

ANNUAL REPORT

For Calendar Year 2008

NEW ENGLAND TRANSPORTATION CONSORTIUM

NETCR75

April 2009

This report was sponsored by the New England Transportation Consortium, a cooperative effort of the Departments of Transportation and the Land Grant Universities of the six New England States, and the U.S. Department of Transportation's Federal Highway Administration.

The contents of this report reflect the views of the author(s) who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Departments of Transportation or the Land Grant Universities of the six New England States, or the U.S. Department of Transportation's Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

NEW ENGLAND TRANSPORTATION CONSORTIUM

POLICY COMMITTEE

James A. Aloisi Jr., Secretary of Transportation, Massachusetts Executive Office of
Transportation and Public Works
George N. Campbell Jr., Commissioner, New Hampshire Department of Transportation
David Cole, Commissioner, Maine Department of Transportation
David Dill, Secretary of Transportation, Vermont Agency of Transportation
Bradley Keazer, Division Administrator, FHWA, Connecticut Division
Michael P. Lewis, Director of Transportation, Rhode Island Department of
Transportation
Joseph F. Marie, Commissioner, Connecticut Department of Transportation

ADVISORY COMMITTEE

Transportation Agencies

William Ahearn, Materials & Research Engineer, Vermont Agency of Transportation
Barbara Breslin, Community Planner, FHWA, Connecticut Division
Colin Franco, Managing Engineer, Research & Technology Development, Rhode Island
Department of Transportation
Dale Peabody, Director of Transportation Research, Maine Department of Transportation
Stephen Pepin, Manager of Research and ITS Planning Programs, Massachusetts
Executive Office of Transportation and Public Works
Glenn Roberts, Chief of Research, New Hampshire Department of Transportation
James Sime, Manager of Research, Connecticut Department of Transportation

Universities

Lisa Aultman-Hall, Director, Transportation Center, University of Vermont
John Collura, Professor, University of Massachusetts, Amherst
David Gress, Professor, University of New Hampshire
Wayne Lee, Professor, University of Rhode Island
Roberto Lopez-Anido, Associate Professor, University of Maine
Adam Zofka, Assistant Professor, John Ivan, Associate Professor, University of
Connecticut

LEAD STATE

James Sime, Manager of Research
Connecticut Department of Transportation

COORDINATOR

Gerald McCarthy
University of Massachusetts Dartmouth

TABLE OF CONTENTS

A.	INTRODUCTION	6
B.	2008 HIGHLIGHTS	6
C.	PROGRESS OF ACTIVE PROJECTS	9

Project

<u>Number</u>	<u>Title</u>	
01-1	Advanced Composite Materials in New England's Transportation	
(T2 Phase 1)	Infrastructure - Technology Transfer Phase 1: Selection of Prototype	9
02-1	Relating Hot Mix Asphalt Pavement Density to Performance	10
02-6	Sealing of Small Movement Bridge Expansion Joints - Phase II:	
(Phase 2)	Field Demonstration and Monitoring.....	13
03-1	Ability of Wood Fiber Materials to Attenuate Heavy Metals	
	Associated with Highway Runoff	16
03-2	Field Studies of Concrete Containing Salts of an Alkenyl	
	Substituted Succinic Acid	17
03-6	Fix It First: Utilizing the Seismic Property Analyzer and MMLS to	
	Develop Guidelines for the Use of Polymer Modified Thin Lift	
	HMA vs. Surface Treatments	19
04-1	Recycling Asphalt Pavements Containing Modified Binders	21
(Phase 1)		
04-1	Recycling Asphalt Pavements Containing Modified Binders	
(Phase 2)	- Phase 2.....	22
04-2:	Driver-Eye-Movement-Based Investigation for Improving	
	Work-Zone Safety	24
04-3:	Estimating the Magnitude of Peak Flows for Steep Gradient	
	Streams in New England	27
04-4:	Determining the Effective PG Grade of Binder in RAP Mixes	28
05-1	Development of Supplemental Resistance Method for the Design of	
	Drilled Shaft Rock Sockets	30
05-5	Measurement of Adhesion Properties Between Topcoat Paint and	
	Metallized/Galvanized Steel with Surface Energy Measurement	
	Equipment.....	31
05-6	Employing Graphic-Aided Dynamic Message Signs to Assist Elder	
	Drivers' Message Comprehension	34
05-7	Warrants for Exclusive Left Turn Lanes at Unsignalized	
	Intersections and Driveways	36
05-8	Evaluation and Implementation of Traffic Simulation	
	Models for Work Zones	39
06-1	New England Verification of NCHRP 1-37A Mechanistic-Empirical	
	Pavement Design Guide with Level 2 & 3 Inputs	40
06-3	Establishing Default Dynamic Modulus Values for New England	43
06-5	The New England Winter Severity Index	45

D.	FINANCIAL STATUS OF PROJECTS ACTIVE DURING 2008	47
	D.1 Financial Status of Active Projects	47
	D.2 Fund Balance	49
E.	REPORTS, PAPERS AND PRESENTATIONS	53
	E.1 Policies and Procedures	53
	E.2 Annual Reports	53
	E.3 Reports, Papers, and Presentations (1988-1994)	53
	E.4 Reports, Papers, and Presentations (1995-2008)	56

A. INTRODUCTION

The New England Transportation Consortium (NETC) is a cooperative effort of the transportation agencies of the six New England States. Through the Consortium, the states pool professional, academic and financial resources for transportation research leading to the development of improved methods for dealing with common problems associated with the administration, planning, design, construction, rehabilitation, reconstruction, operation and maintenance of the region's transportation system.

B. 2008 HIGHLIGHTS

1. NETCAWARDS \$566,465 FOR RESEARCH TO THE FOLLOWING UNIVERSITIES:

a) UNIVERSITY OF CONNECTICUT \$267,538:

- Dr. Ramesh Malla, "Sealing of Small Movement Bridge Expansion Joints: Field Demonstration and Monitoring"; \$75,000
- James Mahoney, "Recycling Asphalt Pavements Containing Modified Binders"; \$82,751
- James Mahoney, "Establishing Default Dynamic Modulus Values for New England"; \$109,787

b) UNIVERSITY OF MASSACHUSETTS AMHERST \$74,000:

- Dr. Sergio Brena, "Advanced Composite Materials in New England's Transportation Infrastructure: Selection of Prototype"; \$25,910
- Dr. Scott Civjan, "Enhancing the Reflectivity of Concrete Barriers"; \$48,090

c) UNIVERSITY OF MASSACHUSETTS DARTMOUTH \$99,927:

- Dr. Walaa Mogawer, "Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments"

d) UNIVERSITY OF RHODE ISLAND \$125,000:

- Dr. Sze Yang, "Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with 'Surface Energy' Measurement Equipment"

2. NETC ALLOCATES \$38,2847 TO BE AWARDED FOR RESEARCH IN THE FOLLOWING AREAS:

a) TRAFFICE SAFETY; \$120,000:

- "Application of the Federal Highway Safety Manual in New England"

b) HIGHWAY STRUCTURES; \$250,000:

- "Active Structural Control of Cantilevered Support Structures"

c) COMPOSITE MATERIALS; \$42,847:

- “Advanced Composite Materials: Prototype Development and Demonstration”

d) ENVIRONMENT \$90,000:

- “Effective Establishment of Native Grasses on Roadsides”

3. FINDINGS FROM THE FOLLOWING RESEARCH PROJECTS WERE DISTRIBUTED TO NEW ENGLAND’S STATE TRANSPORTATION AGENCIES AND STATE UNIVERSITIES, THE FEDERAL HIGHWAY ADMINISTRATION, THE AMERICAN ASSOCIATION OF STATE AND HIGHWAY TRANSPORTATION OFFICIALS’ REGION 1 RESEARCH AND ADVISORY COMMITTEE, THE NATIONAL TECHNICAL INFORMATION SERVICE AND THE NATIONAL TRANSPORTATION LIBRARY:

- * NETC 03-1 “Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff”, MacKay, A.A., July 16, 2008, NETCR65.
- * NETC 03-2 “Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid,” Civjan, Scott A., and Crellin, Benjamin, June 30, 2008, NETCR73.

4. TECHNOLOGY TRANSFER:

- * An exhibit of the Consortium’s research projects was presented at the 94th Annual Meeting of the American Association of State Highway and Transportation Officials held in Hartford, CT in October 2008.
- * In response to a call, from the Transportation Research Board, for papers in the subject area of “New and Emerging Models for State Transportation Organizations to Improve Organizational and System Performance and Increase Funding”, the following paper was submitted and accepted for presentation at the January 2009 Transportation Research Board Meeting in Washington, DC: “The New England Transportation Consortium (NETC): A Model for the Management of a Multistate Cooperative Research Program”, Paper No. 09-0840, Oliveira, D., Sime, J. and McCarthy, G.
- * The following papers arising from NETC sponsored research were presented at technical conferences or published in technical journals by NETC researchers:
 - “Assisting Elder Drivers’ Comprehension of Dynamic Message Signs,” Clark, A.T., Wang, J.H., Maier-Sperdelozzi, V., Collyer, C.E., Proceedings of the 87th Annual Meeting of Transportation Research Board, Paper No. 08-2276, p.1-16, CD-ROM, 2008.
 - “Age Effect on Driver Comprehension of Messages Displayed on Dynamic Message Signs”, Wang, J.H., Clark, A. Y., and Maier-Sperdelozzi, V., Proceedings of IIE Research Conference, Paper No. 307, p.1-6, CD-ROM,

2008.

- “Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies: Case Studies Along Interstate Highways in Massachusetts and Rhode Island,” Moriarty, K.D., Collura, J., Knodler Jr., M.A., Daiheng, N., and Heaslip, K., Paper presented at the TRB Annual Meeting in January 2008.

C. PROGRESS OF ACTIVE PROJECTS

PROJECT NUMBER: 01-1 (T2 Phase 1)

PROJECT TITLE: Advanced Composite Materials in New England's Transportation Infrastructure - Technology Transfer Phase 1: Selection of Prototype

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Sergio F. Breña, PI, and Scott A. Civjan, Co-PI, University of Massachusetts, Amherst

STATUS: New

AGREEMENT TERM: 5/28/2007 – 11/30/2008

ANTICIPATED COMPLETION: 6/30/2009

PROJECT OBJECTIVES:

The main objective of this project is to identify a component commonly used in the transportation infrastructure in New England for fabrication using advanced composite materials (ACMs). A related objective will be to collect sufficient details about this component to be able to develop the research problem statement to solicit proposals to fabricate and implement it in demonstration projects in New England. The selected component will likely be one where safety of the transportation network users is not compromised, to alleviate some of the current concerns that engineers have about long-term performance of ACMs and lack of design standards for these materials. Committal from DOT engineers to incorporate the ACM product in a future project will be sought in this phase of the project.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Meetings at transportation agencies in New England were conducted to discuss opportunities to fabricate and implement an object fabricated using advanced composite materials. Feedback from engineers that work in different areas in the transportation agencies was received during these meetings. Additionally, manufacturers of fiber-reinforced composites were invited to attend these meetings and provided valuable input to the discussions. At this point, several possible applications have been identified and the selection of a prototype application will be made in consultation with the members of the technical advisory committee.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 02-1

PROJECT TITLE: Relating Hot Mix Asphalt Pavement Density to Performance

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, PI, UMass Dartmouth; Rajib Mallick, Co-PI, Worcester Polytechnic Institute; Jo Sias Daniel, Co-PI, University of New Hampshire

STATUS: Continuing

AGREEMENT TERM: 9/1/2003 – 07/31/2007

ANTICIPATED COMPLETION: 6/1/2009

PROJECT OBJECTIVES:

The objective of the proposed study is to determine relationship between pavement density and performance through testing of pavements at different levels of in-place density with accelerated pavement loading equipment and environmental simulation. Another objective is to use the obtained relationship to determine pay adjustments for different densities.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

1. UMass Dartmouth prepared specimens for beam fatigue testing. These beams were cut from the larger MMLS fatigue slabs fabricated using the MMLS vibratory drum compactor. The density of each beam fatigue specimen was determined in accordance with AASHTO T116. After reviewing the density data, it was noted that these new beams fatigue test specimens did not exhibit the desired density levels outlined in the proposal (88%, 91%, 94%, and 97%). Many specimens exhibited densities in the range of 86% to 90%.

In order to construct beam fatigue test specimens with higher density levels, additional slabs were constructed with the MMLS vibratory drum compactor. The compaction setup was changed in order to increase the potential for higher density samples. This was accomplished by reducing the slab size in order to minimize heat loss, compacting directly on top of a ¾" steel plate, and applying more passes with the MMLS vibratory drum compactor. Specimens cut from these slabs again exhibited densities in the range of 86% to 90%.

In order to construct beam fatigue specimens with higher density levels another compactor will be required. UMass Dartmouth arranged to utilize the Pavement Technology Inc. Asphalt Vibratory Compactor (AVC) located at Rutgers University in New Jersey. Rutgers has utilized this device to construct all their beam fatigue specimens.

2. In order to be consistent with the mixes being tested, more plant produced 9.5mm and 12.5mm Superpave mix was obtained and produced in August 2008.
3. UMass Dartmouth personnel fabricated and cut beam specimens at the Rutgers facility in New Jersey in September 2008 for beam fatigue testing. Specimens were fabricated for both the 9.5mm and 12.5mm Superpave mixes. A total of eighteen (18) specimens were fabricated for each mix at varying density levels (low, moderate, high) as shown in Table 1:

9.5mm Mix				12.5mm Mix			
Range	Air Voids	Average	Std Dev	Range	Air Voids	Average	Std Dev
Low	4.6	5.8	0.83	Low	5.9	6.9	0.48
	5.1				6.7		
	5.6				6.9		
	5.9				6.9		
	6.5				7		
	6.8				7.3		
Moderate	7.5	8.7	0.83	Moderate	7.3	9.0	0.68
	8.2				7.9		
	8.4				8.6		
	9.1				9.1		
	9.4				9.4		
	9.7				9.4		
High	9.8	11.6	1.22	High	9.8	11.3	0.52
	10.9				10.7		
	11.7				11		
	11.8				11.1		
	11.9				11.8		
	13.5				11.9		

Table 1: Beam Fatigue Specimen Air Void Data

The target densities for the mixes include in this study, as outlined in the original proposal, were: 88%, 91%, 94%, and 97%. Based on the data in Table 1, the 9.5mm specimens had average densities of 88.4%, 91.3%, and 94.2%. The 12.5mm specimens had average densities of 88.7%, 91.0%, and 93.1%. For each density level, the mix will be tested at three micro-strain levels. Additionally, the beam fatigue data will be used to examine the impact of density on the fatigue endurance limit following a procedure developed in NCHRP 9-38.

Many attempts were made to prepare specimens with higher densities (i.e. 97%) for each mix. Several methods were utilized including raising the compaction temperature, compacting specimens in lifts, and increasing the amount of vibratory time in the compactor. These specimens did not reach densities higher than 94% for the 9.5mm mix and 93% for the 12.5mm mix. Therefore, due to compactor limitations, the higher density slabs (97%) were not fabricated.

4. Rutgers began testing the beam fatigue specimens. Each specimen is being tested in accordance with AASHTO T321 “Standard Method of Test for Determining the Fatigue Life of Compacted Hot-Mix Asphalt (HMA) Subjected to Repeated Flexural Bending.”
5. UMass Dartmouth prepared gyratory specimens for the rutting evaluation of the 9.5mm and 12.5mm mixes for this study. Rutting analysis of each mixture for this study was completed using the Asphalt Pavement Analyzer (APA) in accordance with AASHTO TP63 “Standard Method of Test for Determining the Rutting Susceptibility of Asphalt Paving Mixtures Using the Asphalt Pavement Analyzer (APA).” The 9.5mm Superpave mix was tested at average densities of 87.6%, 91.3%, 94.1%, and 98.5%. The 12.5mm Superpave mix was tested at densities of 85.9%, 91.7%, 94.5%, and 95.9%.
6. Fabrication of specimens for Dynamic Modulus ($|E^*|$) testing commenced.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 02-6 (Phase 2)

PROJECT TITLE: Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Ramesh B. Malla, PI, and Montgomery Shaw, Co-PI, University of Connecticut

STATUS: New

AGREEMENT TERM: 8/1/2008 – 7/31/2011

ANTICIPATED COMPLETION: 7/31/2011

PROJECT OBJECTIVES:

The main objective of this NETC 02-6 (Phase 2) project is to test the behavior of the silicone foam sealant under various in-field conditions, make any necessary changes, and evaluate its performance while on an operating highway bridge in order to determine its cost effectiveness and durability. The project involves pre-field laboratory testing, field installation, post installation monitoring, report preparation, and specification preparation.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

1. Materials for Pre-Field Laboratory Testing have been gathered. Asphalt and steel blocks similar to the concrete samples already used in testing have been gathered. Four new sets of Wabo grey and white material have also been obtained after discovering the material used by the previous graduate students was too old. New crosslinker and platinum catalyst has also been obtained due to an insufficient supply of leftover crosslinker and catalyst. Dow Corning foam sealant (RCS 902) material has also been obtained for comparison study if needed.
The following tests have been completed for both the silicone foam and Wabo solid sealants applied to asphalt and steel (Picture 1 shows two samples using asphalt substrate, while Picture 2 shows testing on a sample with steel substrates):
 - Tack Free Time Test
 - Tension Test
 - Oven-Aged Bond Test
 - Salt Water Immersion Test – The results for the oven-aged bond test and salt water immersion test have been attached to this report (See Figures 1 and 2). Nominal stress-strain results for both asphalt and steel substrates are presented. Below the graphs for asphalt and steel substrates, nominal stress-strain results compiled in Phase 1 of the project using concrete substrate is presented for comparison.
2. Cure Rate Test is underway. A series of tension tests are planned after the sealant samples are cured for various time periods including, 3 hours, 6 hours, 18 hours, 24 hours and then every 24 hours for the duration of 42 days. Some these tests

- have been accomplished. Rest will be completed in this 3rd Quarter of the project (ending March 2009)
3. As traffic congestion can become a problem, a lane on a bridge cannot be shut down for a lengthy period of time to allow the silicone sealant to fully cure. Therefore, to access the performance of the sealant in the initial stage after pouring, tension tests were performed on the sealant specimens having been cured for just one hour. The results showed that even after the sealant was stretched for 300% strain, there was neither a loss of bond between the substrates and the sealant, nor the sealant material tore apart. Understandably, however, because the sealant was only in its initial phase of curing, the specimen did not revert back to its original length when the load was removed. Nonetheless, this should not be a concern as the joint gap movement in the field within a few hours after the application of the sealant is expected to be very small (mostly, due to the traffic load, not due to the temperature fluctuation which is normally the cause for larger joint gap opening and closing.)
 4. A candidate applicator suitable for applying large quantity silicone foam sealant in the field has been identified (See Picture 3 and Figure 3). The idea focuses on using a device much like a grease gun. One end of the device has a pressurized pump handle, which looks a lot like a tire pump for bicycles. Pulling back the handle creates an open tank in which the proper chemicals can be placed and mixed. A simple paint mixer attached to a power drill can create sufficient mixing. The side opposite to the handle screws off revealing the open tank. This top has been slightly modified to provide a small opening that has a metal tube attached to it. After mixing the chemicals and screwing the top back onto the device you can release the handle, allowing the pressure of the pump to squeeze the mixed silicone foam material out of the device.
 5. Materials and components for designing a simulated bridge expansion joint have been gathered (See Picture 4 and Figure 4). The setup includes a wooden pallet with wheels attached to the bottom of it. Two steel I-beams have been placed on the pallet to simulate a bridge expansion joint. This setup provides a simulated joint with which to practice applying the silicone sealant material in large quantity, and expand or contract to recreate bridge movements. By practicing the application of the sealant, a detailed procedure for sealing the bridge can be made. Especially, this will help in to come up with the specific instructions on how high above the backer rod the joint should be filled given the fact that the silicone foam expands 70% of its volume after it has cured. By expanding and contracting the joint we can see how well the material bonds to the substrate. We can also have some displacement sensor installed on this simulated joint to gain knowledge and procedure to monitor the joint gap opening and closing in the field. This task is planned for this quarter (third quarter of the project).

PHOTOS/FIGURES

Picture 1 – Test Samples (Asphalt)



Picture 2 – Sample Testing (Steel)



Picture 3 – Applicator



Picture 4 – Simulated Expansion Joint



Nominal Stress, kPa

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 03-1

PROJECT TITLE: Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Allison MacKay, University of Connecticut

STATUS: Completed

AGREEMENT TERM: 08/23/2003 – 05/31/2006

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

The objective of this research is to identify the key parameters that affect the efficacy of wood fibers for removing typical heavy metal contaminants from roadway runoff. Woody materials constitute a cheap, abundant material with the potential to attenuate the diverse suite of contaminants associated with roadway runoff. Laboratory column studies will be conducted to assess the effects of wood type and particle size, flow rate, wet-dry cycles, salt concentration and wood-aging effects on contaminant retention. Results of this research will be used to evaluate the heavy metal-attenuation effectiveness of current stormwater flow management techniques that incorporate woody materials, such as mulches used in slop stabilization and berm construction, and will be used to design remedial structures incorporating woody materials to be used for stormwater management in future roadway projects.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Final report submitted and distributed.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

“Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff”, MacKay, A.A., July 16, 2008, NETCR65.

PROJECT NUMBER: 03-2

PROJECT TITLE: Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Scott Civjan, University of Massachusetts, Amherst

STATUS: Completed

AGREEMENT TERM: 9/1/2004 – 6/30/2008

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

The overall objective of this project is to determine the field applicability of using DSS in concrete for transportation structures. Specifically, the study will develop mixing and placing procedures for concretes containing DSS and will study how well DSS added to concrete in highway and bridge structures protects against reinforcement corrosion and freeze-thaw damage. Field placements using DSS will be made in various New England states. Procedures for long term monitoring will be implemented. In addition, recommendations for laboratory and field testing to address any concerns with long term performance will be developed.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Contract extension was implemented – allowing the final interactions with Maine DOT, Rockland contractors and final report printing.

Task 1a - Literature Review

Final check of literature review completed to include any new information in Final Report.

Task 1b - Determine Potential Sites for Field Implementation

Maine: Rockland Ferry Terminal – site selection was finalized. Approximately half of construction used Hycrete concretes, with the remainder the standard high performance concrete.

Task 2 – Large-Scale Mixing

N/A

Task 3 - Field Placement

Maine: Rockland Ferry Terminal – Construction completed including monitoring plan.

Task 4 - Standardized Testing

N/A

Task 5 - Develop Specifications

N/A

Task 6 - Develop Monitoring Plan

Initial corrosion readings were taken at Maine Rockland Ferry Terminal. Second set of readings completed at VT curb site.

Task 7 - Prepare Final Report

Decision made to submit one final report (rather than 2 proposed previously). Final draft completed and reviewed by committee. Corrections made and submitted to NETC. Final approval obtained. Final report was printed and delivered to NETC.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

“Hycrete – DSS An Innovative Admixture for Concrete: An Update on NETC 03-2,” Presentation: Civjan, Scott A., and Crellin, Benjamin, 16th Annual NE Materials and Research Meeting Concord, NH. June 7, 2005.

“Hycrete Concretes: An Update on NETC 03-2,” Civjan, Scott A., and Crellin, Benjamin, Presentation made to the Connecticut DOT. November 2, 2005.

“A New Admixture to Mitigate Corrosion Problems,” Civjan, S.A., and Crellin, B.J., *Concrete International*, Volume 28, No. 8, Pp. 78-82.

“Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid,” Civjan, Scott A., and Crellin, Benjamin, June 30, 2008, NETCR73.

PROJECT NUMBER: 03-6

PROJECT TITLE: Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, PI, UMass Dartmouth; Jo Sias Daniel, Co-PI, University of New Hampshire

STATUS: Continuing

AGREEMENT TERM: 4/1/2006 – 11/30/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

- Define and compare thin lift overlay maintenance mixes and surface treatments currently used in the New England States.
- Evaluate the thin lift overlay maintenance mixes and surface treatments currently used in the New England States and compare to those currently used worldwide.
- Determine the current New England DOT procedures for picking rehabilitation methodologies.
- Perform and evaluate non-destructive testing to better determine the optimum time to apply surface treatments or thin lift overlay mixes to the existing pavements in order to properly prioritize rehabilitation projects.
- Evaluate the benefits and drawbacks of using PMA thin lift mixes versus surface treatments with lab testing.
- Evaluate the cost comparisons between PMA thin lift mixes and surface treatments.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

1. Work continued on the literature review.
2. Aggregate stockpiles were received from the two contractors (Aggregate Industries - Wrentham, MA and J.H. Lynch - Cumberland, RI) who will place the field trial of AR Gap Graded (HMA-ARGG). Aggregate consensus property testing (sieve analysis, specific gravity testing, sand equivalent testing, flat and elongated particle determination) was completed on all stockpiles.
3. Two trial blends were developed utilizing the MassHighway provisional specifications for the HMA-ARGG mix. This process was completed for both contractors' aggregate stockpiles.
4. Originally mix designs were to be developed with a PG76-34 binder. However, the supplier ceased manufacturing of the PG76-34. Therefore, the project PI

consulted with the project technical committee chair on a suitable substitution. A PG58-28 with 20% rubber binder was selected.

5. One HMA-ARGG mix design was developed using for each contractors' aggregate stockpiles (i.e. two mix designs) in accordance with the MassHighway provisional specifications for HMA-ARGG mix. The HMA-ARGG mix produced by J.H. Lynch was duplicated using a Warm Mix Asphalt (WMA) additive known as Advera[®].
6. The rutting susceptibility of each mix developed was tested utilizing the Asphalt Pavement Analyzer (APA).
7. The mix designs were submitted to each contractor for production. Plant produced mix of the HMA-ARGG without Advera[®] was obtained from J.H. Lynch to fabricate specimens for further evaluation.
8. UMass Dartmouth ordered and received the Portable Seismic Property Analyzer (PSPA) for Non-Destructive Field Testing. Training on the device was conducted in September at UMass Dartmouth.
9. No significant accomplishments were made in the final quarter as the project agreement expired on November 31st, 2008. UMass Dartmouth had previously requested and extension for this project in February 2008, but the extension has not been processed yet. UMass Dartmouth will re-commence work once the extension agreement is executed.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 04-1 (Phase 1)

PROJECT TITLE: Recycling Asphalt Pavements Containing Modified Binders

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): James Mahoney,
Connecticut Transportation Institute, University of Connecticut

STATUS: Completed

AGREEMENT TERM: 8/23/2005 – 8/22/2007

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

Phase 1

The first objective of this Phase of the research is to provide a universally accepted definition of what constitutes a modified asphalt binder. The second objective of this Phase is to determine what types of modified asphalt binders are currently being used in the region. This will include contacting State Transportation Agencies as well as asphalt binder suppliers.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

The work on Phase 1 of this project was completed.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 04-1 (Phase 2)

PROJECT TITLE: Recycling Asphalt Pavements Containing Modified Binders - Phase 2

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): James Mahoney, Connecticut Transportation Institute, University of Connecticut

STATUS: Continuing

AGREEMENT TERM: 8/23/2007 – 6/30/2009

ANTICIPATED COMPLETION: 6/30/2009

PROJECT OBJECTIVES:

Phase 2

The objectives of the second Phase of this project will attempt to address incompatibilities that may arise when RAP is used in a new HMA pavement that contains a virgin modified asphalt binder. This Phase of the project will also provide guidance as to the proper amount of RAP that can be added to the HMA without causing problems. In addition, the interaction of polyphosphoric acid modified virgin asphalts and the aggregates in the RAP will also be tested to determine if there is a negative impact on the HMA mixes performance.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

The research team has acquired modified asphalt binders from NuStar Asphalt (Formerly Citgo Asphalt) as well as Irving. The material from Irving is a PPA modified asphalt. The virgin binder material came from Hudson Liquid Asphalts. The research team has also acquired RAP samples containing granite from Vermont as well as RAP with schist as its primary aggregate from a milling project in Connecticut, RAP with basalt as its primary aggregate from Connecticut and RAP with limestone as its primary aggregate from a source in Maine.

The research team has acquired the software required for the dynamic shear rheometer in order to conduct the testing of asphalt binders using multiple stress creep recovery (MSCR) test for asphalt binders.

The research team has characterized the aggregate properties for the different types of RAP used on this project. The research team has also designed a Superpave mix design that will be used with the different sources of RAP utilizing basalt aggregates as the source of coarse aggregates and manufactured stone sand. The aggregate was deemed by the research team to be the least likely to interact with the different asphalt binders as it does not have any known interactions with the asphalt. This aggregate structure is being used to incorporate the various RAPs into a mixture that should only require small changes in the aggregate structure to accept the different RAPs.

The research team has prepared numerous samples for testing as well as testing of the mixtures in order to meet volumetric requirements and dial in the mixes prior to data collection. This has comprised the vast majority of effort spent in recent months on this research ensuring that the mixes used still meet the Superpave volumetric requirements.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 04-2

PROJECT TITLE: Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Donald L. Fisher, PI, Mike Knodler, Co-PI, and Alexander Pollatsek, Co-PI, University of Massachusetts, Amherst

STATUS: Continuing

AGREEMENT TERM: 3/1/2005 – 1/31/2007

ANTICIPATED COMPLETION: 03/31/2009

PROJECT OBJECTIVES:

1. Determine how driver eye movements vary with different work zone designs
2. Develop recommendation for more effective use of existing work zone traffic control devices.

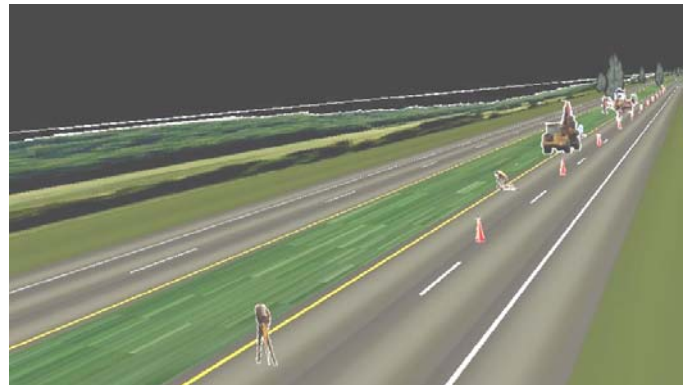
PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Driving Simulator Experiment 1. We have completed the first driving simulator experiment (simulator on left, virtual work zone on right in figure below). A total of 38 drivers between the ages of 18 and 59 years participated in the experiment. The average age of each group was 26.4 years. Analysis of the vehicle data indicated that drivers on the cell phone were closer to a vehicle slowing in the work zone when they first braked, were traveling faster when they were within 49 feet (15 m) of the slowing vehicle, and were more likely to brake hard. Analyses of the eye tracker data were also undertaken. Mirror glances were recorded for lane changes in responses to other vehicles, to work zone transitions (the start of cones) and to signs directing them to move right or left. If a driver failed to glance into the mirror, he or she was much more likely to be on the cell phone than not. Additionally, the spread of the middle 50% of the glances on the horizontal axis was much smaller (by a factor of two almost) for drivers on the cell phone than it was for drivers not on the cell phone. The results strongly suggest that cell phone use reduces situational awareness and will increase the two major types of crashes in work zone activity areas, which are rear end and sideswipe collisions. ..

Field Study: Experiment 2. We have completed the experiment in the field. Twenty-four drivers navigated a closed one mile road on campus a total of four times, in part of which a work zone with barrels was set up. Vehicle data was captured and stored in real time. The vehicle itself was instrumented with three cameras (in addition to the eye tracker), one on the driver's foot, one on the speedometer and one aimed at the readout from a forward facing laser rangefinder that measured the following distance. The driver wore the same eye tracker in the field study that was used in the simulator study. On two of the loops, the driver was engaged in a simulated hands-free cell phone task (the same one that was used in the simulator); on the other two loops the driver was

not so engaged. A lead vehicle was always ahead of the participant driver. Cues that the lead vehicle would stop were used on two of the loops. In this case, a human like mannequin (on a short platform with wheels) was pulled across the work zone when the lead vehicle closed to within 100 feet. The thought was that a pedestrian (i.e., mannequin) entering the path of a lead vehicle should alert an attentive driver that he or she may have to slow for a lead vehicle soon. The lead vehicle never actually decelerated, but the driver of the lead vehicle activated the brake lights half the time that the mannequin was pulled across the road and half the time that the mannequin remained in the work zone. All mannequins wore traffic safety vests with florescent and retroreflective materials. The results are now being analyzed. Drivers on the cell phone who braked while in the work zone transition or activity areas (not all drivers braked; others had their foot on the brakes the entire time) took about twice as long to do such (2.4 s) as drivers not on the cell phone (1.2 s), came about 30% closer to the lead vehicle (23.8 vs. 33.4 ft), and closed about 33% faster (6.4 mph vs. 4.9 mph)

Driving Simulator: Experiment 3. Based upon the results from the first two studies, measures were taken to attempt to mitigate the risk to which cell phone drivers exposed themselves and others. The results from the first two studies suggest that drivers cued that a lead vehicle might be braking who are not on the cell phone perform significantly better than drivers in the same situation who are on their cell phone. However, if the drivers are not cued, both those on and off the cell phone perform equally poorly. This led to the design of a warning for a work zone that traffic ahead could be slowing that was evaluated in the final study. In this third and final study, the driving simulator was again utilized. The lead vehicle braked in a cued and uncued situation. Furthermore, half of the time that a lead vehicle in the work zone was stopped or traveling slowly, the drivers were displayed a message on a flashing variable message sign, “STOP AHEAD CELL OFF. We found that drivers not engaged in a cell phone task were able to reduce their speed earlier in response to a slowing lead vehicle than were drivers engaged in the cell phone task. They were also less likely to brake hard and more likely to make glances at the rear and side view mirrors. Moreover, drivers not engaged in a cell phone task scanned almost twice as far to the left and right. Finally, the use of a variable message sign that is activated by slow traffic speed was associated with improved performance in both the cell and no cell phone driving.



REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Anne Arundel County Police Special Operations Building, Sponsored by the Maryland Association of Traffic Accident Investigators, Hanover, MD. March 20 - 23, 2006.

“Understanding and Quantifying Driver Response,” Muttart, J.W., Texas Association of Accident Reconstructionist Specials, Houston, TX, February 17 & 18, 2006.

“Using Event Data Recorder Information for Driver Response Research and Intelligent Transportation Systems in Rear End Collision,” Muttart, J.W., CDR Users Conference, Dallas, TX. February 13, 2006.

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Canadian Association of Traffic Accident Investigators & Reconstructionists, Fredericton, NB, Canada. July 10 - 13, 2006.

“Driving Simulator Evaluation of Situational Awareness during Hands-Free Communication,” Muttart, J.W., New England Institute of Transportation Engineers Technology Day, Amherst, MA. July 20, 2006.

“Accounting for Moderate Driver Distractions in Work Zones,” Muttart, J.W., Factors, Formulae, Forensic, Technology, & Training Conference, Houston, TX. September 17, 2006.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue,” Muttart, J., Fisher, D. L., and Pollatsek, A., (January 2007), Presentation given at the 86th Transportation Research Board Annual Meeting, TRB, National Research Council, Washington, D.C.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue,” Muttart, J., Fisher, D. L., Knodler, M. and Pollatsek, A., (2007), Transportation Research Record, 2018, pp 9-14.

PROJECT NUMBER: 04-3

PROJECT TITLE: Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jennifer Jacobs, PI, Thomas Ballestero, Co-PI, University of New Hampshire and Richard Vogel, Co-PI, Tufts University

STATUS: Continuing

AGREEMENT TERM: 10/1/2004 – 3/31/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

The main objective of this research is to develop a set of regional regression relationships to predict flood flows for steep slope watersheds from basin characteristics. The regression relationships will be developed using standard USGS regional hydrologic methods. We propose to identify target watersheds in the New England region and to develop a database of physical basin parameters and historical streamflow necessary for the statistical analysis. Regression analyses will be conducted to identify explanatory variables and to develop regression relationships for average daily flow and 2-, 10-, 25-, 50-, and 100-year peak flow recurrence interval events. As appropriate, the New England states will be divided into subregions.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

The Literature Review was presented to the committee and feedback was provided. The watershed selection was completed. The database of 204 steep watersheds is selected for this study. All historical streamflow statistics and basin characteristics are developed for each watershed. A database of supporting values was developed. The regression analyses have been conducted using the finalized flow and watershed characteristics. A preliminary set of equations is available. The final regression analysis and documentation can continue once the contract extension request is approved. The majority of the progress was accomplished prior to 2007 with the project being in hiatus for much of 2008 due to pending contract extension request.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

2006 Maine Water Conference, Augusta, ME, March 22, 2006. Poster presentation.

PROJECT NUMBER: 04-4

PROJECT TITLE: Determining the Effective PG Grade of Binder in RAP Mixes

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): PI: Jo Daniel, University of New Hampshire; Co-PI: Walaa Mogawer, UMass Dartmouth

STATUS: Continuing

AGREEMENT TERM: 10/1/2004 – 3/31/2008

ANTICIPATED COMPLETION: 7/31/2009

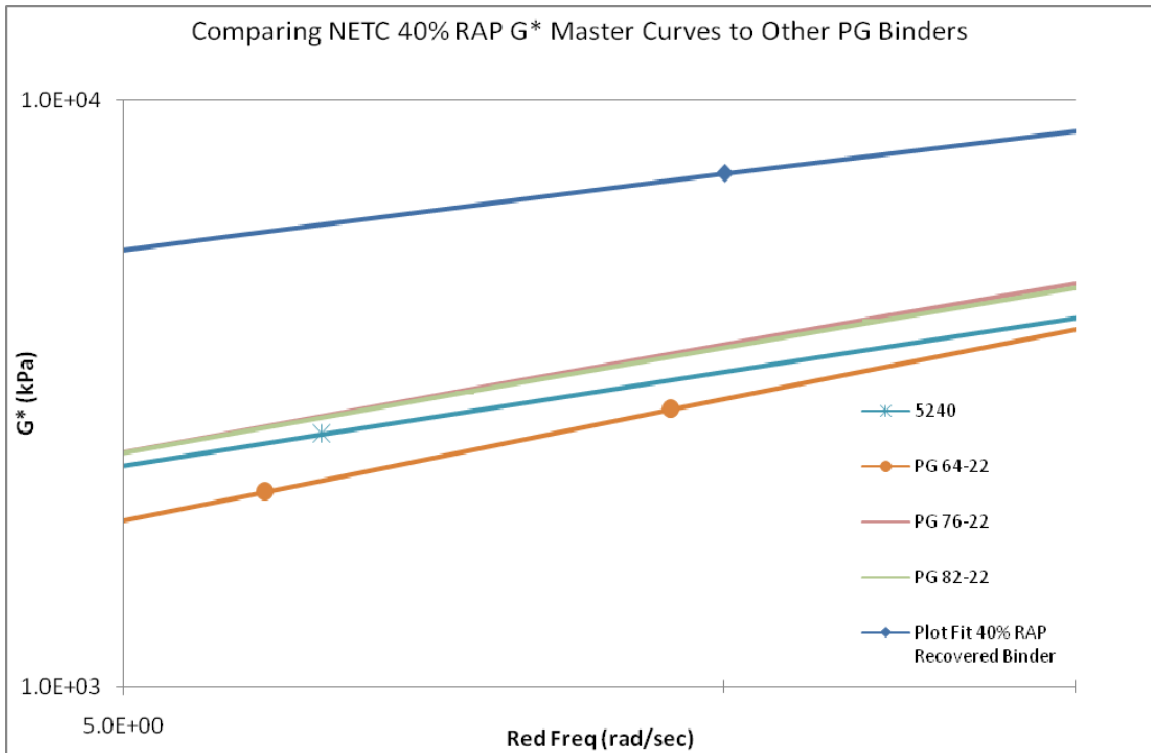
PROJECT OBJECTIVES:

The main objective of this research is to develop a method to determine or estimate the binder grade in mixtures designed with RAP from the properties of the mixture itself.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

All testing for this project was completed in 2008 and analysis of the data is continuing. The original analysis plan has been adjusted due to some difficulties in applying the Hirsch model to shifted data. There is an asymptote in the Hirsch model that makes it impossible to backcalculate the G^* of the binder at the temperatures and frequencies needed to directly estimate the effective PG grade of the binder in the RAP mixtures. Instead, comparative analyses will be done with the back calculated G^* master curves. The Hirsch model will be used to back calculate the effective binder G^* master curve at room temperature. This will then be compared with typical binder master curves and the extracted curve for the RAP mixture to determine an appropriate estimation of the effective PG grade for the mix. The figure below shows comparative curves for the 40% RAP mixture (5240 label). In this case, the back calculated G^* curve falls in between a PG 64-22 and PG 76-22 binder. Also note the recovered G^* curve is much stiffer.

It is anticipated that the draft final report will be submitted to the committee by the end of May 2009.



REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 05-1

PROJECT TITLE: Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Thomas C. Sanford,
University of Maine

STATUS: Continuing

AGREEMENT TERM: 1/1/2006 – 12/31/2007

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

The objective of this study is to produce a drilled shaft design method for evaluating the now unused side shear or end bearing to supplement the AASHTO allowable load. The magnitude of unused side shear or end bearing corresponding to the AASHTO allowable load will be the magnitude that occurs at the same shaft movement as the allowable load. This method should reflect different rock socket geometry and different rock properties typical of New England. The method should be based on past load tests and be robust and easy-to-use.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Received load test data from Connecticut DOT. Total number of tests received from the Connecticut, Massachusetts, and Maine DOT's was 14. Analysis of the data was started. Records of 460 Osterberg load tests conducted for public agencies by LOADTEST were obtained from Dr. Dan Brown of Auburn University. The information has been screened down to 40 tests occurring in hard rock, including the 14 tests indicated above. The geotechnical information on the tests, excluding the 14 tests, is incomplete. We are in the process of tracking down supplemental information from public agencies principally in Pennsylvania, Virginia, and New Jersey. Requirements for special field load tests have been developed and written.

Contacted all eastern states having load tests in hard rock to obtain additional information (subsurface, testing, construction, load testing, and contract documents). Obtained information from Maine, Massachusetts, Connecticut and New Jersey by going to state offices resulting in a total of 10 tests with detailed information. Information on each of 10 tests was transcribed into common format in a written chapter for the draft report. Analysis of the results was begun. The literature review for the finite element modeling was conducted.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 05-5

PROJECT TITLE: Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with Surface Energy Measurement Equipment

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Sze C. Yang, PI, and K. Wayne Lee, Co-PI, University of Rhode Island

STATUS: New

AGREEMENT TERM: 3/1/2008 – 8/31/2009

ANTICIPATED COMPLETION: 12/31/2009

PROJECT OBJECTIVES:

1. Compare the adhesion properties of NEPCOAT-approved topcoat paint over metallizing to topcoat paint over galvanizing using specialized “surface-energy” measuring lab methods.
2. Investigate various factors affecting the adhesion of topcoat paint over galvanizing.
3. Report and recommend practices which produce the best adhesion of NEPCOAT-approved topcoat paints over metallized and particularly galvanized steel surfaces. Examine surface cleaning, phosphating vs. wash primer.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Galvanized and metalized steel have gained popularity over the bare steel for use in new bridges because of their improved protection against corrosion. Associated with this trend is the need for paints suitable for coating on the zinc coated surfaces. Unlike the NEPCOAT list for bare steel, there is not yet a list of qualified coatings for the zinc-coated surfaces. It appears that the paints suitable for the galvanized steel in the auto and appliances industry may not be equally useful for bridges and highway structures. There are anecdotal reports of poor adhesion performance of paints for highway structures. In the absence of a list of qualified paints for zinc coated surfaces, the prudent and practical first step towards the eventual qualification process is to examine whether some of the paints in the current NEPCOAT list for bare steel would also work well for the galvanized and the metalized steel. Our initial test results show that some of the NEPCOAT paints may adhering to the zinc coated surfaces well enough to be useful.

One of the objectives of this project is to evaluate the NEPCOAT paints for adhesion strength on zinc coated steel. In our initial study (started September 2008) we tested the adhesion strength of two different commercial paints from the NEPCOAT list (paints B7-97 and SSC(02)-04). These paints were coated on test plates made of galvanized and metalized steel samples prepared by a commercial coating service (Newport Industrial Fabrication Inc. Newport, ME). The adhesion strengths for these



Figure 1. Paint B7-97 on metalized zinc after pull off at 700 psi.



Figure 2. Paint B7-97 on galvanized steel after pull off at 680 psi.

samples were tested according to ASTM D4541 standard for pull-off strength tests using a model 601 Elcometer. Preliminary test results show that most of the samples (80%) pass the minimum requirement of the minimum strength of 600 psi. These preliminary results indicate that at least some paints on the NEPCOAT list could be used in both the bare steel and the zinc coated steel.

Figures 1 and 2 show the mode of coating separation after a dolly originally glued to the painted surface was pulled off at the end of the ASTM D4541 test. Figure 1 shows the NEPCOAT B7-97 paint (from Carboline Company) pulled off from the test steel plate (4"x4"x1/4") with an Elcometer gauge break off reading at 700 psi. At a closer examination of the paints on the and the test plate we concluded that the separation occurred within the primer layer. The primer / zinc interface appears intact.

Figure 2 shows the same paint (B7-97) painted on galvanized steel after pulled off at 680 psi. The arrow drawn on a white paper indicates the faint depression of the attachment point. The primer / zinc interface was intact. The delamination of the paint occurs mostly at the top coat. There are samples that fail the ASTM D4541 tests at pull off strength in the 400 and 500

psi ranges. The fail rate is not high, but we do not yet have significantly reliable statistics for reporting these numbers.

We have begun a study of the wetting of paint on galvanized and the metalized surfaces using the technique of contact angle analysis. The purpose is to observe if there is a difference in wetting for different commercial primers. We are interested in whether there is a correlation in the wetting property of the primer with the pull off strength. We hope that this approach will provide an understanding of the difference in the adhesion performance

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 05-6

PROJECT TITLE: Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): J. H. Wang, University of Rhode Island

STATUS: Continuing

AGREEMENT TERM: 1/1/2006 - 4/30/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

- Review and evaluate existing research and literature related to the use of graphic-aided DMSs and the effects of such uses on elder drivers.
- Examine the feasibility of employing graphics in DMS messaging to assist drivers' comprehension of the message with a particular focus on elder drivers.
- Compile and or develop a library of graphic-aided text messages if such use were determined to be both feasible and beneficial.
- Make recommendations to identify, re-design, or create elderly friendly dynamic message signs that are effective for the driving population as a whole.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

- A computer-based questionnaire to collect drivers' opinions and preferences and a driving simulation experiment to collect drivers' response times regarding the use of graphics in DMS was successfully developed and tested. Both the survey and simulation were successfully conducted in May and June with 480 people completed the survey and 170 people completed the simulation. The major part of the survey and simulation were conducted in Warwick Mall, RI.
- 35 additional elder drivers between the ages of 60 and 94 were recruited to complete the computer-based questionnaire and the driving simulation experiment to provide a better contrast between young and older drivers. Members of the research team visited local elderly housing communities to recruit subjects and drove them to the URI lab to participate in the research project. The resulting opinions and preferences collected from the survey, and response times from the driving simulation were analyzed across the five age groups.
- The PI has made a presentation about the interim progress and result of this project at the Conn DOT. The presentation was videotaped and was made available for public viewing through the web.
- Aaron Clark, the graduate student who worked in the project, successfully defended his thesis in November 2007.
- A paper was written based on partial findings of this project and was presented at the 88th TRB meeting in Washington, DC in January 2008.

- A second paper was prepared based on further results of this project and was presented at the 2008 IIE Research Conference in Vancouver, Canada in May 2008.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

A presentation was given to the Rhode Island DOT on November 16, 2006.

“Assisting Elder Drivers’ Comprehension of Dynamic Message Signs,” Clark, A.T., Wang, J.H., Maier-Sperdelozzi, V., Collyer, C.E., Proceedings of the 87th Annual Meeting of Transportation Research Board, Paper No. 08-2276, p.1-16, CD-ROM, 2008.

“Age Effect on Driver Comprehension of Messages Displayed on Dynamic Message Signs”, Wang, J.H., Clark, A. Y., and Maier-Sperdelozzi, V., Proceedings of IIE Research Conference, Paper No. 307, p.1-6, CD-ROM, 2008.

PROJECT NUMBER: NETC 05-7

PROJECT TITLE: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways - Phase 2

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): John N. Ivan, University of Connecticut and Adel E. Sadek, University at Buffalo, The State University of New York

STATUS: Continuing

AGREEMENT TERM: 5/23/2006 – 7/31/2008

ANTICIPATED COMPLETION: 3/1/2009

PROJECT OBJECTIVES:

The primary objective of this project is to consider accident and operational experience to develop a set of warrants prescribing conditions under which it is and is not appropriate to install exclusive left turn lanes at unsignalized intersections and driveways. The resulting warrants will balance both safety and operational considerations. Empirical Bayes analysis and negative binomial modeling will be used to compare the accident experience at unsignalized intersections with and without exclusive left turn lanes, especially noting the contributions of other conditions (e.g., volume level, land use, driveway density, and roadway geometry). Traffic simulation will be used to estimate delay to through and left-turning vehicles at these same intersections, again noting the contributions of these other conditions. The resulting warrants will then consider not only traffic volumes, but also observed safety experience and other pertinent characteristics of the intersection or driveway.

A secondary objective is to examine the safety experience at unsignalized intersections and driveways with existing exclusive left turn lanes to see what can be learned about how to design them to be safer. This will involve observing all of the geometric characteristics of the sites studied, along with the precise application of traffic control devices used, including pavement markings and signage, as well as lane and pavement width. Then, in addition to the warrants developed, we will also prepare guidelines for how to physically design and control exclusive left turn lanes to maximize safety for all road users.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

- Volume-based warrants for left turn lanes were developed based on delay and number of stops for rural two-lane roads and urban two- and four-lane roads.
- A safety comparison between intersections with and without left turn lanes was conducted for three- and four-leg intersection on rural two-lane and urban two- and four-lane roads. Strong evidence was found that left turn lanes reduce same-direction crashes on rural two lane roads at four-leg intersections and on urban four-lane roads at three-leg intersections. Some evidence was found that left turn lanes reduce same-direction crashes on rural two-lane roads at three-leg intersections and on urban four-lane roads at four-leg intersections. However,

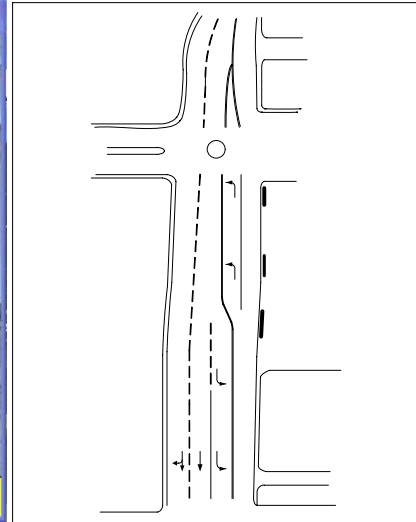
there is no evidence that left turn lanes reduce same direction crashes on urban two-lane roads at either three or four leg intersections.

- A design analysis was also conducted of the intersections with left turn lanes that experienced higher than expected crash counts. These intersections tend to have one of the following conditions:
 - Very short taper and/or storage lengths
 - Multiple driveways using the same left turn lane
 - Other geometric conditions that increase the crash risk, such as horizontal curves
- Consequently, the recommendations of the report are the following:
 - Left turn lanes should strongly be considered on rural two-lane roads at four-leg intersections and on urban four-lane roads at three-leg intersections on the basis of safety, irrespective of whether or not the volume warrants are met. Otherwise, the volume warrants should be followed to determine when left turn lanes should be installed.
 - When designing left turn lanes, use the AASHTO recommended taper and storage lengths, avoid multiple driveways sharing the same left turn lane near a significant intersection, and consider the presence of other geometric features, such as horizontal curves, when designing a left turn lane. For example, do not begin the left turn lane in the middle of a curve where it cannot be seen by drivers approaching from behind. Sample photos and plan views of intersections with these conditions are attached at the end of the report.

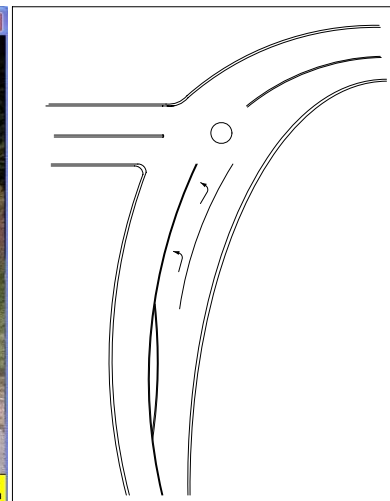
A draft report was submitted to the Technical Committee for comment.



Example location with very short left turn lane taper and storage length



Example location with numerous driveways sharing a left turn lane



Example location with left turn lane on a horizontal curve

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

“A Decision Support System for Predicting the likely Benefits of Left-turn Lane Installation,” Ranade, S., Sadek, A.W. and Ivan, J., 2007, TRB Annual meeting, Paper No. 07-0992; January 2007; *Transportation Research Record*, 2023:28-36, 2007. This paper received the Best Paper Award from the Committee on Operational Effects of Geometrics at the 2008 Annual Meeting.

PROJECT NUMBER: 05-8

PROJECT TITLE: Evaluation and Implementation of Traffic Simulation Models for Work Zones

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): John Collura, University of Massachusetts Amherst

STATUS: Continuing

AGREEMENT TERM: 1/1/2006 – 8/31/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

1) assess the strengths and limitations of readily available computer based simulation models designed to evaluate the impacts of alternative work zone strategies; 2) make recommendations for the use of such simulation models on roadway reconstruction and rehabilitation projects in New England and New York State; and 3) conduct the necessary technology transfer activities in order to ensure that the results of this project are disseminated and provided directly to potential simulation model users, including transportation engineers and planners in New England and New York State.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

The Literature Review (Task 1) focused on the identification of PC-based simulation models to assist State DOTs in the evaluation of alternative work zone strategies (QuickZone, QUEWZ, CA4PRS and CORSIM). The data requirements of these models were identified (Task 2) and incorporated into the assessment of the strengths and weaknesses of these models and their potential use by State DOTs (Task 3). The Simulation Software was used to assess the impacts of work zone strategies along segments of several major routes in New England.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008:

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies: Case Studies Along Interstate Highways in Massachusetts and Rhode Island,” Moriarty, K.D., Collura, J., Knodler Jr., M.A., Daiheng, N., and Heaslip, K., Paper presented at the TRB Annual Meeting in January 2008.

PROJECT NUMBER: 06-1

PROJECT TITLE: New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jo Sias Daniel, PI, University of New Hampshire; Ghassan R. Chehab, Co-PI, Pennsylvania State University

STATUS: Continuing

AGREEMENT TERM: 8/1/2006 - 7/31/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES:

- Determine the design and data collection methods, material tests, and testing equipment currently in use by each state.
- Identify the Level 2 and Level 3 design guide inputs for which regional or local values are required.
- Provide state specific recommendations on implementation of the MEPDG including changes in data collection & measurement, equipment needs, training, and anticipated benefits.
- Provide specific recommendations for regional and local calibration of the MEPDG by identifying appropriate field test & monitoring sites, data to be collected, and perform local calibrations if appropriate field data is available.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Sensitivity analysis using the MEPDG has been completed for four of the New England states. The LTPP sections in each state were used to get a representative pavement cross section for analysis, shown in figure 1 below. Representative values and ranges for various MEPDG inputs were determined from state specifications and then multiple runs with the MEPDG software were conducted to determine the sensitivity of the input parameters to the resulting performance prediction.

New Hampshire*	Connecticut 9-1803	Maine 23-1012	Rhode Island 44-7401
AC 6 inches	AC 3.1 inches	AC 1.2 inches	AC Overlay 3"
Crushed Gravel 12 inches	AC 4.3 inches	AC 8.3 inches	Fractured JPCP 8 inches
Crushed Stone Base 15 inches	Crushed Stone Base 12 inches	Uncrushed Gravel 13 inches	Uncrushed Gravel Base 12 inches
Subgrade A-2-4	Subgrade A-1-b	A-3 Subbase 16.5 inches	Subgrade A-1-b
		Subgrade A-2-4	

Figure 1. Pavement cross sections used for sensitivity analysis

The results obtained from the runs are interpreted graphically to obtain a relationship between each input variable used in the study and each predicted pavement distress. A few general observations made from the results are as follows:

- The trends for all the input parameters and their effects on predicted pavement distresses are the same for all the states studied, and are similar to the performance expected from theoretical explanation
- Level 2 analysis conducted resulted in predicted performance that is lower than Level 3 values, with similar trends being repeated for each of the input variables considered
- The magnitude of variability is different for different states studied due to difference in pavement layer structure, traffic and environmental conditions and the material properties used in the asphalt and unbound layers
- Pavement distresses exceeded the pre-defined failure limits only in the case of New Hampshire, and were very much below the limits for Connecticut, Maine and Rhode Island
- The AC overlay over fractured JPCP structure selected for the state of Rhode Island based on LTPP data returned zero predicted distress values for bottom-up and longitudinal cracking. The reason for zero prediction of cracking could result from a very high modulus fractured concrete course underlying the asphalt concrete layer.

Statistical analysis is also performed to determine the percentage variation caused by all individual input parameters on the predicted pavement distresses. An example for bottom up cracking in NH for Level 3 analysis is shown in Figure 2.

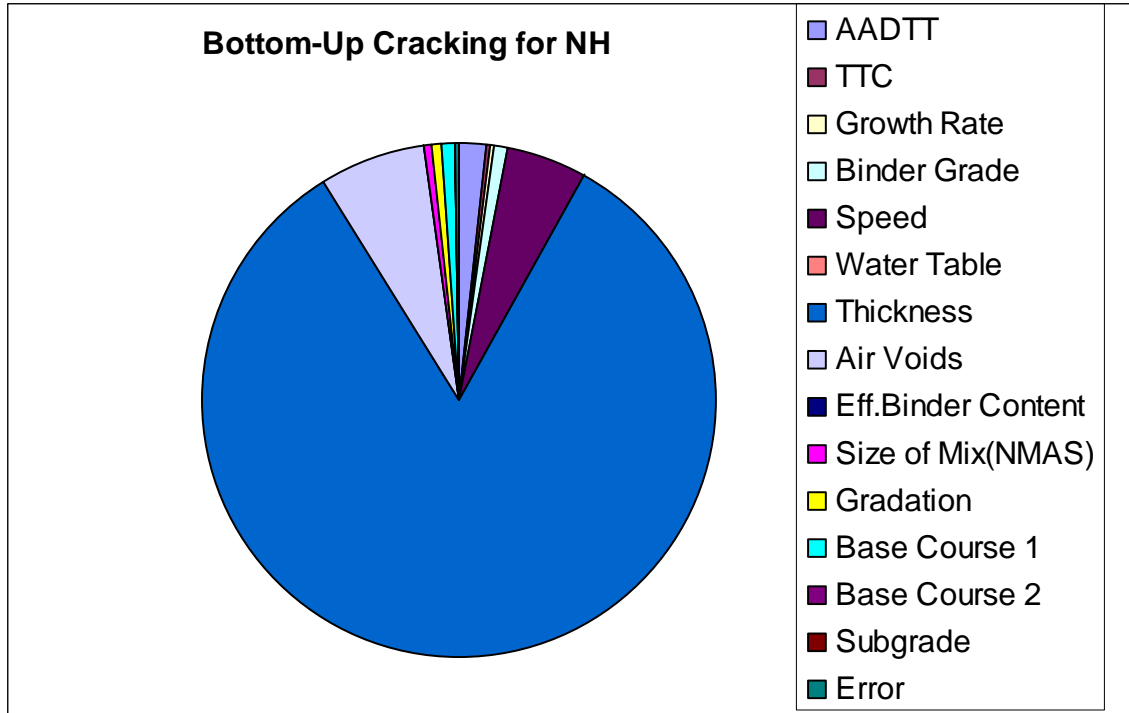


Figure 2. New Hampshire Level 3 – Effect Sizes for Fatigue Cracking

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 06-3

PROJECT TITLE: Establishing Default Dynamic Modulus Values for New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): James Mahoney, PI,
University of Connecticut

STATUS: New

INITIAL AGREEMENT DATE: 7/1/2008 – 12/31/2009

ANTICIPATED COMPLETION: 12/31/2009

PROJECT OBJECTIVES: RESEARCH OBJECTIVE:

The objective of this research is to test commonly used HMA mixtures throughout New England to determine their respective moduli. The results of this testing will be:

- Used to determine if there is a significant difference between dynamic modulus values for materials from throughout the region.
- Used to compare the dynamic modulus of lab produced mixes and plant produced mixes.
- Compared against the master curves derived by performing the reduced testing as outlined by Bonaquist and Christensen. This will reduce the number of temperatures as well as the number of frequencies tested. If this process correlates well with the full set testing master curves, it will reduce the amount of time required to conduct the testing.
- Compared against the predicted moduli obtained by using the Witczak Predictive Model and the Hirsh Model. If there is a strong correlation between the tested and predicted values then this would provide a reasonable value for the dynamic modulus for most HMA designs in the 2002 Pavement Design Guide.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

The kick-off videoconference was conducted on August 8, 2008. The research team outlined the quantities of HMA needed to conduct the testing as well as adding that one plant produced mix will be tested for each state as long as it corresponds to one of the laboratory produced mixes. The research team has conducted an on going literature review of hot mix asphalt dynamic modulus. The great deal of research published in this area over the last couple of years may require some deviation from the models and methods proposed to ensure state-of-the-art practice. Any changes to the work plan would be coordinated with the technical committee.

In October and November the research team was able to collect the necessary raw materials from New Hampshire, Vermont, Maine and Connecticut to start fabricating laboratory specimens and plant mixed specimens. In addition, four mix designs from each state were obtained with the raw material. Preliminary batch sheets for the laboratory specimen fabrication have been generated for each mix and gyratory

specimens are currently being fabricated. However, fine tuning of the total batch weight for each mix is necessary to ensure the fabricated specimens are within the specified tolerances for height and percent air voids. To date test specimens for Connecticut mixes have been generated and are ready for dynamic modulus testing.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

PROJECT NUMBER: 06-5

PROJECT TITLE: The New England Winter Severity Index

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Samuel Miller, PI, Plymouth State University; Brendon Hoch, Co-PI, Plymouth State University

STATUS: Continuing

AGREEMENT TERM: 7/24/2006 – 7/31/2008

ANTICIPATED COMPLETION: Agreement Pending

PROJECT OBJECTIVES: RESEARCH OBJECTIVE: The objective of this study is to develop winter severity indices for the New England region. Anticipated tasks include identifying appropriate and manageable number of weather regions within New England, developing winter severity indices using statistical concepts, developing standard methods to utilize the indices and provide recommendations on maintaining and improving indices.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2008:

Task 1: Literature review – *complete*.

Task 2: Define climate zones – *complete*.

Task 3: Develop a NEWSI for each climate zone – *complete*.

Task 4: Validate NEWSI for each climate zone with historical dataset – *complete*.

Note: We upgraded this task to include five separate NEWSI's for each transportation district. The purpose of this was to achieve higher correlation coefficients between costs and winter weather variables. The first is a general index that calculates all costs associated with winter road maintenance. The other four separately predict costs associated with labor, vehicles and equipment, and chemicals.

Using historical cost data provided by the state transportation department, we have completed this for the state of Maine. The other five New England states did not respond to our request for cost data, so we have not been able to develop a cost predictor for them. All they will receive is a classification of their respective climate zones.

Task 5: Develop a GIS program that computes a NEWSI for zones as defined in task 2 – modified. Following our change of personnel, and in consultation with the Maine transportation department, we decided to create a web-based application that computes the NEWSI(s) for each of the Maine transportation districts, and presents the results in both graphical and numerical form. The webpage will automatically update itself once/month, and be housed on the Plymouth State University/Judd

Gregg Meteorology Institute server.

Task 6: Develop and conduct one-day training workshops for each New England state – under construction. Given the lack of responsiveness from New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island, all we will be able to provide them is a demonstration of how we determined their respective climate zones. Since this is not likely to be of interest to most transportation professionals, we have not begun work on this yet. We are currently focusing our attention on developing demonstrations for the five Maine transportation maintenance districts, since these are the only regions that will have a cost prediction algorithm.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2008: None

D. FINANCIAL STATUS OF PROJECTS ACTIVE DURING 2008

D.1 FINANCIAL STATUS OF ACTIVE PROJECTS:
Table 1: Financial Status of Projects Active During 2008
(As of December 1, 2008)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES APPROVED FOR PAYMENT	PROJECT BALANCE
01-1 T2 Phase 1	Advanced Composite Materials in New England's Transportation Infrastructure - Technology Transfer Phase 1: Selection of Prototype, S. Brena, University of Massachusetts Amherst	\$25,910.00	\$9,998.30	\$15,911.70
02-1	Relating Hot Mix Asphalt Pavement Density to Performance, W. Mogawer, University of Massachusetts, Dartmouth, R. Mallick, Worcester Polytechnic Institute, J. Daniels, University of New Hampshire	\$103,524.00	\$90,721.69	\$12,802.31
02-6 Phase 2	Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring, R. Malla, M. Shaw, University of Connecticut	\$75,000.00	\$3,278.73	\$71,721.27
03-1	Ability of Wood Fiber Materials to Attenuate Heavy Metals, A. MacKay, University of Connecticut	\$72,000.00	\$70,690.16	\$1,309.84
03-2	Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Acid, S. Civjan, University of Massachusetts Amherst	\$140,000.00	\$132,528.33	\$7,471.67
03-6	Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments, W. Mogawer, University of Massachusetts Dartmouth, J. Daniel, University of New Hampshire	\$99,927.00	\$53,967.17	\$45,959.83
04-1 Phase 1	Recycling Asphalt Pavements Containing Modified Binders, J. Mahoney, University of Connecticut	\$109,918.00	\$27,166.58	\$87,279.18
04-1 Phase 2	Recycling Asphalt Pavements Containing Modified Binders - Phase 2, J. Mahoney, University of Connecticut	\$82,751.00	\$17,611.37	\$65,139.63
04-2	Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety, D. Fisher, M. Knodler, University of Massachusetts Amherst	\$74,491.00	\$70,387.66	\$4,103.34
04-3	Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England, J. Jacobs, T. Ballesterio, University of New Hampshire, R. Vogel, Tufts University	\$120,000.00	\$95,101.37	\$24,898.63
04-4	Determining the Effective PG Grade of Binder in RAP Mixes, J. Daniel, University of New Hampshire, W. Mogawer, University of Massachusetts Dartmouth	\$130,876.00	\$115,495.75	\$15,380.25

D.1 FINANCIAL STATUS OF ACTIVE PROJECTS:
Table 1: Financial Status of Projects Active During 2008
(As of December 1, 2008)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES APPROVED FOR PAYMENT	PROJECT BALANCE
05-1	Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets, <i>T. Sandford, University of Maine</i>	\$99,910.00	\$33,675.94	\$66,234.06
05-5	Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with Surface Energy Measurement Equipment, <i>S. Yang, K. W. Lee, University of Rhode Island</i>	\$125,000.00	\$0.00	\$125,000.00
05-6	Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension, <i>J. H. Wang, University of Rhode Island</i>	\$59,991.00	\$46,712.74	\$13,278.26
05-7 Phase 1	Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways, <i>J. Ivan, University of Connecticut, A. Sadek, University at Buffalo, New York</i>	\$100,000.00	\$92,000.36	\$7,999.64
05-7 Phase 2	Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways - Phase 2, <i>J. Ivan, University of Connecticut, A. Sadek, University at Buffalo, New York</i>	\$7,998.00	\$4,231.49	\$3,766.51
05-8	Evaluation and Implementation of Traffic Simulation Models for Work Zones, <i>J. Collura, University of Massachusetts</i>	\$100,000.00	\$93,616.74	\$6,383.26
06-1	New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs, <i>J. Daniel, University of New Hampshire</i>	\$150,295.00	\$67,906.90	\$82,388.10
06-3	Establishing Default Dynamic Modulus Values for New England, <i>J. Mahoney, University of Connecticut</i>	\$109,787.00	\$12,473.48	\$97,313.52
06-5	The New England Winter Severity Index, <i>S. Miller, Plymouth State University</i>	\$100,000.00	\$57,056.35	\$42,942.65

D.2 NETC FUND BALANCE				
As of December 31, 2008				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
Unexpended Balance of NETC funds from AASHTO				
as of 6/5/95 (Per AASHTO memo 12/4/95)				132,777.07
Member Obligations 1994 = 6 X \$75,000	450,000.00			582,777.07
Coord./Admin. of NETC: Calendar Year 1995 Bdgt. = \$73042		58,761.32	FINAL	524,015.75
Continued Projects:				
- Construction Costs of New England Bridges-Phase II		39,500.00	FINAL/CLOSED	484,515.75
- Tire Chips as Lightweight Backfill-Phase II: Full-Scale Testing (Supplemental Funding)		16,000.00	FINAL/CLOSED	468,515.75
- Bridge Rail Crash Test - Phase II: Sidewalk-Mounted Rail		134,127.00	FINAL/CLOSED	334,388.75
- New England Vehicle Classification and Truck Weight Program		6,752.57	FINAL/CLOSED	327,636.18
Member Obligations 1995 = 7 X \$75,000	525,000.00			852,636.18
"95" Project Series:				
95-1: Use of Tire Chips/Soil Mixtures to Limit Pavement Damage of Paved Roads		75,000.00	FINAL/CLOSED	777,636.18
95-2: Suitability of Non-Hydric Soils for Wetland Mitigation		39,867.70	FINAL/CLOSED	737,768.48
95-3: Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Mixes		120,812.12	FINAL/CLOSED	616,956.36
95-5: Buried Joints in Short Span Bridges		61,705.61	FINAL/TERM.	555,250.75
95-6: Guidelines for Ride Quality Acceptance of Pavements		106,124.00	FINAL/CLOSED	449,126.75
"94" Project Series:				
94-1: Structural Analysis of New England Subbase Materials and Structures		110,057.38	FINAL/CLOSED	339,069.37
94-2: Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques		224,901.80	FINAL/CLOSED	114,167.57
Member Obligations 1996 = 6 X \$75,000	450,000.00			564,167.57
Coord./Admin. of NETC: Calendar Year 1996; Bdgt. = \$75,000		69,123.85	FINAL	495,043.72
Member Allocations 1997 = 6 X \$75,000	450,000.00			945,043.72
Coord./Admin. of NETC: Calendar Year 1997; Bdgt. = \$82,494		77,244.35	FINAL	867,799.37
"94" Project Series:				
94-3: Procedures for The Evaluation of Sheet Membrane Waterproofing <i>Note: Project administered by VAOT under TPF Project No. SPR-3</i>		67,002.00	FINAL/CLOSED	800,797.37
94-4: Durability of Concrete Crack Repair Systems		72,036.04	FINAL/TERM.	728,761.33
"96" Project Series:				
96-1: SUPERPAVE Implementation		60,139.25	FINAL/CLOSED	668,622.08
96-2: Optimizing GPS Use in Transportation Projects		27,008.81	FINAL/TERM.	641,613.27
96-3: Effectiveness of Fiber Reinforced Composites as Protective Coverings for Bridge Elements, etc.		135,000.00	FINAL/CLOSED	506,613.27
T2 (per 12/2/97 Adv. Committee Mtg.) for 1998 = \$10,000		9,551.06	FINAL	497,062.21
Coord./Admin. of NETC: Calendar Year 1998; Bdgt = \$73,021		80,422.65	FINAL	416,639.56
Refund Check (No. 15-663337), for CY '98 Management of NETC, from UConn OSP; Ref. 7/19/00 letter to J. Sime from J. Devereux, UConn OSP	336.00			416,975.56
Member Obligations 1998 = 6 X \$75,000	450,000.00			866,975.56
"97" Project Series:				
97-1: A Portable Method for Determining Chloride Concentration on Roadway Pavements	Phase 1	96,669.50	FINAL/CLOSED	770,306.06
	Phase 2	90,667.79	FINAL/CLOSED	679,638.27
97-2: Performance Evaluation & Economic Analysis of Durability Enhancing Admixtures, etc.		108,318.73	FINAL/CLOSED	571,319.54
97-3: Determining Properties, Standards & Performance of Wood Waste Compost, etc.:	Phase 1	27,779.64	FINAL/CLOSED	543,539.90
	Phase 2	16,074.30	FINAL/CLOSED	527,465.60
Alloc. to ConnDOT for Constr. Costs of Test Site (Approved 1/21/99 Ballot)		10,700.00		516,765.60
97-4: Early Distress of Open-Graded Friction Course		57,495.71	FINAL/CLOSED	459,269.89
Travel Tech. Comm. (Aug. 98 tel. poll) for 1998 = \$5,000		0.00		459,269.89

D.2 FUND BALANCE				
As of December 31, 2008				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
Member Obligations 1999 = 6 X \$75,000	450,000.00			909,269.89
Coord./Admin. of NETC: Calendar Year 1999:				909,269.89
- Administration = \$77,666				
-Technology Transfer & Technical Committee				
Travel = \$20,400				
-Total = \$98,066		79,101.20	FINAL	830,168.69
"99" Project Series:				
99-1: Bridge Rail Transitions		240,000.00	FINAL/CLOSED	590,168.69
99-2: Evaluation of Asphaltic Expansion Joints		62,234.76	FINAL/CLOSED	527,933.93
99-3: Bridge Scour Monitoring Systems		78,523.32	FINAL/CLOSED	449,410.61
99-4: Quantifying Roadside Rest Area Usage		44,857.00	FINAL/CLOSED	404,553.61
99-6: The Effects of Concrete Removal Operations on Adjacent That Is to Remain		96,008.36	FINAL/CLOSED	308,545.25
Member Obligations 2000 = 6 X \$100,000	600,000.00			908,545.25
Coord./Admin. of NETC: Calendar Year 2000:		91,899.37	FINAL	816,645.88
- Administration = \$ 85,788				
- Technology Transfer & Technical Committee				
Travel = \$ 16,800				
- Total = \$102,588				
"00" Project Series:				816,645.88
00-1: Ground-Based Imaging and Data Acquisition Systems for Roadway Inventories in New England - A Synthesis of Practice		31,251.92	FINAL/CLOSED	785,393.96
00-2: Evaluation of Permeability of Superpave Mixes		95,499.16	FINAL/CLOSED	689,894.80
00-3: Composite Reinforced Timber Guard Rail - Phase I: Design, Fabrication and Testing		81,989.38	FINAL/CLOSED	607,905.42
00-4: Falling Weight Deflectometer Study		100,000.00	FINAL/CLOSED	507,905.42
00-5: Guard Rail Testing - Modified eccentric Loading Terminal at NCHRP 350 TL2		61,287.00	FINAL/CLOSED	446,618.42
00-6: Implementation of Visualization Technologies to Create Simplified Presentations Within Highway agencies to be Used at Public Hearings		74,914.49	FINAL/CLOSED	371,703.93
00-7: A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn't		45,369.45	FINAL/CLOSED	326,334.48
00-8: Performance and Effectiveness of A Thin Pavement Section Using Geogrids and Drainage geocomposites in A Cold Region		150,000.00	FINAL/CLOSED	176,334.48
Member Obligations 2001 = 6 X \$100,000	600,000.00			776,334.48
Coord./Admin. of NETC: Calendar Year 2001:		104,385.35	FINAL	671,949.13
- Administration = \$89,448				
- Technology Transfer & Technical Committee				
Travel = \$16,800				
- Total = \$106,248				
"01" Project Series:				
01-1: Advanced Composite Materials for New England's Transportation Infrastructure		47,559.27	FINAL/CLOSED	624,389.86
01-1: Advanced Composite Materials for New England's Transportation Infrastructure - Technology Transfer Phase I		25,000.00		599,389.86
01-2: Development of A Testing Protocol for Quality Control/Quality Assurance of Hot Mix Asphalt		80,000.00	FINAL/CLOSED	519,389.86
01-3: Design of Superpave HMA for Low Volume Roads		120,324.15	FINAL/CLOSED	399,065.71
01-6: Field Evaluation of A New Compaction Device		49,944.50	FINAL/CLOSED	349,121.21
Member Obligations 2002 = 6 X \$100,000	600,000.00			949,121.21
NY DOT Obligation = \$52,500	52,500.00			1,001,621.21
Coord./Admin. Of NETC: Calendar Year 2002		109,207.12	FINAL	892,414.09

D.2 FUND BALANCE				
As of December 31, 2008				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
"02" Project Series:				
02-1: Relating Hot Mix Asphalt Pavement Density to Performance		103,524.00		788,890.09
02-2: Formulate Approach for 511 Implementation in New England Phase 1		48,158.19	FINAL/CLOSED	740,731.90
02-2: Formulate Approach for 511 Implementation in New England Phase 2		32,813.16	FINAL/CLOSED	707,918.74
02-3: Establish Subgrade Support Values (M _n) for Typical Soils in New England		79,936.86	FINAL/CLOSED	627,981.88
02-5: Determination of Moisture Content of De-Icing Salt at Point of Delivery		19,679.99	FINAL ² /CLOSED	608,301.89
02-6 : Sealing of Expansion Joints - Phase 1		74,982.81	FINAL/CLOSED	533,319.08
02-7: Calibrating Traffic Simulation Models to Inclement Weather Conditions with Applications to Arterial Coordinated Signal Systems		74,037.57	FINAL/CLOSED	459,281.51
02-8: Intelligent Transportation Systems Applications to Ski Resorts in New England		54,724.71	FINAL/CLOSED	404,556.80
Member Obligations 2003 = 6 X \$100,000	600,000.00			1,004,556.80
NY DOT Obligation = \$40,000	40,000.00			1,044,556.80
Coord./Admin. Of NETC Calendar Year 2003 = \$124,258		118,855.19	FINAL	925,701.61
"03" Project Series:				
03-1: Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff		70,690.16	FINAL/CLOSED	855,011.45
03-2: Field Studies of Concrete Containing Salts of An Alkenyl-Substituted Succinic Acid		140,000.00		715,011.45
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England		20,682.70	FINAL/CLOSED	694,328.75
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England Phase 2		13,135.80	FINAL/CLOSED	681,192.95
03-4: Measuring Pollutant Removal Efficiencies of Storm Water Treatment Units		80,000.00	FINAL/CLOSED	601,192.95
03-5: Evaluation of Field Permeameter As A Longitudinal Joint Quality Control Indicator		77,318.43	FINAL/CLOSED	523,874.52
03-6: Fix It First: Utilizing the Seismic Property Analyzer & MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments		99,927.00		423,947.52
03-7 (Alt.): Basalt Fiber Reinforced Polymer Composites		64,092.29	FINAL/CLOSED	359,855.23
Member Obligations 2004 = 6 X \$100,000	600,000.00			959,855.23
NY DOT Obligation = \$52,000	52,000.00			1,011,855.23
Coord./Admin. Of NETC Calendar Year 2004 = \$126,559		113,012.87	FINAL	898,842.36
"04" Project Series:				
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase I		27,166.58	FINAL	871,675.78
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase II		82,751.00		788,924.78
04-2: Dryver-Eye-Movement-Based Investigation for Improving Work Zone Safety		70,387.66	FINAL	718,537.12
04-3: Estimating the Magnitude of Peak Flows For Steep Gradient Streams in New England		120,000.00		598,537.12
04-4: Determining the Effective PG Grade of Binder in RAP Mixes		130,876.00		467,661.12
04-5: Network-Based Highway Crash Prediction Using Geographic Information Systems		129,020.04	FINAL/CLOSED	338,641.08
Member Obligations 2005 = 6 x \$100,000	600,000.00			938,641.08
NY DOT Obligation = \$50,000	50,000.00			988,641.08
Coord./Admin. Of NETC Calendar Year 2005 = \$130,528		128,934.25	FINAL	859,706.83
"05" Project Series:				
05-1: Develop Base Resistance Load-Displacement Curves for The Design of Drilled Shaft Rock Sockets		100,000.00		759,706.83
05-2 Safety of Reflective Median Barriers Phase 1		48,000.00		711,706.83
05-2: Safety of Reflective Median Barriers Phase 2		72,000.00		639,706.83
05-3: Analysis of Roundabout Operational Characteristics Utilizing Microscopic Simulation Modeling		75,000.00		564,706.83
05-5: Measurement of Work of Adhesion Between Paint and Metalized/Galvanized Steel		125,000.00		439,706.83

D.2 FUND BALANCE				
As of December 31, 2008				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
05-6: Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension		60,000.00		379,706.83
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways Phase I		92,000.36	FINAL	287,706.47
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways Phase II		7,998.00		279,708.47
05-8: Evaluation of Alternative Traffic Simulation Models, Including CA4PRS for Analysis of Traffic Impacts of Highway Construction, Reconstruction and Rehabilitation		100,000.00		179,708.47
Member Obligations 2006 = 5 x \$100,000 (no ME DOT allocation)	500,000.00			679,708.47
Note: Maine 2006 Obligation as of 11/06/06 per Peabody 11/30/06 email	100,000.00			779,708.47
Coord./Admin. Of NETC Calendar Year 2006 = 131,814		100,718.92	FINAL	678,989.55
"06" Project Series:				
06-1: New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide With Level 2 & 3 Input		150,295.00		528,694.55
06-2: Infrastructure Management Systems Enhancement and Integration to Support True Integrated Management Decision-Making		100,000.00		428,694.55
06-3 Establish Default Dynamic Modulus Values for New England		110,000.00		318,694.55
06-4 Preventative Maintenance and Timing of Applications		200,000.00		118,694.55
06-5 Winter Severity Indices for New England		100,000.00		18,694.55
Member Obligations 2007 = 600,000	600,000.00			618,694.55
Coord./Admin. Of NETC Calendar Year 2007		122,644.79	FINAL	496,049.76
"07" Project Series:				
07-1 In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations		150,000.00		346,049.76
07-2 Exploring the Potential of Intelligent Intersections Deployment in New England		100,000.00		246,049.76
07-3 Determining Optimum Distance for a Lane Drop Downstream from a Signalized Intersection		100,000.00		146,049.76
07-4 Reliable Travel Time Estimation to Support Real-Time System Management Information		100,000.00		46,049.76
NETC Research Needs Conference		7,500.00		38,549.76
Member Obligations 2008 = 600,000	600,000.00			638,549.76
NY DOT Obligation (72,000+8,000)	80,000.00			718,549.76
Coord./Admin. Of NETC Calendar Year 2008		131,509.90	FINAL	587,039.86
08-2 Evacuation Modeling to Assist Hazard Management and Response in Urban and Rural Areas of New England		160,000.00		427,039.86
08-3 Best Management Practices for the Invasive Polygonum Cuspidatum (Japanese Knotweed) Along Transportation Corridors		140,000.00		287,039.86
08-4 NETC Research Implementation Survey & Synthesis		35,000.00		252,039.86
08-5 NETC/UVM-UTC Transportation Research Challenge		50,000.00		202,039.86
02-6 Phase II Sealing of Small Mvmt Bldge Expan Joints - Field Inst. & Mntrng		75,000.00		127,039.86
08-6 (Alt.) Interaction Between Salinity, Soil Quality and Amendments in Roadside Plantings		75,000.00		52,039.86
Member Obligations 2009 = 600,000	600,000.00			652,039.86
Coord./Admin. Of NETC Calendar Year 2009 (Approved)		139,309.00		512,730.86
08-1 Applying the Highway Safety Manual in New England		120,000.00		392,730.86
09-1 Active Structural Control of Cantilevered Support Structures:				
Phase 1		150,000.00		242,730.86
Phase 2		100,000.00		142,730.86
09-2 Effective Establishment of Native Grasses on Roadsides		90,000.00		52,730.86
09-3 Advanced Composite Materials: Prototype Development and Demonstration		42,847.00		9,883.86
Notes:				
1 = Member FFY allocations are obligated between October 1 and December 31				
2 = A credit of \$6,599.70 for NETC's overpayment to UConn for CY 2004 NETC Management was applied, by UConn, to the 'Indirect Cost' for project 02-5. Therefore although the total expenditures of the project were \$26,279.69 the amount paid by NETC was \$19,679.99				

E. REPORTS, PAPERS AND PRESENTATIONS

E.1 POLICIES AND PROCEDURES:

- “Policies and Procedures, New England Transportation Consortium,” July 1995.
- “Policies and Procedures, New England Transportation Consortium,” April 2002.

E.2 ANNUAL REPORTS:

- “Annual Report For Calendar Year 1995,” March 1996, NETCR3
- “Annual Report For Calendar Year 1996,” January 1997, NETCR4
- “Annual Report For Calendar Year 1997,” January 1998, NETCR9
- “Annual Report For Calendar Year 1998,” January 1999, NETCR10
- “Annual Report For Calendar Year 1999,” January 2000, NETCR21
- “Annual Report For Calendar Year 2000,” August 2001, NETCR27
- “Annual Report For Calendar Year 2001,” December 2002, NETCR40
- “Annual Report For Calendar Year 2002,” November 2003, NETCR41
- “Annual Report For Calendar Year 2003,” September 2005, NETCR55
- “Annual Report For Calendar Year 2004,” December 2005, NETCR59
- “Annual Report For Calendar Year 2005,” August 2006, NETCR61
- “Annual Report For Calendar Year 2006,” April 2007, NETCR68
- “Annual Report For Calendar Year 2007,” February 2008, NETCR70

E.3 REPORTS, PAPERS, AND PRESENTATIONS 1988-1994:

- “The Development of a Common Regional System for Issuing Permits for Oversize and Overweight Trucks Engaged in Interstate Travel,” Humphrey, T.F., May 1986.
- “Agreement to Implement a Common Set of Procedures for Issuing Permits for Nondivisible Oversize and Overweight Trucks Engaged in Interstate Travel,” The New England Transportation Consortium, October 1988.
- “The New England Transportation Consortium, Round One Activities,” Humphrey, T.F., and Maser, K.R., MIT, December 1988.
- “New Technology for Bridge Deck Assessment - Phase I Final Report,” Vols. I and II, Maser, Kenneth R., MIT Center for Transportation Studies, October 1989.
- “Handbook for Use by the Trucking Industry to Implement The NETC Common Truck Permit Procedures for Certain Nondivisible Oversize/Overweight Vehicles Traveling on State Highways,” MIT Center for Transportation Studies, January 1989.
- “Bridge Rail Design and Crash Worthiness - Final Report,” Elgaaly, M., Dagher, H., and Kulendran, S., University of Maine, May 1989.
- “New England Transportation Consortium, Operational Procedures,” Humphrey, T.F., November 1991.

E.3 NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

“Wetlands: Problem & Issues,” Shuldiner, P.W., University of Massachusetts, August 1990.

“Development of a Uniform Truck Management System,” Vols. I and II, Lee, K.W., and McEwen, E.E., University of Rhode Island. July 1990.

“A Study of STAA Truck Safety In New England - Phases I & II,” MIT, November 1991.

“New Technology for Bridge Deck Assessment - Phase II Final Report,” MIT, May 1990.

“Rail Service In New England,” Martland, C.P. Little, and Alvaro, A.E., MIT Center for Transportation Studies, April 1992.

“CMA Degradation and Trace Metals in Roadside Soil,” Ostendorf, D.W., Palaia, T.A., and Zutell, C.A., University of Massachusetts, March 1993.

“Tire Chips as Lightweight Backfill for Retaining Walls - Phase I,” Humphrey, D., Sandford, T.C., Cribbs, M.M., Gharegrat, H.G., and Manion, W.P., University of Maine, August 1992.

“Cooperative Regional Transportation Research Programs Underway in New England,” Humphrey, T.F., and Sussman, J.M., International Congress on Technology and Technology Exchange, June 1989.

“Uniformity Efforts in Oversize/Overweight Permits,” Humphrey, T.F., NCHRP Synthesis, No. 143, Transportation Research Board, 1988.

“Implementation of a Uniform Truck Permit System by the New England Transportation Consortium,” Humphrey, T.F., AASHTO 1987 Annual Meeting Proceedings, pp. 84-90, 1987.

“Advantages of Oversize/Overweight Truck Permit Uniformity,” AASHTO 1990 Annual Meeting Proceedings, pp. 83-85, 1990.

“Crash Worthiness of Bridge Rails,” Dagher, H., Elgaaly, M., and Kulendran, S., Proceedings, Fourth Rail Bridge Centenary Conference, Heriot-Watt University, Edinburgh, Scotland, August 1990.

“Principles of Radar and Thermography for Bridge Deck Assessment,” Maser, R., and Roddis, W.M.K., ASCE Journal of Transportation Engineering, Vol. 116, No. 5, Sept./Oct. 1990.

E.3 NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

“Regional Rail Planning In New England,” Martland, C.P. Little, and Alvaro, A.E., MIT, August 1993. (Accepted for publication 1994)

“CMA Degradation in Roadside Soil: Acetate Microcosms,” Ostendorf, D.W., Pollock, S.J., De Cheke, M.E., and Palaia, T.A., Transportation Research Record, No. 1366, pp. 41-43, 1992.

“Aerobic Degradation of CMA in Roadside Soils: Field Simulations from Soil Microcosms,” Ostendorf, D.W., Pollock, S.J., De Cheke, M.E., and Palaia, T.A., Journal of Environmental Quality, Vol. 22, pp. 229-304, 1993.

“Shear Strength and Compressibility of Tire Chips for Use as Retaining Wall Backfill,” Humphrey, D.N., Sandford, T.C., Cribbs, M.M., and Manion, W.P., Transportation Research Record No. 1422, pp. 29-35, Transportation Research Board, National Research Council Washington, D.C., 1993.

“Tire Chips as Lightweight Subgrade Fill and Retaining Wall Backfill,” Humphrey, D.N., and Sandford, T.C., Proceedings of the Symposium on Recovery and Effective Reuse of Discarded Materials and By-Products for Construction of Highway Facilities, pp. 5-87 to 5-99, Federal Highway Administration, Washington, D.C., 1993.

E.4 REPORTS, PAPERS AND PRESENTATIONS 1995-2008:

Project No. Title

N/A Construction Costs Of New England Bridges

Reports:

“Construction Costs of New England Bridges,” Alexander, J.A., Dagher, H. and James, S., November 1996, NETCR1.

Papers and Presentations:

“Construction Costs of New England Bridges,” Alexander, J., Dagher, H. and James, S. Presented at the Annual Maine Transportation Conference, December 7, 1995.

N/A Tire Chips As Lightweight Backfill For Retaining Walls, Phase II: Full-Scale Testing

Reports:

“Tire Chips As Lightweight Backfill For Retaining Walls - Phase II,” Tweedie, Jeffrey J., Humphrey, Dana N., and Sandford, T.C., March 11, 1998, NETCR8.

Papers and Presentations:

“Tire Shreds as Lightweight Retaining Wall Backfill-Active Conditions,” Humphrey, D. Submitted for publication in the ASCE Journal of Geotechnical and Geoenvironmental Engineering.

“Civil Engineering Uses for Tire Chips,” Humphrey D.N. A six-hour short course presented to the Nebraska Department of Environmental Quality, the Maine Dept. of Transportation, the Texas Engineering Extension Service, the Manitoba Tire Stewardship Board, the Alberta Tire Recycling Management Board, and the Arkansas Department of Pollution Control and Ecology.

“Tire Chips as Lightweight Subgrade and Retaining Wall Backfill,” by Humphrey, D.N. and Sandford, T.C. Symposium on Recovery and Effective Reuse of Discarded Materials and By-Products for Construction of Highway Facilities, FHWA, Denver, Colorado, October 19-22, 1993.

“Use of Tire Chips as Subgrade Insulation and as Lightweight Fill for Highway Construction,” Humphrey, D.N. Presented at the 18th Annual Meeting of the Asphalt Recycling and Reclaiming Association, Pompano Beach, Florida, February 23-26, 1994.

“Use of Tire Chips in Highway Construction,” Humphrey, D.N. Presented to the New England Environmental Expo, Boston, Massachusetts, May 9, 1995.

N/A

**Tire Chips As Lightweight Backfill For Retaining Walls, Phase II:
Full-Scale Testing (cont'd):**

Papers and Presentations (cont'd):

“Use of Tire Chips in Highway Construction,” Humphrey, D.N. Presented to the AASHTO Region 1 RAC Meeting, Portland, Maine, May 23, 1995.

“Tire Chips for Highway Construction,” Humphrey, D.N. Presented to the Northeast Recycling Council in Sturbridge, Massachusetts on December 8, 1995.

“Tire Chips: A New Road Building Geomaterial,” Humphrey, D. Presented at the Conference on Waste and Recycled Materials in the Transportation Infrastructure, held in conjunction with the 75th Annual Meeting of the Transportation Research Board, January 7, 1996.

“Use of Tire Chips in Civil Engineering.” Presented at the 76th Annual Meeting of the Rubber Association of Canada, March 7, 1996.

“Civil Engineering Uses for Scrap Tires,” Humphrey, D. Presented at Scrap Tire '96 held in Chicago, Illinois on August 16, 1996.

“Full Scale Field Trials of Tire Chips as Lightweight Retaining Wall Backfill-At Rest Conditions,” Tweedie, J.J., Humphrey, D.N., and Sandford, T.C., Transportation Research Board No. 1619, Transportation Research Board, Washington, D.C., p. 64-71, 1998.

“Tire Shreds as Retaining Wall Backfill, Active Conditions,” Tweedie, J.J., Humphrey, D.N., and Sandford, T.C, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 11, Nov., pp.1061-1070, 1998.

“Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short course presented in each of the six New England States, 1998.

“Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short course presented to the RI DOT, April 1999.

N/A

**New England Vehicle Classification And Truck Weight Program,
Phase I**

Reports:

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 1: Toward the Development of a Vehicle Classification Program for New England,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

N/A

**New England Vehicle Classification And Truck Weight Program,
Phase I (cont'd):**

Reports (cont'd):

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 2: Toward the Development of a Truck Weight Program for New England,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 3: Supplemental Analysis of Truck Weight Data Collection at SHRP Continuous Count Stations,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

“New England Vehicle Classification and Truck Weight Program, Phase I,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T. and Shuldiner, P., April 1996, NETCR2.

“An Analysis of Vehicle Class and Truck Weight Patterns in New England,” Collura, J. and Orloski, F. Presented at the 1994 National Traffic Data Acquisition Conference, Rocky Hill, Connecticut, September 18-22, 1994.

“New England Vehicle Classification and Truck Weight Program,” Collura, J. and Orloski, F. Presented to the Transportation Research Board's Highway Traffic Monitoring Committee, Annual Meeting of the Transportation Research Board, Washington, D.C., January 1995.

Papers and Presentations: None

N/A

Bridge Rail Crash Test, Phase II: Sidewalk-Mounted Rail

Reports:

“NETC 2-Bar Curb-Mounted Bridge Rail Design - Plans and Specifications.” Revised January 1997.

“NETC 4-Bar Sidewalk-Mounted Bridge Rail Design - Plans and Specifications.” January 1997.

“Crash Testing and Evaluation of the NETC 2-Bar Curb-Mounted Bridge Rail,” Mak, K.K., and Menges, W.L., February 1998, NETCR10.

“Full-Scale Crash Evaluation of the NETC 4-Bar Sidewalk Steel Bridge Railing,” Kimball, C.E., and Mayer, J.B., March 1999, NETCR14.

Papers and Presentations: None

94-1 Structural Analysis Of New England Subbase Materials And Structures

Reports:

“Structural Analysis of New England Subbase Materials and Structures,”
Lee, K.W., Huston, M.T., Davis, J., Vajjhalla, S., June 30, 2001,
NETCR26.

Papers and Presentations:

“Structural Analysis of New England Subbase Materials and Structures,”
Davis, J. Presented at the Rhode Island Transportation and Civil
Engineering Forum, Kingston, Rhode Island, October 23, 1996.

“Structural Analysis of New England Subbase Materials and Structures.”
Presented at the Northeast Graduate Student Symposium on Applied
Mechanics, University of Rhode Island, April 26, 1997.

“Structural Analysis of New England Subbase Materials and Structures.”
Presented at the Rhode Island Transportation and Civil Engineering
Forum, University of Rhode Island, October 15, 1997.

“Structural Analysis of New England Subbase Materials and Structures,”
Davis, J., Huston, M., and Lee, K.W. Presented at the 1998 Annual
Transportation Research Board Meeting.

“Structural Properties of New England Subbase Materials of Flexible
Pavements.” Presented at the 5th International Conference on the Bearing
Capacity of Roads and Airfields, July 8, 1998.

“Structural Properties of New England Subbase Materials of Flexible
Pavements.” Presented at the 5th International Conference on the Bearing
Capacity of Roads and Airfields on July 8, 1998.

“Characterization of Subbase Materials of Flexible Pavements With and
Without Reclaimed Asphalt Pavement,” Lee, K.W., Davis, J., and
Vajjhalla, S. Presented at the 1999 World Congress for Korean Scientists
and Engineers, July 7, 1999.

“Characterization of Subbase Materials of Flexible Pavements With and
Without Reclaimed Asphalt Pavement,” Lee, K.W., Davis, J. and
Vajjhalla, S. Presented at the 12th Rhode Island Transportation Forum,
University of Rhode Island, October 15, 1999.

94-2 **Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques**

Reports:

“Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques,” Huston, D., Fuhr, P., Maser, K. and Weedon, W., July 1, 2002, NETCR 19.

Papers and Presentations:

“Bridge Deck Structural Monitoring Techniques,” Huston, D. Presented at the New England State Materials Engineer Association Conference, Burlington, Vermont, October 9, 1996.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Maser, K., Weedon, W., Fuhr, P.L., and Adam, C., Structural Health Monitoring, Chang F., Editor, Technomic Publishing, pp. 91-109, Proceedings of the International Workshop on Structural Health Monitoring, Stanford, California, September 1997.

“Ground Penetrating Radar for Nondestructive Evaluation of Concrete Bridge Decks,” Adam, C., M.S. Thesis, Department of Mechanical Engineering University of Vermont, September 1997.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Master, K., Hu, J.Q., Weedon, W., and Adam, C., Proceedings of the GPR '98 7th International Conference on Ground-Penetrating Radar, The University of Kansas, Lawrence, KS, May 27-30, 1998.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Hu, J.Q, Pelczarski, N, and Esser, B., Proceedings Second International Conference on Structural Health Monitoring, Stanford University, September 1999.

“GIMA Antenna Design for Ground Penetrating Radar in Concrete NDE Application,” Hu J.Q., Huston, D. and Fuhr, P. SPIE paper 3670-63, SPIE Conference On Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials, Newport Beach, CA, March 1999.

“Ground Penetrating Radar for Concrete Bridge Health Monitoring Applications,” Huston, D, Hu, J.Q., Maser, K., Weedon, W., and Adam, C. SPIE 3587-23, Proceedings SPIE NDE Techniques for Aging Infrastructure and Manufacturing, Newport Beach, CA, March 1999.

“Electromagnetic Interrogation of Structures,” Huston, D. Fourth Army Research Office on Smart Structures, State College, PA, August 1999.

Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques (cont'd):Papers and Presentations (cont'd):

“GIMA Ground Penetrating Radar System For Infrastructure Health Monitoring,” Huston, D.R., Hu, J.Q, Maser, K., Weedon, W., and Adam, C. Journal of Applied Geophysics 43, 2000, pp. 39-146.

“Good Impedance Match Antenna (GIMA) Design and Its Applications for Ground Penetrating Radar In Concrete Structures NDE Applications,” Hu, J. M.S. Thesis, Department of Mechanical Engineering, University of Vermont, March, 2000.

“Damage Assessment in Roadways with Ground Penetrating Radar,” Huston, D., Pelczarski, N., Esser, B., Maser, K., and Weedon, W. SPIE Conference on Nondestructive Evaluation and Health Monitoring of Aging Infrastructure, 3995A-55, Newport Beach CA, March 2000.

“Damage Detection in Roadways with Ground Penetrating Radar,” Huston, D.R., Pelczarski, N., Esser, B., and Master, K. GPR 2000, 8th International Conference on Ground Penetrating Radar," Gold Coast, Australia, May 2000.

“Wireless Inspection of Structures Aided by Robots,” Huston D.R., Pelczarski N., Esser B., Gaida G., Arms S. and Townsend C. SPIE Symposium on NDE for Health Monitoring and Diagnostics, 4337-24, Newport Beach CA, March 2001.

“Inspection of Bridge Columns and Retaining Walls with Electromagnetic Waves,” Huston D.R., Pelczarski N., and Key C. SPIE Symposium on Smart Systems for Bridges, Structures, and Highways, 4330-09, Newport Beach, CA, March 2001.

“Wireless Electromagnetic Interrogation of Structures,” Huston D., Pelczarski N., Fuhr P., Arms S., and Esser B. (Tentatively accepted) Smart Materials and Structures, April 2001.

“Adaptive Sensors and Sensor Networks for Structural Health Monitoring,” Huston D. SPIE 4512-24, Symposium on Complex Adaptive Structures, Hutchinson Island, FL, June 2001.

- 94-3** **Procedures For The Evaluation Of Sheet Membrane Waterproofing:**
Reports:
“Procedures for the Evaluation Sheet Membrane Waterproofing,”
Korhonen, C.J., Buska, J.S., Cortez, Edel R., and Greatorex, Alan R.,
August 1999, NETCR13.
- Papers and Presentations: None
- 94-4** **Durability Of Concrete Crack Repair Systems:**
Reports: None
- Papers and Presentations:
“Durability of Concrete Crack Repair, Projects,” Robinson, J. Presented at
the University of Rhode Island Graduate Seminar Series, Kingston, RI,
November 19, 1997.
- “Durability of Concrete Crack Repair System,” Tsiatas, G. and Robinson,
J. Presentation to representatives of the Chemical Grouting Division of
Kajima Corporation (Japan), University of Rhode Island, College of
Engineering, October 26, 1999.
- 95-1** **Use Of Tire Chip/Soil Mixtures To Limit Frost Heave And Pavement
Damage Of Paved Road**
Reports:
“Use of Tire Chip/Soil Mixtures to Limit Frost Heave and Pavement
Damage of Paved Roads,” Brian, K.L., and Humphrey, D. N., June 2000,
NETCR12.
- Papers and Presentations:
“Laboratory and Field Measurement of the Thermal Conductivity of Tire
Chips for Use as Subgrade Insulation,” Humphrey, D., Chen, L.H. and
Eaton, R. A paper submitted to the Transportation Research Board for
presentation at the session on “Properties of Unconventional Aggregates”
at the Annual Meeting of the Transportation Research Board, Washington,
D.C., January 1997.
- “Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short
course presented in each of the six New England States, 1998.
- “Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short
course presented to the RI DOT, April 1999.
- “Field Trial of Tire Shreds as Insulation for Paved Roads,” Humphrey, D.,
Chen, L.H., Lawrence, B. A paper presented at the 10th International
Conference on Cold Regions Engineering: Putting Research into Practice,
held in Hanover, NH, August 16-19, 1999.

- 95-2 Suitability Of Non-Hydric Soils For Wetland Mitigation**
Reports:
“Suitability of Non-Hydric Soils for Wetland Mitigation,” Brannaka, L.K. and Evans, C.V., February 28, 1997, NETCR5.
- Papers and Presentations: None
- 95-3 Implementation And Evaluation Of Traffic Marking Recesses For Application of Thermo-Plastic Markings On Modified Open Graded Mixes**
Reports:
“Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Friction Course,” Lee, K.W., Cardi, S.A., and Corrigan, S., July 2000, NETCR23.
- Papers and Presentations:
“Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Mixes,” Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, Kingston, Rhode Island, October 23, 1996.
- “Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open-Graded Mixes,” Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, University of Rhode Island, October 15, 1997.
- 95-5 Buried Joints In Short Span Bridges**
Reports: None
- Papers and Presentations:
“State of the Art Study of Bridge Joint Systems in New England,” Tsiatas, and Chandrasekaran, S. Submitted for presentation at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1997.
- 95-6 Guidelines For Ride Quality Acceptance Of Pavements**
Reports:
“Guidelines for Ride Quality Acceptance of Pavements,” Collura, J., El-Korchi, T., Black K., Chase, M. and Li, J., April 1997, NETCR 6.
- Papers and Presentations: None

96-1

Implementation of Superpave

Reports:

“Superpave Implementation,” Mahoney, James, Stephens, Jack E., September 1999, NETCR18.

96-3

Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides

Reports:

“Effectiveness of High Strength Composites as Structural and Protective Coatings for Structural Elements,” Balaguru, P., and Lee, K.W., May 2001, NETCR28.

Papers and Presentations:

“Inorganic Matrices for Composites,” NSF Workshop on Composites, Hanover, NH, March 15, 1998.

“Behavior of Geopolymer Reinforced with Various Types of Fabrics,” SAMPE 1998, Anaheim, CA, May 1998.

“Use of Ferrocement Theory for Analysis of High Strength Composites,” Ferrocement VI, Ann Arbor, MI, June 1998.

“Advances in Composites,” National University of Singapore, July 19, 1998.

“Effectiveness of Fiber Reinforced Composites as Structural and Protective Covering Bridge Elements Exposed to Deicing-Salt Chlorides,” Visiting Scholar Lecture, Transportation Forum, University of Rhode Island, October 15, 1999.

“Advanced High Strength Fiber Composites,” U.S.-Germany Workshop, Maiz, Germany, May 16-19, 1999.

“Recent Advances in Fiber Composites,” Seminar Series, University Cataleuna, Spain, June 28, 1999.

“Inorganic Coatings for Transportation Infrastructures,” Geopolymer Conference, St. Quentin, France, July 2, 1999.

“State-of-the-Art: Fiber Reinforced Concrete,” NSF Faculty Workshop, Northwestern University, Evanston, IL, July 21, 1999.

“Recent Advances in High Strength Composites and Applications for Repair and Rehabilitation,” 6th International Conference on Structural Failure, Durability, and Retrofitting, Singapore, September 15, 2000.

- 96-3 Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides (cont'd):**
Papers and Presentations (cont'd):
“Durability of Carbon Composites Made With Inorganic Matrix,” Garon, R., and Balaguru, P., "SAMPE", November 2000, pp. 34-43.

“Inorganic Matrix - High Strength Fiber Composites,” University of Missouri, Rolla, July 27, 2000.

“Comparison of Inorganic and Organic Matrices for Strengthening of Reinforced Concrete Beams,” Kurtz, S., and Balaguru, P., Journal of Structural Engineering ASCE, V 127, January 2001, pp. 35-42.

“Durability of High Strength Composite Repairs under Scaling Conditions,” Garon, R., and Balaguru, P., Proceedings of Third International Conference on Concrete Under Severe Conditions, Vancouver, Canada, June 2001 (in print).
- 97-1 A Portable Method To Determine Chloride Concentration On Roadway Pavements**
Reports:
“A Portable Method to Determine Chloride Concentration on Roadway Pavements,” Garrick, N., Nikolaidis, N., P. and Luo, J, September 2002, NETCR17.

Papers and Presentations: None
- 97-2 Performance Evaluation And Economic Analysis Of Combinations Of Durability Enhancing Admixtures (Mineral And Chemical) In Structural Concrete For The Northeast U.S.A**
Reports:
“Performance Evaluation and Economic Analysis of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete for the Northeast U.S.A.,” Civjan, S.A., LaFave, J.M., Lovett, D., Sund, D.J., Trybulski, J., February 2003, NETCR 36.

Papers and Presentations:
“Performance Evaluation of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete,” Sund, D., Report in Partial Fulfillment of Master of Science in Civil Engineering Degree, Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, September, 1999.

97-2 Performance Evaluation And Economic Analysis Of Combinations Of Durability Enhancing Admixtures (Mineral And Chemical) In Structural Concrete For The Northeast U.S.A (cont'd):

Papers and Presentations:

“On the Use of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete,” Lafave, J.M., Lovett, D., and Civjan, S.A., ACI Fall Convention, Toronto, Ontario, Canada, October 15-21, 2000.

“Performance Evaluation of Combinations of Durability Enhancing Admixtures in Concrete - Review and Experimental Program,” Report in Partial Fulfillment of Master of Science in Civil Engineering Degree, Lovette, D., Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, February, 2001.

97-3 Determining Properties, Standards And Performance Of Wood Material As An Erosion Control Mulch And As A Filter Berm

Reports:

“Performance Specifications for Wood Waste Materials as an Erosion Control Mulch and as a Filter Berm,” Demars, K.R., Long, R.P., Ives, J.R. April 2000, NETCR20.

Papers and Presentations:

“Compost Applications for Erosion Control: New and Improved Methods,” K. Demars. Presented at the Conference on ‘Putting Compost in the Specs: Practical Applications for Erosion Control’, Wrentham Development Center, Wrentham, MA, October 8, 2002.

97-4 Early Distress Of Open-Graded Friction Course (OGFC)

Reports:

“Early Distress in Open-Graded Friction Course,” Stephens, J.E., Mahoney, J., Dougan, C.E., July 1999, NETCR16.

Papers and Presentations: None

99-1 Bridge Rail Transitions – Development and Crash Testing

Reports:

Design documents for the NETC 2-Bar Curb-Mounted and 4-Bar Sidewalk-Mounted Bridge Rail Transitions are available from the NETC Coordinator.

“NCHRP Report 350 Testing and Evaluation of NETC Bridge Rail Transitions,” Dean C. Alberson, C. Eugene Buth, Wanda L. Menges, and Rebecca R. Haug, Texas Transportation Institute, Texas A&M University, January 2006, NETCR 53.

- 99-1 Bridge Rail Transitions – Development and Crash Testing (cont’d):**
Papers and Presentations:
“NETC Bridge Rail Transitions,” by Dean C. Alberson and Wanda L. Menges, Concord, New Hampshire, December 13, 2005.

“Summary of NCHRP Report 350,” by Dean C. Alberson, Concord, New Hampshire, December 13, 2005.
- 99-2 Evaluation of Asphaltic Expansion Joints**
Reports:
“Evaluation of Asphaltic Expansion Joints,” Mogawer, W.S., November 2004, NETCR 50.

Papers and Presentations: None
- 99-3 Development Of Priority Based Statewide Scour Monitoring Systems In New England**
Reports:
“Development of Priority Based Statewide Scour Monitoring Systems in New England,” Ho, C.T., Di Stasi, J.M., August 2, 2001, NETCR24.

“Real-Time Bridge Scour Assessment and Warning,” Di Stasi, J.M. and Ho, C.L., Proceedings of International Symposium: Technical Committee No. 33 on Scour of Foundations. Melbourne, Australia, pp. 337-352.

Papers and Presentations: None
- 99-4 Quantifying Roadside Rest Area Usage**
Reports:
“Quantifying Roadside Rest Area Usage,” Garder, P. and Bosonetto, N., November 27, 2002, NETCR 38.

Papers and Presentations:
Results from the rest-area research were included in a presentation by the PI: “The Efficacy and Use of Continuous Shoulder Rumble Strips: Engineering a Solution,” presented at the November 20-21, 2002 National Summit to Prevent Drowsy Driving, National Academy of Sciences, Washington, DC, November 21, 2002 (taped by C-SPAN. Summit also covered by CNN Live Today, CNN Live on Location, CBS Early Show, National Public Radio’s Market Place, and national radio network coverage by ABC, CBS, and AP as well as two stories by nationally syndicated health columnist Jane Brody of The New York Times).

99-6 Analytical and Experimental Investigation Of The Effects Of Concrete Removal Operations On Adjacent Concrete That Is To Remain

Reports:

“Analytical and Experimental Investigation of the Effects of Concrete Removal Operations on Adjacent Concrete That is to Remain,” Masih, R., Wang, T. and Forbes, A., January 15, 2002, NETCR 29.

Papers and Presentations:

“Enhancing the Students' Learning Process Through Interaction Project Between Academia and Industry.” Presented and published in the Abstract of ASEE 2000 at the University of Massachusetts, Lowell, April 2000.

“The Effect of Powerful Demolition Equipment on the Remaining Part of the Concrete Bridge,” Masih, R. Presented and published in the proceedings of the Second International Conference on Computational Methods for Smart Structures and Material. Madrid, June 2000.

“Effect of Demolition on Remaining Part of Concrete Bridge, Numerical Analysis Vs. Experimental Results.” Presented and published in the proceedings of Internationales Kolloquium uber die Anwendungen der Informatik in Architectur und Bauwesen, Germany, June 2000

“The Effect of Bridge Rehabilitation on the Remaining Structural Parts.” Presented and published in the proceedings of the ASCE conference at Stanford University, August 2000.

00-1 Ground-Based Imaging And Data Acquisition Systems For Roadway Inventories In New England - A Synthesis Of Practice

Reports:

“Ground-Based Image and Data Acquisition Systems for Roadway Inventories in New England – A Synthesis of Highway Practice,” Hancock, K. and Degray, J., August 2002, NETCR 30.

Papers and Presentations: None

- 00-2 Evaluation Of Permeability Of Superpave Mixes**
Reports:
“Evaluation of Permeability of Superpave Mixes,” Mogawer, W., Mallick, R., Teto, M. and Crockford, C., July 3, 2002, NETCR34.
- Papers and Presentations:
“An Alternative Approach to Determination of Bulk Specific Gravity and Permeability of Hot Mix Asphalt (HMA),” Bhattacharjee, S., Mallick, R. and Mogawer, W. Submitted to International Journal of Pavement Engineering.
- A Presentation, by W. Mogawer, to the Northeast Asphalt User Producer Group Meeting, October 18, 2001, Albany, New York.
- 00-3 Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail**
Reports:
“Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail,” Davids, W., Botting, J., March 31, 2004, NETCR 39.
- Papers and Presentations: None
- 00-4 Portable Falling Weight Deflectometer Study**
Reports:
“Portable Falling Weight Deflectometer Study,” Steinert, B., Humphrey, D., Kestler, M., March 11, 2005, NETCR52.
- Papers and Presentations: None
- 00-5 Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2**
Reports:
“Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2,” Alberson, D., Menges, W. and Haug, R., July 2002, NETCR35.
- Papers and Presentations:
Dean Alberson, Texas Transportation Institute, Principal Investigator presented the results of the crash tests conducted on the MELT guardrail terminal to the Association of General Contractors/American Road Transportation Builders Association/American Association of State Highway Transportation Officials Task Force 13 meeting in Seattle, Washington, April 2002.

- 00-6 Effective Visualization Techniques for the Public Presentation of Transportation**
Reports:
“Effective Visualization Techniques for the Public Presentation of Transportation Projects,” Luo, J., MS Thesis, University of Connecticut, August 2002.

“Effective Visualization Techniques for the Public Presentation of Transportation Projects,” Garrick, N.W., Minutti, P., Westa, M., Luo, J., Bishop, M., July 2005, NETCR 48.

Papers and Presentations: None
- 00-7 A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn’t**
Reports:
“A Complete Review of Incident Detection Algorithms & Their Deployment: What Works and What Doesn’t,” Parkany, E., Xie C., February 7, 2005, NETCR 37.

Papers and Presentations:
“Use of Driver-Based Data for Incident Detection,” Parkany, Emily, Submitted to the 7th International Conference on Applications of Advanced Technologies in Transportation Engineering (AATT), Boston, August 2002.
- 00-8 Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region**
Reports:
“Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region,” Helstrom, C.L., Humphrey, D.N., and Labbe, J.M., August 2007, NETCR60.

Papers and Presentations:
“Geogrid Reinforced Pavement Structure in a Cold Region,” Helstrom, C.L., Humphrey, D.N., and Hayden, S.A., Proceedings of the 13th International Conference on Cold Regions Engineering, ASCE, Orono, Maine, 12 pp., 2006

- 01-1 Advanced Composite Materials for New England’s Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice**
Reports:
“Advanced Composite Materials for New England’s Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice,” Breña, S.F., Civjan, S.A., and Goodchild, M., May 2006, NETCR62.
- Papers and Presentations: None
- 01-2 Development of a Testing Protocol for QC/QA of Hot Mix Asphalt**
Reports:
“Development of a Testing Protocol for QC/QA of Hot Mix Asphalt (HMA),” Mogawer, W.S., Mallick, R., February 5, 2004, NETCR 43.
- Papers and Presentations:
“An Evaluation of Use of Rapid Triaxial Test In Quality Control of Hot Mix Asphalt (HMA),” Mogawer, W. S., Presented at the 82nd Annual Meeting of the Transportation Research Board, January 12-16, 2003, Washington DC.
- 01-3 Design of Superpave HMA for Low Volume Roads**
Reports:
“Design of Superpave HMA for Low Volume Roads,” Mogawer, W.S., Mallick, R., December 31, 2004, NETCR 51.
- Papers and Presentations:
“Development of Mix Design Criteria for Low Traffic Volume Hot Mix Asphalt Roads,” Nanagiri, Y.V., Mallick, R., Mogawer, W.S. Proceedings of the Annual Meeting of the Canadian Technical Asphalt Association, November 2003.
- 01-6 Field Evaluation of a New Compaction Monitoring Device**
Reports:
“Field Evaluations of A New Compaction Monitoring Device,” Miller, H.J., June 26, 2003, NETCR 42.
- Papers and Presentations: None

- 02-2 Formulate Approach for 511 Implementation in New England**
Reports:
“Formulate Approach for 511 Implementation in New England,”
Shuldiner, P., Loane, G., and Knapick, R., October 2005, NETCR44.
- Papers and Presentations: None
- 02-3 Establish Subgrade Support Values for Typical Soils in New England**
Reports:
“Establish Subgrade Support Values for Typical Subs in New England,”
Malla, R. B., and Joshi, S., April 2006, NETCR57.
- Papers and Presentations:
“Resilient Modulus Prediction Models for Some New England Subgrade
Soils,” Malla, R. and Joshi, S., *Electronic Proceedings* of the 2005 Joint
ASCE/ASME/SES Conference on Mechanics and Materials (McMat
2005), Baton Rouge, LA, June 1-3, 2005.
- “Resilient Modulus of Subgrade Soils A-1-b, A-3, an A-7-6 using LTPP
Data: Prediction Models with Experimental Verification,” Joshi,
Shraddha, and Malla, R., *Proceedings, ASCE GeoCongress 2006*,
(Atlanta, GA, Feb. 26-March 01, 2006), ASCE, Reston, VA; Feb. 2006,
6p (CD ROM).
- 02-5 Determination of Moisture Content of Deicing Salt at Point of
Delivery**
Reports:
“Determination of Moisture Content of Deicing Salt at Point of Delivery,”
Long, R., Demars, K., March 2004, NETCR 45.
- Papers and Presentations: None

02-6

Sealing of Small Movement Bridge Expansion Joints

Reports:

“Sealing of Small Movement Bridge Expansion Joints,” Malla, R.B., Shaw, M.T., Shrestha, M.R. and Boob, S., June 2006, NETCR58.

Papers and Presentations:

“Silicone Foam Sealant for Bridge Expansion Joints,” Malla R. B., Shaw M. T., Shrestha M. R., Boob S., McMat 2005 Mechanics and Materials Conference Baton Rouge, Louisiana, June 1-3, 2005.

“Experimental Evaluation of Mechanical characteristics of Silicone Foam Sealant for Bridge Expansion Joints,” Malla R. B., Shaw M. T., Shrestha M. R., Boob S., 2005 Society for Experimental Mechanics Annual Conference Portland, Oregon, June 7-9, 2005.

“Development and Experimental Evaluation of Silicone Foam Sealant For Small Bridge Expansion Joints,” Matu Shrestha, M.S. Thesis, Dept. of Civil & Environmental Engineering, University of Connecticut, Storrs, CT, September 2005.

“Laboratory Evaluation of Weathering and Freeze-Thaw Effects on Silicone Foam Bridge Joint Sealant,” Shrestha, M.R., Malla, R.B., Boob, S. and Shaw, M.T., Paper #369, *Proceedings, SEM 2006 Annual Conference and Exposition* (St. Louis, MO, June 04-07, 2006), SEM, Bethel, CT, June 2006, 8p (CD ROM).

“Development and Laboratory Analysis of Silicone Foam Sealant for Bridge Expansion Joints,” Malla, R., Shaw, M., Shrestha, M., and Brijmohan, S., *Journal of Bridge Engineering*, ASCE, Reston, VA, July 2006.

02-7

Validating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems
Reports:

“Validating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems,” Sadek, A., El-Dessouki, W., November 2004, NETCR 47.

Papers and Presentations:

“Inclement Weather and Traffic Flow at Signalized Intersections: A Case Study from Northern New England,” Agbolosu-Amison, S.J., Sadek, A.W., and El-Dessouki, W., (2003). Tentatively accepted for publication in the *Journal of the Transportation Research Board*.

“Impact of Inclement Weather on Traffic Signal Operations in New England,” Agbolosu-Amison, S.J., Sadek, A.W., (2003). Presented to the Vermont Chapter of the Institute of Transportation Engineers, Montpelier, Vermont.

“Inclement Weather and Traffic Flow at Signalized Intersections: A Case Study from Northern New England,” Agbolosu-Amison, S.J., Sadek, A.W., and El-Dessouki, W., (2003). Presented at the *83rd Annual Transportation Research Board Meeting*, Washington, D.C.

02-8

Intelligent Transportation Systems Applications to Ski Resorts in New England

Reports:

“Intelligent Transportation Systems Applications to Ski Resorts in New England,” Sadek, A., March 2004, NETCR 46.

Papers and Presentations:

“Addressing Ski Resort Transportation Problems with Intelligent Transportation Systems Applications,” Knapick, R.J., and Sadek, A.W., (2003). Abstract submitted to the Institute of Transportation Engineers District One Meeting, Burlington, VT.

03-1 Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff

Reports:

“Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff”, MacKay, A.A., July 16, 2008, NETCR65.

03-2 Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid

Reports:

“Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid,” Civjan, Scott A., and Crellin, Benjamin, June 30, 2008, NETCR73.

Papers and Presentations:

“Hycrete – DSS An Innovative Admixture for Concrete: An Update on NETC 03-2,” Civjan, Scott A., and Crellin, Benjamin, 16th Annual NE Materials and Research Meeting Concord, NH. June 7, 2005.

“Hycrete Concretes: An Update on NETC 03-2,” Civjan, Scott A., and Crellin, Benjamin, Connecticut DOT, November 2, 2005.

“A New Admixture to Mitigate Corrosion Problems,” Civjan, S.A., and Crellin, B.J., *Concrete International*, Volume 28, No. 8, Pp. 78-82.

03-3 Phase 1 Feasibility Study of an Erosion Control Laboratory in New England

Reports:

“Feasibility Study of an Erosion Control Laboratory in New England,” Long, R.P., and Demars, K.R., December 2004, NETCR 49.

Papers and Presentations: None

03-3 Phase 2 Design Considerations for a Prototype Erosion Control Laboratory in New England

Reports:

“Design Considerations for a Prototype Erosion Control Testing Plot,” Long, R.P., and Demars, K.R., December 2005, NETCR 56.

Papers and Presentations: None

03-4 Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units

Reports:

“Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units,” Zhang, X., September 27, 2005, NETCR54.

Papers and Presentations:

“Evaluation of Pathogenic Indicator Bacteria in Structural BMPs,” Zhang, X. and Lulla, M., to be published in the *Journal of Environmental Science and Health, Volume A41* (November 2006).

“Distribution of Pathogenic Indicator Bacteria in Structural BMPs,” Zhang, X. and Lulla, M. to be published in the *Journal of Environmental Science and Health, Volume A41* (August 2006).

03-5 Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator

Reports:

“Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator”, Daniel, J.S., Mallick, R.B., and Mogawer, W.S., April 20, 2007, NETCR64.

Papers and Presentations:

“Development of a Longitudinal Joint Permeameter as a QC/QA Tool for HMA Pavements,” Daniel, J.S., a Presentation to the Petersen Asphalt Research Conference, Cheyenne, WY, June 2005.

“Longitudinal Joint Permeameter: New Non-Destructive Pavement Joint Test,” Daniel, J.S., a Presentation to the North East Asphalt User/Producer Group Meeting, Burlington, VT, October 2005.

“Longitudinal Joint Permeameter: Non-Destructive Test for QC,” Daniel, J.S., a presentation to PennDOT Bituminous Technician Certification Program, March 14, 2006.

“Development and Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator,” Mallick, R.B., and Daniel, J.S., *International Journal of Pavement Engineering*, Vol. 7, No. 1, March 2006. pp. 11-21.

03-7

Basalt Fiber Reinforced Polymer Composites

Reports:

“Basalt Fiber Reinforced Polymer Composites,” Parnas, R., Shaw, M., and Liu, Q., August 2007, NETCR63.

Papers and Presentations:

“Preliminary Investigation of Basalt Fiber Composite Properties for Applications in Transportation,” Liu, Q., Shaw, M.T., Parnas, R.S., McDonnell, A., Transportation Research Board Annual Meeting, January 2005, Washington, D.C., Paper 05-1117, Session 487.

“Investigation of Basalt Fiber Composite Mechanical Properties for Applications in Transportation,” Q. Liu, M.T. Shaw, R.S. Parnas and A.M. McDonnell, *Polymer Composites*, 27(1), 41-48, 2006.

“Investigation of Basalt Fiber Composite Aging Behavior for Applications in Transportation,” Q. Liu, M. T. Shaw, R. S. Parnas, A.M. McDonnell, *Polymer Composites* (*in press*).

“Basalt Fiber Reinforced Polymer Composites,” Q. Liu, R.S. Parnas, M.T. Shaw, A.M. McDonnell, SAMPE, Seattle, WA, November 2005.

“New Set-up for Permeability Measurement,” Q. Liu, R.S. Parnas, SAMPE, Seattle, WA, November 2005.

04-2

Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety

Reports: None

Papers and Presentations:

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Anne Arundel County Police Special Operations Building, Sponsored by the Maryland Association of Traffic Accident Investigators, Hanover, MD. March 20 - 23, 2006.

“Understanding and Quantifying Driver Response,” Muttart, J.W., Texas Association of Accident Reconstructionist Specials, Houston, TX, February 17 & 18, 2006.

“Using Event Data Recorder Information for Driver Response Research and Intelligent Transportation Systems in Rear End Collision,” Muttart, J.W., CDR Users Conference, Dallas, TX. February 13, 2006.

04-2 Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety (cont'd):

Papers and Presentations (cont'd):

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Canadian Association of Traffic Accident Investigators & Reconstructionists, Fredericton, NB, Canada. July 10 - 13, 2006.

“Driving Simulator Evaluation of Situational Awareness during Hands-Free Communication,” Muttart, J.W., New England Institute of Transportation Engineers Technology Day, Amherst, MA. July 20, 2006.

“Accounting for Moderate Driver Distractions in Work Zones,” Muttart, J.W., Factors, Formulae, Forensic, Technology, & Training Conference, Houston, TX. September 17, 2006.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue,” Muttart, J., Fisher, D. L., and Pollatsek, A., (January 2007), Presentation given at the 86th Transportation Research Board Annual Meeting, TRB, National Research Council, Washington, D.C.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue”, Muttart, J., Fisher, D. L., Knodler, M. and Pollatsek, A., (2007), Transportation Research Record, 2018, pp 9-14.

04-5 Network-Based Highway Crash Prediction Using Geographic Information Systems

Reports:

“Network-Based Highway Crash Prediction Using Geographic Information Systems,” Ivan, J.N., Gårder, P.E., Bindra, S., Jonsson, B.T., Shin, H., Deng, Z., June 2007, NETCR67.

Papers and Presentations:

“A Procedure for Allocating Zonal Attributes to a Link Network in a GIS Environment,” Jonsson, T., Deng, Z., Ivan, J.N., presented at 85th TRB Annual meeting, Jan. 2006, Paper No.: 06-2561.

“Using Land Use Data to Estimate Exposure for Improving Road Accident Prediction,” Jonsson, T., Ivan, J.N., Zhang, C., presented at 32nd Annual Traffic Records Forum, Palm Desert CA, Aug. 3, 2006.

05-6 Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension

Reports: None

Papers and Presentations:

“Assisting Elder Drivers' Comprehension of Dynamic Message Signs,” Clark, A.T., Wang, J.H., Maier-Sperdelozzi, V., Collyer, C.E., Proceedings of the 87th Annual Meeting of Transportation Research Board, Paper No. 08-2276, p.1-16, CD-ROM, 2008.

“Age Effect on Driver Comprehension of Messages Displayed on Dynamic Message Signs,” Wang, J.H., Clark, A. Y., and Maier-Sperdelozzi, V., Proceedings of IIE Research Conference, Paper No. 307, p.1-6, CD-ROM, 2008.

05-7 Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways

Reports: None

Papers and Presentations:

“A Decision Support System for Predicting the likely Benefits of Left-turn Lane Installation,” Ranade, S., Sadek, A.W. and Ivan, J., 2007, TRB Annual meeting, Paper No. 07-0992; January 2007; *Transportation Research Record*, 2023:28-36, 2007. This paper received the Best Paper Award from the Committee on Operational Effects of Geometrics at the 2008 Annual Meeting.

05-8 Evaluation and Implementation of Traffic Simulation Models for Work Zones

Reports: None

Papers and Presentations:

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies: Case Studies Along Interstate Highways in Massachusetts and Rhode Island,” Moriarty, K.D., Collura, J., Knodler Jr., M.A., Daiheng, N., and Heaslip, K., Paper presented at the TRB Annual Meeting in January 2008.