ANNUAL REPORT
For Calendar Year 2002

NEW ENGLAND TRANSPORTATION CONSORTIUM

NETCR41 **NOVEMBER 2003**

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.

NEW ENGLAND TRANSPORTATION CONSORTIUM

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James Sime, Manager of Research
Connecticut Department of Transportation

COORDINATOR

Gerald McCarthy
Connecticut Transportation Institute
University of Connecticut

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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. 2002 HIGHLIGHTS

1. FUNDING APPROVED FOR NEW RESEARCH TO ADDRESS 7 HIGH PRIORITY REGIONAL TRANSPORTATION RESEARCH NEEDS: The NETC Policy Committee, upon recommendation of the Advisory Committee, approved seven research projects, totaling $560,000, to address the following high priority regional transportation research needs:

- Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff
- Field Studies of Concrete Containing Salts of Alkenyl-Subsitituted Succinic Acid
- Feasibility Study and Design of An Erosion Laboratory in New England
- Measuring Pollutant Removal Efficiencies of Storm Water Treatment Units
- Evaluation of Field Permeameter As A Longitudinal Quality Control Indicator
- New England Land Grant University Consortium Transportation Research Challenge
- Basalt Fiber Reinforced Polymer Composites

2. FINDINGS FROM 3 RESEARCH PROJECTS PUBLISHED AND DISTRIBUTED: Final reports for the following projects were published and distributed to New England's State transportation agencies and universities, the Federal Highway Administration, the AASHTO Region 1 Research Advisory Committee, and the National Transportation Library:

- NETC 99-6: "Analytical and Experimental Investigation of the Effects of Concrete Removal Operations on Adjacent Concrete That Is to Remain"
- NETC 00-2: "Evaluation of Permeability of Superpave Mixes"
- NETC 00-5: "Guardrail Testing – Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2"

3. POLICIES AND PROCEDURES UPDATED: An update of the Consortium's Policies and Procedures was completed. The Policies and Procedures were approved by the Consortium's Advisory Committee at its April 5, 2002 meeting and recommended to the Consortium's Policy Committee for approval. The Policy Committee approved the updated Policies and Procedures at its April 15, 2002 meeting.

4.TECHNOLOGY TRANSFER:

- **21 Requests for Information and/or NETC Research Project Reports Were Processed:** The requests were received from a variety of sources including the following: Ohio Department of Transportation; Washington State Department of Transportation; Pennsylvania Department of Environmental Protection; Kentucky Transportation Cabinet; Texas Natural Resources Commission; Yukon Territorial Government, Canada; The Highway Institute, Belgrade Yugoslavia; and a number of consultants and private citizens.
- **Meetings/Conferences:**
  a. **American Association of State Highway Transportation Officials Washington Briefing:** At the invitation of AASHTO, the NETC Coordinator attended the AASHTO Washington Briefing held in Washington, DC in February 2002. The briefing provided transportation officials with an opportunity to hear about current transportation issues and discuss them with personnel and staff of transportation-related Senate and Congressional committees.
  b. **Connecticut Transportation Research Showcase:** The NETC Coordinator made a presentation on the Consortium's mission, organization, project selection procedures and current research projects at the Connecticut Transportation Research Showcase held at the University of Connecticut on March 19, 2002.
  c. **Association of General Contractors/American Road Transportation Builders Association/American Association of State Highway Transportation Officials Task Force 13:** Dean Alberson, Texas Transportation Institute, Principal Investigator for NETC Project 00-5 "Guardrail Testing – Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2," presented the results of the crash tests conducted on the MELT guardrail terminal to the AGC/ARTBA/AASHTO Task Force 13 meeting in Seattle, Washington in April 2002.
  d. **Annual Visit of Transportation Research Board Representative:** The NETC Coordinator made a presentation on the Consortium's mission, organization, project selection procedures and current research projects, at the annual visit of the Transportation Research Board representative to the Connecticut Transportation Institute at the University of Connecticut on May 21, 2002.
  e. **American Association of State Highway Transportation Officials Annual Meeting:** The NETC Coordinator presented an exhibit of NETC research projects at the AASHTO Annual Meeting held in Anchorage, Alaska in October 2002.
  f. **Northeast Association of State Transportation Officials Annual Meeting:** The NETC Coordinator presented an exhibit of NETC research projects at the NASTO Annual Meeting held in Newport Rhode Island, in April 2002.
  g. **Northeast States Materials Engineers Association:** The NETC Coordinator presented an exhibit of NETC research projects at the NESMEA Annual Meeting held in Newport, Rhode Island in October 2002.

h. Groundscapes Erosion Control Conference: Dr. Kenneth Demars made a powerpoint presentation on "Compost Applications for Erosion Control: New and Improved Methods" at the Groundscapes Erosion Control Conference on "Putting Compost in the Specs: Practical Applications for Erosion Control" held at the Wrentham Development Center, Wrentham, MA, October 8, 2002.

- **Papers Presented at Technical Conferences or Published in Technical Journals:**

a. "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.

b. Results from the rest area research were included in a presentation entitled: "The Efficacy and Use of Continuous Shoulder Rumble Strips: Engineering a Solution." Presented by Dr. Per Garder, University of Maine, Orono at the November 20-21, 2002 National Summit to Prevent Drowsy Driving, National Academy of Sciences,Washington, DC. Dr. Garder based his presentation partly on the results from the research he conducted for NETC project 99-4 "Quantifying Roadside Rest Area Usage." The Summit was 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.

c. "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) held in Boston in August 2002.

d. "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.

5. OTHER:

- **NETC Begins Utilizing Video Conferencing for Technical Committee Meetings:** NETC, in cooperation with the FHWA Division Offices in New England, is now encouraging its Project Technical Committees to utilize the FHWA Division Offices' video conferencing facilities for meetings. After completing several pilot meetings utilizing video conferencing, NETC concluded that the use of video conferencing not only saved travel time and related expenses but also resulted in more effective meetings.

C. PROGRESS OF ACTIVE PROJECTS

PROJECT NUMBER: 94-2

PROJECT TITLE: Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Dryver R. Huston, Mechanical Engineering Department, University of Vermont; Peter L. Fuhr, Electrical Engineering Department, University of Vermont; Kenneth Maser, Infrasense Inc., Arlington, MA; William Weedon, Applied Radar Analysis, Watertown, MA

STATUS: Completed

INITIAL AGREEMENT DATE: 10/16/95

END DATE: 9/30/99

PROJECT OBJECTIVES: The overall goal of this project is to advance the state-of-the-art in ground-penetrating-radar (GPR) imaging techniques so that it will become an even more practical and precise tool for assessing the integrity of reinforced concrete bridge decks, with particular attention directed towards the specific problems of the bridges in New England. The plan is to conduct numerical, laboratory and field studies with the ultimate goal of developing a reliable and easy-to-use field technique. **Phase I** involves the numerical modeling of the interactions of defects in concrete bridge decks and GPR through the adaptation of available algorithms, software and dielectric parameter data. **Phase II** involves the laboratory verification of the numerical models through the testing of specimens with known defects. **Phase III** involves the development of radar waveform image processing techniques so that defect conditions can be identified readily. **Phase IV** involves the field-testing of the methods on selected bridge structures in New England. **Phase V** involves the development of the appropriate documentation so the technology developed in this project is capable of being used by the state transportation agencies. This is an interdisciplinary project that has a team of investigators from Vermont and Massachusetts: Prof. Dryver R. Huston and Prof. Peter L. Fuhr from the University of Vermont; Dr. Kenneth Maser of Infrasense, Inc.; and Dr. William Weedon of Applied Radar Analysis, Inc. The project will take three years to complete.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The final report was completed.

REPORTS, PAPERS, AND PRESENTATIONS:

1. "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.
2. "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.
3. "Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques," Huston, D., Fuhr, P., Maser, K. and Weedon, W., NETCR19, July 1, 2002.

4. “Wireless Electromagnetic Interrogation of Structures,” Huston D., Pelczarski N., Fuhr P., Arms S., and Esser B. (Tentatively accepted) Smart Materials and Structures, April 2001.
5. “Adaptive Sensors and Sensor Networks for Structural Health Monitoring,” Huston D. SPIE 4512-24, Symposium on Complex Adaptive Structures, Hutchinson Island, FL, June 2001.
6. “GIMA Ground Penetrating Radar System For Infrastructure Health Monitoring,” Huston, D.R., Hu, J.Q, Maser, K., Weedon, W., Journal of Applied Geophysics 43, 2000, pp. 39-146.
7. “Damage Assessment in Roadways with Ground Penetrating Radar,” Huston, D.R., 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.
8. “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.
9. “Damage Detection in Roadways with Ground Penetrating Radar,” Huston, D.R., Pelczarski N., Esser, B. and Maser, K. GPR 2000, Eighth International Conference on Ground Penetrating Radar, Gold Coast, Australia, May 2000.
10. “Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Hu, J., Pelczarski, N., and Esser, B. Proc. Second International Conference on Structural Health Monitoring, Stanford University, September 1999.
11. “Ground Penetrating Radar for Concrete Bridge Health Monitoring Applications,” Huston, D, Hu, J., Maser, K., Weedon K., and Adam, C. SPIE 3587-23 Proc. SPIE NDE Techniques for Aging Infrastructure and Manufacturing, Newport Beach, CA, March 1999.
12. “GIMA Antenna Design for Ground Penetrating Radar in Concrete NDE Applications,” Hu, J.Q., Huston, D., and Fuhr, P. SPIE 3670-63, SPIE Conf. on Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials, Newport Beach, CA, March 1999.
13. “Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D.R., Maser, K., Hu, J.Q., Weedon, W., and Adam, C. Proc. GPR '98 7th International Conference on Ground-Penetrating Radar, The University of Kansas, Lawrence, KS, May 27-30, 1998.
14. “Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D.R., Maser, K., Weedon, W., Fuhr, P. and Adam C. Structural Health Monitoring, F. Chang, ed., Technomic Publishing, pp. 91-103 Proc. International Workshop on Structural Health Monitoring, Stanford, CA, September 1997.
15. “Ground Penetrating Radar for Nondestructive Evaluation of Concrete Bridge Decks,” Adam, C., M.S. Thesis, Department of Mechanical Engineering, University of Vermont, September 1997.

PROJECT NUMBER: 96-2

PROJECT TITLE: Optimizing GPS Use in Transportation Projects

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): John E. Bean, University of Connecticut

STATUS: Continuing

INITIAL AGREEMENT DATE: 7/1/97

END DATE: 6/30/99

PROJECT OBJECTIVES: To identify ways to optimize the use of GPS in transportation projects.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
Work continues on the development of the following interim reports: 1) documentation of the current state of the art of GPS at the six New England State DOTs 2) summarization of several GIS/GPS studies as indicated in Task 5 of the proposal.

Work continues on the final report.

Worked with individuals from the six states to update GPS status reports. Continued dealing with logistics of running a GPS base station and base station data server. Have received updates from New Hampshire, Rhode Island, Vermont and Massachusetts.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 97-1

PROJECT TITLE: A Portable Method to Determine Chloride Concentration on Roadway Pavements

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Norman W. Garrick and Nikolaos P. Nikolaidis, University of Connecticut

STATUS: Completed

INITIAL AGREEMENT DATE: 9/1/98

END DATE: 9/30/01

PROJECT OBJECTIVES: The objective of this work is the development of technology to be used in conjunction with a management framework for effective deicer deployment. The goal is a system that will result in the optimum use of road deicer, thereby, reducing the cost and minimizing the undesirable water quality effects of chlorine, while, at the same time, preserving highway safety.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The final report was completed.

REPORTS, PRESENTATIONS, AND PAPERS:
"A Portable Method to Determine Chloride Concentration on Roadway Pavements," Garrick, N., Nikolaidis, N., P. and Luo, J, NETCR17, September 2002.

PROJECT NUMBER: 97-2

PROJECT TITLE: Performance Evaluation and Economic Analysis of Combination of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete for the Northeast U.S.A.

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

STATUS: Continuing

INITIAL AGREEMENT DATE: 8/30/98

END DATE: 8/30/02

PROJECT OBJECTIVES: To evaluate the performance of chemical and mineral durability enhancing admixtures in structural reinforced concrete mixes typical of those specified by State Highway Departments in New England. Combinations of silica fume, fly ash, ground granulated blast furnace slag, disodium salts, and chemical corrosion inhibitors are being considered. The final report will contain guidelines for the New England State Highway Departments on the specification and use of mineral and chemical admixtures in structural reinforced concrete, including both expected long-term durability enhancement and overall life cycle economic impacts.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002: The long term testing protocol continued for all specimens. One "non-cracked" specimen of mixes 1, 3 and 4 (control, silica fume, fly ash) and DSS specimens were initiated at the 6-month period (specimens delayed). The first 1-1/2 years of testing was completed. The Draft Final Report was completed and distributed to the Project Technical Committee for review.

REPORTS, PAPERS, AND PRESENTATIONS:

1. "Performance Evaluation of Combinations of Durability Enhancing Admixtures in Concrete – Review and Experimental Program," Lovett, D., Report in Partial Fulfillment of a Master of Science in Civil Engineering Degree, Department of Civil and Environmental Engineering, University of Massachusetts, Amherst. February, 2001.
2. "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.
3. "Performance Evaluation of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete," Sund, D., Report in Partial Fulfillment of a Master of Science in Civil Engineering Degree, Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, September, 1999.

PROJECT NUMBER: 99-1

PROJECT TITLE: NETC Bridge Rail Transitions - Development and Crash Testing

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jerry Zoller, New Hampshire Department of Transportation

STATUS: Continuing

INITIAL AGREEMENT DATE: 6/5/98

END DATE: To be determined

PROJECT OBJECTIVES: (1) To design bridge rail transitions for use with the NETC 2-bar curb-mounted and 4-bar sidewalk-mounted steel bridge railings, and (2) to crash test them to meet NCHRP 350 TL-3 criteria.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002: The technical committee has submitted the design of the three transition sections to FHWA for comment and received approval for two of the three designs. The Massachusetts design is still awaiting official FHWA response.

REPORTS, PAPERS, AND PRESENTATIONS: None

PROJECT NUMBER: 99-4

PROJECT TITLE: Quantifying Roadside Rest Area Usage

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Per Garder, University of Maine

STATUS: Completed

INITIAL AGREEMENT DATE: 9/1/99

END DATE: 2/28/01

PROJECT OBJECTIVES: To use public input in determining the need for and spacing between roadside rest areas along different types of highway

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
Final report submitted and approved for printing. Printed in early January 2003

REPORTS, PAPERS AND PRESENTATIONS:

1. 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).

2. "Quantifying Roadside Rest Area Usage," Garder, P. and Bosonetto, N., NETCR 38, November 27, 2002.

PROJECT NUMBER: 00-1

PROJECT TITLE: Ground-Based Imaging and Data Acquisition Systems for Roadway Inventories in New England - A Synthesis of Practice

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Kathleen Hancock, University of Massachusetts Amherst

STATUS: Completed

INITIAL AGREEMENT DATE: 9/1/00

END DATE: 8/31/01

PROJECT OBJECTIVES: The primary objectives of this research are:
1. To develop a synthesis of practice for ground-based imaging and data acquisition systems for roadway inventories in New England.
2. Provide insight into the different locational referencing schemes that are being used,
3. Determine how states in the region are coordinating those schemes, and
4. Identify how states are incorporating inventory data into geographic information systems (GIS) for transportation analysis activities.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The final report was completed.

REPORTS, PAPERS, AND PRESENTATIONS:
"Ground-Based Image and Data Acquisition Systems for Roadway Inventories in New England – A Synthesis of Highway Practice," Hancock, K. and Degray, J., NETCR30, August 2002.

PROJECT NUMBER: 00-2

PROJECT TITLE: Evaluation of Permeability of Superpave Mixes

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, University of Massachusetts Dartmouth; Rajib B. Mallick, Worcester Polytechnic Institute

STATUS: Completed

INITIAL AGREEMENT DATE: 9/1/00

END DATE: 12/15/01

PROJECT OBJECTIVES:
1. Evaluate the permeability of hot mix asphalt mixes with fine and coarse gradations.
2. Evaluate the permeability of hot asphalt mixes with different nominal maximum aggregate size.
3. Evaluate the effect of different types of aggregates on permeability of HMA.
4. Prepare recommendations for design criteria of permeability values, and in-place and laboratory testing.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The final report was completed.

REPORTS, PAPERS, AND PRESENTATIONS:
1.Presentation: Northeast Asphalt User Producer Group Meeting, October 18, 2001, Albany, New York
2."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.
3."Evaluation of Permeability of Superpave Mixes," Mogawer, W., Mallick, R., Teto, M. and Crockford, C., NETCR34, July 3, 2002.

PROJECT NUMBER: 00-3

PROJECT TITLE: Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): W. Davids, H. Dagher, University of Maine

STATUS: Continuing

INITIAL AGREEMENT DATE: 5/1/01

END DATE: 5/31/03

PROJECT OBJECTIVES: The primary objective of the proposed research is to develop a timber guardrail reinforced with fiber-reinforced polymers (FRP) and having the potential to meet TL-3 crash test performance criteria. This timber guardrail will take advantage of glued-laminated timber technology, allowing the use of more readily available smaller sections of dimensioned lumber. The FRP reinforcement will permit the use of lower grade lumber, making native New England species (such as red maple and Eastern hemlock) competitive with non-native timber.

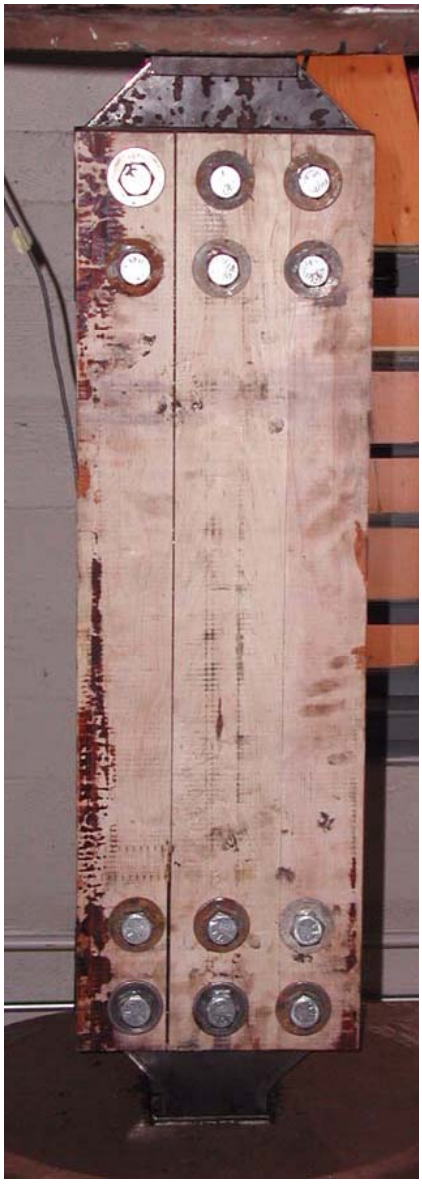
PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:

A. The guardrail design cross-section was finalized to a 10-1/4" wide by 3" deep glulam consisting of a brickwork layup of mixed hardwoods (primarily red maple). Two 5" wide by 1/8" thick pieces of E-glass/epoxy FRP produced by Gordon Composites were selected for tension reinforcement.
B. We purchased 560 board-feet of soft maple from O&R lumber in Milo, Maine and fourteen 5" wide pieces of e-glass/epoxy FRP from Gordon Composites for use in guardrail fabrication. The random-width lumber was ripped into consistent widths suitable for use in a 10-1/4" wide guardrail layup, and was also planed and graded into three grades (#6, #3, and #2) according to the AITC 119-96 Standard Specifications For Structural Glued Laminated Timber of Hardwood Species for red maple.
C. Josh Botting (project graduate student) and Chad Gibson (undergraduate student funded by the NSF REU program) completed finger jointing and planing the mixed hardwoods to be used for rail specimen. 12'-long rail specimens were fabricated for the testing program at the AEWC Center Laboratory (see Figure 1).
D. An effective field splice design was finalized for connecting individual 12' rail sections at alternate post locations. The unique splice relies on a steel-to-steel single shear connection utilizing ¾"-diameter, field-installed bolts. One steel plate is pre-bonded to the rail section with an inexpensive off-the-shelf epoxy, which eliminates the need for the use of any adhesive in the field. This splice is critical to guardrail performance, as it must transfer the entire tensile force developed during impact between each 12' section of guardrail. We note that other timber guardrail systems rely on a continuous steel backing plate or rolled section to carry tension in the guardrail system.
E. Six tension-shear tests of the bolted splice connections were completed that mimicked actual eccentricities of the actual splice (see Figure 2). To determine the effect of bolt pretension on connection performance, tests were performed with bolt torques of 100 ft-lbs, 40 ft-lbs, and 20 ft-lbs. (two nominally identical specimens at each torque level). As expected, the 100 ft-lb. specimens performed best, with a splice capacity near 100 kips. However, even when the torque was reduced to 20 ft-lbs., the connection still sustained approximately 80 kips of

tension. We note that the expected tension during a TL-3 rail impact was estimated at 40 kips using the Barrier VII computer program. These test results indicate that the bolted splice connection will continue to perform well in the field after initially high bolt pretension load is lost due to creep and rail dimensional changes under moisture cycling. In all cases, the steel-FRP epoxy bond performed very well.

F. ASTM D1101 moisture cycling tests were conducted to evaluate the efficacy of the steel-FRP-wood bond lines at the splice connection. It is critical to qualify these bonds for an exterior application: the steel undergoes essentially no dimensional changes with moisture cycling, while the wood swells significantly, inducing large tensile and peeling stresses at the wood-FRP and FRP-steel interface. The specimens performed very well, with no delamination noted at the wood-FRP or FRP-steel interface.
G. We have finalized the testing program for the rail sections, which will include two pure bending tests of 6'-long sections, and tests of four 6'-long sections under combined bending and tension.
H. We have set up a test rig for flexural testing, and have tested three dummy specimens to verify its adequacy and our instrumentation scheme in anticipation of the flexural tests. In addition, we have arranged with an outside consultant to perform laser-based displacement measurement of the rail sections during two days of testing. These measurements will hopefully allow us to gather information on guardrail strains as well as displacements due to combined tension and bending.
I. We designed a test rig that will allow us to perform simultaneous tension and bending tests on the rail specimens. While the design of the test rig is fairly complex, the importance of producing simultaneous bending and tension warrants attempting to design and fabricate such an innovative test rig. We expect delivery of the apparatus within a week, and plan to begin our combined tension-bending tests of the rails sometime in February.

Figure 1: Guardrail Layup in Progress



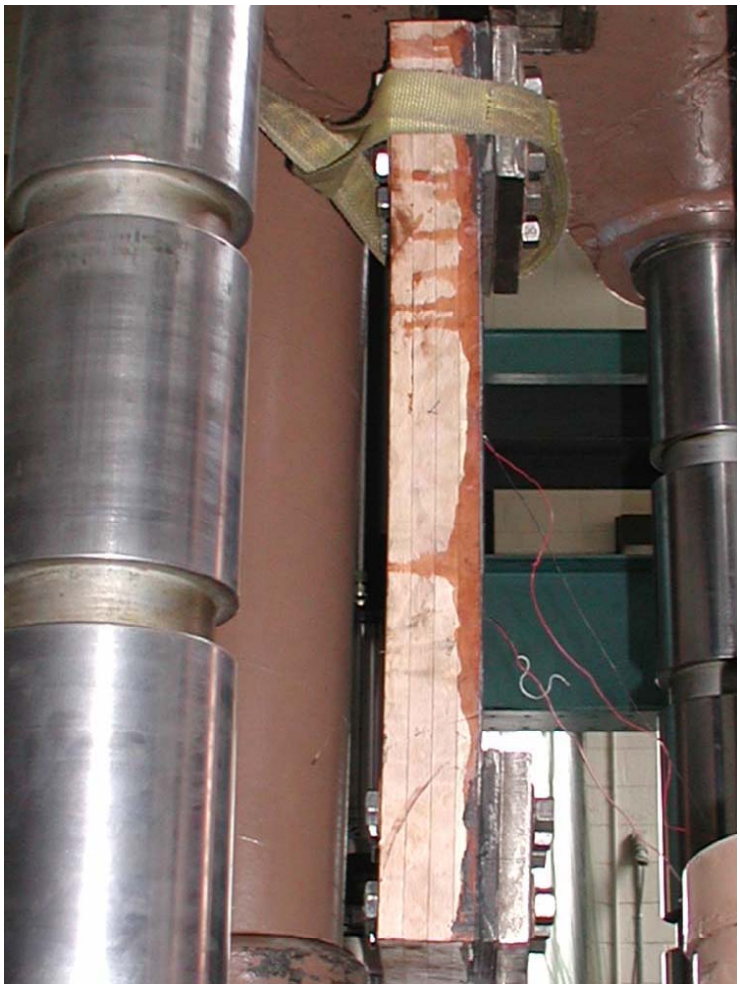


Figure 2: Rail Tension Splice Test

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 00-4

PROJECT TITLE: Portable Falling Weight Deflectometer Study

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Dana N. Humphrey,
Department of Civil and Environmental Engineering, University of Maine, Orono, Maine;
Maureen A. Kestler, Geotechnical/Pavements Engineer, USDA Forest Service

STATUS: New

INITIAL AGREEMENT DATE: 7/1/02

END DATE: 6/30/04

PROJECT OBJECTIVES:
The objective of this project is to evaluate the effectiveness of portable falling weight deflectometers (PFWD) as a means of monitoring compaction, density, or bearing capacity at construction sites. This will include developing correlations between PFWD results and percent compaction for a range of soils. Guidelines for use of PFWDs will be developed. The guidelines will include acceptance and testing protocols. In addition, the PFWD will be evaluated as a means of optimizing timing for load restriction placement and removal on secondary roads in New England. A comparison will be made of the results from different PFWDs and several alternate devices for measuring the degree of compaction of highway subgrade soils and base/subbase aggregates.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The fully executed contract from the Connecticut Department of Transportation was mailed to the University of Maine on October 3, 2002. This allowed the project to officially begin. Preliminary work was initiated on Task 1 (Literature Review) and inquiries were made with manufacturers of PFWD equipment.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 00-5

PROJECT TITLE: Guardrail Testing-Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2

PRINCIPAL INVESTIGATOR(S): Dean C. Alberson, Texas Transportation Institute, Texas A&M University

STATUS: Completed

INITIAL AGREEMENT DATE: N/A

END DATE: N/A

PROJECT OBJECTIVES:
To conduct the testing needed for FHWA consideration of the acceptability of the NETC MELT at NCHRP Report 350 Test T2 criteria, and to document the testing and the results of the testing in sufficient detail for FHWA consideration. The ultimate goal is to achieve FHWA approval of the NETC MELT as an approved TL2 guardrail terminal.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The final report was completed.

REPORTS, 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 in April 2002.

PROJECT NUMBER: 00-6

PROJECT TITLE: Effective Visualization Techniques for the Public Presentation of Transportation Projects

PRINCIPAL INVESTIGATORS: Norman W. Garrick, Peter Miniutti and Mark Westa, University of Connecticut

STATUS: Continuing

INITIAL AGREEMENT DATE: 6/01/01

END DATE: June 31, 2003

PROJECT OBJECTIVES:
The objective of this work is to develop an effective approach that area DOT's can use for presenting transportation projects to the public.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The state transportation agencies were surveyed to gain an understanding of how and where visualization is used by DOT personnel. This survey showed that all the DOTs are using visualization for public presentation but few are using these techniques as an integral part of the design. The survey found that the level of training and support for visualization varied significantly from state to state.

A separate survey of private sector firms (in transportation and allied design fields) was also conducted. This survey was useful in illustrating the full range of visualization tools that are being employed in design and the level to which these tools have been integrated into the design process by these firms. Based on these surveys, a workshop and manual for guiding the use of visualization tools in the DOTs is being developed.

REPORTS, PAPERS AND PRESENTATIONS:
"EffectiveVisualization Techniques for the Public Presentation of Transportation Projects," MS Thesis, Luo, J., August 2002.

PROJECT NUMBER: 00-7

PROJECT TITLE: A Complete Review of Incident Detection Algorithms and their Deployment: What Works and What Doesn't

PRINCIPAL INVESTIGATOR(s) & UNIVERSITY(s): Dr. Emily Parkany, Assistant Professor, University of Massachusetts, Amherst

STATUS: Continuing

INITIAL AGREEMENT DATE: 9/1/00

END DATE: 6/30/02

PROJECT OBJECTIVES: This study focuses on a comprehensive evaluation and comparison on all available sensor technologies and processing algorithms for incident detection. There is an emphasis on implemented algorithms, arterial algorithms and algorithms that utilize section data other than point data.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2001:

1. All academically recognized incident detection algorithms were reviewed and compared and the algorithms used for arterials and based on probe-based and drive based data were emphasized. Previous literature reviews were also investigated, but the focus of this review is distinguished from previous reviews.
2. A new classification system for current incident detection approaches was defined and identified.
3. A review on procedures for calibration of incident detection algorithms was conducted.
4. The first draft of the final report has been finished. However, newly available findings and progress will further be incorporated into this study. Hence the report draft is being revised and improved.
5. A set of recommendations of incident detection implementation approaches based on the previous evaluations and comparisons were made.

REPORTS, PAPERS, AND PRESENTATIONS:

"Use of Driver-Based Data for Incident Detection," Parkany, E. Submitted to the 7th International Conference on Applications of Advanced Technologies in Transportation Engineering (AATT) to be held in Boston in August 2002.

PROJECT NUMBER: 00-8

PROJECT TITLE: Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Dana N. Humphrey, Department of Civil and Environmental Engineering, University of Maine, Orono, Maine.

STATUS: Continuing

INITIAL AGREEMENT DATE: 7/1/01

END DATE: 6/30/05

PROJECT OBJECTIVES:
The objective of this project is to construct twelve experimental test sections to evaluate the performance and effectiveness of several alternative cold regions pavement designs. These designs involve the use of geogrids and/or drainage geocomposite as an integral member in a thin pavement section. The test sections will be constructed as part of a Federal/State, Maine Department of Transportation highway reconstruction project. Pavement sections will be evaluated for: 1) the influence of the location of a geogrid in a relatively thin pavement section on pavement performance; 2) the influence of a drainage geocomposite in a relatively thin pavement section on pavement performance; 3) the influence of a drainage geocomposite in a pavement reclamation application on pavement performance; 4) the influence of using both a geogrid and drainage geocomposite in a relatively thin pavement section on pavement performance; and 5) comparing the performance of a geogrid and/or drainage geocomposite in a relatively thin pavement section to a typical standard thick pavement section.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002: The instrumentation for twelve test sections were fabricated and installed as part of reconstruction of Route 9/126 in Monmouth-Litchfield, Maine. Installation occurred in September, 2001 and July, 2002.

Instrumentation installed in the 2001 and 2002 construction seasons included 120 strain gages attached to geogrid to monitor the in-place deformation of the grid, 16 vibrating wire piezometers to measure pore water pressures in the subbase course and subgrade soils in sections with drainage geocomposite, and 12 thermocouple strings with twelve individual thermocouples in each string to monitor the depth of frost penetration. The strain gages were attached directly to the ribs of the geogrid. They were installed in pairs – one on top and one on bottom of the rib. This allows the elongation of the rib to be separated from bending. They were protected by an epoxy coating. As of December 31, 2002, 103 out of 120 strain gages are operating, which demonstrates the effectiveness of the protective system. The piezometers have a measurement range of 0 to 34 kPa (0 to 5 psi) and an accuracy of ±0.17 kPa (±0.025 psi). This allows heads as low as 1.5 mm (0.06 in.) to be measured. Most of the instruments were attached to an automatic datalogger that takes and stores hourly readings. The readings are downloaded weekly via modem. To analyze the data, the 24 hourly readings are averaged. This eliminates most of the electronic noise, or random scatter, in the data, which allows for easier identification of time-dependent trends. For instrumentation not attached to a datalogger, weekly manual readings were generally taken.

A new system to measure flows from sections with drainage geocomposite was investigated. In previous projects tilt buckets were used to measure flow, however, these proved to be unreliable at low flow rates. Preliminary flow rate observations on the Litchfield-Monmouth project showed that the

flow rates would be low. This made it desirable to find an alternative method to measure these low flows. Two flowmeters were investigated. The first was an Omega FP5600, capable of measuring flows ranging from 2 to 45 L/min (0.5 gpm to 12 gpm). The second was a Signet Microflow2000, capable of measuring flows ranging from 0.1 to 3 L/min (0.03 gpm to 0.7 gpm). The device that will be installed at a particular station will depend on the anticipated flow rate.

To speed installation this spring, protective housings have been installed at each station where flow measurements are required. Extension wires fabricated to plug directly into the instrument lead wires have been installed in PVC conduit and extend from the protective housing to the box containing the datalogger. Separate dataloggers assigned only to the flow measurement devices have been programmed to record readings every hour.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 01-2

PROJECT TITLE: Development of a Testing Protocol for QC/QA of Hot Mix Asphalt (HMA)

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, P.E., UMass Dartmouth; Rajib Mallick, Worcester Polytechnic Institute

STATUS: Continuing

INITIAL AGREEMENT DATE: 9/1/02

END DATE: 12/31/02

PROJECT OBJECTIVES:

1. Evaluate the sensitivity, accuracy and repeatability of the rapid triaxial testing equipment.
2. Develop criteria for using the results from these tests for identifying poor and good performing mixes during production and construction.
3. Develop quality control and quality assurance specification limits based on the results from the triaxial testing equipment.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:

All tasks related to this project were completed. Each of the four tasks consisted of procurement of material, compaction of mixes, testing of volumetric properties, testing for dynamic modulus and phase angle and analysis of data. Testing was carried out at two different temperatures and two different frequencies. The specific phases in which the testing and analyses were conducted are as follows:

1. In the first phase, two different mixes (different in nominal maximum aggregate size, asphalt content and gradation) were used for compacting samples and testing. These mixes, labeled as Class 1 and Class 2, were obtained from a HMA plant in Connecticut. The samples were made by taking 2,000 gram mix, and using the required number of gyrations required to produce samples with 6 to 8 percent (construction) VTM. Since the 9.5 mm NMAS mix sample could not stand the seating load (20N) at the beginning of the dynamic modulus test (it fell apart) at 100^{o}C, all tests were run at 60^{o}C.
2. In Phase 2, samples were made out of granite aggregate, using a coarse gradation and one asphalt content, and different numbers of gyration (to obtain specific heights), to produce samples with different voids in total mix (VTM). A PG 64-28 asphalt binder was used, at an asphalt content of 5.3 %. Target VTM were 5, 7 and 9 percent.
3. Next, to observe the sensitivity of the test procedure, at different conditions, to mix variables, tests were run with samples compacted with different asphalt contents and percent passing the 0.075 mm sieve. The asphalt content was increased and decreased by 0.5 % from the Phase 2 mixes, and the percent passing the 0.075 mm sieve (P75) was increased and decreased by 2 % from the Phase 2 mixes. The same aggregate and gradations as used in Phase 2 were used. These samples were all compacted to 75 gyrations, using approximately 2,000-gram mix for each sample. The samples were tested at 60^{o}C and 100^{o}C, and using 1 Hz and 5 Hz loading rate. Three samples were made for each cell.
4. In Phase 3, part 2, another aggregate was used for preparing a fine graded mix, with different asphalt contents and percentage passing the 0.075 mm sieve. The sample matrix is shown in Table 2. Tests were conducted for the dark shaded cells only. Five samples were made for each cell. Next, a set of samples was made with mixes with design asphalt content and design, design -2 and design +2 percent P75. Unlike the other samples, these were compacted using 50

gyrations, to obtain higher air voids. The compacted samples were tested at 60^{o}C, at 1 Hz and 5 Hz loading rate. The test parameters and test results were then analyzed to determine whether the test procedure is practical and sensitive to key mix properties.

REPORTS, 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.

PROJECT NUMBER: 01-3

PROJECT TITLE: Design of Superpave HMA for Low Volume Roads

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, P.E., UMass Dartmouth, and Rajib Mallick, P.E., Worcester Polytechnic Institute

STATUS: Continuing

INITIAL AGREEMENT DATE: 9/1/01

END DATE: 2/29/04

PROJECT OBJECTIVES:

1. Develop compaction and volumetric (mix design) criteria for designing asphalt mixes for low volume roads.
2. Evaluate the performance of mixes designed according to these criteria.
3. Provide recommendations for proper implementation of the new mix design system by the state DOTs.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:

All work related to design and testing of three mixes has been completed.
First, a set of gyration numbers – 30, 40, 50 and 75 was selected. This selection was based on levels suggested in the literature and levels that are currently being used by many state DOTs. The highest gyration level of 75 was suggested since it is being used by many state DOTs at this time. The lowest number of 30 was suggested since lowering of gyration level below 30 would result in abnormally high asphalt content for most mixes. Next, two commonly used (in the New England states) gradations were selected. The selected gradations were suggested to fall in two broad categories – coarse and fine. It seems that fine mixes are most likely to be used in designing mixes for low volume roads, since they are relatively easy to construct, compared to very coarse graded mixes. The fine graded mixes are easier to compact and also have a "tight" surface. Very coarse graded mixes can have higher permeability, compared to fine graded mixes at similar void level and, hence, are prone to durability problems. In the case of very coarse graded mixes with sufficient asphalt there can be draindown problems. However, coarse graded mixes (gradation lying just below the maximum density line) offer the potential of high resistance against rutting, and are often used in many parts of New England, such as in New Hampshire. Hence a coarse graded mix was selected, along with the fine graded mix, for this study.

Using PG 64-28 asphalt binder, mixes were prepared and compacted with the selected gyration numbers to produce specimens with 4 percent air voids, and the optimum asphalt contents were determined. Samples were then compacted to construction voids (approximately 7 to 8 percent Voids in Total Mix, VTM). Note that the target VTM was between 7 and 8 percent, and that in some cases the samples had higher or lower VTM. The specimens were then tested for bulk specific gravity, and using the theoretical maximum gravity (tested in the laboratory for each mix) volumetric properties, namely, VTM, VMA, VFA and asphalt film thickness were determined.

Samples from each designed mix were tested for resilient modulus in the indirect tensile mode. The samples were then conditioned for long-term aging, using AASHTO TP2 procedure. At the end of conditioning, the samples were again tested for resilient modulus, and then tested for tensile strain at failure. The asphalt binder was extracted from the long-term aged samples and tested for stiffness (using dynamic shear rheometer) at 64^{o}C. Samples at two low asphalt contents were also tested with

the Asphalt pavement Analyzer (APA), for evaluation of rutting potential. Tests were conducted using 4,000 cycles with 690 kPa pressure and temperature of 60^{o}C. Tests were also conducted on samples with different asphalt contents (corresponding to 50, 75 and –1 % of that obtained using 75 gyrations) under water in the APA, using 4,000 cycles at 60^{o}C. The lower number of cycles (4,000) compared to the usual 8,000 cycles was selected to simulate low traffic volume. The results were used to correlate stiffness (of asphalt binder and mix) with volumetric properties such as VMA, VFA and film thickness. This correlation provided the basis for selecting the desired asphalt content for each mix (gradation) and thus helped in determining the most desirable gyration level.

Work is being conducted on extraction and testing of extracted asphalt binder (for dynamic shear rheometer) from the last of the three mixes.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 01-6

PROJECT TITLE: Field Evaluation of a New Compaction Monitoring Device

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Heather J. Miller, PI, University of Massachusetts Dartmouth (UMD); Rajib Mallick, Co-PI, Worcester Polytechnic Institute (WPI)

STATUS: Continuing

INITIAL AGREEMENT DATE: 8/1/01

END DATE: 7/31/03

PROJECT OBJECTIVES:
The primary objective of this study is to verify the effectiveness of the "Soil Compaction Meter" (SCM) as a tool for determining optimum compaction for highway construction applications. The scope of this project will initially involve performing a literature review of previous research performed on the Compaction Meter in order to identify the operational parameters, current capabilities and limitations of the device. Subsequently, testing will be performed to evaluate the effective uses of the device in a variety of applications and for a variety of materials. Based upon statistical analysis of the data obtained, conclusions and recommendations for use of the device in highway applications will be provided.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
All of the Phase A and Phase B testing was completed during the 2002 calendar year. Under Phase A, 5 different soil and aggregate samples were obtained and transported to the labs at UMD and WPI for testing. At UMD, sieve analyses and Proctor compaction testing on the samples were performed. At WPI, the phase A work involved testing soils compacted with a vibratory roller in a large-scale test frame (mold). The dimensions of the mold are 9-ft. long by 3-ft. wide by 1-ft. deep. For each material, three different moisture contents were selected for testing (less than optimum, optimum moisture, and above optimum). The moisture contents selected were within the range corresponding to 90% - 100% maximum dry unit weight (based upon the Standard or modified Proctor tests, as appropriate). Each material/moisture content combination was placed, compacted, and tested in the load frame at a given moisture content three times.

Each test series at WPI was generally performed as follows. A thin layer of soil (approximately 1 to 3 inches) was placed and compacted in the bottom of the frame, to provide a bedding layer for the SCM sensor. After the sensor was installed, the remaining 8 to 10 inches of soil was placed and compacted at the specified moisture content. After each pass of the vibratory roller, a measurement of soil stiffness was obtained with a GeoGauge (produced by Humboldt Manufacturing Co). The alternating roller passes and GeoGauge testing continued until the signal from the Soil Compaction Meter indicated that the lift had been sufficiently compacted (via a blinking "stop compaction" red light). At that point, the in-place density was determined by a nuclear density test and/or a sand cone test, so that direct correlation could be made between the SCM "stop compaction" signal and the percent compaction (e.g., compared to Standard or Modified Proctor Density). Alternate compaction of the material and GeoGauge measurements continued for at several more passes, and then a final nuclear density test and/or a sand cone test was performed.

Based upon the results obtained during Phase A, several sites were selected for the Phase B work, where materials similar to those tested under Phase A were placed and compacted in full-scale highway construction projects. At those sites, SCM sensors were buried beneath lifts of fill that were

compacted by various types of large vibratory rollers. The general testing scheme was similar to that conducted in Phase A, except that multiple lifts of fill were placed and compacted over the SCM sensors at most of the field sites. By taking measurements on multiple successively placed lifts of fill, it was possible to identify depth limitations of the SCM sensors. The Phase B testing was initiated in March 2002 and was completed by the end of the 2002 calendar year.

During the course of the project, the SCM was tested in conjunction with the following materials:

- Material #1: Subbase (Dense-Graded)
- Material #2: Gravel Borrow
- Material #3: Ordinary Borrow
- Material #4: Lightweight Aggregate
- Material #5: Hot Mix Asphalt (HMA)

Although statistical analysis of the data is still in progress, the following general statements can be made based upon analyses completed to date:

- The SCM is not an appropriate tool to assess percent compaction with lightweight aggregates (Material #4).

- Although only a limited body of data was obtained with Material #5 (HMA), comparison of SCM data and conventional nuclear density data on compacted Hot Mix Asphalt did not show a consistently good correlation.

- Comparison of SCM data and conventional sand cone and/or nuclear density tests on Materials #1, #2 and #3 (Dense-Graded Subbase, Gravel Borrow, and Ordinary Borrow) is extremely promising. When these materials are compacted at or near optimum moisture content, there is a strong correlation between the SCM "stop compaction" signal and a percent compaction of 95% or greater. For soils compacted significantly wet of optimum, the SCM often gives a "stop compaction" signal at less than 95 percent compaction.

- For Materials #2 and #3 (Gravel Borrow and Ordinary Borrow) a single SCM sensor can be used to monitor compaction of several successively placed lifts. However, when the thickness of fill above the SCM sensors reaches about 4 feet or more, the sensors often fail to transmit a signal for assessing the sufficiency of compaction.

It is anticipated that the statistical analysis of the data will be completed during the next quarter, and then the project report will be prepared. The literature review, field observations and analysis of results will be utilized to provide conclusions and recommendations about applicability of the Soil Compaction Meter, proper test controls and expected variation in results. The report will include a stand-alone easy-to-read document with testing protocols and recommended criteria for quality control limits. As part of the Technology Transfer plan, a hands-on workshop will be provided for New England highway agency personnel near the conclusion of this project.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 02-2

PROJECT TITLE: Formulate Approach for 511 Implementation in New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):
Paul Shuldiner, Director, University of Massachusetts Transportation Center, Department of Civil and Environmental Engineering

Jeremy Siviter, Senior Systems Engineer, IBI Group

STATUS: New

INITIAL AGREEMENT DATE: 8 /1/02

END DATE: 12/31/03

PROJECT OBJECTIVES:
The overall goal of this project is to develop a multi-faceted regional 511 implementation strategy that will address the following objectives:

- Identify minimum information requirements for a New England regional 511
- Identify the data availability existing within the region to support a minimum level 511 implementation
- Document the regulatory environment and processes that must be implemented for implementation of 511 in each of the New England states
- Identify lessons learned by early 511 adopters and ensure they are integrated in to a regional strategy
- Identify the different options for implementing various system components
- Document business plan approaches that can be used by the New England states to implement a regionally consistent 511 system

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
1. National guidelines, approaches, and case studies for 511 researched and documented
2. Task 1 draft report circulated to committee members for comment
3. Stakeholder survey developed for public and private entities which may participate in a region-wide 511 deployment to identify priorities, data availability, and preferred implementation strategies.
4. A workshop to discuss project objectives and Task 1 activities was conducted in Boston, MA on March 19, 2003.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 02-3

PROJECT TITLE: Establish Subgrade Support Values for Typical Soils in New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):
PI: Ramesh B. Malla, Ph.D., Associate Professor, Department of Civil & Environmental Engineering, University of Connecticut

Co PI: Vincent C. Janoo, Ph.D., Research Civil Engineer, U.S. Army Cold Regions Research and Engineering Laboratory (CRREL)

STATUS: New

INITIAL AGREEMENT DATE: 8/1/02

END DATE: 1/31/05

PROJECT OBJECTIVES: The objective of this research is to collect all relevant data, and based on these findings, develop typical values or a range of typical values for subgrade soils found in New England based on AASHTO soil classification.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:

1. Graduate Research Assistant hired: A Ph.D. graduate research assistant (Mr. Balunaini Umashankar) has been recruited and placed on this project from January 13, 2003.
2. Collection of existing soils data in New England States:
   ***a. Request of Information from NETC Technical Committee*:**
   A request was submitted to the NETC Technical Committee of this project (NETC 02-3) for any existing published references/literature as pertaining to soil classification and studies on resilient modulus and falling weight deflectometer in the six New England States (CT, MA, ME, NH, RI, and VT).
   b. Soil Survey Reports:
   The soil survey reports published by U.S. Department of Agriculture are collected and the existing soil types in New England States are presented in a Tabular form. The soil data is reported county wise for each state.
   A consolidated summary sheet indicating the soil types state-wise of all the six New England States has been developed.
   c. STATSGO Data:
   State Soil Geographic Database (STATSGO) consists of soil data of all states and is designed for use in Geographic Information Systems (GIS). The data can be accessed through GIS software packages (PCARC and ArcView). We are presently working on ArcView to retrieve the data available in STATSGO database (ftp://ftp.ftw.nrcs.usda.gov/pub/statsgo/dos/arc/data/).
3. Literature on Resilient Modulus and Falling Weight Deflectometer:
   a. Search using TRIS, RIP, and other database:
   A detail literature search using TRIS and RIP is in progress to collect information on resilient modulus and falling weight deflectometer studies done nation-wide. Several recent publications on “Resilient Modulus” and “Falling Weight Deflectometer Tests” are gathered.

b. New England States Studies:

Reports on resilient modulus and FWD tests conducted in New England states are collected (Long and Crandlemire 1992, Janoo 1994, Lee at al. 1994, Janoo and Berg 1996, Berg et al. 1996, Kestler 1997, Smart and Humphrey 1999, Janoo et al. 1999, Janoo and Bayer 2001). Journal Papers on the testing procedures and factors influencing resilient modulus and falling weight deflectometer are also collected (Sebaaly et al. 1985, Pezo and Hudson 1994, Jin et al. 1994, Drumm et al. 1996, Livneh et al. 1997, Hjelmstad and Taciroglu 2000, Ping et al. 2002).

c. LTPP Data:

The Long – Term Pavement Performance (LTPP) Data is obtained from LTPP Customer Service Support Center, Oak Ridge, TN. The data is available in the form of compact disc. It consists of Falling weight Deflectometer (FWD) measurement data and the profile data of selected in-service pavement test sections in North America.

4. Soil-Type Data Table:

   The existing soil types in New England States available from the USDA reports have been tabulated. The soil data is reported county-wise for each state. The soils are categorized using AASHTO soil classification as well as under Unified Soil Classification System (USCS).
   A consolidated summary sheet indicating the soil types state-wise of all the six New England States has been prepared.

REPORTS, PAPERS, AND PRESENTATIONS: None

PROJECT NUMBER: 02-5

PROJECT TITLE: Determination of Moisture Content of Deicing Salt at Point of Delivery

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY:
Richard P. Long and Kenneth R. Demars, University of Connecticut

STATUS: New

INITIAL AGREEMENT DATE: 7/1/02

END DATE: 12/31/03

PROJECT OBJECTIVES:
The object of this research is to find or develop a simple affordable method of device for quickly measuring the moisture content of road salt in the field. The test will be carried out in about five minutes and be capable of measuring moisture contents in the range of 3% to 5% to an accuracy equal to +/- 0.5%.

There are several methods of measuring moisture in a material. The analytical and gravimetric methods require substantial time to complete. In the infrared method the material's particle size, particle shape, particle surface characteristics and color can cause moisture measurement errors. The microwave methods require a large space and tend to be expensive. We are investigating the capacitive, neutron and gamma ray, and conductive methods of measuring moisture content.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
The literature review continues but there are few studies to identify the different methods used to measure moisture content. Several companies that manufacture equipment to measure moisture content of various materials have been contacted by email. These efforts suggest that the electrical conductivity/ resistivity method offers the most promise for portable, fast and inexpensive moisture measurements on road salt. However, several of the companies we contacted were skeptical that conductivity techniques could be developed for highly conductive materials such as pure salt with some moisture. Yet, conductivity is the method used for determining salt dissolved in water. One company replied that the conductivity method may work for salt and they could design the electronics if we determined the appropriate range of specific conductivity.

Moisture measurements were started with a conductivity cell to measure specific conductance of road salt over the moisture range of 0 to 8%. These measurements were not very repeatable, however, and were not within the stated range of accuracy (+- 0.5%). Additional measurements have shown that conductivity (at constant moisture) is significantly affected by packing density and to a lesser degree by wetting and mixing method, by degree of drying, by particle size distribution and by test technique. Additional testing results with the wood moisture (conductivity) meter, purchased from Tramex, were highly variable because of these factors and additional testing with this device has been discontinued until the factors that affect reproducible conductivity measurements are defined.

Testing with a nuclear moisture-density gauge was also performed in the laboratory and at the Willington, CT salt storage shed. These gauges employ neutrons to measure moisture and gamma rays to measure density but there was no correlation between the values of moisture and density determined from the nuclear gauge and values measured from oven drying and weighing. As a result, we contacted Troxler Electronics lab, the nuclear gauge manufacturer, and were informed that salt is one of 3 or 4 minerals that causes an interference with nuclear density measurements.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 02-7

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

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):
Adel W. Sadek, University of Vermont

Wael El-Dessouki, University of Connecticut

STATUS: New

INITIAL AGREEMENT DATE: 9/1/02

END DATE: 8/31/04

PROJECT OBJECTIVES:
The objective of the proposed study is twofold. The first objective is to explore how to best calibrate simulation models to inclement weather conditions in New England. With the simulation models calibrated, the second objective of the study will be to use the calibrated model to investigate the feasibility and benefits of tailoring signal timing to adverse weather conditions along New England arterials. Specifically, the proposed project has the following objectives:

(1) To determine the impacts of inclement weather (i.e. snow and ice) on traffic flow parameters such as discharge headway, startup lost times, speeds and speed-density relationships as documented in the literature;
(2) To check whether these values apply to New England conditions;
(3) To calibrate various traffic simulation models to inclement weather travel conditions;
(4) To use the calibrated simulation model to assess whether timing plans could be developed to accommodate inclement weather travel conditions; and to assess the benefits of implementing such tailored plans

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
This project started on September 1, 2003. The accomplishments of the project through December 31, 2002 include:

(1) The conduct of a literature review on the impact of inclement weather on traffic flow parameters;
(2) The conduct of data collection efforts aimed at quantifying the impact of inclement weather on traffic flow along signalized arterials in New England. Specifically, efforts are underway to assess the impact of inclement weather on traffic flow parameters such as startup lost time, saturation headway, and average headways. Once the impacts are quantified, the study will proceed to examine how to best calibrate simulation models for such conditions, and to assess the benefits of developing special signal timing plans for inclement weather conditions. To the best of our knowledge, this is the first study of that nature in New England.
(3) The development of a CORSIM simulation model for a corridor in the State of Vermont for use in assessing the benefits of developing specific signal plans for inclement weather.

REPORTS, PAPERS AND PRESENTATIONS: None

PROJECT NUMBER: 02-8

PROJECT TITLE:
Intelligent Transportation Systems Applications to Ski Resorts in New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):
Adel W. Sadek, University of Vermont

The IBI Group

STATUS: New

INITIAL AGREEMENT DATE: 9/1/02

END DATE: 3/31/04

PROJECT OBJECTIVES:
The main objective of the proposed research is to conduct a comprehensive study aimed at understanding ski resort travel problems in New England, and the applicability of ITS to address these problems. Specifically, the proposed study has the following objectives:

(1) To define and quantify the transportation problems and challenges associated with ski resorts travel in New England, and to study the implications of such problems with respect to traffic management;
(2) To define and understand the needs of travelers to ski resort areas in New England;
(3) To identify ITS strategies and applications that have the potential to address the problems and needs identified in (1) and (2) above;
(4) To assess the costs and benefits of the ITS strategies identified in (3); and
(5) To explore the opportunity for public-private partnerships to fund the strategies identified in (4)

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2002:
1. The conduct of a literature review on transportation problems associated with travel to ski resorts, and the needs of travelers;
2. The beginning of data collection aimed at understanding the transportation problems associated with travel to ski resorts in New England, and the needs of the travelers.
3. The development of a preliminary framework for selecting a representative set of ski resorts in New England for the purposes of data collection.

REPORTS, PAPERS AND PRESENTATIONS: None

D.1 FINANCIAL STATUS OF ACTIVE PROJECTS:

Table 1: Financial Status of Projects Active During 2002
(As of 11/06/02)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES PAID TO DATE	PROJECT BALANCE
94-2	Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques, *D. Huston, University of Vermont*	$224,902.00	$224,901.80	$0.20
96-2	Optimizing GPS in Transportation, *J. Bean, C. Ferguson, University of Connecticut*	$120,000.00	$26,670.01	$93,329.99
97-1	A Portable Method to Determine Chloride Concentration on Roadway Pavements, *N. Garrick, University of Connecticut*	$107,162.00	$76,997.21	$30,164.79
97-2	Performance Evaluation and Economic Analysis of Combinations of Durability Enhancing Admixtures (Chemical and Mineral) in Structural Concrete for the Northeast U.S.A., *S. Civjan, University of Massachusetts, Amherst*	$118,473.00	$104,440.26	$14,032.74
99-1	NETC Bridge Rail Transitions - Development and Crash Testing, *J. Zoller, New Hampshire Department of Transportation*	$240,000.00	$0.00	$240,000.00
99-4	Quantifying Roadside Rest Area Usage, *P. Garder, University of Maine, Orono*	$44,857.00	$17,813.70	$27,043.30
00-1	Ground-Based Imaging and Data Acquisition Systems for Roadway Inventories in New England - A Synthesis of Practice, *K. Hancock, University of Massachusetts, Amherst*	$40,818.00	$28,994.67	$11,823.33
00-2	Evaluation of Permeability of Superpave Mixes, *W. Mogawer, University of Massachusetts, Dartmouth*	$100,002.00	$95,499.16	$4,502.84
00-3	Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail, *W. Davids, University of Maine, Orono*	$83,469.00	$28,087.12	$55,381.88
00-4	Portable Falling Weight Deflectometer Study, *D. Humphrey, University of Maine, Orono*	$100,000.00	$0.00	$100,000.00
00-5	Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2, *D. Alberson, Texas Transportation Institute, Texas A&M University*		$61,287.00 *See Note 2.*	$0.00

Table 1: Financial Status of Projects Active During 2002
(As of 11/06/02)
(Cont'd)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES PAID TO DATE	PROJECT BALANCE
00-6	Effective Visualization Techniques for the Public Presentation of Transportation Projects, *N. Garrick, University of Connecticut*	$74,929.00	$56,105.62	$18,823.38
00-7	A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn't, *E. Parkany, University of Massachusetts, Amherst*	$45,384.00	$40,558.26	$4,825.74
00-8	Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region, *D. Humphrey, University of Maine, Orono*	$150,000.00	$68,005.00	$81,995.00
01-2	Development of a Testing Protocol for QC/QA of Hot Mix Asphalt (HMA), *W. Mogawer, University of Massachusetts, Dartmouth*	$80,000.00	$44,242.31	$35,757.69
01-3	Design of Superpave HMA for Low Volume Roads, *W. Mogawer, University of Massachusetts, Dartmouth*	$99,755.00	$41,710.66	$58,044.34
01-6	Field Evaluation of a New Compaction Monitoring *Device, H. Miller,University of Massachusetts, Dartmouth*	$50,000.00	$31,890.06	$18,109.94
02-2	Formulate Approach for 511 Implementation in New *England, P. Shuldiner, University of Massachusetts, Amherst*	$84,013.00	$0.00	$84,013.00
02-3	Establish Subgrade Support Values for Typical Soils in *New England, R. Malla, University of Connecticut*	$80,000.00	$0.00	$80,000.00
02-5	Determination of Moisture Content of Deicing Salt at Point of Delivery, *K. Demars, University of Connecticut*	$59,236.00	$5,644.98	$53,591.02
02-7	Validating Traffic Simulation Models to Inclement Weather Conditions with Applications to Arterial Coordinated Signal Systems, *A. Sadek, University of Vermont*	$74,731.00	$0.00	$74,731.00
02-8	Intelligent Transportation Systems Applications to Ski Resorts in New England, *A. Sadek, University of Vermont*	$60,000.00	$0.00	$60,000.00

Notes: 1. Retainage is not included in "INVOICES PAID TO DATE"
2. Project 00-5 was a Purchase Order Agreement project

D.2 FUND BALANCE:

Table 2: NETC Fund Balance
(As of 12/31/02)

ITEM	ALLOCATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
Unexpended Balance of NETC funds from AASHTO				
as of 6/5/95 (Per AASHTO memo 12/4/95)				132777.07
Member Allocations 1994 = 6 X $75,000	450000			582777.07
Coord./Admin. of NETC: Calendar Year 1995 Bdgt. = $73042		58761.32	FINAL	524015.75
Continued Projects:				
- Construction Costs of New England Bridges-Phase II		39500	FINAL	484515.75
- Tire Chips as Lightweight Backfill-Phase II: Full-Scale Testing				
(Supplemental Funding)		16000	FINAL	468515.75
- Bridge Rail Crash Test - Phase II:Sidewalk-Mounted Rail		134127	FINAL	334388.75
- New England Vehicle Classification and Truck Weight Program		6752.57	FINAL	327636.18
Member Allocations 1995 = 7 X $75,000	525000			852636.18
"95" Project Series:				
95-1: Use of Tire Chips/Soil Mixtures to Limit Pavement Damage				
of Paved Roads		75000	FINAL/CLOSED	777636.18
95-2: Suitability of Non-Hydric Soils for Wetland Mitigation		39867.7	FINAL/CLOSED	737768.48
95-3: Implementation and Evaluation of Traffic Marking Recesses				
for Application of Thermoplastic Pavement Markings				
on Modified Open Graded Mixes		120812.12	FINAL/CLOSED	616956.36
95-5: Buried Joints in Short Span Bridges		61705.61	FINAL/TERM.	555250.75
95-6: Guidelines for Ride Quality Acceptance of Pavements		106124	FINAL	449126.75
"94" Project Series:				
94-1: Structural Analysis of New England Subbase Materials and				
Structures		110057.38	FINAL/CLOSED	339069.37
94-2: Nondestructive Testing of Reinforced Concrete Bridges				
Using Radar Imaging Techniques		224901.8	FINAL	114167.57
Member Allocations 1996 = 6 X $75,000	450000			564167.57
Coord./Admin.of NETC: Calendar Year 1996; Bdgt. = $75,000		69123.85	FINAL	495043.72
Member Allocations 1997 = 6 X $75,000	450000			945043.72
Coord./Admin. of NETC: Calendar Year 1997; Bdgt. = $82,494		77244.35	FINAL	867799.37
"94" Project Series:				
94-3: Procedures for The Evaluation of Sheet Membrane Waterproofing		67000	FINAL	800799.37
94-4: Durability of Concrete Crack Repair Systems		72036.04	FINAL/TERM.	728763.33
"96" Project Series:				
96-1: SUPERPAVE Implementation		60139.25	FINAL/CLOSED	668624.08
96-2: Optimizing GPS Use in Transportation Projects		120000		548624.08
96-3: Effectiveness of Fiber Reinforced Composites as Protective				
Coverings for Bridge Elements, etc.		135000		413624.08
T2 (per 12/2/97 Adv. Committee Mtg.) for 1998 = $10,000		9551.06	FINAL	404073.02
Coord./Admin. of NETC: Calendar Year 1998; Bdgt = $73,021		80422.65	FINAL	323650.37
Member Allocations 1998 = 6 X $75,000	450000			773650.37

Table 2: NETC Fund Balance (As of 12/31/02)				
		ENCUMB/		CUM.
ITEM	**ALLOCATION**	**EXPEND.**	**INVOICE**	**BALANCE**
"97" Project Series:				
97-1: A Portable Method for Determining Chloride Concentration on		96,669.50	Phase 1/FINAL	676,980.87
Roadway Pavements		107,162.00	Phase 2	569,818.87
97-2: Performance Evaluation & Economic Analysis				
of Durability Enhancing Admixtures, etc.		118,473.00		451,345.87
97-3: Determining Properties, Standards & Performance				
of Wood Waste Compost, etc.		43,853.94	FINAL/CLOSED	407,491.93
Alloc. to ConnDOT for Constr. Costs of Test Site (Approved 1/21/99 Ballot)		11,000.00		396,491.93
97-4: Early Distress of Open-Graded Friction Course		57,495.71	FINAL/CLOSED	338,996.22
Travel Tech. Comm. (Aug. 98 tel. poll) for 1998 = $5,000		0.00		338,996.22
Member Allocations 1999 = 6 X $75,000	450,000.00			788,996.22
Coord./Admin. of NETC: Calendar Year 1999:				788,996.22
- Administration = $77,666				
-Technology Transfer & Technical Committee				
Travel = $20,400				
-Total =$98,066		79,101.20	FINAL	709,895.02
"99" Project Series:				
99-1: Bridge Rail Transitions		240,000.00		469,895.02
99-2: Evaluation of Asphaltic Expansion Joints		62,236.00		407,659.02
99-3: Bridge Scour Monitoring Systems		78,523.32	FINAL/CLOSED	329,135.70
99-4: Quantifying Roadside Rest Area Usage		44,857.00		284,278.70
99-6: The Effects of Concrete Removal Operations on Adjacent				
That Is to Remain		96,008.36	FINAL/CLOSED	188,270.34
Member Allocations 2000 = 6 X $100,000	600,000.00			788,270.34
Coord./Admin. of NETC: Calendar Year 2000:		91,899.37	FINAL	696,370.97
- Administration = $ 85,788				
- Technology Transfer & Technical Committee				
Travel =$ 16,800				
- Total =$102,588				
"00" Project Series:				696,370.97
00-1: Ground-Based Imaging and Data Acquisition Systems for		40,818.00		655,552.97
Roadway Inventories in New England - A Synthesis of				
Practice				
00-2: Evaluation of Permeability of Superpave Mixes		95,499.16	FINAL/CLOSED	560,053.81
00-3: Composite Reinforced Timber Guard Rail - Phase I: Design,		83,469.00		476,584.81
Fabrication and Testing				
00-4: Falling Weight Deflectometer Study		100,000.00		376,584.81
00-5: Guard Rail Testing - Modified eccentric Loading Terminal at		61,287.00	FINAL/CLOSED	315,297.81
NCHRP 350 TL2				
00-6: Implementation of Visualization Technologies to Create		74,929.00		240,368.81
Simplified Presentations Within Highway agencies to be Used				
at Public Hearings				

Table 2: NETC Fund Balance (As of 12/31/02)				
		ENCUMB/		CUM.
ITEM	**ALLOCATION**	**EXPEND.**	**INVOICE**	**BALANCE**
00-7: A Complete Review of Incident Detection Algorithms and		45,384.00		194,984.81
Their Deployment: What Works and What Doesn't				
00-8: Performance and Effectiveness of A Thin Pavement Section		150,000.00		44,984.81
Using Geogrids and Drainage geocomposites in A Cold				
Region				
Member Allocations 2001 = 6 X $100,000	600,000.00			644,984.81
Coord./Admin. of NETC: Calendar Year 2001:		104,385.35	FINAL	540,599.46
- 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		50,000.00		490,599.46
01-2: Development of A Testing Protocol for Quality				
Control/Quality Assurance of Hot Mix Asphalt		80,000.00		410,599.46
01-3: Design of Superpave HMA for Low Volume Roads		126,657.00		283,942.46
Note: Additional funding ($26,902) approved 11/19/02				
01-5: Procedures for the Evaluation of Liquid-Applied Membrane		75,000.00		208,942.46
01-6: Field Evaluation of A New Compaction Device		50,000.00		158,942.46
Member Allocations 2002 = 6 X $100,000	600,000.00			758,942.46
NY DOT Allocation = $52,500	52,500.00			811,442.46
Coord./Admin. Of NETC: Calendar Year 2002		123,967.00		687,475.46
- Administration				
- Technology Transfer & Technical Committee Travel				
-Total				
"02" Project Series:				
02-1: Relating Hot Mix Asphalt Pavement Density to Performance		100,000.00		587,475.46
02-2: Formulate Approach for 511 Implementation in New England		84,012.00		503,463.46
02-3: Establish Subgrade Support Values ($M_{r)}$ for Typical Soils in		80,000.00		423,463.46
New England				
02-5: Determination of Moisture Content of De-Icing Salt at Point of Delivery		59,236.00		364,227.46
02-6: Sealing of Expansion Joints		75,000.00		289,227.46
02-7: Calibrating Traffic Simulation Models to Inclement Weather Conditions		74,731.00		214,496.46
with Applications to Arterial Coordinated Signal Systems				
02-8: Intelligent Transportation Systems Applications to Ski Resorts in		60,000.00		154,496.46
New England				
Projected Allocations & Expenditures:				
Member Allocations 2003 = 6 X $100,000	600,000.00			754,496.46
NY DOT Allocation 2003 = $40,000	40,000.00			794,496.46
Coord./Admin. Of NETC Calendar Year 2003 = $124,258		124,258.00		670,238.46

Table 2: NETC Fund Balance				
(As of 12/31/02)				
		ENCUMB/		**CUM.**
ITEM	**ALLOCATION**	**EXPEND.**	**INVOICE**	**BALANCE**
NY DOT Allocation 2003 = $40,000	40000			754,496.46
Coord./Admin. Of NETC Calendar Year 2003 = $124,258		124258		794,496.46
"03" Project Series:				
03-1: Enhancing the Chemical Retention Capacity of A Roadway Runoff Retention		72000		598,238.46
Pond System Using Wood Filters				
03-2: Field Studies of Concrete Containing Salts of An Alkenyl-Substituted Succini		140000		458,238.46
Acid				
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New Englar		30000		428,238.46
03-4: Measuring Pollutant Removal Efficiencies of Storm Water Treatment Units		80000		348,238.46
03-5: Evaluation of Field Permeameter As A Longitudinal Joint Quality Control		75000		273,238.47
Indicator				
03-6: New England Land Grant University Consortium Members Research Challen		103000		170,238.46
03-7 (Alt.): Basalt Fiber Reinforced Polymer Composites		60000		110,238.46
Note: Member FFY allocations are ol	**obligated between October 1**			
and December 31				

E. NETC REPORTS, PAPERS, AND PRESENTATIONS

E1. POLICIES AND PROCEDURES:

"Policies and Procedures, New England Transportation Consortium," July 1995.
"Policies and Procedures, New England Transportation Consortium," April 2002.

E2. 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

E3. 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.

"Wetlands: Problem & Issues," Shuldiner, P.W., University of Massachussetts, 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.

E3. NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

"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.

"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.

E3. NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

"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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002:

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. **Title**

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

Papers and Presentations (cont'd):

"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.

"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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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

Papers and Presentations (cont'd):

"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.

"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.

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):
Project No. Title

N/A **Bridge Rail Crash Test, Phase II: Sidewalk-Mounted Rail**

Reports (cont'd):

"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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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

Papers and Presentations (cont'd):

"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., NETCR19, July 1, 2002.

Papers and Presentations

"Bridge Deck Structural Monitoring Techniques," Huston, D. Presented at the New England State Materials Engineers 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, Stamford, 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. Proc. 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. Proc. 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 Conf. On Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials, Newport Beach, CA, March 1999.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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

Papers and Presentations (cont'd):

"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.

"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.

"Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques," Huston, D., Fuhr, P., Maser, K. and Weedon, W., NETCR19, July 1, 2002.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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 Roads

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

96-1 Implementation of Superpave

Papers and Presentations: None

96-2 Optimizing GPS Use in Transportation Projects

Reports: None

Papers and Presentations: None

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

96-3 Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides

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 Concenteration on Roadway Pavements," Garrick, N., Nikolaidis, N., P. and Luo, J, NETCR17, September 2002.

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 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.

"Performance Evaluation and Economic Analysis of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete for the Northeast U.S.A," Internal Interim Report Prepared for the New England Transportation Consortium, Lafave. J.M., Civjan. S.A., Lovett, D., and Sund, D.J., July 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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

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

Papers and Presentations (cont'd):

"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.

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

Reports: None

Papers and Presentations: None

99-2 Evaluation of Asphaltic Expansion Joints

Reports: None

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.

E4. REPORTS, PAPERS AND PRESENTATIONS 1995-2002 (cont'd):

Project No. Title

99-3 Development Of Priority Based Statewide Scour Monitoring Systems In New England

Papers and Presentations:

"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.

99-4 Quantifying Roadside Rest Area Usage

Reports:

"Quantifying Roadside Rest Area Usage," Garder, P. and Bosonetto, N., NETCR 38, November 27, 2002.

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., NETCR29, January 15, 2002.

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 Anwedungen der Informatik in Architectur und Bauwesen, Germany, June 2000

E4. NETC Reports, Papers And Presentations 1995-2002 (cont'd):

Project No. Title

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

Papers and Presentations (cont'd):

"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., NETCR30, August 2002.

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., NETCR34, July 3, 2002.

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.

003 Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail

Reports: None

Papers and Presentations: None

004 Portable Falling Weight Deflectometer Study

Reports: None

Papers and Presentations: None

005 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., NETCR35, July 2002.

E4. NETC Reports, Papers And Presentations 1995-2002 (cont'd):

Project No. Title

00-5 Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2

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 Assocation of General Contractors/American Road Transportation Builders Association/American Association of State Highway Transportation Officials Task Force 13 meeting in Seattle, Washington in April 2002.

00-6 Effective Visualization Techniques for the Public Presentation of Transportation

Reports: "Effective Visualization Techniques for the Public Presentation of Transportation Projects," MS Thesis, Luo, J., August 2002.

Papers and Presentations: None

00-7 A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn't

Reports: None

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) held in Boston in August 2002.

00-8 Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region

Reports: None

Papers and Presentations: None

01-2 Development of a Testing Protocol for QC/QA of Hot Mix Asphalt

Reports: None

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: None

Papers and Presentations: None

01-6 Field Evaluation of a New Compaction Monitoring Device

Reports: None

E4. NETC Reports, Papers And Presentations 1995-2002 (cont'd):

Project No. Title

01-6 Field Evaluation of a New Compaction Monitoring Device

Papers and Presentations: None

02-2 Formulate Approach for 511 Implementation in New England

Reports: None

Papers and Presentations: None

02-3 Establish Subgrade Support Values for Typical Soils in New England

Reports: None

Papers and Presentations: None

02-5 Determination of Moisture Content of Deicing Salt at Point of Delivery

Reports: None

Papers and Presentations: None

02-7 Validating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems

Reports: None

Papers and Presentations: None

02-8 Intelligent Transportation Systems Applications to Ski Resorts in New England

Reports: None

Papers and Presentations: None