ANNUAL REPORT For

Calendar Year 2015

NEW ENGLAND TRANSPORTATION CONSORTIUM

NETCR102 **January 2018**

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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COORDINATOR

Amanda Hanaway-Corrente
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INTRODUCTION

The New England Transportation Consortium (NETC) is a cooperative effort of the transportation agencies of the six New England States, the six New England state land grant universities and the Federal Highway Administration (FHWA). 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. The Consortium's activities are currently being managed by the University of Vermont Transportation Research Center (UVM TRC), with the Vermont Agency of Transportation (VAOT) acting as the Lead Agency.

The program is intended to supplement, not to replace, ongoing state and federal research activities and other national programs such as the National Cooperative Highway Research Program (NCHRP). To this end, a Memorandum of Understanding (MOU), establishing NETC has been consummated by the six New England state transportation agencies.

The following goals were established for NETC in order to focus the resolve of participating state transportation agencies and universities:

- Implementation of a three-pronged program for the New England region consisting of research and development; technology transfer; and education and training.
- Development of improved methods for dealing with common transportation problems.
- Providing an important source of trained professionals for employment in the Region.

NETC membership now extends to the following agencies: Connecticut Department of Transportation (ConnDOT); Massachusetts Department of Transportation; Maine Department of Transportation; New Hampshire Department of Transportation (NHDOT); Rhode Island Department of Transportation (RIDOT); Vermont Agency of Transportation (VAOT); and, FHWA.

Each of the member state transportation agencies has designated a state university to participate with the state transportation agency in developing and conducting the transportation research program. The following universities have been designated as member universities: University of Connecticut, University of Maine, University of Massachusetts System, University of New Hampshire System, University of Rhode Island, and University of Vermont.

NETC was first established, and work began, in 1986 and, over the years, has undergone a transformative process wherein the management and administrative processes have been under the governance of various governmental and non-governmental organizations. With each change in leadership, the experiential and institutional lessons that have been learned were incorporated into the administration of the program. And so, at the current time, the collective experience of over two decades is now addressed and incorporated in the administration of the NETC program.

In 1984, the Massachusetts Institute of Technology (MIT), the state transportation agencies of five New England states (Maine, Massachusetts, New Hampshire, Rhode Island and Vermont), the American Association of State Highway and Transportation Officials (AASHTO) and FHWA initiated the first transportation pooled fund (TPF) study, administered by RIDOT, to determine the feasibility of establishing a regional consortium. In 1985, the same group of organizations initiated

a second TPF study, again administered by RIDOT, to develop a work program. From 1986 to 1995, various research projects were funded through the NETC program in five funding blocks called "Rounds".

RIDOT was the Lead Agency for the first two pooled fund studies. For the five Rounds, state funds were transferred to AASHTO, the Lead Agency (i.e., Administrative Agency), through FHWA, and a single contract was effected between AASHTO and MIT, the Coordinator. MIT would then enter into a contract with the selected university for a particular research project.

In 1994, ConnDOT stated its intention to participate in NETC and offered to act as Lead Agency. During Federal Fiscal Year (FFY) 1994, FHWA assumed the Lead Agency designation to facilitate the transition process. MIT and AASHTO exited NETC, effective FFY1994. ConnDOT entered NETC, effective FFY1995, and was the Lead Agency until the Vermont Agency of Transportation assumed the responsibility in March 2010.

2015 HIGHLIGHTS

1. **THE FOLLOWING NETC-FUNDED TRANSPORTATION RESEARCH PROJECTS, VALUED AT $1,866,483 WERE ACTIVE AT NEW ENGLAND STATE UNIVERSITIES IN 2015:**

    a. **University of Massachusetts: $1,323,329**
        - Walaa Mogawer (Dartmouth):
            - "Preventative Maintenance and Timing of Applications"
            - "Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology"
            - "HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures"
        - Sergio F. Breña (Amherst): "Development of High-Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections"
        - Chris Ahamdjian (Amherst): "Measuring the Effectiveness of Competency Models for Job-Specific Professional Development of Engineers & Engineering Technicians"
        - Scott Civjan (Amherst): "Investigation of Northern Long-Eared Bat Roosting Sites on Bridges"
        - Yuanchang Xie (Lowell): "Optimizing Future Work Zones in New England for Safety and Mobility"

    b. **University of New Hampshire: $298,154**
        - Jo-Sias Daniel: "In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations"
        - Eshan Dave: "Improved Regionalization of Quality Assurance (QA) Functions"

    c. **University of Connecticut: $80,000**
        - Julia Kuzovkina: "Effective Establishment of Native Grasses on Roadsides"

    d. **University of Maine: $165,000**
        - Roberto Lopez-Anido:"Advanced Composite Materials: Prototype Development and Demonstration"

2. TECHNOLOGY TRANSFER:

a. Requests for Information and Technical Assistance: The NETC Coordinator's office responded to the following requests: There were no requests received during 2015.

b. Conference Attendance and Exhibiting: The NETC Coordinator's office attended the following conferences and events:

- Annual New England Materials & Research Engineer's 26th Annual Meeting: The NETC Coordinator attended this meeting as per the Advisory Committee's recommendation, to keep updated on current research in New England. The NETC also provided sponsorship for the event. (May 2015)

c. NETC Research Project Reports, Technical Papers and Presentations:

- Research Project Reports: There were no research project reports filed in 2015.
- Technical Papers and Presentations: There were no technical papers or presentations in 2014.

PROGRESS OF ACTIVE PROJECTS

PROJECT NUMBER: 06-4

PROJECT TITLE: "Preventative Maintenance and Timing of Applications"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Dr. Walaa Mogawer, P.E. University of Massachusetts Dartmouth

STATUS: Open

AGREEMENT TERM: 9/16/2013 – 9/15/2016

ANTICIPATED COMPLETION: 9/15/2016

PROJECT OBJECTIVES: The purpose of this project is to research existing best practices for pavement preventative maintenance strategies and adapt them to the unique variety of road conditions in New England (different traffic volumes, pavement materials, and northern climates). Additionally this research will attempt to outline pavement maintenance techniques and the inter-relationship with the timing of their application in New England. To meet the purpose of this project, the following objectives have been established:

1. Identify the components of a Pavement Preventive Maintenance (PPM) program.
2. Evaluate the state-of-the-practice relative to agencies (both US and worldwide) that have demonstrated successful implementation of a pavement preservation program. Identify both single treatment and multi-treatment strategies.
3. Use current and past projects as appropriate to evaluate techniques that have been successfully used to effectively extend the life of the pavement.
4. Identify and quantify the factors that influenced the successful implementation of a preservation technique, including time of treatment application in the existing pavement life cycle.
5. Validate the treatment parameters and methodologies using available tests for surface treatments as well as those for conventional flexible pavements (Hot Mix Asphalt mixtures) that might be modified to test these treatments.
6. Determine the approximate cost for pavement preservation technique identified.
7. Develop an implementation pavement preservation manual for distribution to the state and local transportation agencies within the New England states.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- A new contract was prepared for the consultant Mr. David Peshkin.
- The internet survey was completed and responses tabulated.
- Based on survey and other sources, the current state of practice for preventive maintenance in New England was assessed. This was summarized in a chapter to be included in the final report.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 07-1

PROJECT TITLE: "In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jo Sias Daniel, Ph.D., P.E., Department of Civil Engineering, University of New Hampshire

STATUS: Open

AGREEMENT TERM: 7/1/2013 – 3/31/2016

ANTICIPATED COMPLETION: 3/31/2016

PROJECT OBJECTIVES: The main objective of this research is to determine the in-place properties of pavement cross-sections containing recycled materials common to the New England region, and to relate changes in those properties to variations in temperature and moisture. The study will focus primarily on obtaining field data from base layers (as opposed to asphalt surface layers) that have been constructed with different types of unbound or bound recycled layers such as full depth reclamation (with or without stabilizing additives), plant mix recycled asphalt pavement (PMRAP), or foamed asphalt. The research team will work with the NETC advisory board members to identify appropriate field sites where the pavement design is clearly documented and where pavement performance can be linked to factors such as traffic loadings, moisture regimes and freeze-thaw effects. Laboratory testing will also be included to complement the analysis of in-place test data and instrumentation monitoring.

The importance of testing reclaimed layers with Falling Weight Deflectometer, evaluating the response at the different times of the year, and utilizing good practices during mix design and construction have been emphasized by multiple researchers. Based on their conclusions, the following testing and analysis plan is proposed for the study. In order to accomplish this research, five tasks have been established and are broken into two Phases.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- Focus was on FWD testing at the NH and ME sites. The research team has been analyzing the temperature data to determine the appropriate timing for FWD tests at all sites, and several sets of FWD tests have been conducted at each site.
- The data logger at the Waterford site was replaced and the issue with the thermistor string at Warren Flats was resolved. Currently, all four sites are collecting and transmitting data as expected.
- Focus was on FWD testing at the NH and ME sites and analysis of the data. Regular FWD testing has been conducted at all four sites through the spring thaw and recovery period. Several additional FWD tests will be conducted to capture full recovery into the summer period. Analysis of the FWD data has focused on the adjusted center deflection (ACD) and various parameters that can be calculated directly from the deflection measurements. The frost – thaw depth plots with the adjusted center deflection measurements during the spring thaw and recovery period are shown in Figures 1-3 for Auburn, Waterford, and Warren Flats sites, respectively. The deflections increase to a maximum value shortly after full thaw occurs for each section. Gradual recovery has been observed in the Auburn and Warren Flats sites with

the analysis that has been completed to date. The analysis for the Kancamagus site has not yet been completed.

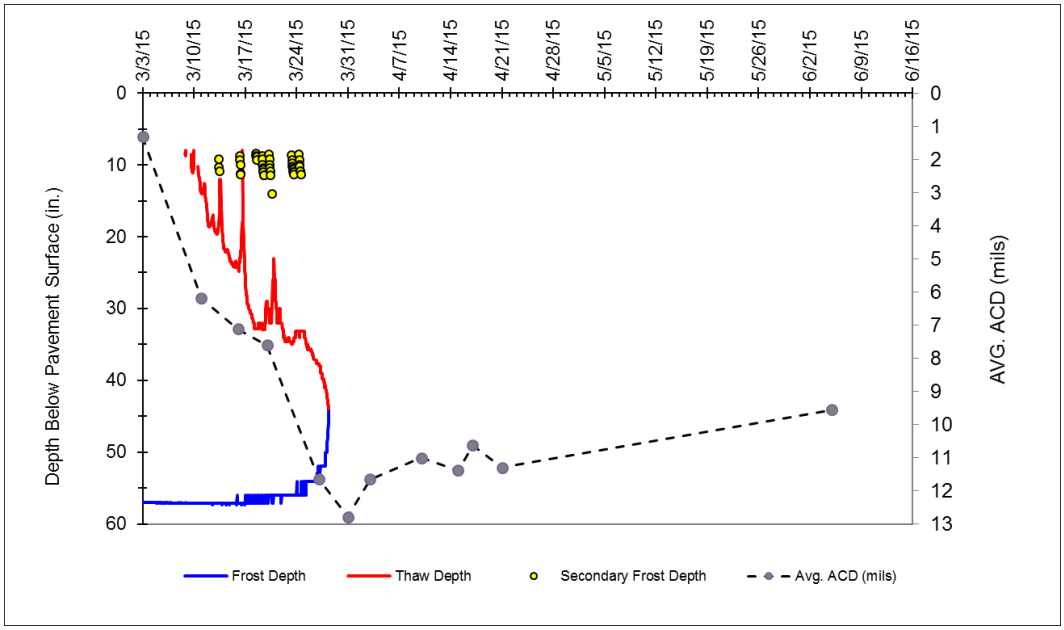

Figure 1 Frost-Thaw Depth and Average Adjusted Center Deflection for Auburn, ME

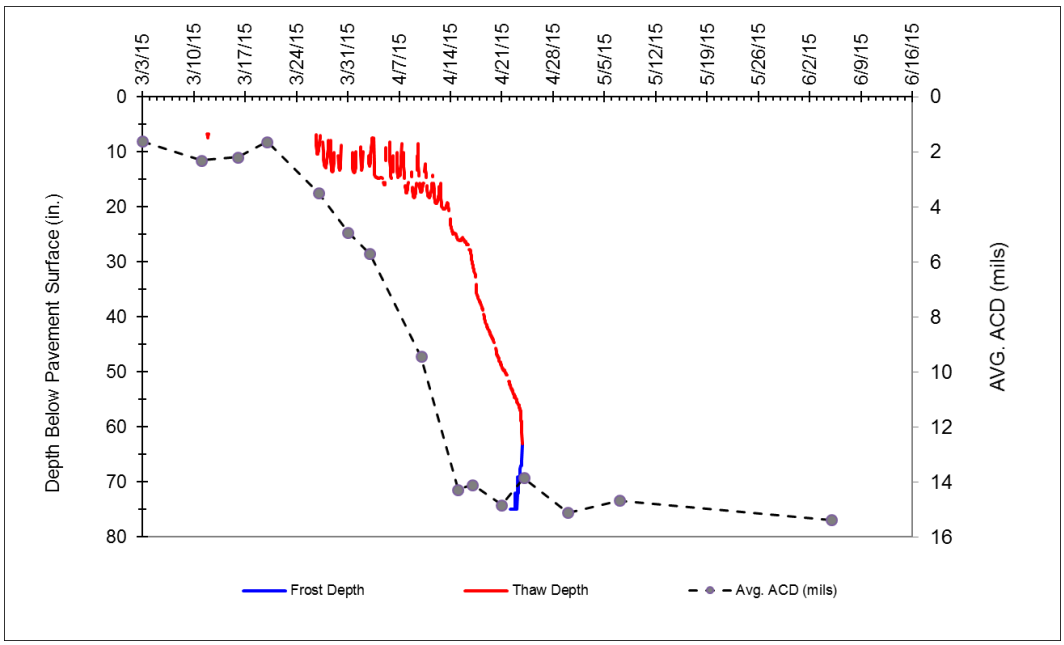

Figure 2 Frost-Thaw Depth and Average Adjusted Center Deflection for Waterford, ME

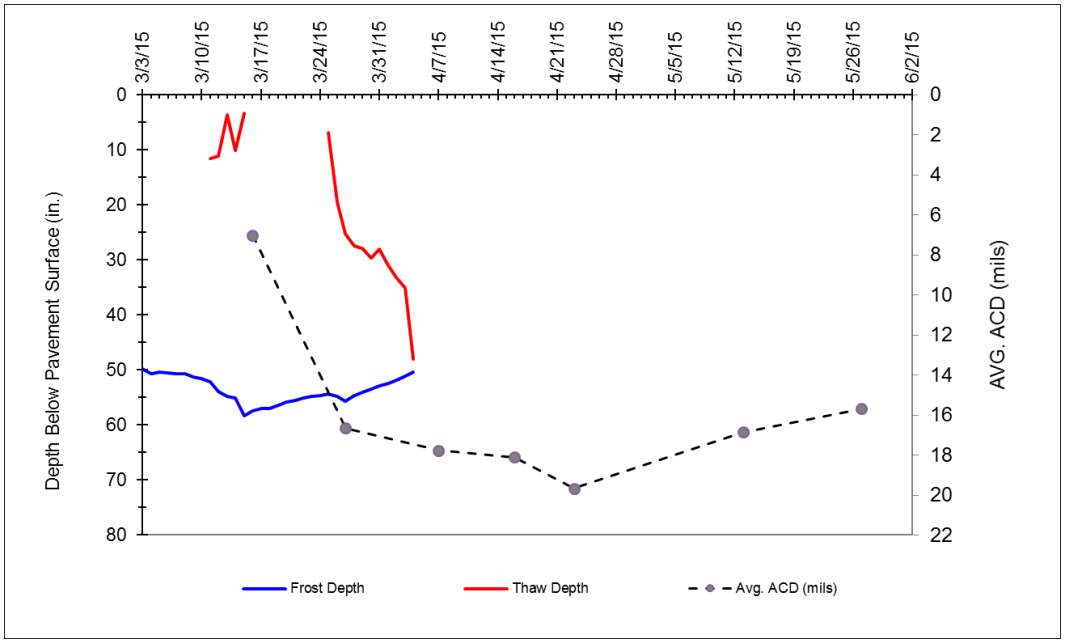

Figure 3 Frost-Thaw Depth and Average Adjusted Center Deflection for Warren Flats, NH

Figures 4-6 show examples of the FWD deflection analysis that the research team is conducting. Figure 4 shows the adjusted center deflection and corrected area parameter for the Auburn, ME site. Figures 5 and 6 show modulus values that are estimated from the measured FWD deflections. Similar plots for the Waterford, ME site were presented during the technical committee meeting on June 9, 2015. Similar analysis for the NH sites is underway.

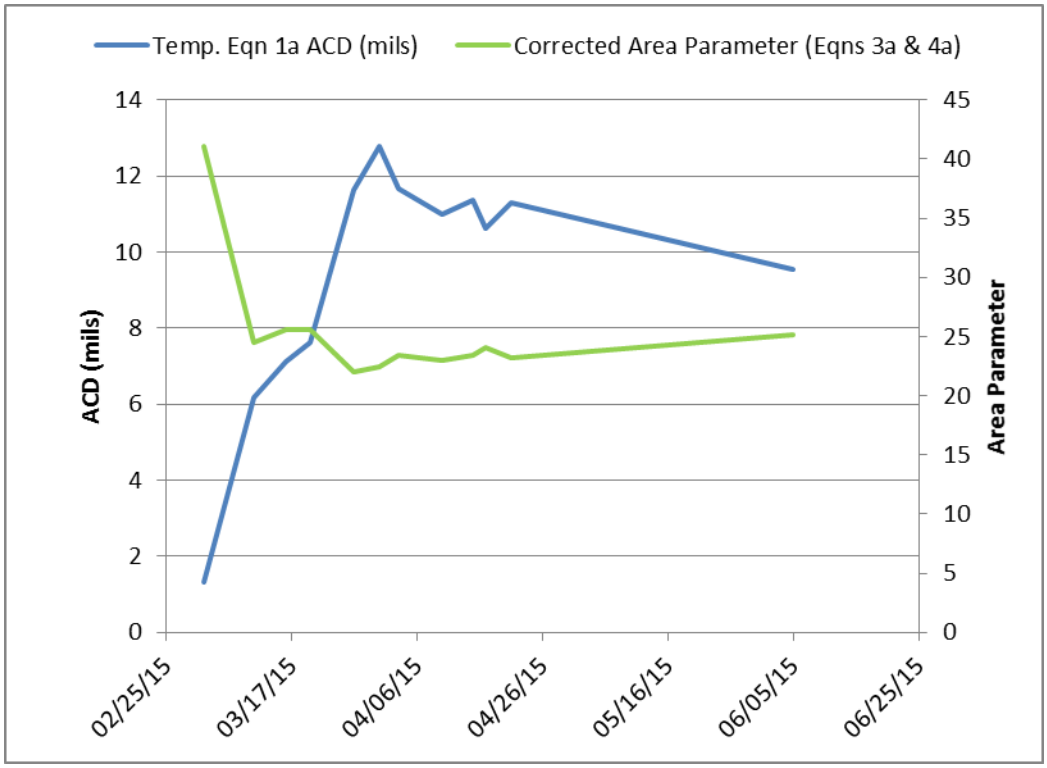

Figure 4 Adjusted Center Deflection and Deflection Area Parameter for Auburn, ME

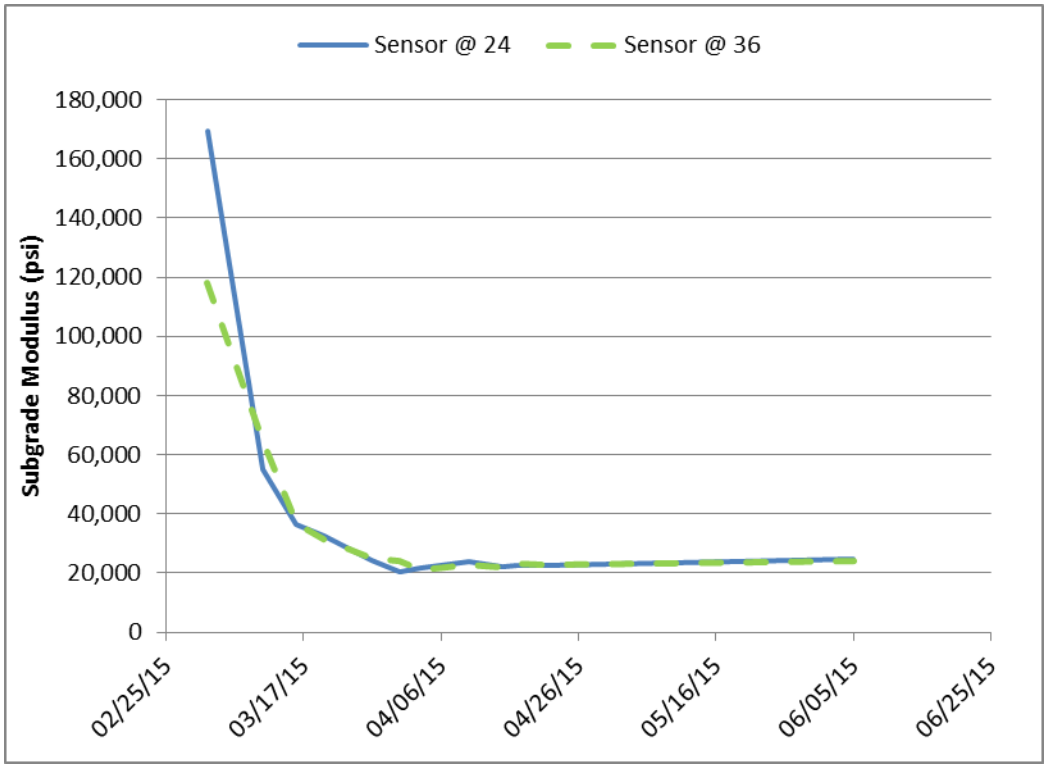

Figure 5 Subgrade Modulus Values Estimated from 24" and 36" FWD Sensors

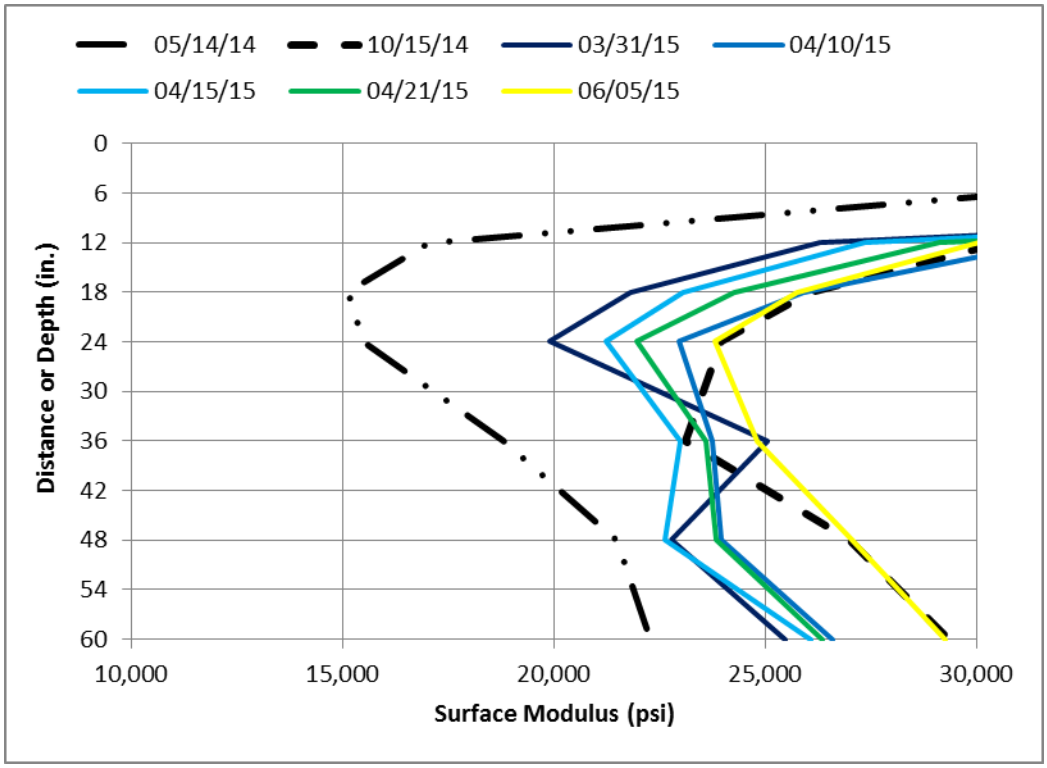

Figure 6 Modulus Values with Depth Estimated from FWD Deflection Measurements

- Focus was on processing and analysis of the FWD test data. The frost – thaw depth plots with the adjusted center deflection measurements during the spring thaw and recovery period are shown in Figures 1-3 for the three Kancamagus sections (similar plots for the other sites were presented in the last quarterly report). Processing of the FWD test data for input to a back calculation software has been completed this quarter. The objective of back calculation will be to evaluate the contribution of different depths during freezing and thawing conditions and examine the modulus over time. The back calculated modulus values will also be compared to modulus values estimated from deflection measurements using available equations..

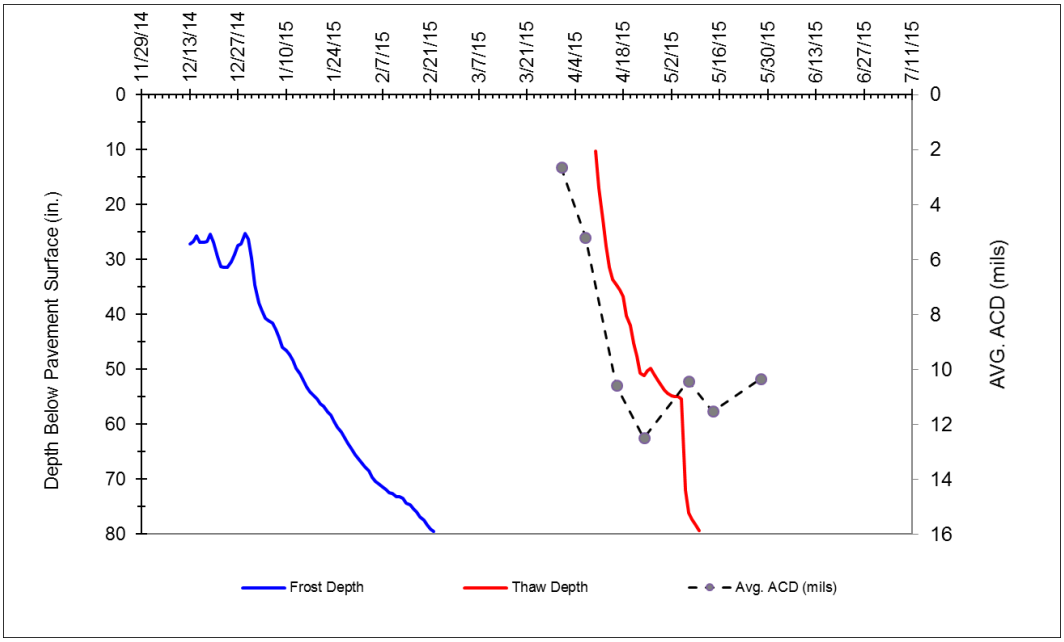

Figure 7 Frost-Thaw Depth and Average Adjusted Center Deflection for Kancamagus Section 1: Conventional Reconstruction

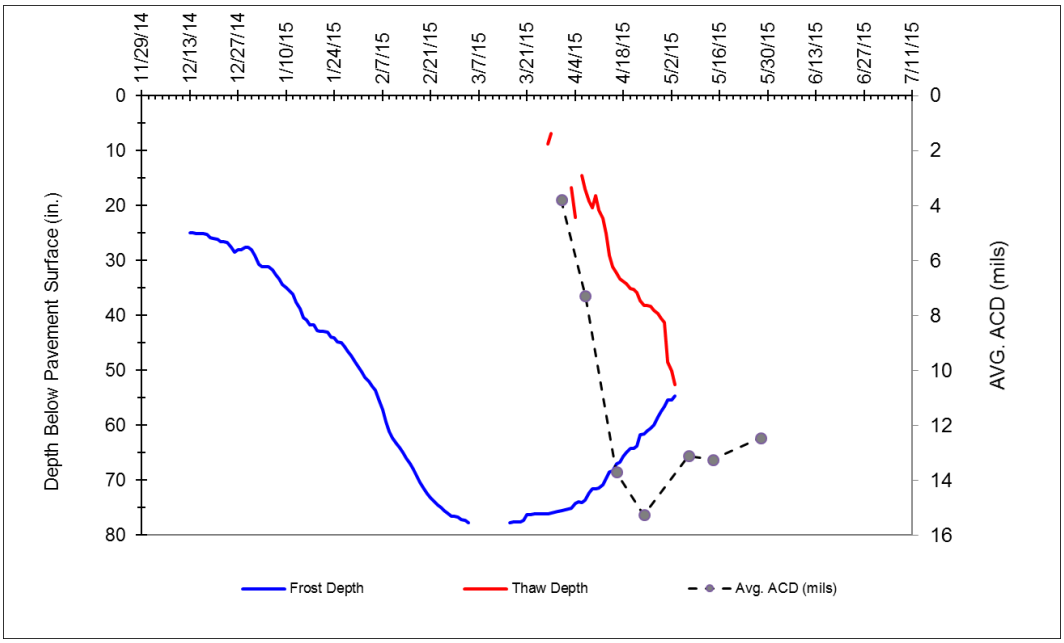

Figure 8 Frost-Thaw Depth and Average Adjusted Center Deflection for Kancamagus Section 2: FDR with Cement Stabilization

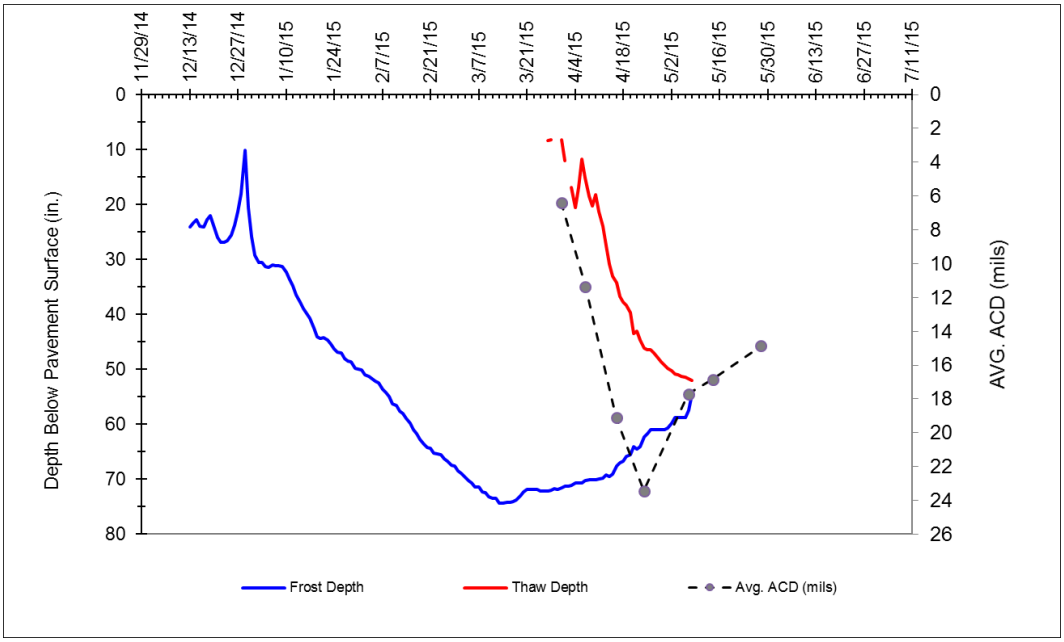

Figure 9 Frost-Thaw Depth and Average Adjusted Center Deflection for Kancamagus Section 3: FDR without Cement Stabilization

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 09-2

PROJECT TITLE: "Effective Establishment of Native Grasses on Roadsides"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):

- Julia Kuzovkina, Cristian Schulthess, Robert Ricard, Department of Plant Science and Landscape Architecture, University of Connecticut, Storrs, CT
- Glenn Dryer, Director, Connecticut College Arboretum, New London, CT

STATUS: Open

AGREEMENT TERM: 9/1/2013 – 2/28/2016

ANTICIPATED COMPLETION: 2/28/2016

PROJECT OBJECTIVES: To build a comprehensive knowledgebase for a gradual transition toward sustainable native roadside vegetation cover which will support transportation goals for safety and infrastructure reinforcement while providing economic, ecological and aesthetic advantages. The direct deliverables to the New England Departments of Transportation include the Manual with guidelines for the effective establishment of native grasses on roadsides in New England and a model for an accelerated adoption and commercialization of this novel ecological restoration approach.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

Survey and Interviews:

- January 6, 2015 – interviewed the Massachusetts DOT
- Throughout January-February 2015: The attempts to schedule a visit to interview the Vermont DOT managers were unsuccessful (contacted 8 times Bill Ahearn and his colleagues by e-mail and phone).
- March 2015: The decision was made to proceed with the interview analyses without input from Vermont. The complete transcripts for 5 states, visited during October-January, were prepared and analyses were completed. The write-up is in preparation.
- The write-up of the interviews of the 5 New England DOT is in progress.

Establishment of the new demonstration sites along Rt. 6:

- April 2015: CT DEEP was contacted to assist with the Truax drill and to provide an operator for the establishment of one demonstration site.

Establishment of the demonstration sites along Rt. 6:

- May 7, 2015 and May 15, 2015 – new demonstration sites were sprayed with RoundUp non-selective herbicide
- May 21, 2015 – some demonstration sites were mowed and raked
- May 22, 2015 – a new trial for the establishment of the little bluestem with was planted using topsoil, hydromulch, straw, clayballs and sawdust at the site #1 along Rt.6.
- May 28, 2015 – a site #2 was planted with the Truax seed drill

- May 22, 2015 all sites along Rt. 6 were visited with Rebecca Brown (University of Rhode Island) to consult about the establishment of native grasses.
- By-weekly site inspections were conducted throughout June to observe the germination and establishment rates.

Maintenance of the demonstration sites along Rt. 6

- Discussion of the treatments for field installation in spring 2015 is in progress.
- During July1-September 30:
    - Kuzovkina and Campanelli conducted weekly visits to the three sites to evaluate the germination rates of newly planted plots along Rt. 6.
    - Maintenance of the plots with grasses and forbs to control weed pressure. Applications of Round Up and Plateau to the newly established small plots along Rt.6.
- July8: Campanelli visited Ernst Conservation Co to discuss various protocols for the production of native grasses and forbs.
- September 9-11: Campanelli visited Iowa DOT Native Grass Establishment Program
- September 15-17: Campanelli participated in the National Vegetation Management Association Conference (Roanoke, Virginia)
- September: preparation for the DOT workshop and Field Day "EFFECTIVE ESTABLISHMENT OF NATIVE GRASSES AND FORBS ON ROADSIDES"
- 28 attendees included New England state Department of Transportation managers and representatives from Northeast native nurseries, including Arch(E)Wild, Earth Tones, and New England Wetland Plants
- Presentations and Discussions included the following topics: • Effective methods for establishing and maintaining warm season native grasses and forb meadows along roadsides • Ecological, environmental, and economic benefits of native warm-season meadows vs cool-season turf grasses • Proper site preparation and the control competition from weeds and cool-season grasses • Decreasing fuel costs and emissions with reduced mowing • Designing seed mixes • Importance of creating seed banks of local New England native plant ecotypes • Building pollinator habits • Benefits of meadows for stormwater runoff management.
- Campanelli planted cover crops to prevent weed competition on hillsides along Route 6 demonstration sites following the removal of invasive species by CT DOT.
- After attending the Pollinator Partnership Conference from October 20th to 22nd, Campanelli participated on the Forage, Nutrition and Roadsides Task Force. He headed the Roadside Task Force's creation of a website that acts as a clearinghouse for information for state DOTs for the establishment of roadside pollinator habitats. He also participated in the creation of two yearly awards that acknowledge innovative programs for increasing pollinator habitats by state DOTs and public-private partnerships.
  Campanelli participated on December 2nd at New England Grows, giving a Sprint Session lecture on the establishment of native grasses and forbs and answering questions about his work at the Ask Extension booth.
  November-December: preparation of the Manual.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 09-3

PROJECT TITLE: Advanced Composite Materials in New England's Transportation Infrastructure: Design, Fabrication and Installation of ACM Bridge Drain System

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Dr. Roberto Lopez-Anido P.E. University of Maine's Advanced Structures and Composites Center

STATUS: Open

AGREEMENT TERM: 9/1/2013 – 8/31/2015
ANTICIPATED COMPLETION: 8/31/2015

PROJECT OBJECTIVES:

1. Design and fabricate a standard FRP drain that can be produced economically for use throughout New England bridges; and
2. Install the fabricated drain system in two to three representative bridge applications in New England to provide information on its performance, ease of construction, and cost.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- Task 4 – Product validation: baseline mechanical properties and durability The laboratory tests to assess environmental durability and generate mechanical properties for the three vendors (Kenway, ACO, and Grace Composites – FRP Bridge Drain Pipe) were completed. Draft reports summarizing baseline mechanical properties and durability performance based on coupon tests for three vendors were submitted to the Technical Committee.
- Tasks 5 and 6 - Document installation of FRP drains in bridges Contacted MaineDOT to coordinate the monitoring of the Westbrook Bridge FRP drains installation, which is scheduled for construction in the Fall.
- Two teleconferences were held with the Project Technical Committee on May 20th and June 24th.
- The installation of FRP drains was documented at the Union Street westbound overpass bridge in Bangor, ME on June 3rd. The bridge visit was coordinated with the AASHTO Domestic Scan Team.
- A Dropbox folder was setup to share technical information with the Project Technical Committee.
- Task 4 – Product validation: baseline mechanical properties and durability The draft reports summarizing baseline mechanical properties and durability performance based on coupon tests for three vendors were reviewed with the Technical Committee.
- Tasks 5 and 6 - Document installation of FRP drains in bridges Contacted MaineDOT to coordinate the inspection of FRP drains installation in three bridges: 1) Westbrook Bridge, 2) Howland-Enfield Bridge, and 3) Union Street Eastbound Overpass Bridge. Develop an inspection protocol for FRP bridge drains.
- Conducted mechanical property and durability tests for Task 4 - Qualification of FRP drain suppliers through material testing.
- Planned inspection of FRP bridge drains.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 10-3

PROJECT TITLE: "Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Professor Walaa S. Mogawer, PE, F.ASCE, Highway Sustainability Research Center (HSRC), University of Massachusetts

STATUS: Open

AGREEMENT TERM: 9/16/2013 – 9/15/2015

ANTICIPATED COMPLETION: 9/15/2015

PROJECT OBJECTIVES: The research project will evaluate the moisture susceptibility and low temperature cracking properties of RAP mixtures produced with WMA technologies. Plant mixtures produced with varying RAP contents and warm mix technologies will be sampled. Laboratory testing will include an evaluation of mixtures susceptibility to moisture damage using one or more of the following tests: (1) AASHTO T324 "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)", (2) AASHTO T-283 "Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage", and (3) ratio of wet to dry dynamic modulus measured at 20ºC. The test(s) selection will be based on the literature review conducted under Task 1. Also, the low temperature cracking susceptibility will be evaluated using the following two tests: (1) AASHTO TP10-93 "Standard Test Method for Thermal Stress Restrained Specimen Tensile Strength (TSRST)" and (2) AASHTO T322 "Standard Method of Test for Determining the Creep Compliance and Strength of Hot Mix Asphalt (HMA) Using the Indirect Tensile Test Device." Additional testing will include evaluating the effect of the different WMA technologies on the workability of the mixtures and evaluating the degree of blending between the RAP binder and the virgin binder using a procedure developed by Bonaquist.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- UMass Dartmouth contacted Tilcon CT about reproducing the mixtures produced in October 2014 that did not meet the required volumetric properties.
- UMass Dartmouth contacted the other contractor (Palmer Paving) who agreed to produce mixture for this study. This contractor stated that they will produce the mixtures in April or May 2015.
- An additional contractor was contacted (PJ Keating) to determine if they would help with producing the mixtures for this study in the event one of the selected contractors cannot supply the mixtures.
- The survey for Task 2 was distributed to the technical committee for comments. Comments were received and incorporated. The PI obtained a list of regional contacts consisting of both agency and industry members for distribution of the survey.
- The participating contactor (Aggregate Industries Wrentham, MA) produced the mixtures for this study on 11-13-15. The following 12.5mm SSC (100 gyration) mixtures were produced using the contractors drum plant and a PG64-28 binder:
    - 12.5mm with 15% RAP (typical mixture) + 0.5% SonneWarmix (Liquid) WMA
    - 12.5mm with 27.8% RAP (1.5% binder replaced) + 0.5% SonneWarmix (Liquid) WMA

    - 12.5mm with 46.3% RAP (2.5% binder replaced) + 0.5% SonneWarmix (Liquid) WMA
- Please note that SonneWarmix was the only WMA technology utilized by the contractor at the time of production.
- A loader bucket of each mixture was dropped in a safe location and mixture samples were appropriately collected. Temperature measurements were taken in the pile of each mixture.
- The moisture contents of the aggregate and RAP stockpiles were measured by the contractor prior to production. The results are shown at the bottom of the attached table. It should be noted that these moisture contents were generally higher than those noted for the dry run trial performed in September 2015. A total rainfall of approximately 0.4 inches was noted in the three days prior to production at a weather station near the plant. The RAP stockpiles at the plant were covered and only a slight increase in moisture content from 1.4% to 1.6% was noted since the dry run trial in September 2015.
- The moisture content of each mixture was tested immediately at the contractor's facility after sampling. Moisture content of each mixture was determined in accordance with AASHTO T329. The results are shown in the attached table. The total moisture content in the mixture was below 0.16% for all the mixtures.
- Laboratory verification and testing of the plant produced mixtures commenced.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 13-1

PROJECT TITLE: "Development of High Early-Strength Concrete for Accelerated Bridge Construction Closure Pour Connections"

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

STATUS: Open

AGREEMENT TERM: 9/1/2014 – 4/2/2016

ANTICIPATED COMPLETION: 8/31/2016
A no cost extension is expected to be requested to accommodate the current coordination contract that NETC has with the University of Vermont. The proposed project was for 24 months.

PROJECT OBJECTIVES: To develop and validate concrete mixtures capable of developing high early strength without detrimentally affecting their long-term durability. The mixtures are for use in projects using accelerated bridge construction methods.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:
Task 1: Literature Search

- Progressed on written summary of the literature review including main findings of relevant research reports, technical papers and survey responses.
- Performed additional literature review to obtain research reports and technical papers to assist in further development of mix design trial batches.
- Performed literature review as necessary to obtain research reports and technical papers to assist in further development of mix design trial batches.

Task 3: Develop Mix Design

- Tested 7 concrete mix deign trial batches initially based off of a state-of-practice mix design, and compared test results using compressive strength tests on 4 by 8 in. cylinders and workability. The adjustments made to the state-of-practice mix design throughout the 7 trial batches include decreased maximum coarse aggregate size, elimination of fly ash, modification of admixture quantities and variation of the water-to-cement ratio.
- Developed new base mix design using proportioning specified in ACI 211.4-R: Guide for Selecting High-Strength Concrete Using Portland Cement and Other Cementious Materials.
- Developed a mix design based on proportions from ACI 211.4R; 4 trial batches were tested based off of these initial proportions. The coarse and fine aggregates were adjusted in order to improve strength and workability.
- The optimal ratio of coarse aggregate to fine aggregate in terms of maximum compaction was determined.
- Using the *w/cm* ratio specified in ACI 211.4R, and the maximum compaction of aggregates, a series of trial batches were tested to find the optimum volume of paste to volume of voids ratio.
- Based on the *w/cm* ratio specified in ACI 211.4R, the maximum compaction of aggregates and the optimum volume of paste to volume of voids ratio, various fly ash replacement quantities (Class C and Class F) were tested.
- The *w/cm* ratio and fly ash class and quantity are currently being adjusted to determine the

final trial batch mixture before moving on to additional testing.

- Adjusted the w/cm ratio and adjusted the fly ash class and quantity to determine the final trial batch mixture before moving on to additional testing.
- Added accelerating admixture in an attempt to increase compressive strengths of trial batches as needed. Inconsistent compressive strength results were found with the use of accelerating admixtures; therefore, test results using accelerating admixtures cannot be deemed accurate in small scale batches used for this project.
- A combination of maximum coarse aggregate sizes used to smooth the aggregate gradation curve in order to reduce concerns related to segregation of trial batches.

Task 4: Test Mixture

- Shrinkage test (AASHTO PP 34-99) setup has been fully designed and fabricated nearly to completion.
- The set time test (AASHTO T197 / ASTM C403) and the slump test (AASHTO T119 / ASTM C143) were performed on each trial batch starting at the beginning of the quarter.
- Shrinkage test (AASHTO PP 34-99) setup has been fully designed and fabricated. The test setup is ready for the shrinkage test to be performed.

- Began a written summary of the literature review including main findings of relevant research reports, technical papers and survey responses.
- Tested preliminary concrete mix designs and compared test results using compressive strength tests on 4 by 8 in. cylinders and workability of each trial batch.
- Adjusted existing concrete mix design specifications based on preliminary test results; design specifications will continue to be modified throughout the duration of the project.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 13-2

PROJECT TITLE: "HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Professor Walaa S. Mogawer, PE, F.ASCE, Highway Sustainability Research Center (HSRC), University of Massachusetts

STATUS: Open

AGREEMENT TERM: 6/1/2014 – 5/31/2016

ANTICIPATED COMPLETION: 5/31/2016

PROJECT OBJECTIVES: The goal of this research is to evaluate plant-produced HMA mixtures that contain RAS to identify the critical material properties and plant operations needed to produce RAS mixtures with fatigue and low temperature cracking properties equivalent (or better than) typical mixtures that are produced. Research objectives:

1. Determine the current state-of-practice for recycled shingle usage in paving mixtures.
2. Locate regional asphalt mixture producers in New England with capabilities and willingness to produce mixtures incorporating RAS for this study. From this list of producers, select producers so that both batch and drum plant are utilized for production.
3. Assist the selected producers in evaluating the properties of the RAS and RAP to be used in production.
4. Construct a matrix of mixtures that will be produced. An all-virgin material control mixture, 5% RAS mixture and a 5% RAS + RAP mixture will be designed.
5. Assist the selected producers in developing laboratory mixture designs utilizing RAS that meet the required volumetric criteria.
6. Produce the mixtures using a batch plant and drum plant. Produce mixtures assuming 100% blending of the RAS and virgin binder and at the calculated actual RAS binder contribution.
7. Sample the mixture at the plant and verify volumetric properties. Mixtures not meeting the volumetric properties should be produced again with alteration to the production parameters (use higher temperatures, longer silo storage or increased mixing times).
8. Construct a matrix for evaluating the performance of the mixtures with emphasis of low temperature and fatigue cracking. The matrix should contain a component to evaluate the effect of aging on the degree of blending between aged and virgin binders.
9. Identify critical material properties and plant operations that yield RAS mixtures with performance properties equivalent to typical all-virgin material mixtures.
10. Develop a guideline for the use of RAS in virgin and RAP mixtures.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- UMass Dartmouth continued to contacted several producers of asphalt mixtures in New England about their availability and willingness to participate in the study. Finally, one contractor stated that his company will help the research team with the study.
- Work commenced on the literature review for this project.
- A kickoff meeting with project update was held on Friday October 16th, 2015 via online meeting software. A brief presentation of the project on a task-by-task basis was conducted. The current progress to date and problems encountered was also discussed. The representative from Massachusetts asked why a 12.5mm mixture was selected over a 9.5mm mixture as a 9.5mm mixture typically has a larger binder content which would assist in the use of more RAS. The project PI responded that this mixture was selected by the contractor assisting producing the

mixtures for this study with RAS. No other questions were presented. The PI will schedule another update meeting for winter 2015/2016. The PI also emailed a copy of the presentation to the committee at the conclusion of the meeting.

- The survey for Task 3 was distributed to the technical committee for comments. Comments were received and incorporated. The PI obtained a list of regional contacts consisting of both agency and industry members for distribution of the survey.
- Testing continued on the virgin aggregates, RAS, and RAP stockpile materials related to the 12.5mm mixture identified by the contractor assisting producing the mixtures for this study (Task 5). The contractor only utilizes one source of RAS which is manufacturers shingle waste (MSW).
- Based on the testing of stockpile materials, four 12.5mm mixtures were developed with similar gradations (Task 6). The mixtures were:
  - Control mixture using all virgin materials
  - Control mixture incorporating 15% RAP (Typical)
  - Control mixture incorporating 5% RAS (Using the MSW RAS Source)
  - Control mixture incorporating 5% RAS and 15% RAP (Using the MSW RAS Source)

  Note for the second and a fourth mixture that 15% RAP contents were used as it is the amount typically utilized by the contractor for this 12.5mm mixture.

- Volumetric verification of each of the developed mixtures was completed using the same PG64-28 binder that the contractor intends to use during production. Verifications were completed assuming 100% contribution of RAS and/or RAP binders.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 13-3

PROJECT TITLE: "NETC 13-3"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Eshan V. Dave, University of New Hampshire

STATUS: Open

AGREEMENT TERM: 3/27/2015 – 3/31/2016

ANTICIPATED COMPLETION: 3/31/2016

PROJECT OBJECTIVES:

1. Review of current QA process used by New England DOTs for precast and prestressed concrete elements (PCE/PSE).
2. Review of QA specifications for PCE/PSE.
3. On the basis of the review and through working with the technical review committee of the project, develop common acceptance standards for PCE/PSE to be used by NETC constituents.
4. Develop a cost-sharing mechanism to accompany the common acceptance standards.
5. Identify agencies and contractors to conduct pilot implementation of the common acceptance standards.
6. Develop a list of additional materials and services for which common acceptance standards might be beneficial and feasible.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- The final contract execution for this research study occurred just before the end of the quarter, thus it was not possible to make significant progress on this research study. However, during this past quarter the researchers collected the information on the QA process of PCE/PSE form all constituent states. The information is currently being processed to develop the state of the practice review.
- During this past quarter good progress was made in this study. The researchers reviewed a number of specifications and QA process documents from various New England State DOTs as well as continued the literature review on the topic. The project kick-off meeting was held at University of New Hampshire on April 30th. The meeting aided in refining the research activities and also aided in making initial contact with the various DOT personnel involved with the study. The meeting also helped refine the interview questionnaire prepared by researchers.
- Co-PI of the project is also involved in developing inspector training course for NETTCP for PCE/PSE. The pilot for this course was taught during this quarter and was attended by the student working on the project.
- During this quarter the researchers visited three DOTs (NH, ME and RI) as part of the QA process reviews through interview of DOT engineers and QA inspectors. All interviews have already been transcribed and the information is being processed towards developing a common acceptance standard for PCE/PSE.
- Completion of the DOT QA personnel interviews as well as visits to PCE/PSE fabricators in New England. The data collected through literature review, review of specifications and QA manuals, interview of New England agency engineers and QA inspectors, and interview of PCE/PSE

fabricators was compiled and analyzed. The analysis focused on evaluating the similarities and differences between the current agency practices.

- A highlight of findings from review of QA processes for PCE/PSE of the New England DOTs are as follows:
    - Large number of PCE/PSE fabricators supply elements to multiple New England states
    - For PSE, producer qualification requirements are comparable between different New England states. For PCE there are some differences, some states allow PCI plant certification also for PCE whereas, others prefer NPCA certification.
    - There is a full spectrum of QA inspector types in New England in terms of agency employee versus consultant QA inspector usage. On basis of the current consultant inspection contracts, the range of cost per hour per inspector is found to be from $50 to $100. The lower range does not include travel reimbursement which is paid separately.
    - The pre-pour inspection processes amongst the states were found to be comparable.
    - The plastic testing was similar amongst the states as they all require the necessary tests to ensure the quality of the mix. However, the frequencies of these tests were found to vary significantly amongst the state agencies. It was found that the frequency of testing ranged from testing per sub-lot (typically defined as one element) to a consistency based sampling frequency.
    - The majority of the states require inspectors to be present for the destressing of prestressed elements.
    - The requirements between states are not similar in the number of compressive strength cylinders that were required to be cast and tested. Also, all states conduct 28 day strength testing, but some require additional testing, such as 56 day strength measurements by Massachusetts. Furthermore, only two states currently have requirements in place to determine durability of concrete in terms of permeability through rapid chloride ion permeation (Maine) or surface resistivity testing (New Hampshire).
    - The post-pour inspection processes were found to be also very similar amongst the states.
    - All agencies allow accelerated curing of precast elements. Majority of agencies do not specify controls associated with curing conditions, internal temperature etc. (Maine being only exception).
    - A few currently utilized practices as well as some that are currently under implementation at various DOTs could really aid in implementation of the unified QA process between New England DOTs. For example, use of RFID (Radio Frequency Identity) tag with cloud based data-storage system that is being evaluated by MassDOT could serve as a vehicle for management of information and the use of "Shift Planning" system used by VTrans can make it streamlined to keep database of eligible inspection personnel in the region, their availability as well as tracking of their work hours.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015:
None thus far.

PROJECT NUMBER: 14-1

PROJECT TITLE: "Measuring the Effectiveness of Competency Models for Job Specific Professional Development of Engineers & Engineering Technicians"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Chris Ahmadjia, UMass Amherst

STATUS: Open

AGREEMENT TERM: 3/1/2015 – 4/2/2016

ANTICIPATED COMPLETION: 9/2/2016

PROJECT OBJECTIVES:

1. To identify and review existing Competency Models (CM) and matrices that can help in the development of a DOT specific competency model
2. To perform a gap analysis on the existing CM's and matrices to create a DOT specific employee competency matrix
3. To create a CM framework for each of the NETC member states
4. To run a pilot program in one of the NETC member states
5. To determine the financial benefits (return on investment) of having a CM in place
6. To create an implementation plan and technology transfer strategy for the research results
7. To deliver a final report (as required in Task 5)

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- The kickoff meeting was held on 9/25/15.
- The technical committee discussed the goals of the project, scheduling, and progress on Tasks 1 and 2.
- The planned schedule is for completion of:
    - Task 1 by March 2016.
    - Tasks 2 and 3 – Determine Gaps and Develop a CM Framework - by July 2016.
    - Task 4 – Pilot Program – by October 2016.
    - Task 5 – Final Report – By December 2016.
- Task 1 involves researching existing competency models and matrices. A number of articles and references have been found; however, specific models for DOT's have been more difficult to identify than anticipated. Work on Task 1 will continue.
- Task 2 involves determining gaps in existing competency models. The technical committee agreed that a good first step would be to propose standard employment classifications for both technicians and civil engineers within a DOT. The competency model developed will then be based on those standard classifications. Research on existing grades within DOT's is underway. A proposal on standard grades is scheduled for our next technical committee meeting, which will be in February.
- Maine offered to host the pilot Program.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015:

None thus far.

PROJECT NUMBER: 14-2

PROJECT TITLE: "Investigation of Northern Long-Eared Bat Roosting Sites on Bridges"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Scott A. Civjan (PI) – University of Massachusetts Amherst, Elizabeth Dumont (Co-PI) – University of Massachusetts Amherst, Alyssa Bennett (External Research Associate) – VT Fish and Wildlife department

STATUS: Open

AGREEMENT TERM: 2/1/2015 – 4/2/2016

ANTICIPATED COMPLETION: 4/2/2016

PROJECT OBJECTIVES:

The main objective of the proposed research project is to develop a screening tool and to demonstrate its accuracy in determining the presence of NLEB roosting in New England bridges. Additional information will be collected and disseminated related to preferred structural types for bat roosting, New England bat population distributions and evaluation of existing public data already collected by State Fish and Wildlife Departments and Transportation Agencies throughout New England.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

- Kick –off meeting on May 18, 2015
- Literature review completed including searches in databases, web searches and contact with researchers and relevant organizations
- Phone interviews with Fishery and Wildlife, DOT and other organization personnel completed
- Joined and posted inquiries regarding bats in bridges to relevant listserv groups
- Acoustic monitoring equipment ordered and partially received
- Infra-red camera ordered and received
- Miscellaneous supplies purchased for field work
- Advertising, interviewing and hiring of two undergraduate research assistants completed
- Training by Alyssa Bennett completed for Scott Civjan, Angela Berthaume and Helen Yurek
- Initial use of acoustic monitoring equipment at VT bridge site known to have active bat roosting.
- GIS software set up to integrate maps with National Bridge Inventory to determine routes for visual screening and instrumentation
- Rapid visual screening of over 70 bridges in VT, NH, RI and MA to evaluate for signs of roosting to narrow down instrumented structures
- Acoustic monitoring equipment and software received
- Infra-red software received
- Miscellaneous supplies purchased for field work
- GIS software used to integrate maps with National Bridge Inventory to determine routes for visual screening and instrumentation
- Completed Rapid Visual Screening of 182 bridges in VT, NH, RI, ME and MA to evaluate for signs of roosting to narrow down instrumented structures and evaluate structural characteristics of regional bridges and likelihood of roosting
- Selected 15 bridges for monitoring in Summer 2015
- Acoustic monitoring of 15 bridges during maternity roosting season

- Acoustic monitoring of 15 bridges during post-maternity roosting season
- Preliminary evaluation of thermal imaging camera and data from one bridge
- Initial screening of data
- Initial reporting of bridge characteristics including signs of structural causes of staining and signs of possible bat roosting

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

PROJECT NUMBER: 14-4

PROJECT TITLE: "Optimizing Future Work Zones in New England for Safety and Mobility"

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Yuanchang Xie, Nathan H. Gartner, and Chronis Stamatiadis, University of Massachusetts Lowell

STATUS: Open

AGREEMENT TERM: 7/6/2015 – 7/5/2017

ANTICIPATED COMPLETION: 7/5/2017

PROJECT OBJECTIVES: Given the aging infrastructure and the anticipated growing number of work zones in New England, it is of utmost importance to optimize their layouts to improve safety and to mitigate their impact on mobility. This study aims to use the Transportation Research Board's SHRP2 Naturalistic Driving Study (SNDS) data for investigating driver behavior in work zones under different traffic, lighting, and weather conditions. In addition, data from the smart work zones (SWZs) in Massachusetts (and other New England states if available) to validate the findings obtained from the analysis of the SNDS data is also proposed. Based on the analysis of the SNDS and SWZs data, improved work zone TTCPs will be developed. These TTCPs will be evaluated using an advanced driving simulator and a microscopic traffic simulation tool. The main objectives of this study include:

- **Literature Review:** A focused review on work zone safety will be conducted.
- **SNDS Data Analysis**: Critical factors that may potentially affect (either positively or negatively) driver behavior in work zones under various conditions will be reviewed and analyzed based on the SNDS data. These factors may include traffic signs, variable message signs, law enforcement, work zone layout, etc.
- **Identify and Quantify Strategies:** The identified factors will be further examined and tools will be developed to quantify these factors' impacts on three key aspects of improving work zone safety: reducing speed, maintaining safe distances, and preventing driver distraction. In addition, the impacts of these factors on reducing near crash events will be studied. Investigating near crash events and driver behavior/maneuvers immediately prior to them will allow us to better understand how work zone crashes occur.
- **Proposed Work Zone Control Plans**: Based on the SNDS data analysis results and a review of work zone control strategies, new and improved work zone TTCPs will be developed.
- **Validate the Results**: Field data collected from smart work zones (SWZs) in Massachusetts (and other New England states if available) will be used to evaluate the performance of certain work zone TTCPs. If there is a match between the SWZs and the work zones in the SNDS data, the corresponding data sets will be compared both quantitatively and qualitatively. In addition, an advanced driving simulator and a microscopic traffic simulator will be used to evaluate the safety and mobility performance of various work zone layouts and controls. Extensive driving simulator studies will be conducted to evaluate how drivers respond to different work zone layouts and controls.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2015:

A total of seven tasks have been identified for the proposed study, which are 1) literature review; 2) development of Temporary Traffic Control Plan (TTCP) metrics; 3) development of methodology

for testing and analyzing TTCPs; 4) development of new TTCPs; 5) evaluation of new TTCPs through simulation; 6) project meetings; and 7) reporting. During the first quarter, the team planned to work on Tasks 1, 2, 3, 6 and 7. The accomplishments in terms of each of these tasks are detailed in the following sections.

Task 1 – Literature Review

- The research team is nearing completion of the review of standards for work zone TTCPs specified in the Manual for Uniform Traffic Control Devices (MUTCD) and by other state DOTs, driver distractions in work zones, external factors affecting driver behavior in work zones, speed variances and work zone configurations. The team is now working on summarizing the literature review results and preparing *Post Task Report 1 – Literature Review & Development of TTCP Metrics* due to NETC Coordinator, Ms. Laurie Eddy, and the Project Technical Committee before January 16, 2016.

Task 2 – Development of TTCP Metrics

- The team reviewed work zone TTCP metrics. Several work zone safety, mobility and operational performance measures were short listed. Some examples of safety performance measures are:
    - Crash frequency (e.g., total crashes, crashes by different levels of severity)
    - Percentages of crashes in various categories (e.g., severities, types of collisions, and contributing factors)
    - Crash rates (i.e., per million-vehicle-miles)
    - Crash costs
    - Service patrol dispatch frequency
    - Fire department dispatch frequency
    - Speeds
    - Speeding citation frequency
    - Inspection scores
    - Worker fatalities and injuries
    - Work zone intrusion frequency
- Some examples of work zone mobility and operational performance measures are:
    - Delay per vehicle
    - Queue length
    - Duration of queue
    - Volume/capacity ratio
    - Level-of-service
    - Volume (throughput)
    - % time at free-flow speed
    - % work zones meeting expectations for traffic flow
    - User complaints
- Based on these performance measures and the literature review conducted thus far, the team has the following recommendations for work zone TTCPs. They are further detailed in *Post Task Report 1*.
    - Widening the travel path to include a temporary 3-foot paved shoulder;
    - Applying object markers at fixed object locations within 8 feet of the travel path;
    - Increasing the lateral offsets to fixed object locations;
    - Utilizing in-vehicle devices or on-board navigation devices to warn drivers of construction projects;

- Using barrels instead of cones for expressway work zones to improve visibility and ensure delineation for lane shifts;
- Providing desired spacing of 2 feet between concrete barriers and travel lanes to instill a sense of safety in high-speed roadways;
- Use of ITS devices and arrow heads to ensure on-time merge before entering work zones; and
- Collaborating with companies to develop user-based mobile applications such as WAZE or Google Maps and to provide up to date work zone related information.

- In addition, the team is working on a survey questionnaire for work zone TTCP metrics. This questionnaire will be sent out to different state DOTs to solicit inputs on TTCPs and metrics.

Task 3 – Development of Methodology for Testing and Analyzing TTCPs

- All project team members have successfully completed the training for human subject protection. This training is required for the team to access the SHRP 2 NDS data and the associated roadway information database. Other than the training, the team has to fill out many forms and to obtain permissions from UMass Lowell Institutional Review Boards (IRB) and Virginia Tech. This process took longer time than we initially expected. The team has finished all the required paperwork and has obtained the roadway information database and some shapefiles. Such data can be used to identify work zones and roadway segments that have been frequently traveled by NDS volunteers. The team is expected to finalize the selection of roadway segments in the next 10 days so that we can order the NDS data for 2010 and 2011. Once the NDS data is available, the team will start to work on processing the NDS data.
- In addition, attempts were made to acquire SWZ data. The team has received some data from MassDOT. The data seems to be relevant and useful. However, it was difficult to obtain additional information associated with the data, such as sensor location and work zone layout. Without such information, the usefulness of the SWZ data is limited.

Task 6 – Project Meetings

- The project kickoff meeting was held on September 16, 2015. All technical committee members were invited to provide suggestions on types of work zones that should be included in this research. Based on the suggestions, a scenario of median closure for multilane highways/expressways/freeways was added in addition to the five types listed in Table 2 of the proposal.
- The first quarterly meeting will be held on December 21, 2015 from 2:00 PM to 3:00 PM. Progress thus far will be discussed at this meeting and suggestions from the project technical committee will be incorporated into the next quarter.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2015: None thus far.

FINANCIAL STATUS

1. FINANCIAL STATUS OF ACTIVE PROJECTS:

Table 1: Financial Status of Projects Active During 2015 (As of December 31, 2015):

NO.	PROJECT TITLE	APPROVED BUDGET	INVOICES APPROVED FOR PAYMENT	PROJECT BALANCE
6-4	Preventative Maintenance and Timing of Applications	$242,909.00	$76,162.00	$166,747.00
7-1	In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations	$198,154.00	$149,080.00	$49,074.00
9-2	Effective Establishment of Native Grasses on Roadsides	$80,000.00	$80,000.00	$0.00
9-3	Advanced Composite Materials: Prototype Development and Demonstration	$165,000.00	$149,950.00	$15,050.00
10-3	Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology	$150,158.00	$61,881.00	$88,277.00
13-1	Development of High-Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections	$174,923.00	$89,604.00	$85,319.00
13-2	HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures	$249,785.00	$28,000.00	$221,785.00
13-3	NETC 13-3	$100,000.00	$29,000.00	$71,000.00

14-1	Measuring the Effectiveness of Competency Models for Job Specific Professional Development of Engineers & Engineering Technicians	$100,000.00	$13,684.00	$86,316.00
14-2	Investigation of Northern Long-Eared Bat Roosting Sites on Bridges	$205,554.00	$54,654.00	$150,900.00
14-4	Optimizing Future Work Zones in New England for Safety and Mobility	$200,000.00	$16,503.00	$183,497.00

2. FUND BALANCE:

NETC FUND BALANCE
As of December 31, 2014

ITEM	OBLIGATION FOR PROJECTS	TRAVEL OBLIGATIONS AND EXPENDITURES	BUDGET	EXPENDED	INVOICE	CUMMULATIVE BALANCE	NOTES
Unexpended Balance of NETC funds from AASHTO as of 6/5/95 (Per AASHTO memo 12/4/95)						132,777.07	
Member Obligations 1994 = 6 X $75,000	450,000.00					582,777.07	
Coord./Admin. of NETC: Calendar Year 1995 Bdgt. = $73042				58,761.32	FINAL	524,015.75	
- Construction Costs of New England Bridges-Phase II				39,500.00	FINAL/CLOSED	484,515.75	
- Tire Chips as Lightweight Backfill-Phase II: Full-Scale Testing (Supplemental				16,000.00	FINAL/CLOSED	468,515.75	
- Bridge Rail Crash Test - Phase II: Sidewalk-Mounted Rail				134,127.00	FINAL/CLOSED	334,388.75	
- New England Vehicle Classification and Truck Weight Program				6,752.57	FINAL/CLOSED	327,636.18	
94-1: Structural Analysis of New England Subbase Materials and Structures				110,057.38	FINAL/CLOSED	217,578.80	
94-2: Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging				224,901.80	FINAL/CLOSED	-7,323.00	
94-3: Procedures for The Evaluation of Sheet Membrane Waterproofing				67,002.00	FINAL/CLOSED	-74,325.00	Note: Project admini
94-4: Durability of Concrete Crack Repair Systems				72,036.04	FINAL/TERM.	-146,361.04	
Member Obligations 1995 = 7 X $75,000	525,000.00					378,638.96	
95-1: Use of Tire Chips/Soil Mixtures to Limit Pavement Damage of Paved Roads				75,000.00	FINAL/CLOSED	303,638.96	
95-2: Suitability of Non-Hydric Soils for Wetland Mitigation				39,867.70	FINAL/CLOSED	263,771.26	
95-3: Implementation and Evaluation of Traffic Marking Recesses for Application of				120,812.12	FINAL/CLOSED	142,959.14	
95-5: Buried Joints in Short Span Bridges				61,705.61	FINAL/TERM.	81,253.53	
95-6: Guidelines for Ride Quality Acceptance of Pavements				106,124.00	FINAL/CLOSED	-24,870.47	
Member Obligations 1996 = 6 X $75,000	450,000.00					425,129.53	
Coord./Admin.of NETC: Calendar Year 1996; Bdgt. = $75,000				69,123.85	FINAL	356,005.68	
96-1: SUPERPAVE Implementation				60,139.25	FINAL/CLOSED	295,866.43	
96-2: Optimizing GPS Use in Transportation Projects				27,008.81	FINAL/TERM.	268,857.62	
96-3: Effectiveness of Fiber Reinforced Composites as Protective Coverings for				135,000.00	FINAL/CLOSED	133,857.62	
Member Allocations 1997 = 6 X $75,000	450,000.00					583,857.62	
Coord./Admin. of NETC: Calendar Year 1997; Bdgt. = $82,494				77,244.35	FINAL	506,613.27	
97-1: A Portable Method for Determining Chloride Concentration on				96,669.50	FINAL/CLOSED	409,943.77	Phase I
Roadway Pavements				90,667.79	FINAL/CLOSED	319,275.98	Phase II
97-2: Performance Evaluation & Economic Analysis of Durability Enhancing				108,318.73	FINAL/CLOSED	210,957.25	
97-3: Determining Properties, Standards & Performance				27,779.64	FINAL/CLOSED	183,177.61	Phase I
of Wood Waste Compost, etc.:				16,074.30	FINAL/CLOSED	167,103.31	Phase II
Alloc. to ConnDOT for Constr. Costs of Test Site (Approved 1/21/99 Ballot)				10,700.00		156,403.31	
97-4: Early Distress of Open-Graded Friction Course				57,495.71	FINAL/CLOSED	98,907.60	
Member Obligations 1998 = 6 X $75,000	450,000.00					548,907.60	
Coord./Admin. of NETC: Calendar Year 1998; Bdgt = $73,021				80,422.65	FINAL	468,484.95	
- Travel Tech. Comm. (Aug. 98 tel. poll) for 1998 = $5,000				0.00		468,484.95	
- T2 (per 12/2/97 Adv. Committee Mtg.) for 1998 = $10,000				9,551.06	FINAL	458,933.89	
- Refund Check (No. 15-663337), for CY '98 Management of NETC, from UConn OSP;	336.00					459,269.89	Refund Check (No. 1
Member Obligations 1999 = 6 X $75,000	450,000.00					909,269.89	
Coord./Admin. of NETC: Calendar Year 1999: Bdgt = $98,066				79,101.20	FINAL	830,168.69	
99-1: Bridge Rail Transitions				240,000.00	FINAL/CLOSED	590,168.69	
99-2: Evaluation of Asphaltic Expansion Joints				62,234.76	FINAL/CLOSED	527,933.93	
99-3: Bridge Scour Monitoring Systems				78,523.32	FINAL/CLOSED	449,410.61	
99-4: Quantifying Roadside Rest Area Usage				44,857.00	FINAL/CLOSED	404,553.61	
99-6: The Effects of Concrete Removal Operations on Adjacent Concrete that Is to				96,008.36	FINAL/CLOSED	308,545.25	
Member Obligations 2000 = 6 X $100,000	600,000.00					908,545.25	
Coord./Admin. of NETC: Calendar Year 2000: Bdgt = $102,588				91,899.37	FINAL	816,645.88	
00-1: Ground-Based Imaging and Data Acquisition Systems for Roadway Inventories				31,251.92	FINAL/CLOSED	785,393.96	
00-2: Evaluation of Permeability of Superpave Mixes				95,499.16	FINAL/CLOSED	689,894.80	
00-3: Composite Reinforced Timber Guard Rail - Phase I: Design, Fabrication and				81,989.38	FINAL/CLOSED	607,905.42	
00-4: Falling Weight Deflectometer Study				100,000.00	FINAL/CLOSED	507,905.42	
00-5: Guard Rail Testing - Modified eccentric Loading Terminal at NCHRP 350 TL2				61,287.00	FINAL/CLOSED	446,618.42	
00-6: Implementation of Visualization Technologies to Create Simplified				74,914.49	FINAL/CLOSED	371,703.93	
00-7: A Complete Review of Incident Detection Algorithms and Their Deployment:				45,369.45	FINAL/CLOSED	326,334.48	
00-8: Performance and Effectiveness of A Thin Pavement Section Using Geogrids				150,000.00	FINAL/CLOSED	176,334.48	
Member Obligations 2001 = 6 X $100,000	600,000.00					776,334.48	
Coord./Admin. of NETC: Calendar Year 2001:Bdgt = $106,248				104,385.35	FINAL	671,949.13	
01-1: Advanced Composite Materials for New England's Transportation				47,559.27	FINAL/CLOSED	624,389.86	
01-1: Advanced Composite Materials for New England's Transportation				25,286.18	FINAL/CLOSED	599,103.68	
01-2: Development of A Testing Protocol for Quality Control/Quality Assurance of				80,000.00	FINAL/CLOSED	519,103.68	
01-3: Design of Superpave HMA for Low Volume Roads				120,324.15	FINAL/CLOSED	398,779.53	
01-6: Field Evaluation of A New Compaction Device				49,944.50	FINAL/CLOSED	348,835.03	
Member Obligations 2002 = 6 X $100,000	600,000.00					948,835.03	

NETC FUND BALANCE
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ITEM	OBLIGATION FOR PROJECTS	TRAVEL OBLIGATIONS AND EXPENDITURES	BUDGET	EXPENDED	INVOICE	CUMMULATIVE BALANCE	NOTES
NY DOT Obligation = $56,551.38	56,551.38					1,005,386.41	
Coord./Admin. Of NETC: Calendar Year 2002				109,207.12	FINAL	896,179.29	
02-1: Relating Hot Mix Asphalt Pavement Density to Performance				103,260.73	FINAL/CLOSED	792,918.56	
02-2: Formulate Approach for 511 Implementation in New England Phase 1				48,158.19	FINAL/CLOSED	744,760.37	
02-2: Formulate Approach for 511 Implementation in New England Phase 2				32,813.16	FINAL/CLOSED	711,947.21	
02-3: Establish Subgrade Support Values (Mr) for Typical Soils in New England				79,936.86	FINAL/CLOSED	632,010.35	
02-5: Determination of Moisture Content of De-Icing Salt at Point of Delivery				19,679.99	FINAL[2]/CLOSED	612,330.36	
02-6 : Sealing of Expansion Joints - Phase 1				74,982.81	FINAL/CLOSED	537,347.55	
02-7: Calibrating Traffic Simulation Models to Inclement Weather Conditions with				74,037.57	FINAL/CLOSED	463,309.98	
02-8: Intelligent Transportation Systems Applications to Ski Resorts in New England				54,724.71	FINAL/CLOSED	408,585.27	
Member Obligations 2003 = 6 X $100,000	600,000.00					1,008,585.27	
NY DOT Obligation = $50,000	50,000.00					1,058,585.27	
Coord./Admin. Of NETC Calendar Year 2003 = $124,258				118,855.19	FINAL	939,730.08	
03-1: Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with				70,690.16	FINAL/CLOSED	869,039.92	
03-2: Field Studies of Concrete Containing Salts of An Alkenyl-Substituted Succinic				133,385.33	FINAL/CLOSED	735,654.59	
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England				20,682.70	FINAL/CLOSED	714,971.89	
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England -				13,135.80	FINAL/CLOSED	701,836.09	
03-4: Measuring Pollutant Removal Efficiencies of Storm Water Treatment Units				80,000.00	FINAL/CLOSED	621,836.09	
03-5: Evaluation of Field Permeameter As A Longitudinal Joint Quality Control				77,318.43	FINAL/CLOSED	544,517.66	
03-6: Fix It First: Utilizing the Seismic Property Analyzer & MMLS to Develop				54,085.45	FINAL/CLOSED	490,432.21	Cont'd as 03-6 (FHW
03-6 (FHWA) : Fix It First: Utilizing the Seismic Property Analyzer & MMLS to				44,479.52	FINAL/CLOSED	445,952.69	FHWA Led Project. F
03-7 (Alt.): Basalt Fiber Reinforced Polymer Composites				64,092.29	FINAL/CLOSED	381,860.40	
Member Obligations 2004 = 6 X $100,000	600,000.00					981,860.40	
NY DOT Obligation = $50,000	50,000.00					1,031,860.40	
Coord./Admin. Of NETC Calendar Year 2004 = $126,559				113,012.87	FINAL	918,847.53	
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase I				27,166.58	FINAL/CLOSED	891,680.95	
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase II				82,750.99	FINAL/CLOSED	808,929.96	
04-2: Driver-Eye-Movement-Based Investigation for Improving Work Zone Safety				70,387.66	FINAL/CLOSED	738,542.30	
04-3: Estimating the Magnitude of Peak Flows For Steep Gradient Streams in New				98,025.49	FINAL/CLOSED	640,516.81	Cont'd as 04-3 (FHW
04-3 (FHWA) : Estimating the Magnitude of Peak Flows For Steep Gradient Streams				21,950.37	FINAL/CLOSED	618,566.44	FHWA Led Project. B
04-4: Determining the Effective PG Grade of Binder in RAP Mixes				130,876.00	FINAL/CLOSED	487,690.44	
04-5: Network-Based Highway Crash Prediction Using Geographic Information				129,020.04	FINAL/CLOSED	358,670.40	
Member Obligations 2005 = 6 x $100,000	600,000.00					958,670.40	
NY DOT Obligation = $50,000	50,000.00					1,008,670.40	
Coord./Admin. Of NETC Calendar Year 2005 = $130,528				128,934.25	FINAL	879,736.15	
05-1: Develop Base Resistance Load-Displacement Curves for The Design of Drilled				52,155.25	FINAL/CLOSED	827,580.90	Cont'd as 05-1 (FHW
05-1 (FHWA) : Develop Base Resistance Load-Displacement Curves for The Design of				46,820.24	FINAL/CLOSED	780,760.66	FHWA Led Project. B
05-5: Measurement of Work of Adhesion Between Paint and Metalized/Galvanized				104,987.55	FINAL/CLOSED	675,773.11	Cont'd as 05-5 (FHW
05-5 (FHWA) : Measurement of Work of Adhesion Between Paint and				19,907.99	FINAL/CLOSED	655,865.12	FHWA Led Project. B
05-6: Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers'				46,712.74	FINAL/CLOSED	609,152.38	Cont'd as 05-6 (FHW
05-6 (FHWA) : Employing Graphic-Aided Dynamic Message Signs to Assist Elder				13,222.32	FINAL/CLOSED	595,930.06	FHWA Led Project. B
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and				92,000.36	FINAL/CLOSED	503,929.70	
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and				7,431.26	FINAL/CLOSED	496,498.44	
05-8: Evaluation of Alternative Traffic Simulation Models, Including CA4PRS for				94,964.22	FINAL/CLOSED	401,534.22	Cont'd as 05-8 (FHW
05-8 (FHWA) : Evaluation of Alternative Traffic Simulation Models, Including CA4PRS				5,035.00	FINAL/CLOSED	396,499.22	FHWA Led Project
Member Obligations 2006 = 5 x $100,000 (no ME DOT allocation)	500,000.00	10,000.00				896,499.22	
Note: Maine 2006 Obligation as of 11/06/06 per Peabody 11/30/06 email	100,000.00					996,499.22	
Coord./Admin. Of NETC Calendar Year 2006 = 131,814				100,718.92	FINAL	895,780.30	
06-1: New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement				82,209.78	FINAL/CLOSED	813,570.52	
06-1 (FHWA) : New England Verification of NCHRP 1-37A Mechanistic-Empirical				68,085.00	FINAL/CLOSED	745,485.52	FHWA Led Project
06-3 Establish Default Dynamic Modulus Values for New England				109,787.00	FINAL/CLOSED	635,698.52	
06-5 Winter Severity Indices for New England				73,639.62	FINAL/CLOSED	562,058.90	Note: Project termin
Member Obligations 2007 = 600,000	600,000.00	5,000.00				1,162,058.90	
Coord./Admin. Of NETC Calendar Year 2007 = 136,061				122,644.79	FINAL	1,039,414.11	
Member Obligations 2008 = 600,000	600,000.00	10,000.00				1,639,414.11	
NY DOT Obligation (50,000)	50,000.00					1,689,414.11	
Coord./Admin. Of NETC Calendar Year 2008 = 134,998				131,509.90	FINAL	1,557,904.21	
02-6 Phase II Sealing of Small Mvmnt Bridge Expan Joints - Field Inst. & Mntrng				74,558.62	FINAL/CLOSED	1,483,345.59	
Member Obligations 2009 = 600,000	600,000.00					2,083,345.59	
Coord./Admin. Of NETC Calendar Year 2009 (Approved) = 139,309				131,157.45	FINAL	1,952,188.14	
Member Obligations 2010 = 600,000	600,000.00	15,000.00				2,552,188.14	
Coord./Admin. Of NETC Calendar Year 2010 (Approved) = 134,809				127,097.21	FINAL	2,425,090.93	

NETC FUND BALANCE
As of December 31, 2014

ITEM	OBLIGATION FOR PROJECTS	TRAVEL OBLIGATIONS AND EXPENDITURES	BUDGET	EXPENDED	INVOICE	CUMMULATIVE BALANCE	NOTES
Member Obligations 2011 = 600,000	600,000.00	10,000.00				3,025,090.93	
Coord./Admin. Of NETC Calendar Year 2011 (Approved) = 133,793				133,793.00	FINAL	2,891,297.93	
Reconciliation of previous Pooled Fund Accounts	-354,400.71					2,536,897.22	See Note 5
Member Obligations 2012 = 100,000	100,000.00	5,000.00				2,636,897.22	See Note 6
Coord./Admin. Of NETC Calendar Year 2012 (Approved) = 179,344.49				179,344.49	FINAL	2,457,552.73	
06-4 Preventative Maintenance and Timing of Applications			242,908.82			2,214,643.91	
07-1 In-Place Response Mechanisms of Recycled Layers Due to Temperature and			198,154.00			2,016,489.91	
09-2 Effective Establishment of Native Grasses on Roadsides			80,000.00			1,936,489.91	
09-3 Advanced Composite Materials: Prototype Development and Demonstration			165,000.00			1,771,489.91	See Note 3
10-3 Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix			150,157.70			1,621,332.21	
Member Obligations 2013 = 0	0.00					1,621,332.21	See Note 6
Coord./Admin. Of NETC Calendar Year 2013 (Approved) = 179,344.49				179,344.49	FINAL	1,441,987.72	
13-1: Development of High Early Strength Connections for Accelerated Bridge			174,923.00			1,267,064.72	
13-2: HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature			249,785.00			1,017,279.72	
13-3: Improved Regionalization of QA Functions			100,000.00			917,279.72	
Member Obligations 2014 = $500,000	300,000.00	10,000.00				1,217,279.72	See Note 6
Coord./Admin. Of NETC Calendar Year 2014 (Approved) = 179,344.49				179,344.49	FINAL	1,037,935.23	
14-1: Measuring the Effectiveness of Competency Models for Job-Specific			100,000.00			937,935.23	
14-2: Investigation of Northern Long-Eared Bat Roosting Sites on Bridges			75,000.00			862,935.23	
14-3: Bridge Expansion Joint Deterioration and Repair			100,000.00			762,935.23	
14-4: Optimizing future work zones in New England for safety			200,000.00			562,935.23	
Travel Expenditures to date		-27,257.95					
Totals =	10,277,486.67	37,742.05	1,835,928.52	8,011,399.99			

NETC Fund Balance Notes:

1. Member FFY allocations are obligated between October 1 and December 31
2. A credit of $6,599.70 for NETC's overpayment to UConn for CY 2004 NETC Management was applied, by UConn, to the 'Indirect Cost' for project 02-5. Therefore although the total expenditures of the project were $26,279.69 the amount paid by NETC was $19,679.99.
3. Per minutes of NETC Adv. Comm. Mtg. 5/12/08: "It was agreed that since the encumbered amount for NETC 05-7 was incorrectly shown in the Fund Balance Report (April 30, 2008) as $70,000 and the correct amount is $100,000, the amount of funding to be allocated for the third ranked problem statement for the FFY 09 research program (NETC 09-3) would be set at the amount of the revised unencumbered fund balance remaining (at that time) after the allocation of funds for NETC 09-1 and NETC 09-2, i.e., $48,847." (Note no longer relevant. TAC revised budget. AHC 6/25/2013)
4. Work on project suspended pending resolution of authorization of payment for costs incurred prior to execution of project agreement. VAOT to submit request to FHWA for approval of costs incurred prior to execution of the project agreement in accordance with 23CFR Section 1.9.
5. During the Process to Close out SPR-3(089) and TPF-5(201), it became clear that there was a discrepancy between the NETC Coordinator's Fund Balance Tracking Sheet and what was actually left over in the accounts. The reconciliation is approximately $-450,000. This leads me to believe that an annual contribution from the 1990s might have been canceled, but it is not reflected in the tracking sheet. Unfortunately, SPR-3(009) has been closed for a long time, so the detailed account information cannot be obtained.
6. Contributions for FY 2012 and FY 2013 were canceled in an Advisory Committee ballot dated 1/10/14. Connecticut had already made their contribution. Therefore, they will not need to make a contribution for FY 2014.

REPORTS, PAPERS AND PRESENTATIONS

1. POLICIES AND PROCEDURES:

"Policies and Procedures, New England Transportation Consortium," July 1995.
"Policies and Procedures, New England Transportation Consortium," April 2002.
"Policies and Procedures, New England Transportation Consortium," May 2008.
"Policies and Procedures, New England Transportation Consortium," March 2015.

2. ANNUAL REPORTS:

"Annual Report For Calendar Year 1995," March 1996, NETCR3
"Annual Report For Calendar Year 1996," January 1997, NETCR4
"Annual Report For Calendar Year 1997," January 1998, NETCR9
"Annual Report For Calendar Year 1998," January 1999, NETCR10
"Annual Report For Calendar Year 1999," January 2000, NETCR21
"Annual Report For Calendar Year 2000," August 2001, NETCR27
"Annual Report For Calendar Year 2001," December 2002, NETCR40
"Annual Report For Calendar Year 2002," November 2003, NETCR41
"Annual Report For Calendar Year 2003," September 2005, NETCR55
"Annual Report For Calendar Year 2004," December 2005, NETCR59
"Annual Report For Calendar Year 2005," August 2006, NETCR61
"Annual Report For Calendar Year 2006," April 2007, NETCR68
"Annual Report For Calendar Year 2007," February 2008, NETCR70
"Annual Report For Calendar Year 2008," April 2009, NETCR75
"Annual Report For Calendar Year 2009," March 2010, NETCR79
"Annual Report For Calendar Year 2010," April 2011, NETCR84
"Annual Report For Calendar Year 2011," December 2011, NETCR90
"Annual Report For Calendar Year 2012," February 2013, NETCR92
"Annual Report For Calendar Year 2013," February 2014, NETCR94

3. REPORTS, PAPERS, AND PRESENTATIONS 1988-1995:

"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.

NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1995 (cont'd):

"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 Massachusetts, August 1990.

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

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

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

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

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

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

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

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

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

"Advantages of Oversize/Overweight Truck Permit Uniformity," AASHTO 1990

Annual Meeting Proceedings, pp. 83-85, 1990.

NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1995 (cont'd):

"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.

"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.

4. REPORTS, PAPERS AND PRESENTATIONS 1995-2015:

Project No. **Title**

N/A **Construction Costs Of New England Bridges**

Reports:

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

Papers and Presentations:

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

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

Reports:

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

Papers and Presentations:

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

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

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

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

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

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

Papers and Presentations (cont'd):

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

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

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

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

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

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

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

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

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

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

Reports:

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

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

Reports (cont'd):

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

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

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

Papers and Presentations:

"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.

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

"Full-Scale Crash Evaluation of the NETC 4-Bar Sidewalk Steel Bridge Railing," Kimball, C.E., and Mayer, J.B., March 1999, NETCR14. Papers and Presentations: None

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

Reports:

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

Papers and Presentations:

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

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

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

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

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

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

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

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

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

Reports:

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

Papers and Presentations:

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

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

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

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

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

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

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

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

94-2 **Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques (cont'd):**

Papers and Presentations (cont'd):

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

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

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

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

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

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

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

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

94-3 **Procedures For The Evaluation Of Sheet Membrane Waterproofing:**

Reports:

"Procedures for the Evaluation Sheet Membrane Waterproofing," Korhonen, C.J., Buska, J.S., Cortez, Edel R., and Greatorex, Alan R., August 1999, NETCR13.

Papers and Presentations: None

94-4 **Durability Of Concrete Crack Repair Systems:**

Reports: None

Papers and Presentations:

"Durability of Concrete Crack Repair, Projects," Robinson, J. Presented at the University of Rhode Island Graduate Seminar Series, Kingston, RI, November 19, 1997.

"Durability of Concrete Crack Repair System," Tsiatas, G. and Robinson, J. Presentation to representatives of the Chemical Grouting Division of Kajima Corporation (Japan), University of Rhode Island, College of Engineering, October 26, 1999.

95-1 **Use Of Tire Chip/Soil Mixtures To Limit Frost Heave And Pavement Damage Of Paved Road**

Reports:

"Use of Tire Chip/Soil Mixtures to Limit Frost Heave and Pavement Damage of Paved Roads," Brian, K.L., and Humphrey, D. N., June 2000, NETCR12.

Papers and Presentations:

"Laboratory and Field Measurement of the Thermal Conductivity of Tire Chips for Use as Subgrade Insulation," Humphrey, D., Chen, L.H. and Eaton, R. A paper submitted to the Transportation Research Board for presentation at the session on "Properties of Unconventional Aggregates" at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1997.

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

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

"Field Trial of Tire Shreds as Insulation for Paved Roads," Humphrey, D., Chen, L.H., Lawrence, B. A paper presented at the 10th International Conference on Cold Regions Engineering: Putting Research into Practice, held in Hanover, NH, August 16-19, 1999.

95-2 **Suitability Of Non-Hydric Soils For Wetland Mitigation**

Reports:

"Suitability of Non-Hydric Soils for Wetland Mitigation," Brannaka, L.K. and Evans, C.V., February 28, 1997, NETCR5.

Papers and Presentations: None

95-3 **Implementation And Evaluation Of Traffic Marking Recesses For Application of Thermo-Plastic Markings On Modified Open Graded Mixes**

Reports:

"Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Friction Course," Lee, K.W., Cardi, S.A., and Corrigan, S., July 2000, NETCR23.

Papers and Presentations:

"Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Mixes," Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, Kingston, Rhode Island, October 23, 1996.

"Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open-Graded Mixes," Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, University of Rhode Island, October 15, 1997.

95-5 **Buried Joints In Short Span Bridges**

Reports: None

Papers and Presentations:

"State of the Art Study of Bridge Joint Systems in New England," Tsiatas, and Chandrasekaran, S. Submitted for presentation at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1997.

95-6 **Guidelines For Ride Quality Acceptance Of Pavements**

Reports:

"Guidelines for Ride Quality Acceptance of Pavements," Collura, J., El-Korchi, T., Black K., Chase, M. and Li, J., April 1997, NETCR 6.

Papers and Presentations: None

96-1 **Implementation of Superpave**

Reports:

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

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

Reports:

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

Papers and Presentations:

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

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

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

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

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

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

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

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

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

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

96-3 **Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides (cont'd):**

Papers and Presentations (cont'd):

"Durability of Carbon Composites Made With Inorganic Matrix," Garon, R., and Balaguru, P., "SAMPE", November 2000, pp. 34-43.

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

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

"Durability of High Strength Composite Repairs under Scaling Conditions," Garon, R., and Balaguru, P., Proceedings of Third International Conference on Concrete Under Severe Conditions, Vancouver, Canada, June 2001.

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, September 2002, NETCR17.

Papers and Presentations: None

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

Reports:

"Performance Evaluation and Economic Analysis of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete for the Northeast U.S.A.," Civjan, S.A., LaFave, J.M., Lovett, D., Sund, D.J., Trybulski, J., February 2003, NETCR 36.

Papers and Presentations:

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

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

Papers and Presentations:

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

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

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

Reports:

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

Papers and Presentations:

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

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

Reports:

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

Papers and Presentations: None

99-1 **Bridge Rail Transitions – Development and Crash Testing**

Reports:

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

Note:

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

99-1 **Bridge Rail Transitions – Development and Crash Testing (cont'd):**

Papers and Presentations:

"NETC Bridge Rail Transitions," by Dean C. Alberson and Wanda L. Menges, Concord, New Hampshire, December 13, 2005.

"Summary of NCHRP Report 350," by Dean C. Alberson, Concord, New Hampshire, December 13, 2005.

99-2 **Evaluation of Asphaltic Expansion Joints**

Reports:

"Evaluation of Asphaltic Expansion Joints," Mogawer, W.S., November 2004, NETCR 50.

Papers and Presentations: None

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

Reports:

"Development of Priority Based Statewide Scour Monitoring Systems in New England," Ho, C.T., Di Stasi, J.M., August 2, 2001, NETCR24.

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., November 27, 2002, NETCR 38.

Papers and Presentations:

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

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

Reports:

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

Papers and Presentations:

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

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

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

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

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

Reports:

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

Papers and Presentations: None

00-2 **Evaluation Of Permeability Of Superpave Mixes**

Reports:

"Evaluation of Permeability of Superpave Mixes," Mogawer, W., Mallick, R., Teto, M. and Crockford, C., July 3, 2002, NETCR34.

Papers and Presentations:

"An Alternative Approach to Determination of Bulk Specific Gravity and Permeability of Hot Mix Asphalt (HMA)," Bhattacharjee, S., Mallick, R. and Mogawer, W. Submitted to International Journal of Pavement Engineering.

A Presentation, by W. Mogawer, to the Northeast Asphalt User Producer Group Meeting, October 18, 2001, Albany, New York.

00-3 **Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail**

Reports:

"Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail," Davids, W., Botting, J., March 31, 2004, NETCR 39.

Papers and Presentations: None

00-4 **Portable Falling Weight Deflectometer Study**

Reports:

"Portable Falling Weight Deflectometer Study," Steinert, B., Humphrey, D., Kestler, M., March 11, 2005, NETCR52.

Papers and Presentations: None

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

Reports:

"Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2," Alberson, D., Menges, W. and Haug, R., July 2002, NETCR35.

Papers and Presentations:

Dean Alberson, Texas Transportation Institute, Principal Investigator presented the results of the crash tests conducted on the MELT guardrail terminal to the Association of General Contractors/American Road Transportation Builders Association/American Association of State Highway Transportation Officials Task Force 13 meeting in Seattle, Washington, April 2002.

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

Reports:

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

Papers and Presentations:

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

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

Reports:

"A Complete Review of Incident Detection Algorithms & Their Deployment: What Works and What Doesn't," Parkany, E., Xie C., February 7, 2005, NETCR 37.

Papers and Presentations:

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

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

Reports:

"Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region," Helstrom, C.L., Humphrey, D.N., and Labbe, J.M., August 2007, NETCR60.

Papers and Presentations:

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

01-1 **Advanced Composite Materials for New England's Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice**

Reports:

"Advanced Composite Materials for New England's Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice," Breña, S.F., Civjan, S.A., and Goodchild, M., May 2006, NETCR62.

Papers and Presentations: None

01-1 T2 Phase I **Advanced Composite Materials in New England's Transportation Infrastructure - Technology Transfer Phase 1: Selection of Prototype**

Reports:

"Advanced Composite Materials in New England's Transportation Infrastructure – Technology Transfer Phase 1: Selection of Prototype," Breña, F., and Civjan, S.A., November 1, 2009, NETCR77.

Papers and Presentations: None

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

Reports:

"Development of a Testing Protocol for QC/QA of Hot Mix Asphalt (HMA)," Mogawer, W.S., Mallick, R., February 5, 2004, NETCR 43.

Papers and Presentations:

"An Evaluation of Use of Rapid Triaxial Test In Quality Control of Hot Mix Asphalt (HMA)," Mogawer, W. S., Presented at the 82nd Annual Meeting of the Transportation Research Board, January 12-16, 2003, Washington DC.

01-3 **Design of Superpave HMA for Low Volume Roads**

Reports:

"Design of Superpave HMA for Low Volume Roads," Mogawer, W.S., Mallick, R., December 31, 2004, NETCR 51.

Papers and Presentations:

"Development of Mix Design Criteria for Low Traffic Volume Hot Mix Asphalt Roads," Nanagiri, Y.V., Mallick, R., Mogawer, W.S. Proceedings of the Annual Meeting of the Canadian Technical Asphalt Association, November 2003.

01-6 **Field Evaluation of a New Compaction Monitoring Device**

Reports:

"Field Evaluations of A New Compaction Monitoring Device," Miller, H.J., June 26, 2003, NETCR 42.

Papers and Presentations: None

02-1 **Relating Hot Mix Asphalt Pavement Density to Performance**

Reports:

"Relating Hot Mix Asphalt Pavement Density to Performance," Mogawer, W.S., Daniel, J.S., and Austerman, A.J., April 1, 2010, NETCR76.

Papers and Presentations:

"Evaluation of the Effects of HMA Density on Mixture Fatigue and Rutting Performance," Mogawer, W.S., Northeast Asphalt User/Producer Group (NEAUPG) Annual Meeting, South Portland, Maine, October 8, 2009.

"Evaluation of the Effects of Hot Mix Asphalt Density on Mixture Fatigue Performance, Rutting Performance and MEPDG Distress Predictions," Mogawer, W.S., Austerman, A.J., Daniel, J.S., Fujie, Z., and Bennert, T., International Journal of Pavement Engineering, 2011.

02-2 **Formulate Approach for 511 Implementation in New England**

Reports:

"Formulate Approach for 511 Implementation in New England," Shuldiner, P., Loane, G., and Knapick, R., October 2005, NETCR44.

Papers and Presentations: None

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

Reports:

"Establish Subgrade Support Values for Typical Subs in New England," Malla, R. B., and Joshi, S., April 2006, NETCR57.

Papers and Presentations:

"Resilient Modulus Prediction Models for Some New England Subgrade Soils," Malla, R. and Joshi, S., Electronic Proceedings of the 2005 Joint ASCE/ASME/SES Conference on Mechanics and Materials (McMat 2005), Baton Rouge, LA, June 1-3, 2005.

"Resilient Modulus of Subgrade Soils A-1-b, A-3, an A-7-6 using LTPP Data: Prediction Models with Experimental Verification," Joshi, Shraddha, and Malla, R., Proceedings, ASCE GeoCongress 2006, (Atlanta, GA, Feb. 26-March 01, 2006), ASCE, Reston, VA; Feb. 2006, 6p (CD ROM).

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

Reports:

"Determination of Moisture Content of Deicing Salt at Point of Delivery," Long, R.P., Demars, K.R., and Balunaini, U., March 2004, NETCR 45.

Papers and Presentations: None

02-6 Sealing of Small Movement Bridge Expansion Joints

Reports:

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

Papers and Presentations:

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

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

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

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

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

02-6 Phase 2 Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring

Reports:

"Sealing of Small Movement Bridge Expansion Joints - Phase 2: Field Demonstration and Monitoring," Malla, R.B., Shaw, M., Swanson, B., and Gionet, T., July 31, 2011, NETCR86.

Papers and Presentations:

"Laboratory Evaluation of a Silicone Foam Sealant for Field Application of Bridge Expansion Joints," Malla, R.B., Swanson, B., and Shaw M.T., Proceedings of the 2010 SEM Annual Conference & Exposition, SEM, Bethel, CT, 12 pages, June 2010.

"Development and Installation of Foam Sealant for Small Movement Bridge Expansion Joints," Malla, R.B., Swanson, B., and Shaw M.T., Poster presentation to the Proceedings, 27th Annual International Bridge Conference, Pittsburgh, PA, June 6-9, 2010.

"Laboratory Evaluation, Field Application, and Monitoring of a Silicone Foam Sealant Bonded to Various Bridge Expansion Joint Headers," Swanson, B.J., (2011), M.S. Thesis, Department of Civil and Environmental Engineering, University of Connecticut, Storrs, CT, 128 pages.

"Laboratory Evaluation of a Silicone Foam Sealant Bonded to Various Header Materials used in Bridge Expansion Joints," Malla, R.B., Swanson, B.J., and Shaw, M.T., "Construction and Building Materials – An International Journal, (published on-line http://dx.doi.org/10.1016/j.conbuildmat.2011.04.050 ; May 26, 2011).

"Laboratory Testing Field Installation, and Monitoring of a Silicone Foam Sealant for Bridge Expansion Joints," Swanson, B.J., Malla, R.B., and Shaw, M.T., J. Bridge Engineering, ASCE, Reston, VA. (In Review).

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

Reports:

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

Papers and Presentations:

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

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

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

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

Reports:

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

Papers and Presentations:

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

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

Reports:

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

Papers and Presentations: None

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

Reports:

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

Papers and Presentations:

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

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

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

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

Reports:

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

Papers and Presentations: None

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

Reports:

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

Papers and Presentations: None

03-4 Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units

Reports:

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

Papers and Presentations:

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

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

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

Reports:

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

Papers and Presentations:

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

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

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

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

03-6 **Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments**

Reports:

"Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments", Mogawer, W.S. and Daniel, J.S., September 1, 2012, NETCR91.

Papers and Presentations: None

03-7 Basalt Fiber Reinforced Polymer Composites

Reports:

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

Papers and Presentations:

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

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

"Investigation of Basalt Fiber Composite Aging Behavior for Applications in Transportation," Q. Liu, M. T. Shaw, R. S. Parnas, A.M. McDonnell, Polymer Composites.

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

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

04-1 Phase2 Recycling Asphalt Pavements Containing Modified Binders - Phase 2

Reports:

"Recycling Asphalt Pavements Containing Modified Binders," Mahoney, J., Zinke, S., DaDalt, J., Zofka, A., Bernier, A. and Yut, I., March 3, 2011, NETCR66.

Papers and Presentations:

"Laboratory Evaluation of HMA Containing RAP and PMB," Zofka A., Bernier A., Mahoney J., and Zinke S., presented at NEAUPG Annual Meeting Poster Session, October 6-7, 2010, Saratoga, New York.

"Laboratory Evaluation of HMA Containing RAP and PMB," Zofka A., Bernier A., Mahoney J., and Zinke S., presented at ASCE 1st T&DI Green Streets & Highways Conference Poster Session, November 14-17, 2010, Denver, Colorado**.**

04-2 **Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety**

Reports:

"Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety," Fisher, D.L., Knodler, M., and Muttart, J., January 28, 2009, NETCR71.

Papers and Presentations:

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

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

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

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

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

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

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

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

04-3 **Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England**

Reports:

"Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England," Jacobs, J., November 17, 2010, NETCR81.

Papers and Presentations:

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

04-4 **Determining the Effective PG Grade of Binder in RAP Mixes**

Reports:

"Determining the Effective PG Grade of Binder in RAP Mixes," Daniel, J.S. and Mogawer, W.S., January 2010, NETCR78.

Papers and Presentations:

"The Impact of RAP on the Volumetric, Stiffness, Strength and Low Temperature Properties of HMA," Krishna Swamy, A., Mitchell, L.F., Hall, S.J., and Daniel, J.S., Journal of Materials in Civil Engineering.

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

Reports:

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

Papers and Presentations:

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

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

05-1 **Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets**

Reports:

"Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets," Sandford, T.C., McCarthy, J., and Bussiere, J., March 31, 2011, NETCR83.

Papers and Presentations: None

05-5 **Measurement of Adhesion Properties Between Topcoat Paint and Metalized/Galvanized Steel with Surface Energy Measurement Equipment**

Reports:

"Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with Surface Energy Measurement Equipment," Yang, S.C., Lee, K.W., Lu, C., Mirville, M. and Pahram, A., September 23, 2013, NETCR93.

Papers and Presentations:

"Measurement of Adhesion Properties Between Topcoat Paint and Metalized / Galvanized Steel With Surface Energy Measurement Equipment," Paper # CET-25, Yang, S.C., Lee, K.W., Lu, C., and Mirville, M., Presented at the US-Korea Conference on Science, Technology, and Entrepreneurship (UKC2010), Seattle, Washington, August 14, 2010.

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

Reports:

"Employing Graphic-Aided DMS to Assist Elder Drivers' Message Comprehension," Wang, J.H. and Clark, A. Y., December 30, 2010, NETCR82.

Papers and Presentations:

"Improving Elder Drivers Comprehension of Dynamic Message through a Human Factors Study," Clark, A., Wang, J.H., Maier-Speredelozzi, V., and Collyer, C., Proceedings of the 12th International Conference on Industrial Engineering – Theory, Application, and Practice, p.747-753, 2007.

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

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

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

Reports:

"Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways," Ivan, J.N., Sadek, A.W., Hongmei, Z., and Surang, R., February 12, 2009, NETCR72.

05-7 **Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways (cont'd):**

Papers and Presentations:

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

"Safety Effects of Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways," Zhou, H., Ivan, J. and Sadek, A., Transportation Research Board Annual Meeting; Paper No. 09-2000, Washington, DC, Jan. 2009.

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

Reports:

"Evaluation and Implementation of Traffic Simulation Models for Work Zones," Collura, J., June 18, 2010, NETCR80.

Papers and Presentations:

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

"Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies," Collura, J., Heaslip, K., Moriarty, K., Wu, F., Khanta, R., and Berthaume, A., Paper presented at the TRB Annual Meeting in January 2010.

06-1 **New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs**

Reports:

"New England Verification of National Cooperative Highway Research Program (NCHRP) 1-37A Mechanistic-Empirical Pavement Design Guide (MEPDG)," Daniel, J. S., Chehab, G. R., Ayyala, D., and Nogaj, I.M., November 2012, NETCR87.

Papers and Presentations:

"Sensitivity of MEPDG Level 2 and 3 Inputs using Statistical Analysis Techniques for New England States," Ayyala, D., Chehab, G. R., and Daniel, J. S., accepted for publication in the Transportation Research Record 2010.

06-1 **New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs (cont'd):**

Papers and Presentations:

"Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG," Daniel, J. S., Chehab, G. R., and Ayyala, D., Journal of the Association of Asphalt Pavement Technologists, Vol. 78, 2009, pp. 352-376.

"Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG," Presentation by Jo Sias Daniel to the Association of Asphalt Paving Technologists Annual Meeting, March 2009.

06-3 **Establishing Default Dynamic Modulus Values for New England**

Reports:

"Establishing Default Dynamic Modulus Values for New England," Jackson, E., Jingcheng, L., Zofka, A., Iliya, Y., and Mahoney, J., April 11, 2011, NETCR85.

Papers and Presentations: None

06-4 **Preventative Maintenance and Timing of Applications**

Reports: None

Papers and Presentations: None

07-1 **In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations**

Reports: None

Papers and Presentations: None

09-2 **Effective Establishment of Native Grasses on Roadsides**

Reports: None

Papers and Presentations: None

09-3 **Advanced Composite Materials: Prototype Development and Demonstration**

Reports: None

Papers and Presentations: None

10-3 **Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology**

Reports: None

Papers and Presentations: None

13-1 **Development of High Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections**
Reports: None

Papers and Presentations: None

13-2 **HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures**
Reports: None

Papers and Presentations: None

13-3 **NETC 13-3**
Reports: None

Papers and Presentations: None

14-1 **Measuring the Effectiveness of Competency Models for Job Specific Professional Development of Engineers & Engineering Technicians**
Reports: None

Papers and Presentations: None

14-2 **Investigation of Northern Long-Eared Bat Roosting Sites on Bridges**
Reports: None

Papers and Presentations: None

14-4 **Optimizing Future Work Zones in New England for Safety and Mobility**
Reports: None

Papers and Presentations: None