



# RMRC Status Update:

## Past and Current Research

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Northeast and Mid-Atlantic States In-Place Recycling Conference  
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# RMRC Overview

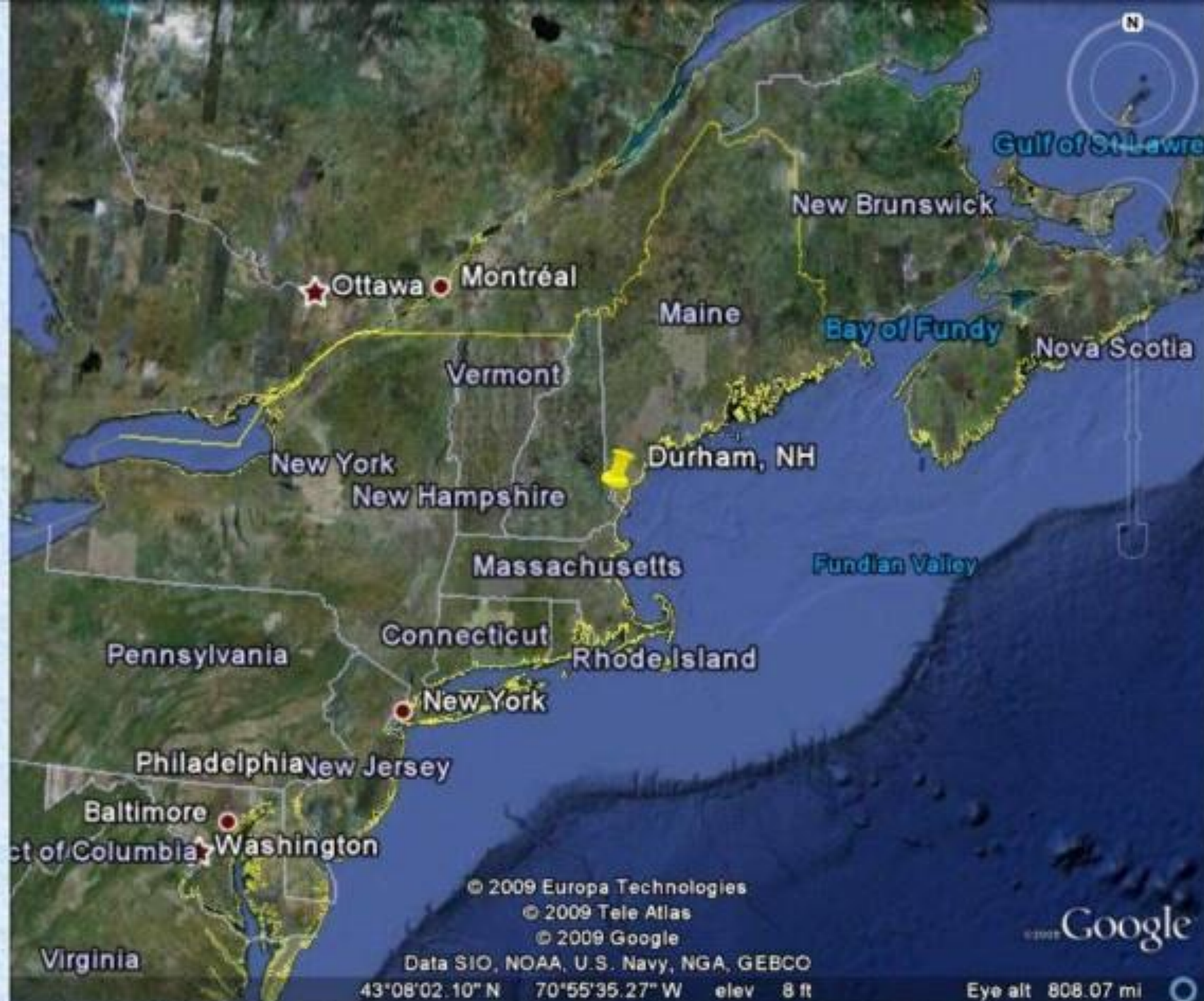


## **MISSION**

**Overcome barriers to the appropriate use of recycled materials in the highway environment**

- Established in 1998 - \$14,000,000 in Funding
- National center in partnership with US Federal Highway Administration
- Focus on the long term engineering and environmental performance of recycled materials in the highway environment
- Main activities are research and outreach







# Basic Premise of Recycling

From WI DOT – When recycling in roads,  
they want their roads to:

“Perform as well or better for the same or  
less **cost**”

But what is the “cost”?

# Meaning of Value

- Value is used in two ways:
  - Value is used as a measure of what you get for your money.
  - Value is also used to define what is a good or bad application for a given material.
  - They are not the same thing and can be at odds.



# Value For Money



3/4" Crushed Granite  
\$25/yd

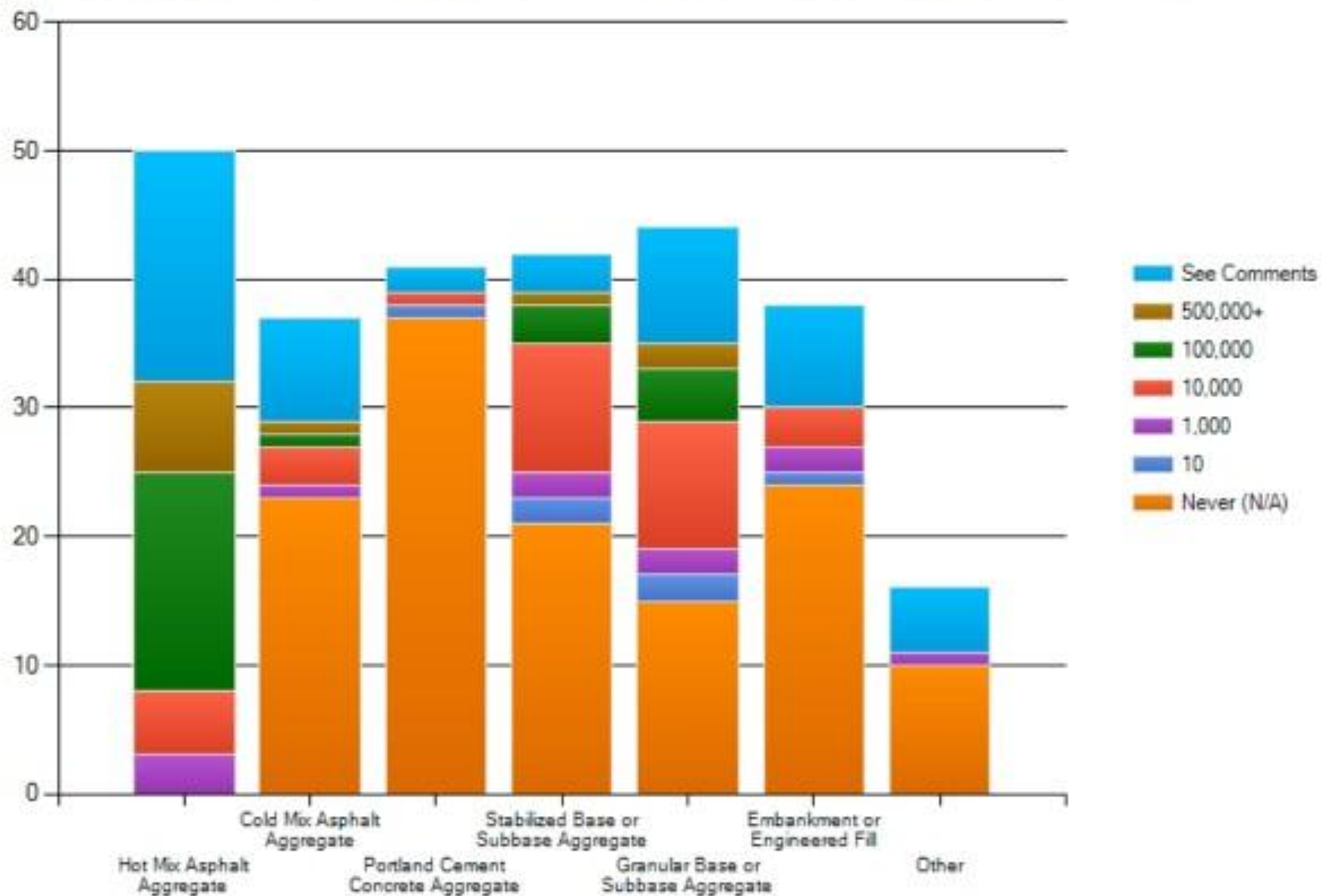


3/4" Dixie Pink  
\$240/yd



# Value of a Material in Recycling

- The RMRC promotes the use of RAP in HMA/WMA as the best or highest value use of RAP.
- However, local conditions do matter, and saving RAP for HMA may not be the best value for the money.





## RMRC Past Projects

<http://www.recycledmaterials.org/Research/past/pastresearch.asp>

RMRC Project 16:  
Using Foamed Asphalt as a  
Stabilizing Agent in Full Depth  
Reclamation of Route 8 in  
Belgrade, Maine

Brian Marquis, Dale Peabody and  
Rajib Mallick



# Foamed Asphalt Train



# Compacting the Foamed Asphalt





# 36 Hour Cured Foamed Asphalt



# RMRC Project 17:

## DEVELOPMENT OF A RATIONAL AND PRACTICAL MIX DESIGN SYSTEM FOR FULL DEPTH RECLAIMED (FDR) MIXES

Rajib B. Mallick  
Prithvi S. Kandhal  
Elton Ray Brown  
Richard L. Bradbury  
Edward J. Kearney



# Pavement for Rehabilitation



# FDR Using Superpave Compactor



## **Additive Contents**

Water 2%, 4%, 6%, 8%, and 10%

Emulsion 1%, 3%, 5%, and 7%

Cement 5%

Emulsion and Cement 3%

Emulsion and 2% Cement

Emulsion and Lime 3%

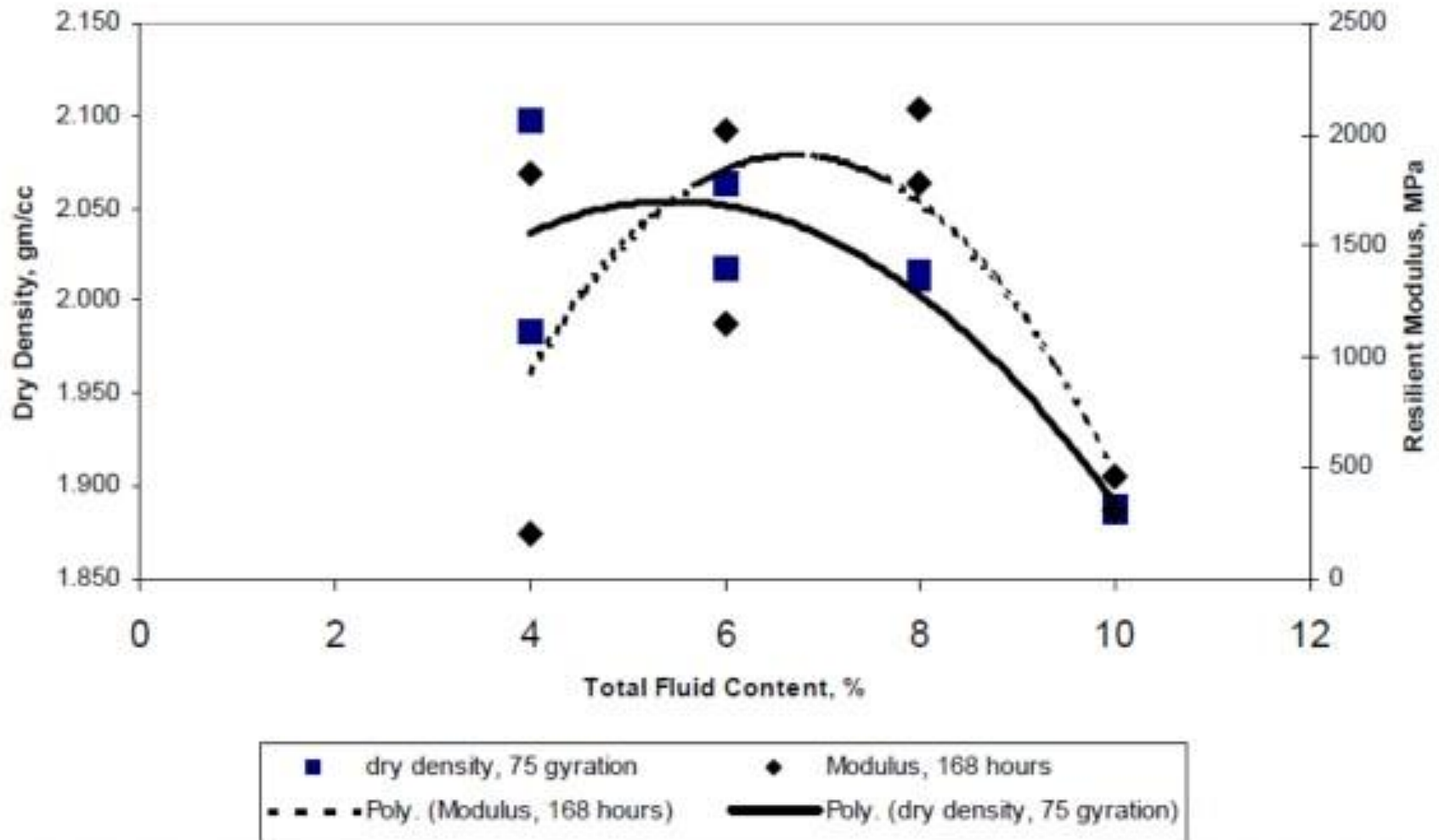
Emulsion and 2% Lime

Note: 2% pre-mix water was added to each mix



# Example of Laboratory Data

Water, 75 gyration samples



# Reclaimer



Test Sections: 3.4 % emulsion, 3.4 % emulsion with lime, water, 5% cement and 2.2 % emulsion.



## Project 26:

Determination of Structural Layer  
Coefficient for Roadway Recycling  
Using Foamed Asphalt

Brian Marquis, Dale Peabody,  
Rajib Mallick and Tim Soucie

# Collected Cores





# Calculated Layer Coefficients

Project	Age (years)	Laboratory Resilient Modulus <sup>1</sup>		Backcalculated Modulus		Layer Equivalence Based on Equal Strain		Layer Coefficient <sup>2</sup>
		MPa	ksi	MPa	ksi	BSM	ATB	
Belgrade-Rt8	>2	1243.8	180.4	999.3	144.9	1.00	0.67	0.22
Orient Cary-Rt.1	<1	2111.3	306.2	655.0	95.0	1.18	0.78	0.23
Farmington-Rt.156	<1	2453.7	355.9	1827.1	265.0	1.23	0.82	0.22
Macwahoc-Rt 2A	<1	3325.8	482.4	2505.1	363.3	1.35	0.91	0.35

RMRC Project 28:  
EVALUATION OF CEMENT-  
STABILIZED FULL-DEPTH-  
RECYCLED BASE  
MATERIALS FOR FROST AND  
EARLY TRAFFIC CONDITIONS

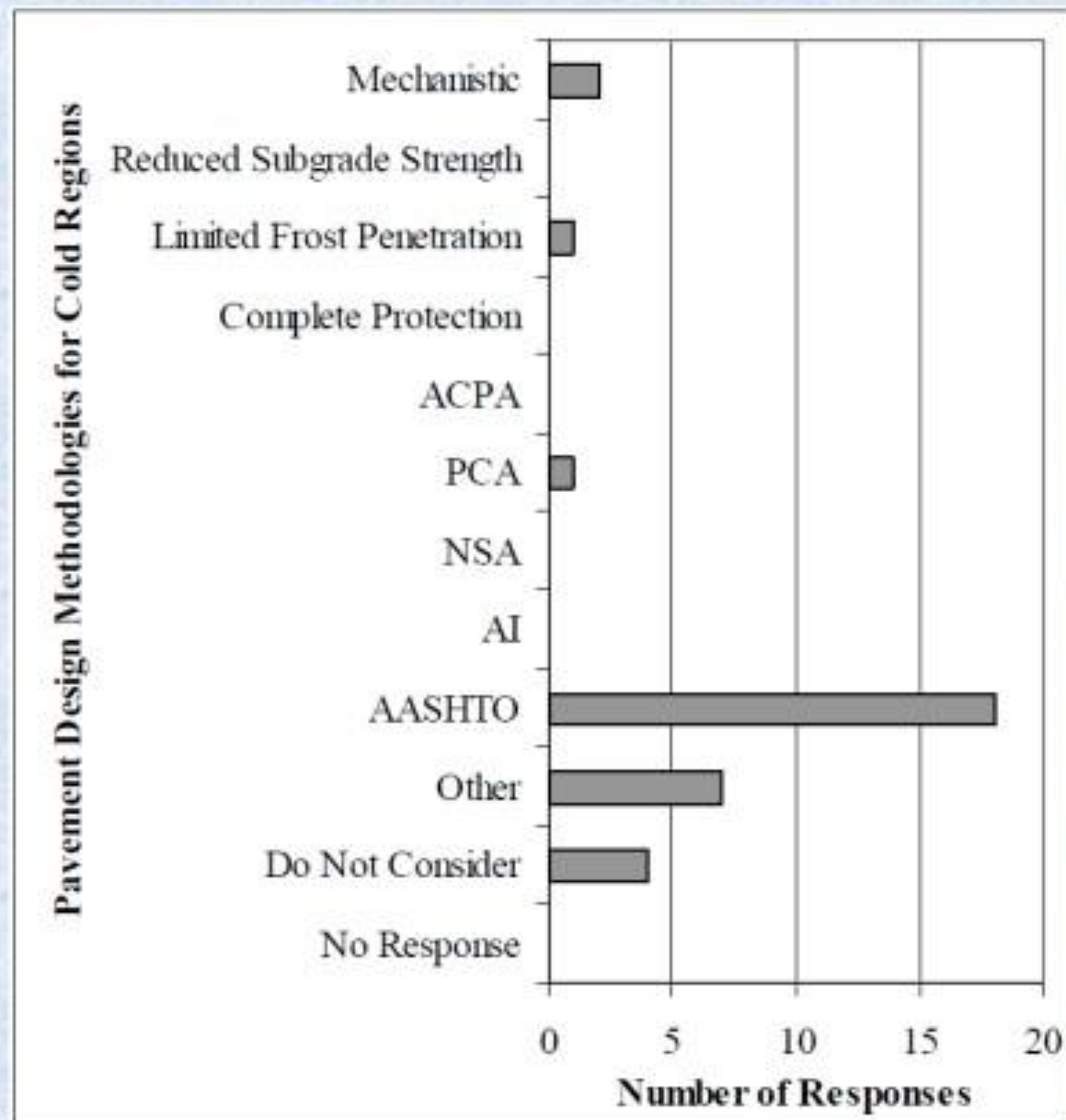
Heather Miller and Rebecca Crane



# How do Frost and Early Traffic Affect FDR?

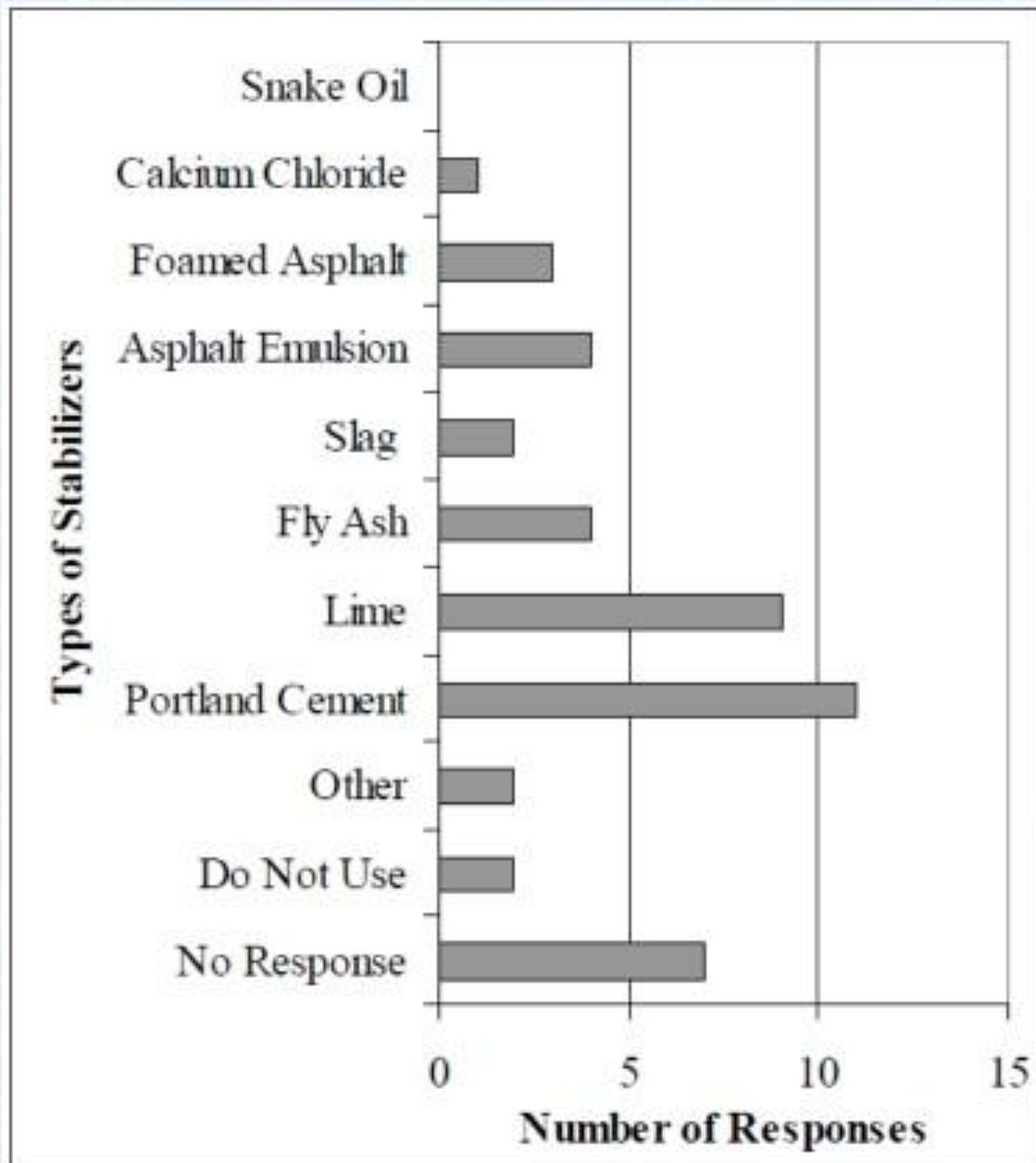
- Traffic loads within 1 or 2 days of placement did cause a reduction in stiffness of cement treated base.
- Cement treated base still heaved during spring thaw. Results suggest the CTB bridges soft subgrades, but will still heave with susceptible subgrades.

# Design Techniques Used





# Stabilization Materials Used



## RMRC Current Research

[www.recycledmaterials.org/Research/current/currentresearch.asp](http://www.recycledmaterials.org/Research/current/currentresearch.asp)



# Projects Related to In-Place Recycling

- Project 46-Engineering Properties of RAP and RCA for Unbound Base Course Applications
- Project 47-Stabilization of Reclaimed Pavement Material and Road Surface Gravel with Coal Combustion Project
- Project 48-Using High Carbon Coal Fly Ashes to Stabilize Recycled Asphalt Pavement Materials
- Project 61-Characterization of Cementitiously Stabilized Layers for Use in Pavement Design and Analysis



# Final Plea

Keep your data! We will need it in  
the future!

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