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NEW ENGLAND TRANSPORTATION CONSORTIUM

NETCR107

April 2018

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NEW ENGLAND TRANSPORTATION CONSORTIUM

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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.
2017 HIGHLIGHTS

1. THE FOLLOWING NETC-FUNDED TRANSPORTATION RESEARCH PROJECTS, VALUED AT $1,904,696, WERE ACTIVE AT NEW ENGLAND STATE UNIVERSITIES IN 2017:

   a. University of Massachusetts: $1,489,726
      - 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 Ahmadijian (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”
      - Siby Samuel (Amherst): “Using the New SHRP2 Naturalistic Driving Study Safety Databases to Examine Safety Concerns for Teens and Older Drivers”

   b. University of New Hampshire: $414,970
      - Eshan Dave:
         - “Improved Regionalization of Quality Assurance (QA) Functions”
         - “Moisture Susceptibility Testing for Hot Mix Asphalt Pavements in New England”
      - Jeffrey Foster: “Use of Forested Habitat Adjacent to Highways by Northern Long Ear Bats (and Other Bats)”

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 2017.

   b. Conference Attendance and Exhibiting: The NETC Coordinator’s office attended the following conferences and events: None during 2017.

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

      1. NETC 06-4: “Preventative Maintenance and Timing of Applications,” Smith, Kelly; Peshkin, David; Mogawer, Walaa; Austerman, Alexander; June 2017, NETCR101
2. NETC 14-2: “Investigation of Northern Long-Eared Bat Roosting Sites on Bridges,” Civjan, Scott; Dumont, Elizabeth; Bennett, Alyssa; Berthaume, Angela; May 2017, NETCR100

d. Technical Papers and Presentations:


- NETC 14-2:
  - Lunch and Learn and Project Summary Workshop for ME/VT/NH: Concord NH 3/13/17
  - Project Summary Workshop for MA/CT/RI: Westborough MA 3/24/17

- NETC 14-4:
  - A paper entitled “Modelling Highway Work Zone Traffic Safety and Driver Behaviours in the United States Using a Virtual Reality Driving Simulator” has been accepted to the 2017 Road Safety & Simulation Conference to be held in The Hague, Netherland in October 2017.
  - A paper entitled “Cooperative Merging in Highway Work Zone Enabled by Connected and Autonomous Vehicles” has been accepted by the 2018 ASCE International Conference on Transportation & Development to be held in Pittsburgh, Pennsylvania on July 15-18, 2018.
  - Dr. Xie has been invited to give a talk at the 2018 TRB Annual Meeting. The title of his talk is “Cooperative Highway Work Zone Merge Control for Improved Mobility and Safety.”
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: Closed

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, 2017:
The final report was competed in June 2017.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:
“Preventative Maintenance and Timing of Applications,” Smith, Kelly; Peshkin, David; Mogawer, Walaa; Austerman, Alexander; June 2017, NETCR101
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 – 5/31/2017

ANTICIPATED COMPLETION: 5/31/2017

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 20°C. 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, 2017:
1. UMass Dartmouth continued analysis of the test data for all the mixtures tested to date.
2. UMass Dartmouth followed up with the second contractor producing mixtures for this study. The contractor stated that the high RAP mixtures prepared using foaming as the WMA technology would be produced in the spring.
3. UMass Dartmouth received the following plant produced mixtures from the second contractor (Palmer Paving, Springfield MA) in mid-May 2017:
   - SSC 12.5mm 75 Gyration WMA with 29% RAP (1.5% Binder Replacement) Foaming WMA
   - SSC 12.5mm 75 Gyration WMA with 39% RAP (2.0% Binder Replacement) Foaming WMA
   - SSC 12.5mm 75 Gyration WMA with 48% RAP (2.5% Binder Replacement) Foaming WMA
4. The following tests were completed on each mixture using multiple replicates:
   - Volumetric verification (density, VMA, VFA, etc.)
   - Moisture susceptibility testing using the Hamburg wheel tracking device (HWTD) in accordance with AASHTO T324 at 45°C
   - Low temperature cracking using the disk-shaped compact tension (DCT) test at -18°C
   - Constructed performance space diagram (HWTD vs. DCT) for each mixture
• Moisture susceptibility (TSR) in accordance with AASHTO T283
• Low temperature cracking using the thermal stress restrained specimen test (TSRST)
• Mixture dynamic modulus and subsequent construction of mixture master curve
• Dynamic modulus (E*) ratio evaluation of moisture susceptibility

5. Summary sheets of results were constructed and data was analyzed
6. UMass Dartmouth began work on the draft final report.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

A Transportation Research Board (TRB) paper entitled “Understanding Influence of Moisture on Performance of Plant-Produced High Reclaimed Asphalt Pavement Content Mixtures Incorporating Warm-Mix Asphalt Technologies” was presented in at the Transportation Research Board 96th Annual Meeting in Washington DC on January 10th, 2017 in TRB session 636 “Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures.”
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 – University of Massachusetts Amherst

STATUS: Open

AGREEMENT TERM: 9/1/2014 – 1/31/2018

ANTICIPATED COMPLETION: 1/31/2018

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, 2017:
1. Task 1 (literature search) and Task 3 (developing mix design) are complete.
2. For Task 4 (test mixture), most activities have been completed. Freeze-thaw testing and panel tests are the only two activities missing that will be conducted during the extension granted for the project.
3. The geometry and preliminary design of the specimens for panel testing (Task 4) were sent to the TAC for review and comments.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017: 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 – 12/1/2017

ANTICIPATED COMPLETION: 12/1/2017

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, 2017:

1. UMass Dartmouth consistently contacted the contractor during the last quarter to discuss production of the mixtures for this study. No response was received from the contractor.
2. For blending analysis, Post Consumer Asphalt Shingles (PCAS) binder was extracted and recovered. The recovered binder was blended with virgin binder assuming three conditions: no blending, partial blending, and full blending. PG grading of the blended binders was completed for each condition as well as construction of partial binder master curves. These curves were used in an attempt to assess the degree of blending.
3. Since no plant produced mixtures had been received, UMass Dartmouth began development of mixture designs with a blend of RAS at a 50-50 ratio (i.e. 2.5% Post Consumer Asphalt Shingles blended with 2.5% Manufactures Shingle Waste for a total of 5% RAS in the
mixture). Previous mixture work had been completed with and MSW and PCAS alone at a dose of 5% in the mixture.

4. A mixture design using 5% blended RAS (PCAS + MSW) was developed using the same source of aggregates as the previous testing.

5. Performance testing of the mixture developed using 5% blended RAS (PCAS + MSW) commenced. Specifically, dynamic modulus testing, flexural beam fatigue, Thermal Stress Restrained Specimen Test (TSRST), Illinois Flexibility Index Test (IFIT), and Disk Shaped Compact Tension Test (DC(T)) were undertaken.

6. Based on the problems to date the contractor’s willingness to produce the RAS mixtures, the PI is proposing to utilize laboratory produced samples for the remainder of the project. The PI began organizing a project update meeting with the technical committee to be held in the first two weeks of July 2017 to discuss this matter.

7. A project progress meeting was held on July 7, 2017 to update the TAC on the status of the project. The project PI requested that the mixtures for this study shift from plant-produced mixtures to lab-produced mixtures. This is due to the fact that no plant-produced mixtures have been produced to date.

8. Work began on the draft final report.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

A Transportation Research Board (TRB) paper entitled “Performance Characterization of Asphalt Mixtures Incorporating Recycled Asphalt Shingles: Mechanical Approach to Asphalt Binder Degree of Blending” was presented at the Transportation Research Board 96th Annual Meeting in Washington DC on January 10th, 2017 in TRB session 636 “Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures.”
PROJECT NUMBER: 13-3

PROJECT TITLE: “Improved Regionalization of Quality Assurance (QA) Functions”

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

STATUS: Open

AGREEMENT TERM: 12/1/2014 – 4/2/2017

ANTICIPATED COMPLETION: 4/30/2017

PROJECT OBJECTIVES:

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, 2017:

1. Revisions to the final report were made on basis of feedback from the project technical committee. Simultaneously Vermont Agency of Transportation (VAOT) established a SharePoint file sharing site for all New England DOTs to share QA information for PCE/PSE in New England region.
2. Work continues on the draft final report.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

A SharePoint site has been setup by VAOT with a file directory structure set up in terms of various producers that manufacture PCE/PSE for New England agencies.
PROJECT NUMBER: 14-1

PROJECT TITLE: “Measuring the Effectiveness of Competency Models for Job-Specific Professional Development of Engineers and Engineering Technicians”

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Chris Ahmadjian, University of Massachusetts, Amherst

STATUS: Open

AGREEMENT TERM: 3/1/2015 – 12/31/2017

ANTICIPATED COMPLETION: 12/31/2017

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

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2017:

1. A No Cost Extension was requested for 12/31/2017. This was granted and Cole Fitzpatrick of the research team is back on salary.
2. A progress meeting was held with the TAC. Next steps were discussed and outlined. Draft Competency Model frameworks were discussed and outlined.
3. Plans were made for site visits to review next steps.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017: None thus far.
PROJECT NUMBER: 14-2

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

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

STATUS: Closed

AGREEMENT TERM: 2/1/2015 – 4/2/2017

ANTICIPATED COMPLETION: 4/2/2017

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, 2017:

1. Guano samples sent to 2 labs for species identification and received results.
2. Hand vetting results of MYSE calls received from Sarah Boyden of MaineDOT.
3. Began compiling inspection and data collection forms into report format. Obtained quotes from consultants for data analysis. Received acoustic analysis from consultants.
4. Sent acoustic data to two consultants for further acoustic analysis with automated programs and select hand vetting.
5. Modified presentation of research and revised for conferences as appropriate.
6. Continued work on Draft Final Report and delivered to TAC for review.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

1. Presented at the North American Society for Bat Research (NASBR) conference at San Antonio TX.
2. Presented (remotely) at Maine Bat Working Group Annual Meeting.
5. Conference call to discuss planning of Transportation Research Board Workshop 114: Bats at the Crossroads: Regulatory Compliance
7. Lunch and Learn and Project Summary Workshop for ME/VT/NH: Concord NH 3/13/17
8. Project Summary Workshop for MA/CT/RI: Westborough MA 3/24/17
10. “Investigation of Northern Long-Eared Bat Roosting Sites on Bridges,” Civjan, Scott; Dumont, Elizabeth; Bennett, Alyssa; Berthaume, Angela; May 2017, NETCR100
PROJECT NUMBER: 14-4

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

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Yuanchang Xie, University of Massachusetts, Lowell

STATUS: Open

AGREEMENT TERM: 7/6/2015 – 12/31/2017

ANTICIPATED COMPLETION: 12/31/2017

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, 2017:

Task 3 – Development of Methodology for Testing and Analyzing TTCPs

- The team received the second set of NDS data on April 7, 2017, then started analysis.

Smart Work Zone (SWZ) Data
The team has finished analyzing the data obtained from one SWZ in Massachusetts. The team has decided to focus on NDS data analysis, virtual reality simulation, and VISSIM simulation.

**Driving Simulator**

- A no cost extension was requested and approved along with a budget reallocation in order to allow for purchase of a motion simulator and eye tracking device.

**Task 4 – Development of New TTCPs**

- The team identified radar speed sign, variable message sign, tubular marker, and narrow lane for further consideration.

**Task 5 – Evaluation of New TTCPs**

- The team evaluated speed control scenarios in a virtual reality environment. The results have been summarized in a paper titled “Modelling Highway Work Zone Traffic Safety and Driver Behaviors Using a Virtual Reality Driving Simulator.” The paper was submitted to the 2017 Road Safety and Simulation International Conference for presentation only and it is currently under review.
- The team has been working on (1) summarizing and documenting previous VISSIM simulation results; (2) evaluating the safety performances of identified work zone merge control strategies; (3) further evaluating previously identified work zone control strategies using Aimsun; and (4) developing and evaluating a custom work zone control strategy considering vehicle connectivity and automation.
- The team has developed a custom work zone control strategy (other than the previous identified seven strategies) considering vehicle connectivity and automation. This strategy has been coded in VISSIM and is being tested. Based on the preliminary results, an abstract entitled “Cooperative Merging in Highway Work Zone Enabled by Connected and Autonomous Vehicles” has been prepared and it has been accepted for presentation at the 2018 ASCE International Conference on Transportation & Development.

**REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:**

A paper entitled “Modelling Highway Work Zone Traffic Safety and Driver Behaviours in the United States Using a Virtual Reality Driving Simulator” has been accepted to the 2017 Road Safety & Simulation Conference to be held in The Hague, Netherland in October 2017.

A paper entitled “Cooperative Merging in Highway Work Zone Enabled by Connected and Autonomous Vehicles” has been accepted by the 2018 ASCE International Conference on Transportation & Development to be held in Pittsburgh, Pennsylvania on July 15-18, 2018.

Dr. Xie has been invited to give a talk at the 2018 TRB Annual Meeting. The title of his talk is “Cooperative Highway Work Zone Merge Control for Improved Mobility and Safety”.

An abstract entitled “Cooperative Highway Work Zone Merge Control for Improved Mobility and Safety” has been submitted to the 2018 MassDOT Moving Together Conference.
PROJECT NUMBER: 15-1

PROJECT TITLE:  “Use of Forested Habitat Adjacent to Highways by Northern Long Ear Bats (and Other Bats)”

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jeffrey Foster, University of New Hampshire

STATUS: Open

AGREEMENT TERM: 12/1/2016 – 11/30/2018

ANTICIPATED COMPLETION: 11/30/2018

PROJECT OBJECTIVES: Our overall objective addresses several major gaps in the knowledge of Northern long-eared bat (NLEB; Myotis septentrionalis) distributions and activity as they relate to the use of highway habitat in New England.

The research objectives will be achieved by accomplishing 8 tasks:

- Task 1. Literature review on NLEB habitat requirements and effects of anthropogenic disturbance, focusing on the effects of roadways.
- Task 2. Develop a “Zone of Influence” matrix for highway induced stressors.
- Task 3. Compile existing data on NLEB and other rare bat species distributions.
- Task 4. Request presence/absence data from State Depts of Transportation and other sources.
- Task 5. Determine land cover (habitat) being used or not used by NLEB.
- Task 6. Determine data gathering needs to improve model inference.
- Task 7. Identify data gaps in sampling of NLEB in specific habitats that may require additional data collection on presence/absence.
- Task 8. Develop screening tool and GIS model that would show zones of influence around highways.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2017:

- Task 1: Completed the literature review.
- Task 2: Identified the main stressors of roads on bats, which include direct mortality and movement barrier due to reduced landscape permeability and vehicle noise.
- Task 3: Continued compilation of NLEB distribution data. All states have sent the data except CT, whose data is expected in a few months (2018).
- Task 4: Presence/absence data have been received from some transportation departments (MA).
- Task 5: Landscape data was collected, including road variables such as the traffic level and width of nearest road.
- Task 6: Presence/absence data were compiled; there are few presences, thus the team may need to combine these data with presence-only data from other sources.
- Task 7: Created presence-absence maps from the accumulated data.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

None thus far.
PROJECT NUMBER: 15-2

PROJECT TITLE: “Using the New SHRP2 Naturalistic Driving Study Databases to Examine Safety Concerns for Teens and Older Drivers”

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Siby Samuel, University of Massachusetts, Amherst

STATUS: Open

AGREEMENT TERM: 01/01/2017 – 12/31/2018

ANTICIPATED COMPLETION: 12/31/2018

PROJECT OBJECTIVES: To examine SHRP2 NDS and identify primary concerns with older driver safety when navigating left turns at permissive and protected signalized intersections.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2017:

1. The TAC kickoff meeting was held.
2. A comprehensive data plan was completed to acquire relevant NDS data from the SHRP2 and RID databases.
3. The team conducted preliminary querying of the Insight database to identify the specific nature of the quantity and quality of data available for analyses.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

None thus far.
PROJECT NUMBER: 15-3

PROJECT TITLE: “Moisture Susceptibility Testing for Hot Mix Asphalt Pavements in New England”

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

STATUS: Open

AGREEMENT TERM: 08/01/2016 – 07/31/2018

ANTICIPATED COMPLETION: 07/31/2018

PROJECT OBJECTIVES:

1. Evaluate good and poor performing asphalt mixtures in New England and determine mechanisms responsible for poor performing mixtures
2. Determine impacts of remedial measures (anti-stripping additives and hydrated lime) in reducing moisture susceptibility of poor performing mixtures
3. Assess impacts of moisture induced-damage on pavement performance and service life
4. Recommend an evaluation framework consisting of appropriate test procedure(s), specification, analysis procedure verified with field performance data that is reliable and suitable for moisture susceptibility testing of asphalt mixtures used in New England

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2017:

- Task 1, State of the Practice and Literature Review: The research team continued the literature review process, as well as collected current agency specifications to review the current state of practice. A comprehensive survey was developed to collect additional information from various agencies regarding their practices as well as experiences in context of moisture-induced damage in asphalt mixtures. The survey will be distributed to the 6 New England state transportation agencies.
- Task 2, Identify and Inspect Moisture Susceptibility Mixes and Develop Testing Plan: A preliminary testing plan was developed and proposed to the TAC during the project kickoff meeting. The material sampling plan was also finalized. 9 mixes have been sampled with 1 more anticipated.
- Task 3, Laboratory Testing: Laboratory compaction characteristics were determined for fabrication of test specimens. Production of laboratory specimens is underway at both UNH and WPI. UNH researchers have started indirect tensile strength testing and Hamburg specimen preparation. WPI researchers have started to finalize MiST conditioning parameters. Significant amounts of laboratory testing was completed. For all ten mixtures that have been sampled, compaction characteristics and volumetric testing has been completed. All ten of these mixtures have been tested for indirect tensile strength with both unconditioned specimens and specimens conditioned using AASHTO T-283 as well as eight of the mixtures having been tested for indirect tensile strength with MiST conditioning. Most of the mixtures have been tested for dynamic modulus in an unconditioned state while a few have been tested with MiST conditioning. In addition, all of the Hamburg wheel tracker testing and preliminary work for the freeze-thaw conditioning has been completed. Seismic modulus testing has been carried out for eight of the mixtures with unconditioned and MiST conditioned specimens. Most of the mixtures have had semi-circular bending tests with unconditioned and MiST conditioned samples conducted.
REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2017:

None thus far.
# FINANCIAL STATUS

## 1. FINANCIAL STATUS OF ACTIVE PROJECTS:

<table>
<thead>
<tr>
<th>NO.</th>
<th>PROJECT TITLE</th>
<th>APPROVED BUDGET</th>
<th>INVOICES APPROVED FOR PAYMENT</th>
<th>PROJECT BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-4</td>
<td>Preventative Maintenance and Timing of Applications</td>
<td>$242,909</td>
<td>$214,777.87</td>
<td>FINAL</td>
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<tr>
<td>10-3</td>
<td>Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology</td>
<td>$150,158</td>
<td>$87,819.56</td>
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<td>13-1</td>
<td>Development of High-Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections</td>
<td>$191,710</td>
<td>$184,986.78</td>
<td>$6,723.22</td>
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<tr>
<td>13-2</td>
<td>HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures</td>
<td>$249,785</td>
<td>$168,835.93</td>
<td>$80,949.07</td>
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<td>13-3</td>
<td>Improved Regionalization of Quality Assurance (QA) Functions</td>
<td>$100,000</td>
<td>$70,810.41</td>
<td>$29,189.59</td>
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<tr>
<td>14-1</td>
<td>Measuring the Effectiveness of Competency Models for Job-Specific Professional Development of Engineers &amp; Engineering Technicians</td>
<td>$100,000</td>
<td>$71,428.25</td>
<td>$28,571.75</td>
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<tr>
<td>14-2</td>
<td>Investigation of Northern Long-Eared Bat Roosting Sites on Bridges</td>
<td>$205,554</td>
<td>$166,251.89</td>
<td>FINAL</td>
</tr>
<tr>
<td>14-4</td>
<td>Optimizing Future Work Zones in New England for Safety &amp; Mobility</td>
<td>$200,000</td>
<td>$197,283.82</td>
<td>FINAL</td>
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<tr>
<td>15-1</td>
<td>Use of Forested Habitat Adjacent to Highways by Northern Long Ear Bats (and Other Bats)</td>
<td>$164,970</td>
<td>$92,047.45</td>
<td>$72,922.55</td>
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<td>15-2</td>
<td>Using the New SHRP2 Naturalistic Driving Study Safety Databases to Examine Safety Concerns for Teens and Older Drivers</td>
<td>$150,000</td>
<td>$118,517.93</td>
<td>$31,482.07</td>
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<td>15-3</td>
<td>Moisture Susceptibility Testing for Hot Mix Asphalt Pavements in New England</td>
<td>$150,000</td>
<td>$99,318.35</td>
<td>$50,681.65</td>
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</tbody>
</table>
2. FUND BALANCE:

NETC FUND BALANCE
As of January 8, 2017

ITEM

OBLIGATION FOR PROJECTS

TRAVEL OBLIGATIONS AND EXPENDITURES

BUDGET

EXPENDED

INVOICE

CUMULATIVE BALANCE

NOTES

Unexpended Balance of NETC funds from AASHTO
as of 6/5/96 (Per AASHTO memo 12/4/95)

132,777.07

Member Obligations 1994 = $6,750,000

450,000.00

Member Obligations 1995 = $7,500,000

525,000.00

Member Obligations 1996 = $6,750,000

450,000.00

Member Obligations 1997 = $6,875,000

450,000.00

Member Obligations 1998 = $7,500,000

451,080.55

Member Obligations 1999 = $8,675,000

452,156.82

Member Obligations 2000 = $8,500,000

600,000.00

Member Obligations 2001 = $6,500,000

600,000.00

Unexpended Balance of NETC funds from AASHTO
as of 6/5/96 (Per AASHTO memo 12/4/95)

39,238.68

- Construction Costs of New England Bridges - Phase II
- Bridge Rail Crash Test - Phase III: Sidewalk-Mounted Rail
- New England Vehicle Classification and Truck Weight Program
- Structural Analysis of New England Subbase Materials and Structures
- Nondestructive Testing of Reinforced Concrete Bridges Using Radiar Imaging Techniques
- Procedures for The Evaluation of Sheet Membrane Waterproofing
- Durability of Concrete Crack Repair Systems
- Use of Tine Chips/Soil Mixtures to Limit Pavement Damage of Paved Roads
- Implementation and Evaluation of Traffic Marking Reccesses for Application of Thermoplastic Pavement
- Buried Joints in Short Span Bridges
- Guidelines for Ride Quality Acceptance of Pavements
- Optimizing GPS Use in Transportation Projects
- Effectiveness of Fiber Reinforced Composites as Protective Coverings for Bridge Elements, etc.
- Travel Tech. Comm (A. Age. stip. pol.) For 1998 = $5,000
- T2 (per 12/2/97 Adv. Committee Mtg.) For 1998 = $10,000
- Refund Check (No. 25-663337), for CY '98 Management of NETC, from UConn OSP; Ref. 7/19/00 letter to J. Sime
- Refund Check (No. 25-663337), for CY '98 Management of NETC, from UConn OSP; Ref. 7/19/00 letter to J. Sime
- New England Vehicle Classification and Truck Weight Program
- Effectiveness of Fiber Reinforced Composites as Protective Coverings for Bridge Elements, etc.
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- Refund Check (No. 25-663337), for CY '98 Management of NETC, from UConn OSP; Ref. 7/19/00 letter to J. Sime
**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 for 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.

7. Contributions for FY 2016 have been waived.
1. POLICIES AND PROCEDURES:


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 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
“Annual Report For Calendar Year 2014,” February 2015, NETCR95
“Annual Report For Calendar Year 2015,” January 2016, NETCR102
“Annual Report For Calendar Year 2016,” April 2018, NETCR106
“Annual Report For Calendar Year 2017,” April 2018, NETCR107

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


“The New England Transportation Consortium, Round One Activities,” Humphrey,


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


4. REPORTS, PAPERS AND PRESENTATIONS 1995-2017:

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>N/A</td>
<td>Construction Costs of New England Bridges</td>
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<td></td>
<td><strong>Reports:</strong></td>
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<tr>
<td></td>
<td><strong>Papers and Presentations:</strong></td>
</tr>
<tr>
<td>N/A</td>
<td>Tire Chips as Lightweight Backfill for Retaining Walls, Phase II: Full-Scale Testing</td>
</tr>
<tr>
<td></td>
<td><strong>Reports:</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Papers and Presentations:</strong></td>
</tr>
<tr>
<td></td>
<td>“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.</td>
</tr>
</tbody>
</table>
Tire Chips as Lightweight Backfill for Retaining Walls, Phase II: Full-Scale Testing (cont’d):
Papers and Presentations (cont’d):


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

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


Papers and Presentations:


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


Structural Analysis of New England Subbase Materials And Structures

Reports:

Papers and Presentations:


Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques

Reports:

Papers and Presentations:


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


Procedures for the Evaluation of Sheet Membrane Waterproofing: Reports:

Papers and Presentations: None
94-4  Durability of Concrete Crack Repair Systems:
Reports: None

Papers and Presentations:

“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

Papers and Presentations:


"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

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:

Papers and Presentations:


95-5 Buried Joints In Short Span Bridges

Reports: None

Papers and Presentations:

95-6 Guidelines for Ride Quality Acceptance of Pavements

Reports:

Papers and Presentations: None

96-1 Implementation of Superpave

Reports:
“Superpave Implementation,” Mahoney, James, Stephens, Jack E., September 1999, NETCR18.
Effectiveness of Fiber Reinforced Composite as Structural and Protective Coverings for Bridge Elements Exposed To Deicing Salt Chlorides

Reports:

Papers and Presentations:


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


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):


97-1 A Portable Method to Determine Chloride Concentration on Roadway Pavements

Reports:

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:

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.

41
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:


Determining Properties, Standards and Performance of Wood Material as an Erosion Control Mulch and as a Filter Berm

Reports:

Papers and Presentations:

Early Distress of Open-Graded Friction Course (OGFC)

Reports:

Papers and Presentations: None

Bridge Rail Transitions – Development and Crash Testing

Reports:

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:


99-2 Evaluation of Asphallic Expansion Joints
Reports:

Papers and Presentations: None

99-3 Development of Priority Based Statewide Scour Monitoring Systems In New England
Reports:

Papers and Presentations:

99-4 Quantifying Roadside Rest Area Usage
Reports:

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:

Papers and Presentations:


“Effect of Demolition on Remaining Part of Concrete Bridge, Numerical Analysis Vs. Experimental Results.” Presented and published in the proceedings of Internationales Kolloquium über die Anwendungen der Informatik in Architektur 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:

Papers and Presentations: None

00-2  Evaluation of Permeability of Superpave Mixes

Reports:

Papers and Presentations:

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

Reports:

Papers and Presentations: None

Portable Falling Weight Deflectometer Study

Reports:

Papers and Presentations: None

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

Reports:

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

Effective Visualization Techniques for the Public Presentation of Transportation

Reports:

Papers and Presentations:
A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn’t

Reports:

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.

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

Reports:

Papers and Presentations:

Advanced Composite Materials for New England’s Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice

Reports:

Papers and Presentations:  None

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

Reports:

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.,

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,

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.,
02-2  Formulate Approach for 511 Implementation in New England Reports:

Papers and Presentations:  None

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

Papers and Presentations:


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

Papers and Presentations:  None
Sealing of Small Movement Bridge Expansion Joints

Reports:

Papers and Presentations:


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

Reports:

Papers and Presentations:


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


Papers and Presentations:


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


Papers and Presentations:


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


Papers and Presentations: None
03-2  Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid
Reports:

Papers and Presentations:


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

Papers and Presentations: None

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

Papers and Presentations: None

03-4  Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units
Reports:

Papers and Presentations:

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

Reports:

Papers and Presentations:


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:

Papers and Presentations: None
**03-7 Basalt Fiber Reinforced Polymer Composites**

**Reports:**

**Papers and Presentations:**


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


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

**Reports:**

**Papers and Presentations:**

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

Reports:

Papers and Presentations:

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


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

Reports:

Papers and Presentations:

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

Reports:

Papers and Presentations:

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

Reports:

Papers and Presentations:


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

Reports:

Papers and Presentations: None
Measurement of Adhesion Properties Between Topcoat Paint and Metalized/Galvanized Steel with Surface Energy Measurement Equipment

Reports:

Papers and Presentations:

Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers’ Message Comprehension

Reports:

Papers and Presentations:


Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways

Reports:
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.


Evaluation and Implementation of Traffic Simulation Models for Work Zones
Reports:

Papers and Presentations:


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

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


06-3 Establishing Default Dynamic Modulus Values for New England Reports:

Papers and Presentations: None

06-4 Preventative Maintenance and Timing of Applications Reports: NETC 06-4: “Preventative Maintenance and Timing of Applications,” Smith, Kelly; Peshkin, David; Mogawer, Walaa; Austerman, Alexander; June 2017, NETCR101

Papers and Presentations: None

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

Papers and Presentations: None

09-2 Effective Establishment of Native Grasses on Roadsides Reports:
“Effective Establishment of Native Grasses on Roadsides,” Kuzovkina, Julia; Schulthess, Cristina P.; Ricard, Robert; Dryer, Glenn, June 2016, NETCR97.

Papers and Presentations: None

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

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

Papers and Presentations: None

13-1 Development of High Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections

Papers and Presentations: None

13-2 HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures


13-3 Improved Regionalization of Quality Assurance (QA) Functions

Papers and Presentations: None

14-1 Measuring the Effectiveness of Competency Models for Job-Specific Professional Development of Engineers & Engineering Technicians

Papers and Presentations: None

14-2 Investigation of Northern Long-Eared Bat Roosting Sites on Bridges
Reports: “Investigation of Northern Long-Eared Bat Roosting Sites on Bridges,” Civjan, Scott; Dumont, Elizabeth; Bennett, Alyssa; Berthaume, Angela; May 2017, NETCR100

Papers and Presentations:

Lunch and Learn and Project Summary Workshop for ME/VT/NH: Concord NH 3/13/17

Project Summary Workshop for MA/CT/RI: Westborough MA 3/24/17


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

Papers and Presentations:
A paper entitled “Modelling Highway Work Zone Traffic Safety and Driver Behaviours in the United States Using a Virtual Reality Driving Simulator” has been accepted to the 2017 Road Safety & Simulation Conference to be held in The Hague, Netherlands in October 2017.

A paper entitled “Cooperative Merging in Highway Work Zone Enabled by Connected and Autonomous Vehicles” has been accepted by the 2018 ASCE International Conference on Transportation & Development to be held in Pittsburgh, Pennsylvania on July 15-18, 2018.

Dr. Xie has been invited to give a talk at the 2018 TRB Annual Meeting. The title of his talk is “Cooperative Highway Work Zone Merge Control for Improved Mobility and Safety.”

15-1 Optimizing Future Work Zones in New England for Safety and Mobility
Reports: None

Papers and Presentations: None

15-3 Optimizing Future Work Zones in New England for Safety and Mobility
Reports: None

Papers and Presentations: None