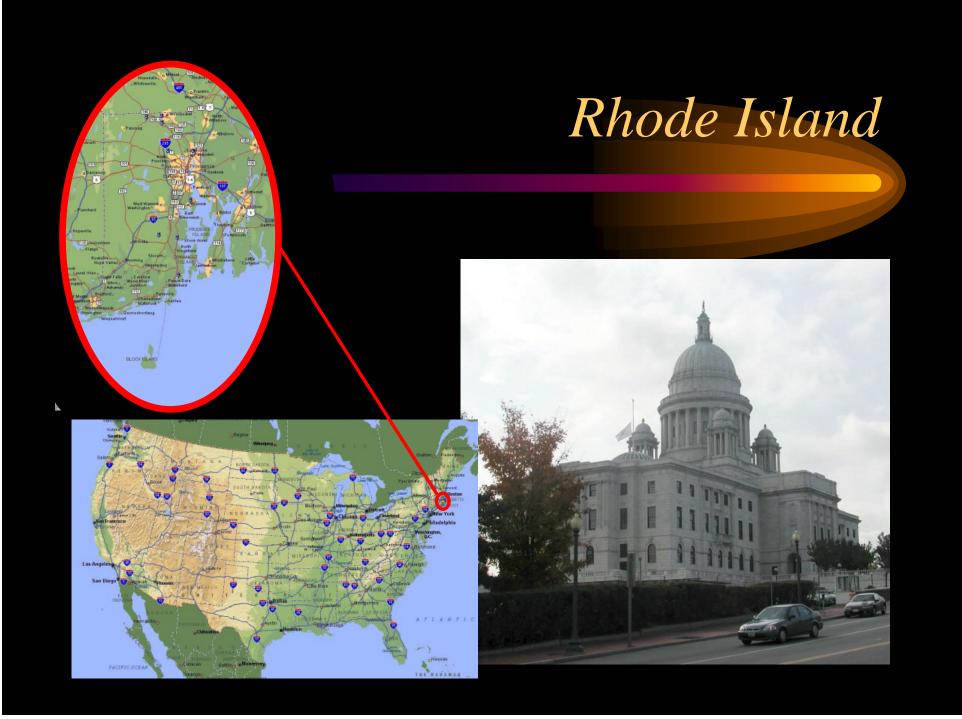


February 1-3, 2006 Indianapolis, Indiana Colin A. Franco, P.E. RIDOT Research and Technology

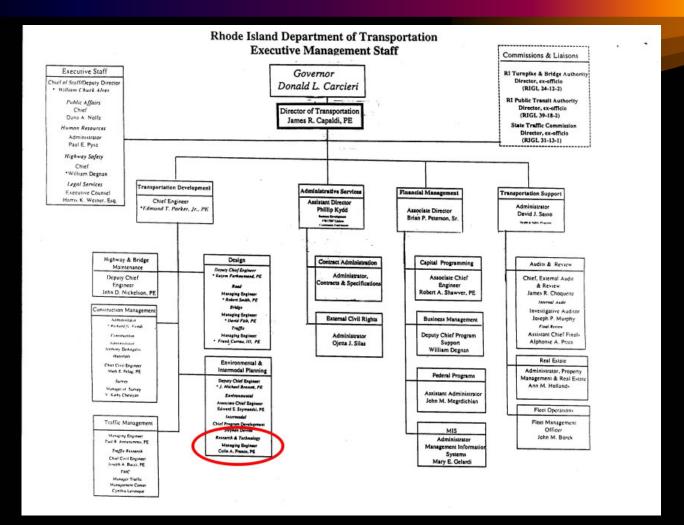


#### Presentation Outline

- 1) Introduction
- 2) RIDOT Organizational Chart Highway Data
- 3) RIDOT Experience with Modified Rubber
- 4) Pavement Preservation Experience
- 5) Crack Sealing w/Mod. Rubber Asphalt
- 6) Chip Sealing w/Mod. Rubber Asphalt
- 7) Thin Overlay w/Mod. Rubber Asphalt
- 8) Pavement Preservation Monitoring



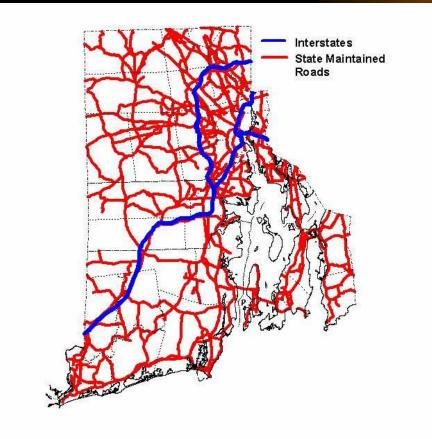
#### **RIDOT Organization Chart**



#### NASTO Highway Data (2003) - RI

	RI
Area (Thousand sq. mi.)	1
Population (Million)	1
Daily VMT (Million)	23
All Road Miles (Thousand)	6.4
SHA	1.1
Other	5.3
SHA ROADS	
Miles (Thousand)	1.1
Lane Miles (Thousand)	2.9
Daily VMT (Million)	19
BRIDGES	
Total Bridges	751
Deficient Bridges (%)	59
SHA Bridges	603
SHA Bridges (%)	60
<b>STATE FUNDING (\$Million)</b>	
Total	273
Capital Outlay	133
Maintenance	41

#### **RIDOT** Maintained Roads



#### Background - RIDOT's Experience with Crumb Rubber

- 1987 Demo Project with Plusride
- 1991 ISTEA Mandate Research with crumb rubber modified asphalt
- 1999 to 2005 Crumb rubber used in RIDOT Pavement Preservation Program
  - Crack Seal
  - Chip Seal
  - Modified Asphalt Thin Overlay
- 2005 Use of crumb rubber with warm asphalt technology in Rubber Chip Seal

#### Plusride Project

- Year Placed 1987
- Location Rt. 2 in East Greenwich
- Mix Details
  - AC 8.2%
  - Rubber 3.5%, max nominal size  $\frac{1}{4}$ "
  - Aggregate 88.3%
- Layer Thickness 1.5"
- Performance Same as control section after 5 years

#### 1991 - ISTEA Mandate

- Research at URI on crumb rubber asphalt binder using Arizona Wet Process
   SuperPave Binder Specification
- PG binder range of virgin asphalt extended 2 to 3 grades
- Mixture testing indicated rutting would be mitigated

### 1999-2005 Pavement Preservation

- Worked with Hudson/All States Asphalt to incorporate the chemically modified crumb rubber asphalt (CMCRA) into the following
- Crack seal Low viscosity CMCRA w/fibers
- Chip Seal Used CMCRA in demo sections with chip seal (requires less rubber)
- Elastomeric Mix Used CMCRA binder to produce crack resistant mix
- \*Also used in department's overlay program





#### Pavement Preservation Program (P<sup>3</sup>) 1998 - Present



#### Prevention versus Repair — Managing Your Budget

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

we 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 taxpayors that it's the right thing to do?

Every dollar spent on preventive maintenance arrest three to four dollarts in future woul veptime according to the conservative softmate from the National Conperior tive Highway Research Postron

reservation, reports that it are p-to-810 for each preventive mintenaives dollar epent.

Even as, some states still use very little presentive work. Florila, Hawaii, Kontucky, North Car

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ducted by the American Association of State Highway and Trans

fightigan, a leader in the



pertation Officials' Presentation Persentation Lead States Theorem The study found that presented preservation maniferences give grams were most often integrated with presenter management gyterms, forting the state depart ments of transportation and their engineers make optimal use of commutativation.

Of the status respirating to the questionnairy for the study, 80%, had FPM pergrams. Hall of those had been in use for more than 10 years.

Practices used vary widely, with some states learning PPM versus repair doctaines to district manuples and organisers. Other DOTs

#### From the June 2003 Issue of:



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, Ohic, 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.

24 June 2023 Better Boards

#### 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** 

#### 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 Planned Strategy of cost effective treatments that preserve the system

# Welcome to Extending Pavement Life

#### Extending Pavement Life

- Why Extend Pavement Life?
  - Because it <u>Maximizes</u> the Return on the Taxpayers Investment
- Pavements represent billions of dollar of investment
  - WE MUST PROTECT THEM!

# 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
  - Whitetopping

# Crack Sealing — Definition

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

#### Crack Seal Material Composition

Hot Applied – ASTM 6690 Type II
Neat Asphalt – PG 58 – XX
Crumb Rubber – Minimum 5%, 80 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



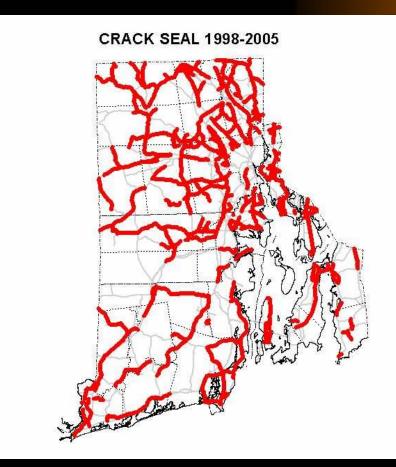
### Crack Sealing — Preparation (Hot Air Lance)



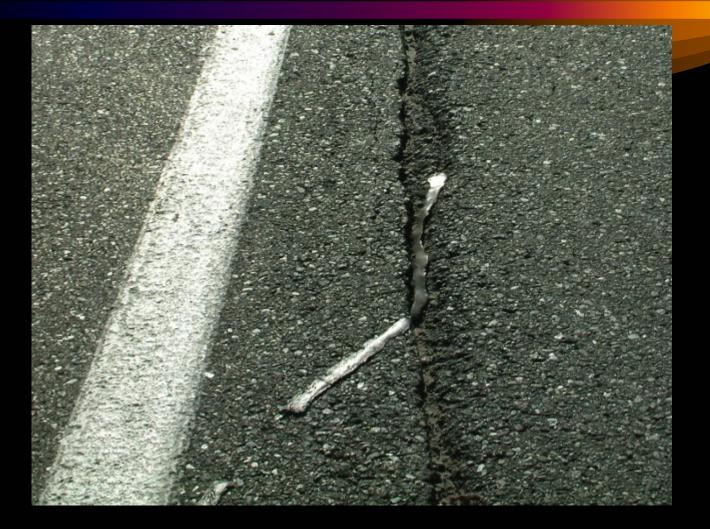
# Crack Sealing — Sealing Operation



# Crack Seal Maps (1998-2005)











# Rubberized Asphalt Chip Seal (RACS) — Description

The RACS binder 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 SS 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 Material Composition

- Neat Asphalt PG 58 28
- Rubber Max size #10 sieve
- Rubber %  $20 \pm 3$
- Aggregate Size  $-\frac{1}{4}$ " to  $\frac{1}{2}$ " (single size)
- Aggregate Coating 100% coating w/PG 58 - 22

#### Rubberized Asphalt Chip Seal



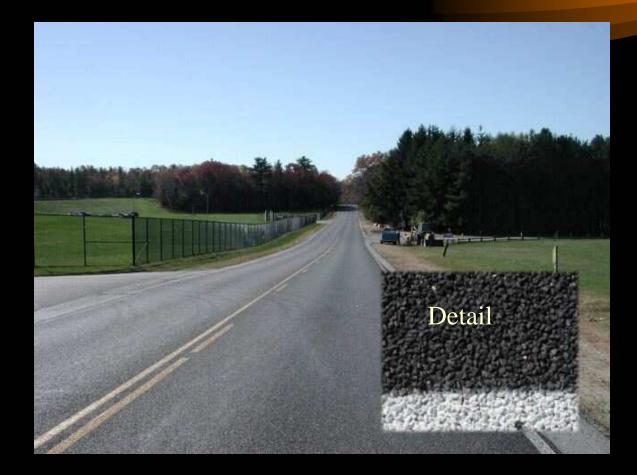
#### Rubberized Asphalt Chip Seal Prep - Shim and Crack Seal



# 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





# Paver-Placed Elastomeric Surface Treatment (PPEST) — Definition

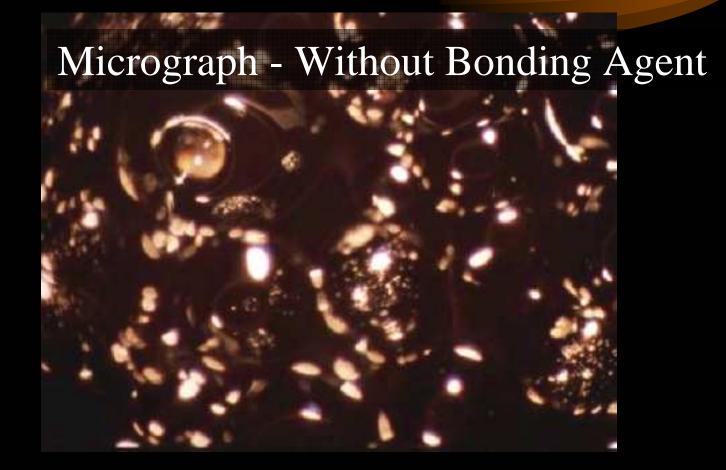
PPEST is a mixture of nominal 3/8 inch crushed aggregate and a chemically modified crumb rubber (CMCR) asphalt binder. The binder is PG 76-34 and contains a minimum 7% CMCR. The mix has a binder content of 6.0 to 7.5%. PPEST is:

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

New Generation of Crumb Rubber Modified Asphalt (CRMA)

- Improved low temperature properties
- Increasing both ends of the binder PG grade
- Enhanced chemical bond between the asphalt and crumb rubber molecules due to the chemical bonding agent

#### Paver-Placed Elastomeric Surface Treatment — New Technology



#### Paver-Placed Elastomeric Surface Treatment — New Technology



#### Micrograph - With Bonding Agent

#### Elastomeric Surface Treatment Composition

Neat Asphalt – PG 58 – XX Crumb Rubber – 7% Chemical Bonding Agent Asphalt Blend – PG 76 – 34 Separation < 5% PAV < 5000 KPa @ 7 °C El Rec > 70% @ 4°C Aggregate – Maximum size 1/2" Marshall Mix Design – Stability 1000 lbs, Flow 8-16

### 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 — Open Texture



#### Paver-Placed Elastomeric Surface Treatment — Tack Streaking



### Paver-Placed Elastomeric Surface Treatment — Tearing



#### Paver Placed Elastomeric Surface Treatment – Paving Joints



#### Paver Placed Elastomeric Surface Treatment – Appurtenances



#### Special Treatment PPEST/RCS SAMI - Tack Coat



#### Special Treatment PPEST/RCS SAMI - Paving



#### Rhode Island Use of Crumb Rubber -Crack Seal (General Roads)

Year	Miles	<u>1000 Ft.</u>
1998	135.8	2058
1999	121.2	2617
2000	39.6	1519
2001	65.0	1962
2002	61.8	2271
2003	64.7	2276
2004	89.0	3000
2005	70.7	2700

1288 tons of Rubber

Rhode Island Use of Crumb Rubber - Crack Seal (Limited Access Highways)

<u>Year</u>	<u>Miles</u>	<u>1000 Ft</u>	
1999	26.4	295	
2000	65.7	500	
2004	41.0	500	
2005	33.9	500	

125 tons of Rubber

#### Rhode Island Use of Crumb Rubber - Rubberized Asphalt Chip Seal (RACS)

Year	<u>Miles</u>	<u>1000 Yd²</u>
1999	6.7	133
2000	6.7	272
2001	20.0	302
2002	18.8	286
2003	20.6	371
2004	23.0	406
2005	21.8	400

= 890 tons of Rubber

#### Rhode Island Use of Crumb Rubber - Paver-Placed Elastomeric Surface Treatment (PPEST)

Year	<u>Miles</u>	<u>1000 Yd²</u>
2001	7.4	152
2002	5.4	135
2003	5.4	108
2004	10.0	206
2005	7.5	183

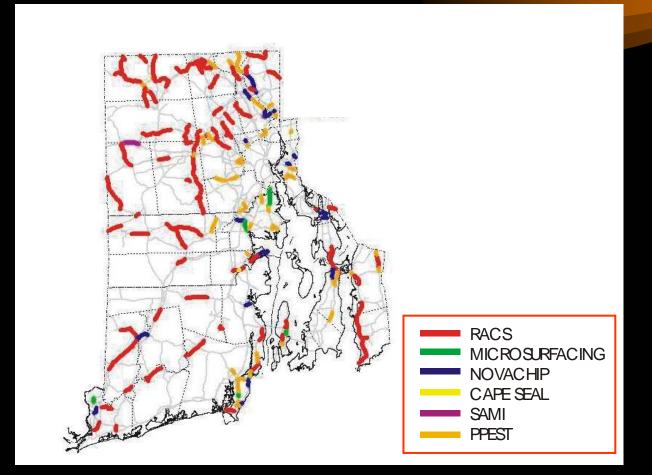
154 Tons of Rubber

#### Total Rubber Usage

Program Total Rubber Usage to Date = 2457 Tons Program Total for 2005 = 446 Tons

- This amount is expected to increase in future years as:
- 1] RIDOT's Pavement Preservation Program is expanding
- 2] Rubber-modified binders are increasingly being used in typical overlays on rehabilitation and reconstruction projects

#### Map of Surface Seals 1999-2005



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



